

Low Socioeconomic Status and Female-Biased Parental Investment: The Mukogodo Example

Hierarchies of wealth and ethnic prestige among East African herders present an opportunity to test the Trivers-Willard hypothesis that low socioeconomic status should correlate with female biases in parental investment. The Mukogodo are at the bottom of such a regional hierarchy due to their poverty and low status as former hunters. As a result of these factors, Mukogodo men have lower polygyny rates than their neighbors, and Mukogodo women have higher mean reproductive success than Mukogodo men. The data fulfill the prediction that there should be a bias in parental investment in favor of daughters. The sex ratio of the 0-4 age group and the reported sex ratio at birth are both female-biased. Although there is no evidence of infanticide, sons may be neglected in favor of daughters. Evidence from a dispensary and from a clinic run by a Catholic mission both show that the Mukogodo take daughters for treatment more often than they take sons. Also, daughters may be nursed longer than sons.

THE MUKOGODO ARE A SMALL GROUP OF PASTORALISTS living in Mukogodo Division, Laikipia District, Kenya. Until the 1920s and 1930s they lived in caves, spoke a disappearing language called Yaaku (Heine 1974), and subsisted on wild foods and honey. When they acquired livestock, they quickly dropped their old language in favor of Maa, the language of the Maasai and Samburu, and replaced many of their traditional customs with those of their Maa-speaking neighbors (Cronk 1989).

Mukogodo demography is in most respects fairly typical of traditional African societies, with the exception of their female-biased childhood sex ratio. In 1986, there were 98 females and 66 males in the 0-4 age group ($\chi^2 = 5.734, p < .025$). This article is an examination of the possibility that the Mukogodo childhood sex ratio is the result of female-biased parental investment and male-biased child neglect in response to the relatively poor reproductive prospects of Mukogodo males compared to Mukogodo females, in accordance with the Trivers-Willard model of facultative sex ratio manipulation (Trivers and Willard 1973).

Sex Ratio Theory: The Trivers-Willard Model

R. A. Fisher (1930) showed that natural selection tends to favor equal parental investment (Trivers 1972) in sons and daughters in panmictic populations. R. Trivers and D. Willard (1973) hypothesized that under certain conditions, natural selection should favor deviations from equal parental investment in the sexes. They predicted that if the condition of mothers during parental investment correlates with the probable reproductive success of their offspring, natural selection should favor the ability of parents to adjust their investment in the sexes to favor the sex with the best reproductive prospects. In a great many species, male reproductive success is more variable than that of females, and so males may benefit more than females from good maternal condition and suffer more than females from poor maternal condition (Figure 1). Accordingly, natural selection

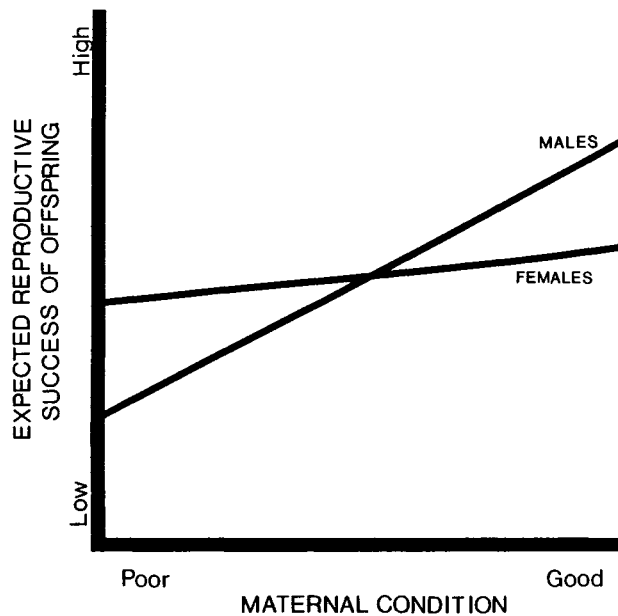


Figure 1
Necessary preconditions for the application of the Trivers-Willard model of sex ratio manipulation and sex-biased parental investment.

should favor mothers that invest more in daughters when in poor condition and in sons when in good condition. This idea has had a complex but generally successful history of application to nonhuman species (for recent reviews see Clutton-Brock and Iason 1986; Gray 1985; and Hrdy 1987, 1988).

Trivers and Willard suggested that this idea could be applied to humans differentiated in a socioeconomic hierarchy, as long as expected reproductive success of male offspring is greater than that of females at the higher, wealthier end of the hierarchy and less than that of females at the lower end. The model predicts that parents at the higher end of the hierarchy will invest more in sons than in daughters and that parents at the lower end will favor daughters. This modified Trivers-Willard hypothesis has been used in studies of sex-biased parental investment in feudal north India, imperial China, medieval Europe (Dickemann 1979), Germany between the 17th and 19th centuries (Voland 1984, 1988), medieval Portugal (Boone 1986), and the Micronesian island of Ifaluk (Betzig and Turke 1986).

Because the Mukogodo frequently marry their neighbors, they form only part of a larger regional mating system. The predictions of the modified Trivers-Willard hypothesis are fulfilled for the Mukogodo if the following conditions are met (also see Figure 2): (1) the Mukogodo are at the bottom of a regional socioeconomic hierarchy; (2) average male reproductive success is lower than average female reproductive success for the Mukogodo due to their place in the hierarchy; and (3) Mukogodo parental investment is biased in favor of females, either prenatally through physiological means, producing a biased sex ratio at birth, or postnatally through behavioral means, producing a biased sex ratio at the end of the period of parental investment.

Data Collection

Coworker Beth Leech and I spent about 13 months among the Mukogodo from December 1985 to January 1987. Among the data we gathered were a census of all Muko-

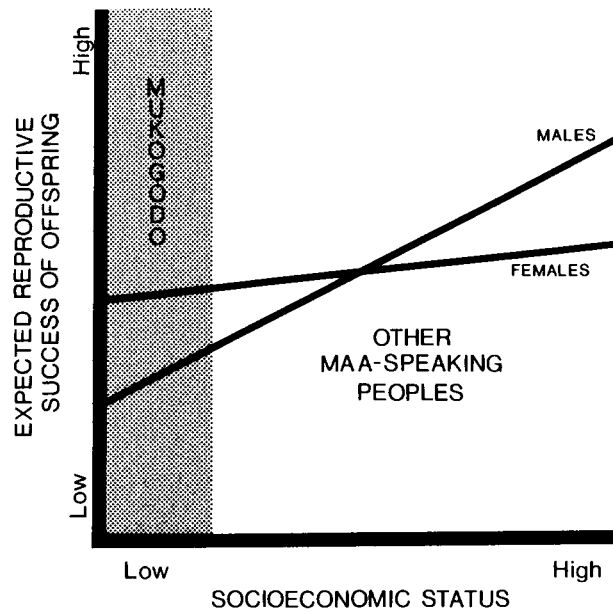


Figure 2

Necessary preconditions for the application of the Trivers-Willard model in the Mukogodo case.

godo resident in the area during 1986; reproductive histories of 121 Mukogodo females of child-bearing years and older (69% of the total number possible; interviews conducted entirely by Beth Leech); data on livestock wealth for the Mukogodo and their neighbors from Kenyan government censuses of group ranches conducted in 1983 and 1985; genealogies of all 13 Mukogodo lineages going back to the middle of the 19th century; bride-wealth estimates for about 400 Mukogodo marriages from the 19th century to 1986; and data on the ages, sexes, and ethnic groups of all attendants of a dispensary and an underweight child clinic run by the local Catholic mission in 1986. I also collected some historical materials from the Kenya National Archives. Maa was our principal fieldwork language. Age estimates and dating of past events were accomplished with reference to the Mukogodo age-set chronology and to other historical events of known date.

The Socioeconomic Hierarchy

The Mukogodo have long been at the bottom of a regional hierarchy of wealth, ethnic status, and reproductive opportunities. They live among several other groups of Maa-speaking pastoralists, namely, the Mumonyot, Digirri, and IIng'wesi. The Samburu, a large group that lives mainly north of Mukogodo, are also well represented in the Mukogodo area. All Maa-speaking pastoralists allow polygyny, and it is customary for a man to pay his wife's family several head of cattle, some small stock, and nowadays often some cash and manufactured goods as bridewealth.

Wealth

The Mukogodo were the last in their area to make the transition to pastoralism, and they have long been the poorest in terms of livestock wealth. Figure 3 shows mean livestock holdings for the Mukogodo and their neighbors in 1934. Parametric statistics cannot be performed on these data because only sums were recorded, not individual hold-

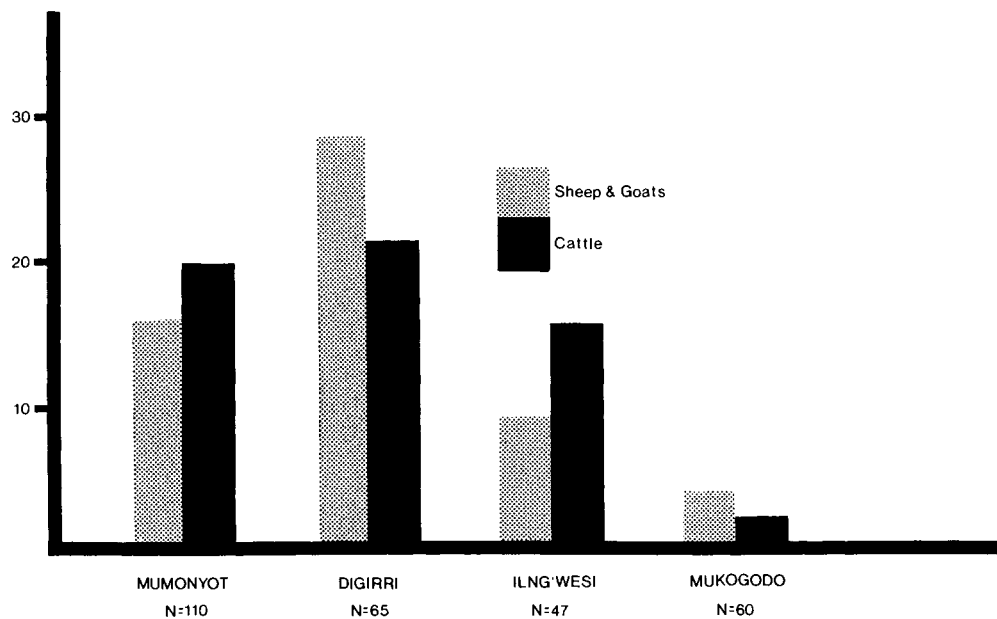


Figure 3
Mean livestock per adult male, by ethnic group, 1934 (District Commissioner 1934).

ings, but chi-square tests show that the differences among the mean stock holdings were statistically significant (for cattle, chi-square = 15.676, $p < .005$; for small stock, chi-square = 17.993, $p < .001$). The figures for Mukogodo stock holdings may even be slightly inflated because colonial records indicate that Mumonyot probably lent large numbers of stock to Mukogodo in the early 1930s (Sharpe 1935). The Samburu in the Mukogodo area were not included in the 1934 census, but in 1935, 58 adult Samburu men and their families were moved from Mukogodo with mean livestock holdings of 47.67 cattle, 105.55 sheep and goats, and 3.76 donkeys per adult male (Sharpe 1935).

Later colonial records indicate that the Mukogodo position as the poorest group has never varied. In 1956, for example, the Mukogodo and Mumonyot combined¹ had the highest proportion of adult men who owned no cattle (24%, as opposed to 16% for the Digirri and 19% for the Ilng'wesi; District Officer 1956). Since the Mumonyot were quite probably wealthier and more numerous than the Mukogodo, figures for the Mukogodo alone probably would have revealed even greater poverty.

More recent records show that relative Mukogodo poverty persists. Figure 4 shows mean small stock holdings for members of ten Mukogodo Division group ranches in 1983.² The Mukogodo also have fewer cattle than their neighbors. The mean number of cattle owned by Mukogodo group ranch members was 15.492, while that owned by non-Mukogodo members was 20.305. It is not known if this difference is statistically significant because the original data were not available for tests. This problem is not serious because small stock holdings may be better than cattle as guides to relative wealth among poorer East African pastoralists. Compared to Maasai and Samburu, all of the ethnic groups shown in Figure 4 are poor in cattle. In a 1980 study of 41 Maasai household heads, for example, the mean for cattle holdings was 109 (Grandin 1987), and Samburu cattle herds were estimated to have on average about 80 cattle in the late 1950s (Spencer 1973:10). High small-stock-to-cattle ratios may be typical of poorer Maa-speaking pastoralists (Grandin 1987), and sheep and goats tend to be more important than cattle to

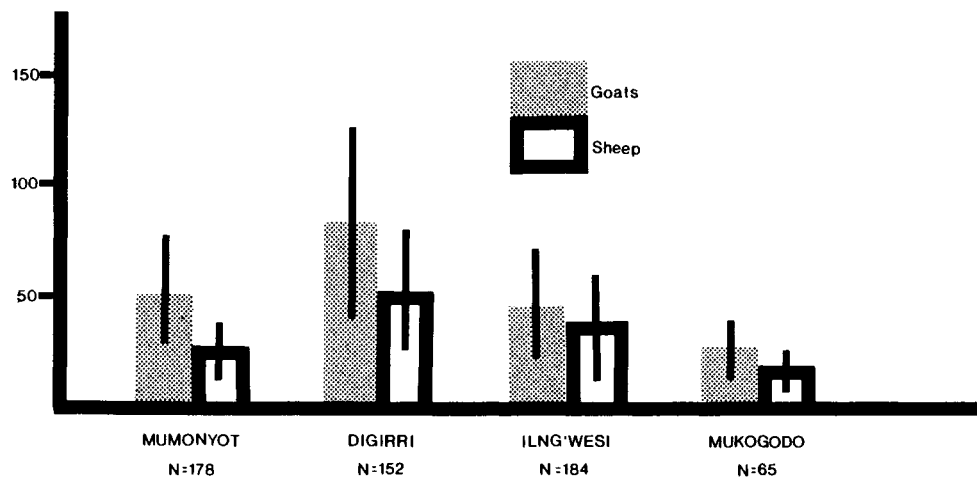


Figure 4

Mean numbers of small stock per group ranch member by ethnic group, 1983, showing standard deviations. The differences between the Mukogodo and non-Mukogodo means are all statistically significant (Mumonyot: goats, $p < .0005$, sheep, $p < .01$; Digirri: goats, $p < .0005$, sheep, $p < .0005$; Ilng'wesi: goats, $p < .0025$, sheep, $p < .0005$).

Mukogodo area herders. Small stock are easier to acquire than cattle, less risky as investments, and easier to sell for cash in the Mukogodo area. Local butchers refuse to buy cattle because they have no refrigeration and few customers.

Data from a 1985 livestock census were not yet available for detailed analysis when I was there, but summary figures suggested that the situation had not changed much since 1983. Also, the same basic patterns appear in the 1983 data as in data gathered in my own 1986 census of Mukogodo livestock, indicating that the government data are reliable.

Ethnic Status

The economic position of the Mukogodo corresponds with their position in the Maa-speaking world's hierarchy of ethnic groups. The hierarchy is based primarily on wealth and on the prestige value of various subsistence patterns. Although Maa, the Maasai language, is mainly associated with pastoralists, many Maa-speaking groups have had other modes of subsistence (Berntsen 1979). The Mukogodo were one of several fairly small groups scattered across East Africa, usually in and around forests, who were traditionally hunters, gatherers, and beekeepers.

Maa-speaking pastoralists view hunters warily and with contempt. While pastoralists are associated with everything of value, including concepts such as honor, wealth, prestige, respect, maleness, fertility, and self-control, hunters are despised (Jacobs 1965; Galaty 1979, 1981, 1982; Spencer 1965, 1973). They are referred to by the derogatory term *il-torrobo*, usually written Dorobo, and associated with concepts such as offensiveness, meanness, poverty, cowardice, womanhood, degradation, imperfection, degeneration, and contamination (Galaty 1979, 1981, 1982). Dorobo are associated in Maasai myths with the original fall from grace (Hollis 1905).

Dorobo-ness is a variable quality to Maa-speakers, some peoples being more tainted than others. A group's taint is determined by factors like how much they continue to hunt and keep bees, how long ago their ancestors were hunters, how long they remained hunters, the extent to which they follow a variety of Maasai customs and taboos, their current livestock wealth, whether they have Maasai ancestors, and their personal comportment.

From the point of view of the main body of Maasai and Samburu, the Mukogodo, Mumonyot, Digirri, and Iing'wesi are all Dorobo because they all went through at least a short period as hunters, but the Mukogodo bear the greatest stigma. This is because they continued to hunt until relatively recently, they still keep bees, their ancestors were hunters for as long as anyone can remember, they continue to ignore many Maasai customs, they still have very small herds, and, except for two of their original 13 (now 11) lineages, they have no known patrilineal roots among the Maasai or Samburu. The issue of personal comportment is hard to measure, but the Mukogodo do bear the burden of the Dorobo reputation for disrespect. The other groups, in contrast, do not usually keep bees, follow Maasai customs at least a little more faithfully than the Mukogodo, and include many former Maasai who hunted for only a brief period. In Galaty's (1982:14) depiction of the Maasai ethnosociological system, while the Mumonyot, Digirri, and Iing'wesi might be perceived as only moderately socially distant from the Maasai and classified merely as "foreigners" (*inkuapi*), the Mukogodo would be seen as veritable social aliens, and therefore "enemies" (*ilmang'ati*).

Reproductive Opportunities

Mukogodo poverty and low ethnic status have important effects upon the reproductive prospects of Mukogodo males. The Mukogodo began to intermarry with their Maaspeaking neighbors mainly after 1900, and since that time there has been a net outflux of Mukogodo women. Of 422 known marriages involving Mukogodo individuals, 152 (36%) have been between Mukogodo women and non-Mukogodo men, while only 97 (23%) have been between Mukogodo men and non-Mukogodo women (the remaining 173 marriages [41%] have been between Mukogodo men and women). As a result, many Mukogodo men have gone their entire lives without a wife. The situation of Mukogodo males is made worse by the fact that they typically must pay more bridewealth for women from other groups than men from other groups pay for Mukogodo women (Figure 5). This discrepancy is well known to the Maasai and Samburu, who consider it shameful to

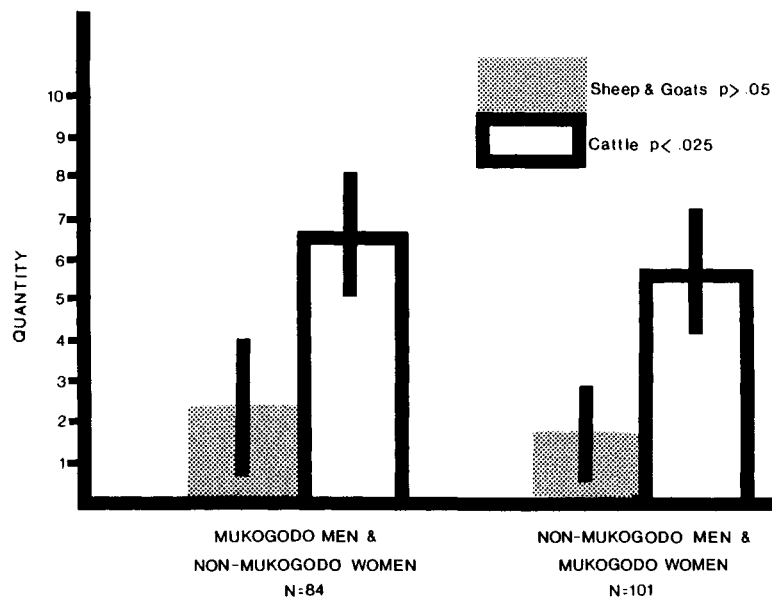


Figure 5
Mean livestock components for all known bridewealth payments, by the ethnic groups of the brides and grooms, showing standard deviations.

marry one's daughter to a Dorobo and who think that Dorobo girls make poor, disrespectful, and unruly wives (Galaty 1982; Spencer 1965, 1973).

The bridewealth levels shown in Figure 5 represent quite a burden to Mukogodo men. Since most young men can expect little help from their parents in paying for a wife, many of them spend what once were their warrior years working instead in Kenyan cities and on farms, earning money to pay for a wife. In contrast, comparatively wealthy Maa-speaking pastoralists consider bridewealth to be a token payment. Among the Samburu, for example, bridewealth payments amount to less than a tenth the size of an average cattle herd (Spencer 1965:69-70).

A comparison of polygyny rates for the Mukogodo and the Samburu shows that, overall, the Mukogodo have fewer wives than their wealthier neighbors (Table 1). The Suiei, another Dorobo group in the Matthews Range in Samburu country, are included in the table to show the similarity of their figures with those of the Mukogodo, despite the different dates of the studies. The figures for the youngest age group are higher for the Mukogodo and Suiei than for the Samburu because the former groups do not follow Samburu and Maasai restrictions on marriage of men in the warrior age grade, a fact that contributes to their low status.

Mukogodo women, on the other hand, have comparatively good reproductive prospects. All but a tiny number have no trouble finding husbands in one group or another, and many of them marry wealthy non-Mukogodo men. Mukogodo women have higher average reproductive success than Mukogodo men. Figure 6 shows mean numbers of offspring surviving to age 15 or to the end of 1986 for men and women in two different samples.

Proximate Causes of Bias: Physiological vs. Behavioral Factors

It is clear that it would be advantageous in the view of evolutionary theory for the Mukogodo to bias their parental investment toward females, since daughters have better reproductive prospects than sons. Although the high number of females in the 0-4 age group suggests that Mukogodo parental investment is biased in this way, it remains to be shown that this is the result of a tendency to manipulate the sex ratio of offspring and is not just fortuitous. In order to show that something besides chance plays a part in the determination of Mukogodo sex ratios, it is necessary to look at proximate mechanisms of sex ratio determination and manipulation.

Offspring sex ratios can be adjusted through either a physiological mechanism before birth or a behavioral mechanism after birth, or by some combination of factors. Possible physiological mechanisms include sex biases in sperm production or survival and sex biases in fetal mortality. Even the timing of copulation may be able to influence the secondary sex ratio (James 1983; Guerrero 1974).

Table 1
Mean numbers of wives for the Mukogodo, Suiei, and Samburu.

| Approximate age range | Mukogodo | Suiei | Samburu |
|-----------------------|----------|-------|---------|
| 58-71 | 1.07 | 1.13 | 1.95 |
| 43-58 | 1.26 | 1.28 | 1.67 |
| 32-43 | 0.98 | 1.04 | 1.35 |
| 18-32 | 0.39 | 0.39 | 0.16 |
| Total | 0.76 | na | 0.86 |
| Standard deviation | 0.74 | na | 0.72 |
| Sample size | 147 | 190 | 5,736 |

p (no difference between mean numbers of wives for Mukogodo and Samburu men) = 0.048.
Non-Mukogodo figures from Spencer (1965).

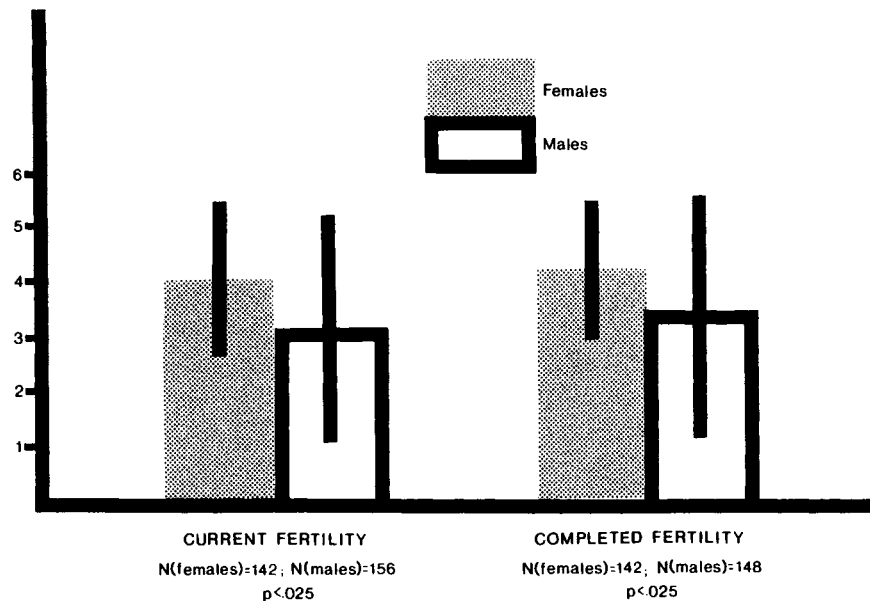


Figure 6

Mean numbers of offspring surviving to present or to age 15, by the sex of the parent, in 1986. ("Current fertility" sample includes self-reported fecund women and living and presumably sexually able men; "completed fertility" sample includes postmenopausal women, dead women, and dead men.)

Slightly more than half (51%) of known Mukogodo births are female, but this slight bias is not significant ($N = 1,299$, chi-square = 0.339, $p > .25$). Infant and child mortality figures suggest that the real sex ratio at birth may very well be normal, that is, slightly more boys born than girls. Figure 7 compares known Mukogodo deaths per 1,000 known births in the 0–4 age group to figures for Laikipia District and for Kenya as a whole. Since Laikipia District, particularly Mukogodo Division, is among the poorest areas in Kenya, the figures for both places are probably inaccurately low, which is typical of child mortality data from Kenyan pastoralist areas (Central Bureau of Statistics 1981:92).

In the Mukogodo case, many childhood deaths are probably missing, despite the fact that reproductive history interviews were conducted in Maa by a female fieldworker. The problem is in the Mukogodo conception of when a baby counts as a person. Although Ms. Leech tried to make it clear to her informants that she wanted to know about every pregnancy, regardless of its outcome, it seems that no pregnancy counted in the minds of the Mukogodo until the child had been born, and most did not count a child until it had been alive for several months. Many women would not even acknowledge current third-term pregnancies. Several obviously pregnant women answered "no" to the question, "Are you now pregnant?" However, if Ms. Leech then asked, "How many months has it been?" she would get a straightforward answer, indicating that they knew they were pregnant and that they understood the question. Another revealing incident occurred when we were conducting our census. One of our best informants insisted he had only six children, despite the fact that his seventh, a newborn baby, was asleep in his wife's arms. The new child was not yet old enough to count.

The missing deaths, then, are probably mostly in the first few months of life. Further evidence indicates that the missing deaths are probably mostly of males. Ms. Leech was able to learn about a total of 39 deaths in the first year of life, which are shown graphically

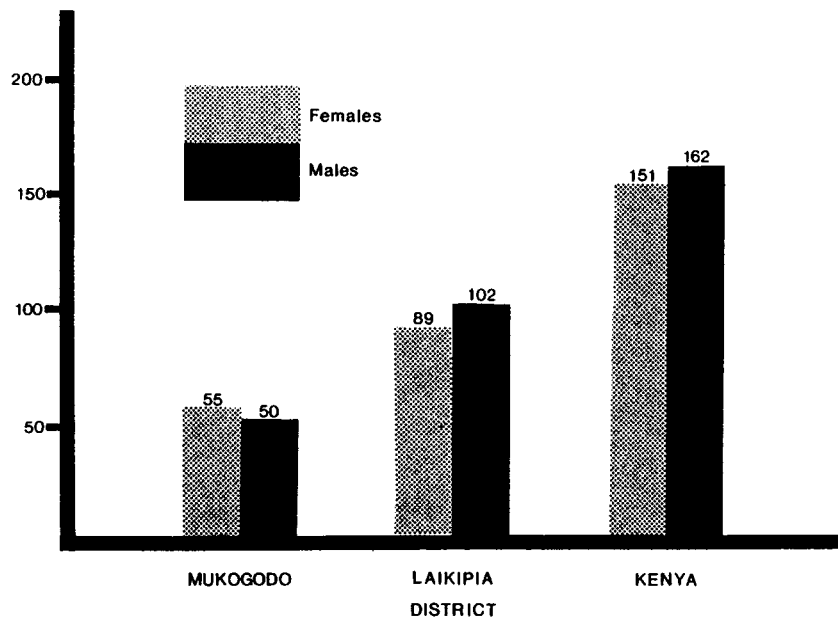


Figure 7

Deaths per 1,000 known live births, ages 0-4; figures for Laikipia District and Kenya are from the 1979 Kenyan census (Central Bureau of Statistics 1981:96, 114). (Mukogodo figures based only on births to women with complete, self-reported reproductive histories.)

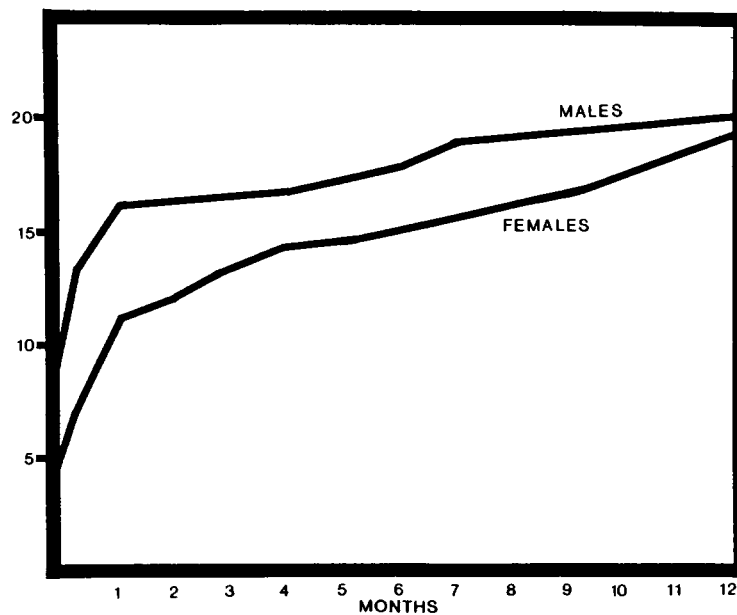


Figure 8

Known Mukogodo deaths in the first year of life, by sex.

in Figure 8. The sex ratio of deaths begins with a male bias, and female deaths do not equal male deaths until the end of the first year of life. If there actually are more male

than female deaths in the first year of life, then the Mukogodo sex ratio at birth would be something like normal. High male mortality soon after birth would also fit the expectations of the Trivers-Willard model, since it is most efficient to adjust sex ratios as early in the period of parental investment as possible (Trivers and Willard 1973:91). Therefore it is likely that something besides physiological factors is involved in the production of the Mukogodo sex ratio.

Parents can adjust their parental investment in the sexes after birth by deliberately killing offspring of one sex (infanticide), by neglecting offspring of one sex, or by biasing investment in favor of offspring of one sex. Infanticide has been found in many human societies, and it is often sex-biased (for theory and analysis, see Dickemann 1975, 1979, 1984; Daly and Wilson 1984; Scrimshaw 1984; for a recent case study, see Bugos and McCarthy 1984). Infanticide is also known to exist among Maa-speaking pastoralists. For example, the Samburu traditionally killed first-born twins, children with at least one uncircumcised parent, and children whose parents were considered to have committed incest (Spencer 1965:185). Such children were killed by putting tobacco in their mouths and leaving them in the bush immediately after birth (Spencer 1973:83). The Maasai do not share the custom of killing one of a pair of twins; in fact, they consider twin births to be lucky (Jacobs 1973:403).

We did not find any evidence of deliberate infanticide among the Mukogodo. The Mukogodo do believe that some "lazy" women fail to maintain a squatting position during childbirth and inadvertently crush their babies. This is one reason why women rarely give birth alone. The closest any woman came to telling us that she had ever killed a baby or deliberately allowed one to die was a woman who explained that she once had borne twins, but that one died soon after birth because she could not feed them both. Like the Maasai, the Mukogodo do not have a general custom of killing one of a pair of twins, and many other pairs of Mukogodo twins survive. Since infanticide deaths would presumably occur very soon after pregnancy, it is possible that they are part of the many infant deaths we do not know about, but it is impossible to say. A tendency to neglect male babies could produce the same result.

Overt abuse of older babies and children is unlikely to be the cause of male-biased Mukogodo childhood mortality. The Mukogodo are very gentle with their children, and harsh physical punishment of children is quite rare.

The Mukogodo do, however, seem to be more solicitous of daughters than of sons. Figure 9 shows the female proportion of visits to a Catholic mission dispensary for Mukogodo and non-Mukogodo children ages 0-4. Mukogodo visitors were identified by their surnames.³ All 1986 visits by people with Mukogodo names were recorded, and a random sample of 25 days was taken for the non-Mukogodo sample. Older children were not included because they are capable of visiting the clinic without their parents. The dispensary is in the town of Don Dol, and is run by an Italian physician and a Swiss nurse. It has an excellent reputation locally for the quality of the care given, and people from all of the groups mentioned in this article visit it. It charges each patient a fee of five shillings (about \$0.31 in 1986), which is waived for people considered unable to pay. This amount discourages frivolous visits, and it is significant by local standards. Most people walk to the dispensary, which for the Mukogodo can mean a trip of as little as half an hour or as much as an entire day just to get there. Travel times for non-Mukogodo visitors are, on average, about the same.

The female bias in visits by Mukogodo children ages 0-4 is statistically significant both when compared to the null hypothesis that both sexes are equally likely to visit the dispensary (chi-square = 4.191, $p < .05$) and when compared with the frequencies of visits by non-Mukogodo children (chi-square = 13.4869, $p < .001$). Table 2 shows all of the available data on dispensary visits by children in this age group, broken down by ethnic group and by whether the visit was for a new complaint or was a follow-up to a previous visit. Considering new visits only, the female bias in the Mukogodo sample is statistically significant when compared with the frequencies of new visits by non-Mukogodo children

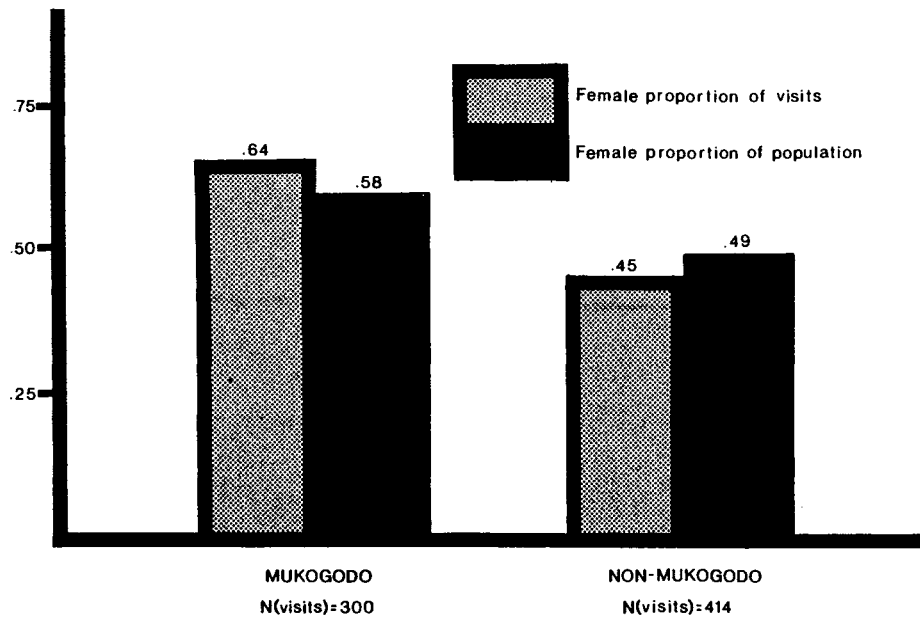


Figure 9

Female proportion of dispensary visits compared to proportion of population, by ethnic group, for children ages 0–4, 1986. (Figure of 49% for the female proportion of the non-Mukogodo population is based on 1979 Kenyan census [Central Bureau of Statistics 1981:122].)

Table 2

Visits by children ages 0–4 to the Don Dol Roman Catholic mission dispensary in 1986, by ethnic group, sex, and whether new or repeat visit.

| | Mukogodo | | | | Non-Mukogodo | | | |
|---------------------------------------|----------|---------|---------|---------|--------------|---------|---------|---------|
| | Males | | Females | | Males | | Females | |
| | New | Repeat | New | Repeat | New | Repeat | New | Repeat |
| | 74 | 35 | 113 | 78 | 153 | 76 | 116 | 69 |
| Total (new + repeat) | 109 | (36.3%) | 191 | (63.7%) | 229 | (55.3%) | 185 | (44.7%) |
| Population proportion ^a | .422 | | .578 | | .51 | | .49 | |

^aThe Mukogodo figures are based on the numbers of person-years lived by children of each sex in the 0–4 age group in 1986. The non-Mukogodo figures are based on the 1979 Kenyan census (Central Bureau of Statistics 1981:122).

(chi-square = 6.031, $p < .025$), but not when compared to the null hypothesis that Mukogodo children of both sexes are equally likely to visit the dispensary (chi-square = 0.5175, $p > .25$). Repeat visits must be analyzed differently because the probability of a repeat visit is dependent on the probability that a first visit has been made. If we compare the proportion of new visits that are followed by another visit for children of both sexes, we find a statistically significant female bias in repeat visits ($t = 2.996$, $p < .0025$). There is also a slight female bias in repeat visits by non-Mukogodo patients, but it is not statistically significant ($t = 1.609$, $p > .05$), indicating that the female bias in repeat visits

among the Mukogodo could not be the result simply of a tendency for the dispensary staff to ask parents to bring daughters back more often than sons.

Figure 10 shows the female proportion of participants in a Catholic clinic for underweight children, broken down by ethnic group. The clinic is held once a month at each of ten locations throughout Mukogodo Division. Enrollment is open to mothers with babies under normal weight. Because almost all mothers in Mukogodo Division have babies that are technically under normal weight, regardless of the baby's sex, a female bias in enrollment would not indicate that female babies are more often eligible for the program. Every child in the program must be vaccinated. The Catholics encourage mothers to enroll their babies in the program as soon after birth as possible, but in fact their records show that mothers wait until their children are at least six months old to do so. Each mother must pay 22 shillings per visit (about \$1.38 in 1986). The Catholics occasionally waive the fee for people they consider unable to pay. Mothers receive six kilos of bulghur wheat, three kilos of corn soya milk, and one kilo of cooking oil. Nurses and other staff members give lessons on child care and disease prevention, and each baby is weighed. For most mothers, it takes about a whole day to attend the clinic. In terms of both time and money, taking one's child to the clinic is a significant investment.

There is a female bias in both Mukogodo and non-Mukogodo⁴ clinic enrollment, although in neither case is the bias statistically significant when compared to the female proportion of the 0-4 age group (Mukogodo: chi-square = 0.5165, $p > .25$; non-Mukogodo: chi-square = 0.991, $p > .25$). However, not all mothers enrolled in the program actually attend consistently, and, as mentioned above, mothers do not enroll their children until they are at least six months old. If we compare actual monthly attendance during 1986 to the numbers of person-months lived by Mukogodo children in the age group actually enrolled (6 to 59 months) in 1986, the sex bias in the Mukogodo sample is significant (chi-square = 4.441, $p < .05$; or, analyzing monthly attendance as the proportion of total possible attendance per sex, $t = 2.353$, $p < .025$). Sufficiently detailed census data do not exist to conduct similar tests for non-Mukogodo clinic attendance.

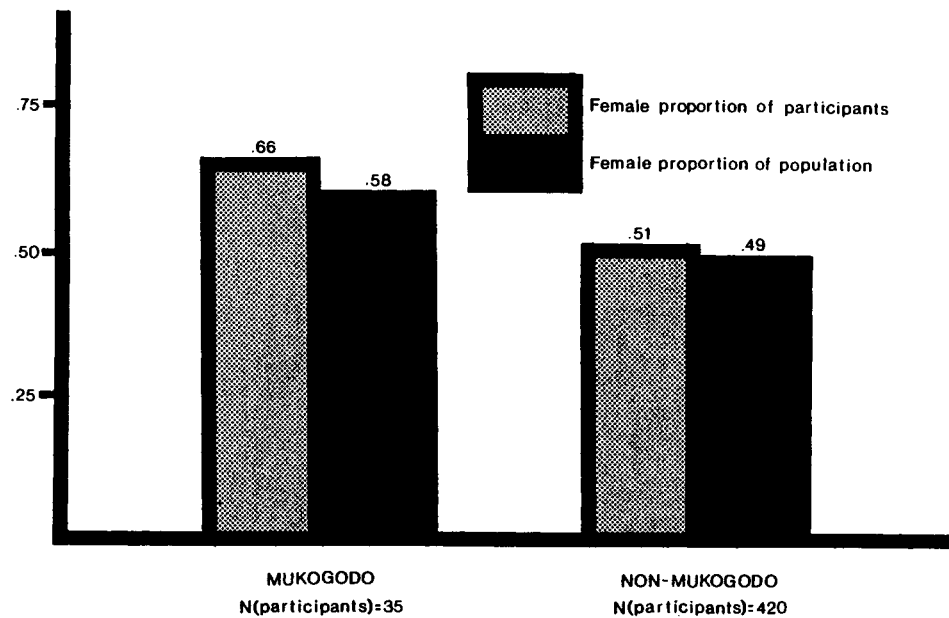


Figure 10
Female proportion of child clinic participants compared to proportion of population, by ethnic group, in 1986.

Mukogodo mothers may also nurse their daughters longer than their sons. In 1986, the oldest child of a mother included in the sample of reproductive history interviews still being nursed was a 31-month-old girl. Forty-one of 49 females (84%) and 24 of 34 males (70%) in the 0–31-month-old age group were being nursed (for the difference between these two proportions, $t = 1.389$; p [one-sided] $< .10$).

Although Mukogodo standards and customs regarding child care differ greatly from our own, we were still able to note a few obvious cases of child neglect, all involving boys. In one case, a mother refused to take her infant son to the Catholic dispensary or clinic, despite the fact that he was made miserable for several months by a chronic eye infection.

In another case, an infant boy was underdeveloped, immature, listless, and easily frightened, while his older sister was bright, healthy, and well fed. We suspected that he was not receiving enough food, and we later learned that the dispensary physician had diagnosed the boy's condition as malnutrition.

In the last case, a boy of about five years had a large, festering wound behind one ear for the entire time we were among the Mukogodo. The reason his parents gave for not taking him to the dispensary was that it cost five shillings, although both his mother and his father had jobs that provided them with a more than normal supply of cash. There is also a free clinic run by the government nearby, although local people avoid it because of the poor quality of the treatment given. Ms. Leech and I bandaged the wound several times, but it never completely healed during our stay. We heard later that eventually one of the Catholic nuns saw the wound, bandaged it, and it finally did heal completely.

Conclusion

Female-biased parental investment among the Mukogodo appears to fit the Trivers-Willard model of sex-biased parental investment. Mukogodo daughters on average have better reproductive prospects than their brothers due to Mukogodo poverty and low status. Mukogodo parents respond to this by favoring daughters and neglecting sons. This pattern might be termed "aggressive neglect" of sons (Dickemann 1975) or "underinvestment" in them (Scrimshaw 1984). If neglect of sons raises male infant mortality, as it probably does in this case, it can also be seen as a form of "passive infanticide" (Scrimshaw 1984).

This study suggests many opportunities for future research. First, the psychological mechanisms behind sex-biased parental investment are open for study. Second, this study is unusual in anthropology in that it can easily be replicated without a wasteful repetition of my fieldwork and without major problems of controlling for cultural variation. The world of Maa-speaking pastoralists extends far beyond Mukogodo, and several other groups in situations very similar to that of the Mukogodo remain virtually unstudied. They include the LeUaso, who live in the extreme western part of Mukogodo and who rival the Mukogodo in poverty; the Suici of the Matthews Range, mentioned in Table 1; and several others. Third and last, the elites of the Maa-speaking world can be studied to see if they show a male bias in parental investment, as the Trivers-Willard model would predict. Until we know more about the sex ratios and parental investment patterns of higher-status Maa-speakers, the conclusion that Mukogodo favoritism toward daughters is a result of their status must remain tentative.

No explanation of any human behavior in terms of evolutionary biology can be taken or should be used as a justification of that behavior. On the contrary, studies like this one may help us to find solutions to many important social and behavioral problems. Child abuse and neglect is just one topic that can be approached in this way.

Notes

Acknowledgments. Beth Leech has helped my research in innumerable ways, in Kenya and at home, but most tangibly in this case by conducting the reproductive history interviews. Katherine Dettwyler, Mildred Dickemann, Malcolm Dow, Sarah Blaffer Hrdy, William Irons, Alice Schlegel,

Brian Shea, and two anonymous reviewers offered helpful comments and encouraged me in my work. I presented some of my findings on Mukogodo sex ratios at a seminar at the Institute of African Studies at the University of Nairobi, and I read an earlier version of this article at the 1988 Evolution and Human Behavior Conference at the University of Michigan. Participants at both events made many useful suggestions. The staff of the Don Dol Roman Catholic mission did us a million favors, including letting us see their records. The staff of the Don Dol livestock office allowed me to see their census records. The University of Cincinnati anthropology department has provided me with logistical support since my return from Kenya. The Population Council, the National Science Foundation, and the Institute for Humane Studies provided financial support for the fieldwork. Most important, the Mukogodo made this study possible and generously cooperated with us during our fieldwork. Thanks to all. Of course, I retain responsibility for any errors.

¹The British tried many times to move the Mumonyot to other parts of Kenya, and it appears that when they were not successful in keeping them out of Mukogodo, they maintained a sort of bureaucratic fiction that the Mumonyot were not there by referring to the Mumonyot and Mukogodo together as the Mukogodo.

²Group ranches are supposed to maintain a common herd, quotas on allowable individual holdings, and control over grazing lands, but in fact none of the Mukogodo Division group ranches functions as planned. Everyone maintains an individual or family herd.

³The privacy of dispensary and clinic visitors was assured by their custom of having a variety of personal names and nicknames. We knew most people by one name, usually a Maasai one, while most used another name in their dealings with the mission, often a "Christian" (i.e., English) one. Family and lineage names, however, are used consistently, and it was easy to classify people by ethnic group.

⁴One of the ten clinics is attended primarily by people of the LeUaso ethnic group, who live in the extreme western part of Mukogodo Division. Because the Mukogodo have almost no contact or interaction with the LeUaso, the latter are not included in the data presented in Figure 10.

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