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Wealth, Status, and Reproductive Success among the Mukogodo of Kenya

The evolutionary biological hypothesis that culturally defined values and goals are proximate means of enhancing reproductive success is tested on data from the Mukogodo, a small group of Maa-speaking pastoralists in north-central Kenya who value the accumulation of livestock. The results support the prediction that, at least among males, livestock wealth should correlate with reproductive success. This correlation appears to be due mainly to greater polygyny among wealthier men. Lower age at first marriage among wealthier men may also contribute to the correlation between livestock wealth and reproductive success. The association between livestock wealth and reproductive success does not appear to be due to the productivity of wives and children, to bridewealths obtained when daughters marry, or to the effects of wealth on the reproductive success of men's wives.

WILLIAM IRONS HAS HYPOTHESIZED THAT "in most human societies cultural success consists in accomplishing those things which make biological success . . . probable," and that therefore success in achieving culturally defined goals should tend to correlate with reproductive success (Irons 1979:258). Such correlations have been documented among many different groups, including the Yomut Turkmen of Iran (Irons 1976, 1979), the Hausa of Nigeria (Barkow 1977), the Yanomamo of Venezuela and Brazil (Chagnon 1979, 1988), Mormons (Faux and Miller 1984; Mealey 1985), wealthy Americans (Essock-Vitale 1984), Micronesian islanders (Turke and Betzig 1985), the Ache of Paraguay (Kaplan and K. Hill 1985; see also Minnegal and Dwyer 1986 and Kaplan and K. Hill 1986), Trinidadian villagers (Flinn 1986), the people of 18th-century Lancashire (Hughes 1986), and the Kipsigis of Kenya (Borgerhoff Mulder 1987; see also White 1989 and Borgerhoff Mulder 1989). Cross-cultural surveys have also supported the proposition that among males in traditional societies that have not experienced the demographic transition to low fertility and mortality, attainment of culturally defined success tends to correlate with high reproduction among males (J. Hill 1984; Betzig 1986; see also Kaplan 1985 and J. Hill 1985).

This article focuses on the Mukogodo, a small group of Maa-speaking pastoralists in north-central Kenya. In earlier articles on the Mukogodo I have examined culture change as a reproductive strategy (Cronk 1989a) and sex-biased parental investment patterns (Cronk 1989b). The purposes of this article are, first, to use data on the Mukogodo to test Irons's hypothesis about cultural and reproductive success and, second, to explore further the causal links between wealth, status, polygyny, and reproduction. The specific issues to be addressed are (1) whether the Mukogodo show the predicted correlation between wealth, status, and reproductive success, and (2) whether that correlation is attributable to the reproduction-enhancing effects of wealth, to the wealth-enhancing effects of marriage and reproduction, or to some other factor that has positive effects on both wealth and reproduction.

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Ethnographic Background

The Mukogodo live about 65 kilometers north of the peaks of Mt. Kenya (Mukogodo Division, Laikipia District, Rift Valley Province). Until the 1920s and 1930s, the Mukogodo lived in caves, subsisted on wild foods and on honey from both wild and man-made hives, and spoke a unique Cushitic language called Yaaku (Heine 1974). They circumcised their sons, and from at least the middle of the 19th century they followed the age-set system of their various Maa-speaking neighbors, such as the Maasai, Samburu, and a few other culturally similar groups. The Mukogodo married mostly among themselves, and the usual bridewealth was a few beehives made from hollowed logs. The people were organized into four clans and thirteen exogamous patrilineages. Each lineage had its own territory for hunting, trapping, gathering, and the placement of beehives. Postmarital residence was and still is usually virilocal.

Early in the 20th century, the Mukogodo came increasingly into contact with several groups of Maa-speaking pastoralists, many of whom were being pushed northward by British appropriation of Kenya's central highlands for European settlement. The Mukogodo began to acquire livestock from their new neighbors, mainly in the form of bridewealth payments. Livestock rapidly replaced beehives as the usual form of bridewealth, even in marriages involving only Mukogodo. As their herds grew, Mukogodo began to build Maasai-style houses because the caves were awkward places for cattle and often far from good pasture. By about 1936, all but a handful of people had moved out of the caves, and the Mukogodo had begun to depend primarily on their herds for subsistence. They soon dropped their old Yaaku language in favor of the completely unrelated Maa language, and they adopted most of the material culture, ceremonies, and religious beliefs of Maa-speaking pastoralists. To casual observers, the Mukogodo of today are indistinguishable from their Maa-speaking neighbors. However, the Mukogodo are generally much poorer than their neighbors and form the bottom level of a regional socioeconomic hierarchy (for more on the current status of the Mukogodo, see Cronk 1989b and 1990).

The Mukogodo area has continued to change with the development of the local economy and the expansion of government services and local religious missions. Formal education is still new to the area, and only the youngest men interviewed in the livestock census sample have spent any time in school. Local opportunities for wage employment are very limited, but nowadays it is common for men to spend a few months to a few years working in Kenyan cities and on large commercial farms and ranches outside the Mukogodo area. Many men save their wages for bridewealth payments, and remittances from working family members are also important sources of support for a few Mukogodo families.

Data Collection

My coworker Beth Leech and I conducted fieldwork among the Mukogodo between December 1985 and January 1987. Maa was our principal fieldwork language. To examine the correlation between livestock wealth and reproductive success we conducted complete censuses of the Mukogodo and their livestock.[1] The livestock census included all men over 20 years of age, even those who owned no livestock. Additional demographic data were obtained by Beth Leech in reproductive-history interviews with 142 Mukogodo women and by the author in genealogical interviews with elder males from each lineage. We were able to meet nearly all of the 800 Mukogodo living in their traditional area, and we made regular visits about every six weeks to about half of the population for the purposes of a time allocation study. To control for possible confounding variables we also collected data on men's educational levels and histories of wage employment.

In order to make comparisons between numbers of cattle, sheep, and goats, I have followed a procedure used in an International Livestock Center for Africa study of herd structures among the Maasai of southern Kenya to convert data on livestock wealth to the common currency of livestock units. One livestock unit is defined as equivalent to 250

kg, with one head of cattle defined as 0.71 livestock units and one sheep or goat defined as 0.17 livestock units (Evangelou 1984:183; Grandin 1988:4).

Wealth, Status, and Reproductive Success

All Maa-speaking pastoralists value the accumulation of livestock, and the Mukogodo are no exception. A man's prestige depends greatly on the size of his livestock herd. Livestock are important among Maa-speakers not only for their economic value, but also for their many social uses, including bridewealth payments and livestock sharing and lending arrangements, and for their use in a variety of important rituals (Jacobs 1965:159–165).

Although all types of livestock are valued, cattle are more important than small stock for status and prestige, and wealthier Maa-speaking pastoralists tend to keep larger proportions of their herds in cattle than do poorer Maa-speakers like the Mukogodo (see Spencer 1984; Grandin 1988; Herren 1988a, 1988b). Paul Spencer's Samburu informants told him flatly that "A man who has cattle is important" (Spencer 1965:3). Small stock are considered less appropriate than cattle for noncommercial exchanges, loans, and gifts, which are very important economically and socially to Maa-speaking pastoralists (Spencer 1984:65). Because small stock multiply more quickly than cattle, they make it easy for stock borrowers to cheat by failing to tell an animal's owner of the birth of a kid or lamb. Because small stock are less individualized, shorter-lived, and less individually valuable than cattle, they are also less appropriate for bridewealth payments, which are intended to cement long-lasting relationships between affines.

Elsewhere I have shown that among the Mukogodo and their neighbors there is a general association between livestock wealth and polygyny rates (Cronk 1989b, 1990). The Mukogodo are poorer than their neighbors on average, and they are also of lower ethnic status because of their history of hunting, which Maa-speaking pastoralists associate with the uncivilized existence of wild animals. As a result of their poverty and low status, the Mukogodo are able to acquire fewer wives than their neighbors. If polygyny rates correlate with male reproductive success, these findings by themselves lend support to the proposition that wealth and reproductive success correlate among Maa-speaking pastoralists.

When we restrict ourselves to the Mukogodo alone, livestock wealth and male reproductive success still correlate (Table 1). Because age correlates positively with both wealth and reproductive success, its effects have been controlled for first by breaking the sample down into age sets and second by presenting a partial correlation between wealth and reproductive success for the entire sample, controlling for the effects of age. Almost all of the correlations presented in Table 1 are both substantial and statistically significant.

Although the range of variation among most Mukogodo men in terms of both livestock wealth and reproductive success is fairly limited, one man, the government-appointed chief, is extreme in both respects. Thanks largely to his position, the chief has been able to accumulate a great deal of livestock, several wives, and many children at an early age. Because his data point lies far outside those of the rest of the men in the livestock census, his inclusion in the analysis may distort the statistics by causing an overestimation of the correlation between livestock wealth and reproductive success. Table 1, therefore, includes correlations between livestock wealth and reproductive success for both the entire sample and for the sample with the chief excluded. The chief's age set, Kimaniki, is broken down in the same way. The chief's removal lowers the correlations between wealth and reproductive success, but only slightly.

Because of the greater acceptability of cattle compared to small stock for bridewealth and other important social transactions, one's status is determined not only by simple herd size but also by the composition of one's herd. A further prediction, then, is that there should be a slightly higher correlation between reproductive success and number

Table 1
Correlations between livestock wealth and reproductive success. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Age set (approximate dates of circumcision)	All known births	Offspring surviving to age 15 or to present
Tiyeki, $N = 14$ (1918–32)	.668[b]	.673[c]
Mekuri, $N = 14$ (1933–45)	.140	.259
Kimaniki, $N = 22$ (1946–60)	.693[e]	.708[e]
Kimaniki,[a] $N = 21$ (1946–60)	.480[b]	.499[b]
Kishille, $N = 39$ (1961–73)	.326[b]	.345[b]
Kiroro, $N = 54$ (1974–85)	.411[d]	.430[d]
All, $N = 143$	.561[e]	.582[e]
All,[a] $N = 142$	.391[e]	.427[e]

[a]Excluding the chief.
[b]$p < .05$.
[c]$p < .01$.
[d]$p < .005$.
[e]$p < .001$.

of cattle than between reproductive success and either number of small stock or total number of livestock units. Table 2 shows that this prediction is also fulfilled.

Mechanisms Underlying the Correlation between Livestock Wealth and Reproductive Success

The possible mechanisms responsible for the observed correlation between livestock wealth and reproductive success among Mukogodo males fall into four categories (Figure 1). First, a confounding variable, such as age, education, or wage employment, could enhance both wealth and reproductive success, creating a spurious correlation between them. Second, a correlation could exist between wealth, access to medical care, and offspring survivorship. Third, reproductive success could enhance wealth. Fourth, wealth could enhance reproductive success.

If age, education, or wage employment is causing a spurious correlation between wealth and reproductive success, this would cast doubt on Irons's (1979) hypothesis, since age cannot be considered a culturally defined goal and since the Mukogodo do not much value either education or employment. Doubt would also be cast on Irons's hypothesis if wealth is found to enhance reproductive success through access to modern medical care, since this would indicate that the correlation between wealth and reproductive success is a result of a recent and exogenous change. If reproductive success is found to enhance wealth, this could lend support to an argument made by White and Burton (1988) and White (1989) that the labor provided by polygynously married women may enhance their households' wealth. If livestock wealth is found to enhance reproductive success, this would support the hypothesis that the culturally defined and valued goal of livestock accumulation is proximate to the ultimate goal of reproduction (Irons 1979).

Table 2
Correlations between cattle and small-stock wealth and reproductive success. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Age set (approximate dates of circumcision)	Cattle		Small stock	
	All known births	Offspring surviving to age 15 or to present	All known births	Offspring surviving to age 15 or to present
Tiyeki, $N = 14$ (1918–32)	.607[b]	.599[b]	.623[b]	.675[c]
Mekuri, $N = 14$ (1933–45)	.167	.287	.075	.158
Kimaniki, $N = 22$ (1946–60)	.702[c]	.711[c]	.623[d]	.647[d]
Kimaniki,[a] $N = 21$	.616[d]	.612[d]	.332	.364
Kishille, $N = 39$ (1961–73)	.314*T*	.349[b]	.288*T*	.286*T*
Kiroro, $N = 54$ (1974–85)	.441[d]	.458[c]	.314[b]	.329[b]
All, $N = 143$	.573[e]	.592[c]	.454[e]	.473[e]
All,[a] $N = 142$	.408[e]	.446[c]	.286[d]	.312[e]

[a]Excluding the chief.
[b]$p < .05$.
[c]$p < .01$.
[d]$p < .005$.
[e]$p < .001$.
T $0.05 < p < 0.10$.

The results that follow support the hypothesis that wealth enhances reproductive success among the Mukogodo. The correlation between wealth and reproductive success appears to be due mainly to greater polygyny among wealthier men. Lower age at first marriage among wealthier men may also contribute to the correlation. The correlation does not appear to be due to the productivity of wives and children, to bridewealths obtained when daughters marry, to the effects of wealth on the reproductive success of men's wives, or to differential access to modern medical care. The effects of age have already been controlled for. Education does not positively correlate with either wealth or reproductive success, and there is no correlation between wealth and wage employment.

Confounding Variables

Age. Age has already been factored out as a cause of the correlation between wealth and reproductive success, both by dividing the sample into age sets and by running partial correlations, controlling for age, between the two variables.

Education. Education could create a spurious correlation between livestock wealth and reproductive success if it has positive effects on both, but the available data show no such effects. Education could enhance men's livestock wealth if, for example, better-educated men are better able and more likely to travel farther within Kenya in search of good deals at livestock auctions, or if they are able to earn more money with which to pay for livestock. Education could also enhance reproductive success if it, for example, makes men more attractive as potential husbands and sons-in-law, or if it increases access to purchased foods, medical care, or government benefits.

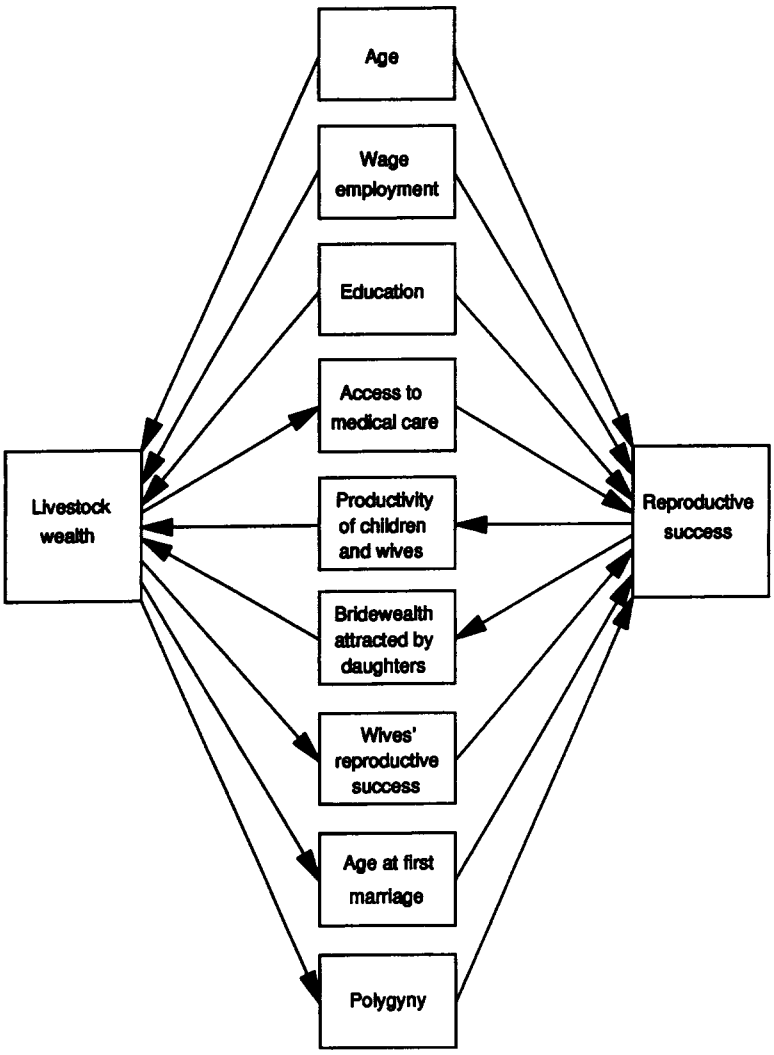

Figure 1
Possible mechanisms underlying the correlation between livestock wealth and reproductive success.

The available data reveal no links either between education and wealth or between education and reproductive success. Detailed information on numbers of years of formal education is available for a subsample of 57 of the 143 men in the livestock census. There is no significant correlation between livestock wealth and years of education, whether or not age is controlled (Pearson's $r = 0.125, p = 0.352$; partial correlation [controlling for age] $= -0.083, p = 0.544$). Thus, it is unlikely that the observed correlation between livestock wealth and reproductive success is due to formal education. Furthermore, there is no significant correlation between education and reproductive success, no matter whether livestock wealth, age, both livestock wealth and age, or neither livestock wealth nor age are controlled.

Wage Employment. The extent of wage employment varies only slightly among the men in the sample, and it does not appear to be the cause of the correlation between wealth

and reproductive success. Almost every man in the livestock census has spent at least a year or two working, but rarely any more than that. Detailed data on years and types of wage employment are available for a subsample of 55 of the 143 men in the livestock census. In this subsample, there is a slight but insignificant negative correlation between livestock wealth and years of employment (Pearson's $r = -0.100$, $p = 0.466$; partial correlation [controlling for age] $= -0.128$, $p = 0.356$]. This negative correlation may be explained by the fact that jobs are often a last-resort solution to hardship for a man with little or no livestock. However, this proposition cannot be definitively tested because men who have moved permanently away from Mukogodo in order to work full-time are not included in the livestock census. Because there is no correlation between wage employment and livestock wealth, it is unlikely that the observed correlation between livestock wealth and reproductive success is due to wage employment.

Access to Health Care

Because medical care is not expensive in the Mukogodo area, it is unlikely that the correlation between wealth and reproductive success is the result of greater access to modern medicines on the part of wealthier Mukogodo. There are two clinics available to the Mukogodo, a free one run by the government, and one that charges a nominal fee run by Catholic missionaries. Although many people avoid the free government clinic because of its bad reputation, the Catholics often waive their fee, which in 1986 was equivalent to about $0.31, for people considered too poor to pay, so a correlation between wealth and access to medical care is unlikely.

Possible Effects of Reproductive Success on Livestock Wealth

If it were shown that reproductive success enhances wealth, then it would be difficult to accept exclusively the reverse hypothesis that wealth enhances reproductive success. The argument that reproductive and marital success could enhance wealth accumulation has been discussed by anthropologists for many years, with mixed findings in cross-cultural tests and controlled comparisons (Boserup 1970; Burton and Reitz 1981; Dorjahn 1959; Ember 1984; Goldschmidt and Kunkel 1971; Goody 1973, 1976; Grossbard 1976, 1980, 1984; Heath 1958; Lee 1979; Osmond 1965). This idea was put forward most recently and forcefully by White and Burton, who found a significant correlation between female contributions to agriculture and the incidence of polygyny in a worldwide sample of 142 societies, indicating that polygyny is more likely to occur where females make large contributions to subsistence (White and Burton 1988; see also White 1989).

Reproductive and marital success could enhance wealth in at least two ways among the Mukogodo. First, the labor of men's children and wives could enable men to have larger herds (cf. White and Burton 1988 and White 1989). Second, having many daughters could enhance a man's wealth because of the bridewealths he would obtain when they marry.

Productivity of Children and Wives. The hypothesis that the productivity of children and wives causes the correlation between wealth and reproductive success has been explored among the Kipsigis of western Kenya by Borgerhoff Mulder (1987, 1989). White (1989) suggested that she could control for the possible labor contributions of multiple wives and children by looking at a sample of Kipsigis men in the youngest age cohorts who have only been monogamously married. Borgerhoff Mulder (1989) found that even in such a limited sample the correlation between wealth and reproductive success persisted, indicating that the correlation among the Kipsigis between wealth and reproductive success could not be the result solely of the productivity of wives and children.

The same correlation between wealth and reproductive success also persists among a subsample of 20 Mukogodo men who have only been married monogamously and who have never had any children over age five. The Pearson correlation between livestock wealth and all known births in this sample is 0.432 ($0.05 < p < 0.10$), and that between

surviving offspring and livestock wealth is 0.487 ($p < 0.05$). This suggests that, as among the Kipsigis, the general correlation observed among the Mukogodo between wealth and reproductive success could not be due solely to the productivity of men's wives and children.

Bridewealths Attracted by Daughters. Bridewealth payments received at the marriages of daughters are another possible route whereby a man's reproductive success could enhance his wealth. However, observed correlations among these variables indicate that this is unlikely. With the chief included in the sample, the partial correlation between men's numbers of married daughters and their livestock wealth, controlling for age, is only 0.087 ($p = .305$, $N = 143$). With the chief—a wealthy man with many children but no married daughters—excluded, the correlation rises to 0.198, but men's ages and their numbers of married daughters together still explain only about 3% of the variation in livestock wealth ($p = .019$, $N = 142$). Given such slight correlations, it is unlikely that bridewealth payments brought in by the marriages of daughters could be responsible for the observed correlation between livestock wealth and reproductive success.

Possible Effects of Livestock Wealth on Reproductive Success

Livestock wealth may have positive effects on reproductive success in at least three ways. First, the added food provided by larger livestock herds may increase the reproductive success of men's wives. This could come about through an increase in infant and child survivorship or through an increase in the frequency of births due either to a reduction in nutritional amenorrhea or to earlier weaning and a decrease in lactational amenorrhea. Second, livestock wealth might enable men to pay bridewealth and to marry sooner than they otherwise would, giving them longer reproductive lifespans. Third, because men must pay livestock to marry and to support families, livestock wealth might enable men to have more wives. Confirmation of any of these possibilities would support the hypothesis that livestock accumulation is a goal proximate to the ultimate goal of reproductive success among Mukogodo males. The primary cause of the correlation between livestock wealth and reproductive success appears to be polygyny, and age at first marriage may also contribute.

Wives' Reproductive Success. A small proportion of the correlation between men's livestock wealth and their reproductive success may be explained by the correlation between their wealth and their wives' reproductive success. Because the Mukogodo are very reluctant to discuss the deaths of infants and children, the data available on child mortality are not detailed enough to examine offspring survivorship and birth frequency separately. Instead, the effects of wealth on female reproductive success in general were explored, without any speculation about the mechanisms that might be at work. Because of the problem of herd sharing among cowives, a sample of women who have only been monogamously married was examined. The partial correlation between livestock wealth and number of children surviving to present or to age 15 in this sample, controlling for age, is 0.149 ($p = 0.003$, $N = 56$). Although this suggests that livestock wealth may have a slight positive effect on female reproductive success, the proportion of variation in female reproductive success explained by livestock wealth is so small that this factor could not be the main cause of the correlation between livestock wealth and male reproductive success.

Age at First Marriage. Because a substantial bridewealth payment in livestock is required for marriage, livestock wealth might make it possible for men to marry sooner than they otherwise would. If this is true, men's ages at first marriage should correlate negatively both with livestock wealth and with reproductive success.

Table 3 shows correlations between livestock wealth and age at first marriage. Age is controlled because it is likely to correlate positively with both livestock wealth and age at first marriage: older men have had more of a chance both to accumulate livestock and to

Table 3
Correlations between livestock wealth and age at first marriage. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Tiyeki, $N = 11$ (1918–32)	$-0.550T$
Mekuri, $N = 13$ (1933–45)	-0.306
Kimaniki, $N = 21$ (1946–60)	-0.450^b
Kimaniki,[a] $N = 20$ (1946–60)	-0.525^b
Kishille, $N = 31$ (1961–73)	-0.228
Kiroro, $N = 19$ (1974–85)	-0.113
All, $N = 95$	-0.307^c
All,[a] $N = 94$	-0.333^c

[a]Excluding the chief.
[b]$p < .05$.
[c]$p < .005$.
$T 0.05 < p < 0.10$.

marry at greater ages than younger men. If age were not controlled, its positive effects on both livestock wealth and age at first marriage would reduce the apparent negative correlation between them, creating a deceptive picture of the effect of livestock wealth in reducing age at first marriage. Although the correlations in the whole sample and in the three oldest age sets are considerable, they reach conventional levels of statistical significance in only the whole sample and the Kimaniki age set. Table 4 shows correlations between age at first marriage and reproductive success. In the sample as a whole and in two of the age sets, the correlations are both sizable and statistically significant. Age at first marriage may have a moderate association with livestock wealth and an appreciable although not overwhelming effect on male reproductive success. However, the overall link between age at first marriage, livestock wealth, and reproductive success is neither consistent enough nor strong enough to account by itself for the association between livestock wealth and male reproductive success.

Polygyny. Differential marital success appears to be the best explanation of the correlation between livestock wealth and reproductive success among the Mukogodo. Men's total numbers of wives show a strong and significant correlation with the sizes of their herds (Table 5). Polygyny, in turn, is a major determinant of men's reproductive success (Table 6). The strength of these correlations, along with the failure of all of the other possible mechanisms to explain the correlation between wealth and reproductive success, suggests that the reproductive success of Mukogodo men increases with livestock wealth primarily because wealth enables men to be more polygynous.

Conclusions

Livestock wealth and reproductive success correlate among Mukogodo men. This correlation appears to be attributable mainly to greater polygyny among wealthier men. Lower age at first marriage among wealthier men may also contribute to the correlation. The correlation does not appear to be due to the productivity of wives and children, to bridewealths obtained when daughters marry, or to the effects of livestock wealth on the

Table 4

Correlations between age at first marriage and reproductive success. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Age set (approximate dates of circumcision)	All known births	Offspring surviving to age 15 or to present
Tiyeki, $N = 11$ (1918–32)	−0.460	−0.481
Mekuri, $N = 13$ (1933–45)	−0.505T	−0.344
Kimaniki, $N = 21$ (1946–60)	−0.680[b]	.−0.696[c]
Kimaniki,[a] $N = 20$ (1946–60)	−0.670[b]	−0.694[b]
Kishille, $N = 31$ (1961–73)	−0.686[c]	−0.683[c]
Kiroro, $N = 19$ (1974–85)	−0.282	−0.292
All, $N = 143$	−0.499[c]	−0.507[c]
All,[a] $N = 142$	−0.507[c]	−0.515[c]

[a]Excluding the chief.
[b]$p < .005$.
[c]$p < .001$.
T $0.05 < p < 0.10$.

Table 5

Correlations between livestock wealth and total number of wives. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Tiyeki, $N = 14$ (1918–32)	.568[b]
Mekuri, $N = 14$ (1933–45)	.072
Kimaniki, $N = 22$ (1946–60)	.476[b]
Kimaniki,[a] $N = 21$ (1946–60)	.309
Kishille, $N = 39$ (1961–73)	.384[b]
Kiroro, $N = 54$ (1974–85)	.261T
All, $N = 143$	.405[c]
All,[a] $N = 142$	.363[c]

[a]Excluding the chief.
[b]$p < .05$.
[c]$p < .001$.
T $0.05 < p < 0.10$.

Table 6
Correlations between total number of wives and reproductive success. Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

Age set (approximate dates of circumcision)	All known births	Offspring surviving to age 15 or to present
Tiyeki, $N = 14$ (1918–32)	.698[b]	.698[b]
Mekuri, $N = 14$ (1933–45)	.360	.211
Kimaniki, $N = 22$ (1946–60)	.788[c]	.767[c]
Kimaniki,[a] $N = 21$ (1946–60)	.748[c]	.721[c]
Kishille, $N = 39$ (1961–73)	.751[c]	.779[c]
Kiroro, $N = 54$ (1974–85)	.832[c]	.841[c]
All, $N = 143$	.638[c]	.636[c]
All,[a] $N = 142$	.618[c]	.615[c]

[a]Excluding the chief.
[b]$p < .01$.
[c]$p < .001$.

reproductive success of men's wives. Education does not correlate positively with either livestock wealth or reproductive success, and there is no correlation between livestock wealth and wage employment.

A determination of exactly what proportions of the variation in lifetime reproductive success among Mukogodo men are attributable to each of these factors, along with other variables such as male lifespan, wives' fertility, and offspring survivorship (see Brown 1988; Borgerhoff Mulder 1987, 1988), will have to wait until more data are available on lifetime reproductive success for more Mukogodo men and women. The current sample of people who are old enough to be considered to have completed their reproductive careers is simply too small for such an analysis to have meaningful results. Although dead people could be added to the sample, this would require combining people whose reproductive careers occurred mostly during the foraging period of Mukogodo history with those who have been reproductively active mainly after the transition to pastoralism. The two periods are too different for such a combination to be advisable.

Interpretation of these findings would be further complicated if there were strong interaction effects between the two most important intermediate variables, age at first marriage and polygyny. One might expect these variables to correlate highly, since men who marry young have more opportunity to become polygynous than men who marry at older ages. One way to tease apart the effects of these two variables is to examine the correlation between polygyny and reproductive success, while controlling for age at first marriage, as shown in Table 7. Comparison of these correlations among ever-married men with those given in Table 6 for all men included in the livestock census would be misleading since the larger sample includes men who have never married, and who therefore have no age at first marriage. For that reason, Table 7 also shows correlations between wealth and reproductive success, without controlling for age at first marriage, for this more limited subsample of ever-married men. Because the correlations between polygyny and re-

Table 7
Correlations between polygyny and reproductive success for a sample of 95 ever-married men, both controlling for and not controlling for age at first marriage.

	Not controlling for age at first marriage[a]		Controlling for age at first marriage[b]	
Age set (approximate dates of circumcision)	All known births	Offspring surviving to age 15 or to present	All known births	Offspring surviving to age 15 or to present
Tiyeki, $N = 11$ (1918–32)	.461	.486	.409	.437
Mekuri, $N = 13$ (1933–45)	.292	.145	.238	.090
Kimaniki, $N = 21$ (1946–60)	.775[g]	.749[g]	.783[g]	.752[g]
Kimaniki,[c] $N = 20$	.721[g]	.685[f]	.757[g]	.720[f]
Kishille, $N = 31$ (1961–73)	.593[g]	.634[g]	.517[f]	.576[f]
Kiroro, $N = 19$ (1974–85)	.476[d]	.565[d]	.536[d]	.633[e]
All, $N = 143$	.572[g]	.567[g]	.516[g]	.511[g]
All,[c] $N = 142$	.516[g]	.511[g]	.459[g]	.453[g]

[a]Pearson correlations are given for each age set, and partial correlations, controlling for age, are given for the entire sample.

[b]Partial correlations, controlling for age at first marriage, are given for each age set, and partial correlations, controlling for both age at first marriage and current age, are given for the entire sample.

[c]Excluding the chief.

[d]$p < .05$.

[e]$p < .01$.

[f]$p < .005$.

[g]$p < .001$.

productive success are reduced only slightly by controlling for age at first marriage, the interaction effects between age at first marriage and polygyny do not appear to be very strong.

One possible objection to this analysis is that because herd sizes vary over time, current livestock wealth may not be a reliable indicator of relative wealth over significant portions of the people's reproductive lifetimes. This is a valid criticism, and there is no way to control completely for it. On the other hand, it is very unlikely that the correlations seen in this sample between wealth and reproductive success, between wealth and polygyny, and between polygyny and reproductive success would be as strong and as statistically significant if the hypothesis had no validity. Furthermore, these results fit the general pattern among Maa-speaking pastoralists of wealthy men being more polygynous and more reproductively successful than poor men, and they therefore seem reasonable and reliable. The only way to control completely for variations in herd size over time is to continue to study the Mukogodo over the next few decades.

Discussion

In specific terms, these results indicate that livestock accumulation, in addition to being an important economic and social goal, can also be considered a reproductive strategy for Mukogodo men. More generally, these findings support Irons's (1979) hypothesis

that culturally defined values are goals proximate to the ultimate goal of reproductive success. The alternative hypothesis that wealth and reproductive success correlate because of the productivity of children and wives (White and Burton 1988; White 1989) is not supported by these data.

This study suggests several possibilities for further research. For example, the Mukogodo economic situation is changing rapidly, and one might expect their reproductive strategies to change accordingly, as they did earlier in this century when the Mukogodo shifted from hunting and gathering to pastoralism. Although it was shown above that wage employment does not correlate strongly with livestock wealth, correlations between wage employment and reproductive success (Table 8) suggest that wage employment may be developing into an alternative strategy for Mukogodo men, enabling some of them to accumulate bridewealth and to support families without ever maintaining significant herds. If this correlation persists, then we might expect the prestige associated with wage employment to increase among the Mukogodo, who now consider it an occasional necessity but rarely anything to be especially proud of. Such a study would have to consider variables not examined in this one, such as an increased risk of cuckoldry for men who spend long periods of time away from home.

The details of the connections between livestock wealth and marital success also present interesting opportunities for further research. Do wealthy Mukogodo men have greater reproductive success because they are able to pay more bridewealths or because they are able to support more wives and children? In two similar polygynous bridewealth societies, the Yomut Turkmen of Iran and the Kipsigis of Kenya, Irons (1979) and Borgerhoff Mulder (1987) suspected that wealthy men had enhanced reproductive success primarily because they were able to pay more bridewealths. This is also probably the case among the Mukogodo. The Mukogodo are in general very poor, and livestock are in short supply for almost everyone. Bridewealth payments are expensive and it is not uncommon for men to remain unmarried into old age. An average bridewealth payment of about six cattle and one or two small stock represents almost a third of an average Mukogodo herd, and the cattle portion alone is equivalent to about half of an average Mukogodo cattle herd (see Cronk 1989b and 1990 for more on bridewealth and marriage).

Among wealthier Maa-speakers, where bridewealth is considered a token payment that almost all men can easily afford, the situation may be reversed. A typical bridewealth among the Samburu, for example, amounts to less than a tenth the size of one of their average cattle herds (Spencer 1965:69–70; see also Spencer 1984:62). This would suggest that among such wealthy groups little of the variation in marital success among such men is attributable to differences in abilities to pay bridewealth. Variations in marital success in such wealthy groups would have to be explained in terms of other factors that make

Table 8
Correlations between years of wage employment and reproductive success ($N = 55$).

	All known births	Offspring surviving to age 15 or to present
Simple correlation	.242*T*	.222
Controlling for age only	.190	.166
Controlling for livestock wealth only	.326[a]	.309[a]
Controlling for both age and livestock wealth	.284[a]	.262

[a] $p < .05$.
T $0.05 < p < 0.10$.

some men more attractive as husbands and as in-laws than others. One such factor would be one's ability to provide for an additional wife and her children.

Studies of cultural and reproductive success among other, wealthier Maa-speakers would provide other interesting comparisons with the Mukogodo, without any major problems of controlling for cultural variations. For example, if the ability of men to pay bridewealth is indeed less variable among such wealthier groups than among the Mukogodo, then such groups would present opportunities to examine other possible sources of variability in marital success, such as the numbers of kinsmen and other allies men have. Among all of these groups, the productive and reproductive strategies of females are clearly in need of detailed analysis (Irons 1983; White 1989).

Maa-speakers also present an opportunity to expand the study of cultural and biological success beyond simple material wealth and into other culturally valued characteristics, such as behavioral patterns, personality characteristics, and the reputations of individuals. This approach was pioneered by Barkow (1977; see also Gray 1985:279–281) among the Hausa of Nigeria. Barkow compared the correlations among Muslims and non-Muslims between reproductive success and conformity to an ethos of emotional inhibition and control, which Muslims value more highly than non-Muslims. Maa-speakers have a similar ethos, summed up by the word *nkanyit,* which translates loosely as "respect." People who follow the rules of the age-set system, who act respectfully toward their elders, who do not drink to excess, and who do not show extreme emotions are said to have *nkanyit.* Some groups, mainly the Mukogodo and other poorer Maa-speakers, have reputations for having very little *nkanyit.* If a good method could be devised for ranking individuals in terms of *nkanyit,* an interesting study could be done on the relationship between this value and reproductive success.

Notes

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[1]Among other groups of Maa-speakers, the measurement of male reproductive success is complicated by the custom of wife-sharing among fellow age-set members. The Mukogodo, however, barely pay lip service to this custom, and wife-sharing among them is quite uncommon.

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