# Helping-at-the-Nest and Sex-Biased Parental Investment in a Hungarian Gypsy Population

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Unlike their counterparts elsewhere, Hungarian Gypsies live in small settled communities, some of which form isolated (Gypsy-only) villages while others form part of a larger urban community whose composition is mainly ethnic Hungarian. In contrast to rural Gypsies, those living in urban communities encounter opportunities for exogamy. As a result, although Gypsy communities are traditionally highly endogamous, those in Hungary exhibit varying levels of exogamy, a practice that seems both to favour differential investment in daughters and to yield high fitness returns (measured in terms of numbers of grandchildren) (Bereczkei and Dunbar 1997). Yet despite high levels of endogamy, rural Gypsies nonetheless show a female-biased sex ratio at birth and invest more heavily in daughters much as urban Gypsies do (Bereczkei and Dunbar 1997). That even those populations that experience fewer opportunities for endogamy should show female-biased investment seems anomalous. One possible explanation is that daughters provide a valuable service in that they are more likely than Gypsy boys or ethnic Hungarian girls to help their parents in taking care of siblings.

One of the potentially altruistic social interactions between genetic relatives is that in which older siblings help with the rearing of younger ones (Emlen 1984). Since the production of a full sibling contributes to the individual's reproductive success as much as the production of an offspring, a trade-off is expected to develop which allows individuals to increase their inclusive fitness. One strategy is to invest directly in one's own reproductive effort by having more offspring of one's own; the other is to help parents rear younger siblings (Charnov 1981, Woodroffe and Vincent 1995). The latter is likely to be realized when (*a*) the offspring can provide valuable help in child care and (*b*) parents have opportunities for producing additional children when the older offspring begin helping (Betzig and Turke 1986, Turke 1988). In one of the few studies carried out on humans, Turke (1988) has shown that daughters contributed to their parents' reproductive success on Ifaluk (Micronesia): among women who had completed fertility, those who had borne a daughter first had a larger number of surviving children than those who had borne a son first.

The present study investigates the circumstances under which helping-at-the-nest might be advantageous in a Hungarian Gypsy population. Gypsy girls traditionally help with raising younger children, and their parents expect them to engage in various kinds of duties such as looking after babies, playing with children, and cooking. Gypsy families differ considerably in these respects from the ethnic Hungarians among whom they live; the ethnic Hungarians thus provide a benchmark population against which to evaluate the behaviour of the Gypsies.

The following assumptions and predictions are tested:

*Assumption 1:* Gypsy girls spend more time caring for their younger siblings than Gypsy boys. The difference is not expected to be significant among ethnic Hungarians.

*Assumption 2:* Given the assistance expected by Gypsy mothers from older girls, first-born daughters will remain at home with their parents longer than first-born sons or later-born daughters, even if they have already married.

If these assumptions hold, then the following functional consequences should follow if the helpers-at-the-nest hypothesis is true: Gypsy mothers of daughters who act as helpers should have (1) shorter inter-birth intervals and (2) longer reproductively active life spans (the period between first and last offspring) than mothers of nonhelpers; if (1) and (2) are both true, then it should follow that (3) mothers of helpers will have more children than those having first-born sons, whereas no such differences are expected among ethnic Hungarians.

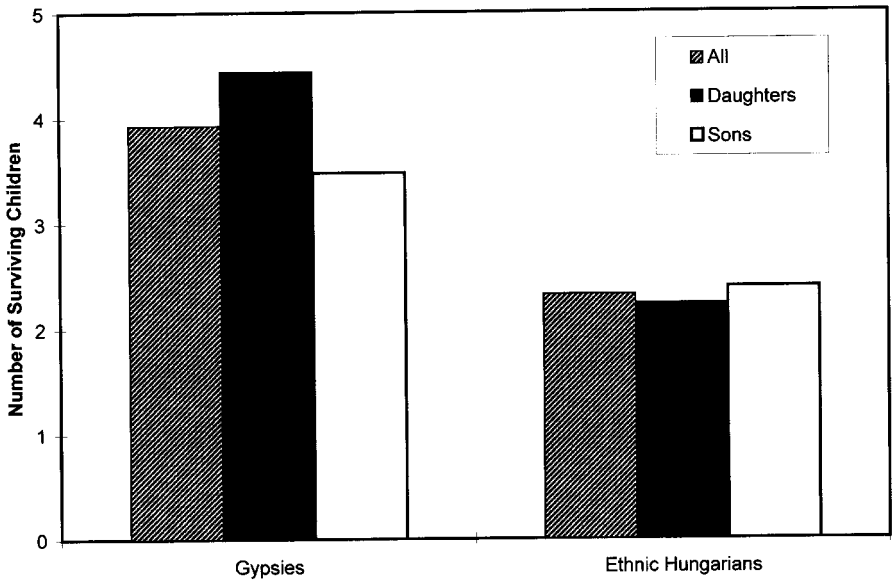


FIG. 1. *Mean lifetime fertility (completed family size) of Gypsy and non-Gypsy mothers as a function of the sex of their first-born offspring.*

## METHODS

The present study involved two rural populations: a Gypsy population living in Gilvanfa and a number of small villages around Gilvanfa (total number of adult female subjects aged above 45 years = 119) and a non-Gypsy (ethnic Hungarian) population living in a predominantly ethnic Hungarian village named Magyarmecske and other small nearby villages, which acted as a control group (total number of adult female subjects aged above 45 years = 137). Gilvanfa and Magyarmecske, which are 5 km apart, are relatively poor areas of Hungary, the inhabitants of both ethnic groups all being victims of recent economic changes. They are located in the same culturally and historically homogeneous county (Baranya) and the same administrative district. There are significant differences between the two populations in education, income, and occupation. More Gypsies than ethnic Hungarians are unemployed, and they are more likely to have completed fewer than eight years of education and to have an annual income lower than the national average (see Bereczkei and Dunbar 1997).

The fieldwork lasted from August 1994 to June 1995. All 256 individuals were interviewed, using a questionnaire with 590 variables covering a full reproductive history (pregnancies, births, stillbirths, deaths, and interbirth intervals) as well as details of the family social and educational circumstances and history. Additionally, the extent of helping behaviour was determined for a sample of 55 Gypsy girls over a total of 56 days and 42 ethnic Hungarian girls over 45 days. Observations were carried out in the subject's home for up to two hours at a time at intervals of three to four days, recording all gross behavioural acts performed by the subject. Since village houses were quite open, observation conditions were excellent. More than 12,000 behavioural acts were recorded. The subject's activity was later coded as one of eight mutually exclusive categories (changing the baby, holding babies, guarding babies and children, playing with children, cooking for children, helping in preparation for school, earning money for siblings, and a general category for all non-child-care behaviours).

Since our interest was in measures of fitness rather than fertility per se, we indexed completed family size as the number of offspring who survived to 12 months of age for females aged 45 and above. Birth-spacing data were analysed by the survival (or cumulative hazard) method (Forthofer and Lee 1995). These data are used to examine the distribution of different lengths of time between two events and to calculate the proportion of cases for which the terminal event has occurred. The hazard function enables us to compare two sets of inter-birth intervals (for women having first-born daughters and those having first-born sons) and to estimate the probabilities of intervals' occurring at different time points.

## RESULTS

The Gypsy women in this sample had had an average of $3.93 \pm 2.56$ live births, compared with $2.32 \pm 1.72$ live-born infants for the ethnic Hungarian women (Mann-Whitney $z = 6.08$; $N[G] = 119$, $N[H] = 137$, $P < 0.001$). Gypsy mothers who bore daughters first had more children than those who bore sons first (fig. 1) (mean number of living offspring at the time of the study 4.44 versus 3.48 offspring, respectively; Mann-Whitney $z = 2.89$,

TABLE 1
*Cumulative Probability of Having a Subsequent Birth as a Function of the Sex of the Firstborn Offspring for Gypsy Women*

| Duration of Interval (months) | Cumulative Probability[a] of a Subsequent Birth | | | | | |
|---|---|---|---|---|---|---|
| | First Birth Interval After | | Second Birth Interval After | | Third Birth Interval After | |
| | A Son | A Daughter | A Son | A Daughter | A Son | A Daughter |
| 12 | 0.13 | 0.25 | 0.11 | 0.36 | 0.29 | 0.07 |
| 24 | 0.50 | 0.73 | 0.19 | 0.54 | 0.35 | 0.36 |
| 36 | 0.65 | 0.86 | 0.44 | 0.68 | 0.58 | 0.71 |
| 48 | 0.83 | 0.89 | 0.52 | 0.79 | 0.76 | 0.86 |
| 60 | 0.87 | 0.97 | 0.63 | 0.82 | 0.83 | 0.93 |
| 72 | 0.91 | 0.99 | 0.73 | 0.86 | 0.91 | 0.97 |
| 84 | 0.98 | 1.00 | 0.82 | 0.93 | 0.98 | 1.00 |

NOTE: Median inter-birth intervals are as follows: first, 38.4 (son), 54.0 (daughter) ($P < 0.05$); second, 38.2 (son), 37.6 (daughter) ($P < 0.05$); third, 40.8 (son), 37.6 (daughter) ($P > 0.05$).
[a]Estimated by the hazard method of Forthofer and Lee (1995).

$N = 64$ and 53, $P = 0.002$). Among the non-Gypsy ethnic Hungarians, the difference between these two groups was not significant (means of 2.23, $N = 61$ versus 2.39, $N = 73$, respectively; Mann-Whitney $z = 0.102$; $P = 0.91$).

Significant differences in birth spacing occur between Gypsy mothers having first-born daughters and those who bore sons first. Table 1 shows the cumulative probability of having a subsequent birth at different points in the birth order as a function of the sex of the first offspring when inter-birth intervals are allowed to vary between 12 and 84 months. Women having first-born daughters ($N = 64$) typically have shorter birth intervals (irrespective of individual offspring's sex) than those having first-born sons ($N = 53$). Nearly three-quarters of the women in the former group gave birth to a second child within two years, compared with half of the women in the latter group. Although the difference between the two groups of mothers is not significant for the third interval, a relatively large cumulative effect can be seen over a life span (fig. 2). Gypsy mothers gave birth to their fourth child 8.63 years after their first-born daughter but 11.09 years after a first-born son (Long Rank Test [see Forthofer and Lee 1995] $z = 2.11$, $P = 0 < 0.05$). Most

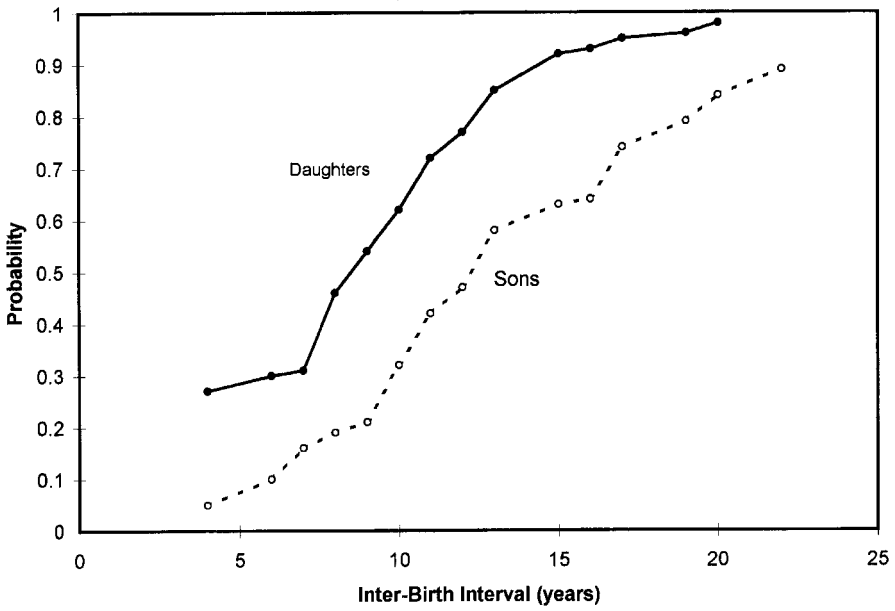


FIG. 2. *Probability of having a subsequent birth (prior to the fourth birth) as a function of sex of the first-born offspring among Gypsy women.*

of this difference can be attributed to shortened inter-birth intervals after each successive birth, not just a shorter inter-birth interval after the first-born daughter. Moreover, this difference occurs despite the fact that Gypsies breast-feed their daughters longer than they do their sons (see Bereczkei and Dunbar 1997).

Among 53 Gypsy women who had sons first, only 12 bore more than four children, whereas 29 of the 64 women having first-born daughters bore five or more surviving children. Put another way, 7.6% of the 184 children in son-first families were born as fifth or subsequent children compared with 16.3% of 286 children in daughter-first families ($\chi^2 = 31.12$, $P < 0.001$). In contrast, there is no difference between the equivalent two groups in the ethnic Hungarian population ($\chi^2 = 2.85$, $P = 0.89$).

These data suggest that females who bore a daughter first continue reproducing to an older age. Indeed, for women over 45 whose first child was a daughter, the age at the birth of the last child was 37.4 compared with 34.2 for women whose first child was a son (Mann-Whitney $z = 5.24$, $N = 64$ and 53 respectively, $P < 0.001$).

During the interviews, 80% of both Gypsy and ethnic Hungarian mothers reported that their oldest girls participated in household duties (comparison between ethnic groups of number of subjects making such a statement: $\chi^2 = 0.795$, $N = 97$, $P < 0.85$). As far as housework (such as cleaning and cooking) is concerned, no significant differences were found between the two communities in a comparison across households for children of approximately the same age. However, striking differences were found in respect of child-care-related activities such as looking after babies, playing with children, and helping in preparation for school. In households where there was at least one younger child to be looked after, 77.9% of the 73 first- and second-born Gypsy girls older than ten years of age were regularly involved in the care of their younger sibling(s) compared with only 51.2% of 46 later-born Gypsy girls ($\chi^2 = 12.54$ corrected for continuity, $P < 0.01$); in contrast, 58.4% of first- and second-born and 39.2% of later-born ethnic Hungarian girls older than ten years of age engaged in these tasks ($\chi^2 = 2.16$ corrected for continuity, $P > 0.05$). Neither of these values is significantly different from that for later-born Gypsy girls, but both are significantly less than the equivalent figure for early-born Gypsy girls.

Table 2 shows the mean proportion of time spent in various helping activities during the observational samples by ethnic Hungarian and Gypsy daughters. First- and second-born Gypsy girls of all ages devoted a significantly higher proportion of their time to child-care activities than later-born girls, and these differences hold up even when only girls older than ten years are considered (overall mean for individual subjects for all child-care categories 39.8% versus 21.8% of activities, respectively; Mann-Whitney test, $z = 3.12$, $P < 0.005$). The differences are highly significant for each helping category. Similar differences have been found between early-born Gypsy daughters and early-born ethnic Hungarian daughters, although they are not significant in three categories (changing the baby, guarding babies and children, helping in preparation for school).

Many of these activities continue even after the girls get married. First-born Gypsy daughters marry on average at 17.5 years of age, but they do not leave home and begin to live separately from their parents until they are on average 19.7 years old (fig. 3). In other words, early-born Gypsy girls stay at home for almost two years after marriage or cohabitation (Mann-Whitney test comparing age at marriage and age at leaving home: $z = 2.75$, $N = 46$, $P < 0.005$), during which time they continue to help their parents raise their younger siblings. For Gypsy sons and ethnic Hungarian sons and daughters, the difference between the age of marriage and the age of separation from parents is reversed and, in each case, also significant (Gypsy sons, $z = 4.18$, $P < 0.001$; ethnic Hungarian daughters, $z = 3.96$, $P < 0.001$; ethnic Hungarian sons, $z = 3.39$, $P < 0.001$). In other words, they typically leave home first and marry afterwards.

## DISCUSSION

We have shown that, in this rural population, (1) early-born Gypsy girls engage in substantial help in housework related to child care of their younger siblings even after their marriage; (2) this assistance both increases the length of the mother's reproductive career and reduces inter-birth intervals for subsequent children; and (3) Gypsy women giving birth to first-born daughters have significantly more children than those giving birth to sons first.

These results raise the question of how female-biased strategies increase inclusive fitness. Natural selection may favour sex biases in parental investment if one sex of offspring enhances the reproductive success of its parents (or siblings) by providing resources (Hamilton 1967). Offspring that provide help to their parents or siblings repay some of the costs of parental investment, and this assistance may reduce the parents' net reproductive cost (Sieff 1990). Although these ideas have only rarely been tested in human societies (Cronk 1989, 1991), there is evidence that offspring can contribute to parents' reproductive costs in a number of different ways. In South Asia, for example, Kanjar females are more economically productive than males and help their brothers to marry. Among the Mundugumor of Papua New Guinea, fathers favour daughters, who are then used to obtain wives for their brothers (Cronk 1991). On the Micronesian island of Ifaluk, daughters are more likely than sons to assist their parents in future reproduction. Women who bear a daughter first have greater reproductive success than those who bear a son first (Turke 1988). However, there is no evidence of female-biased investment among the Ifaluk.

Our data from a rural Gypsy population seem to provide another example of the same phenomenon: having a first-born daughter reduces the mother's costs of rearing her current infant, thus allowing her to transfer the resulting spare time and energy to producing and raising additional children. The female surplus among first-born

TABLE 2
*Child Care Activities Involving Siblings by Girls Older than Ten Years as a Proportion of All Recorded Behavioural Acts*

| | Percentage of Time[a] | | | |
|---|---|---|---|---|
| Activity | Early-Born[b] Gypsy Daughters | Later-Born Gypsy Daughters | Early-Born[b] Ethnic Hungarian Daughters | Later-Born Ethnic Hungarian Daughters |
| Changing the baby | 4.8 | 4.6 | 3.7 | 1.9 |
| Holding babies | 4.7 | 2.1 | 2.8 | 0.9 |
| Guarding babies and children | 7.1 | 3.4 | 5.2 | 2.8 |
| Playing with children | 8.3 | 4.7 | 3.9 | 2.1 |
| Cooking for children | 5.6 | 2.3 | 2.1 | 0.8 |
| Helping in preparation for school | 5.2 | 2.6 | 5.8 | 1.3 |
| Earning money for siblings | 4.1 | 2.1 | 1.0 | 0.1 |

[a]Overall mean of values for individual subjects.
[b]First- and second-born.

offspring and the female-biased child-care patterns observed in this rural Gypsy population may therefore be intended to increase the number of children rather than to produce a Trivers-Willard (1973) effect (which may be a strategy more characteristic of urban Gypsy populations).

A female-biased sex ratio thus seems to be associated with two kinds of parental strategies among the Gypsies. In an urban environment, given relatively scarce and unpredictable resources and the opportunity for hypergamy into the sympatric wealthier ethnic Hungarian population, Gypsy girls, rather than sons, are favoured by their parents because, in contrast to sons, they have the opportunity of "marrying up" into the ethnic Hungarian population. In terms of breast-feeding and education, these Gypsy parents therefore invest more heavily in their daughters (Bereczkei and Dunbar 1997). In the more endogamous rural environment, in contrast, there are no large local status and wealth differentials (Gypsies and ethnic Hungarians live in separate villages), and thus there is no real chance of marrying up. Instead, early-born Gypsy girls are expected to engage in helping activities related to child care that reduce the mother's burden from parental duties. Among rural Gypsies, therefore, older girls enhance the resource base of their younger siblings. These results thus suggest that the

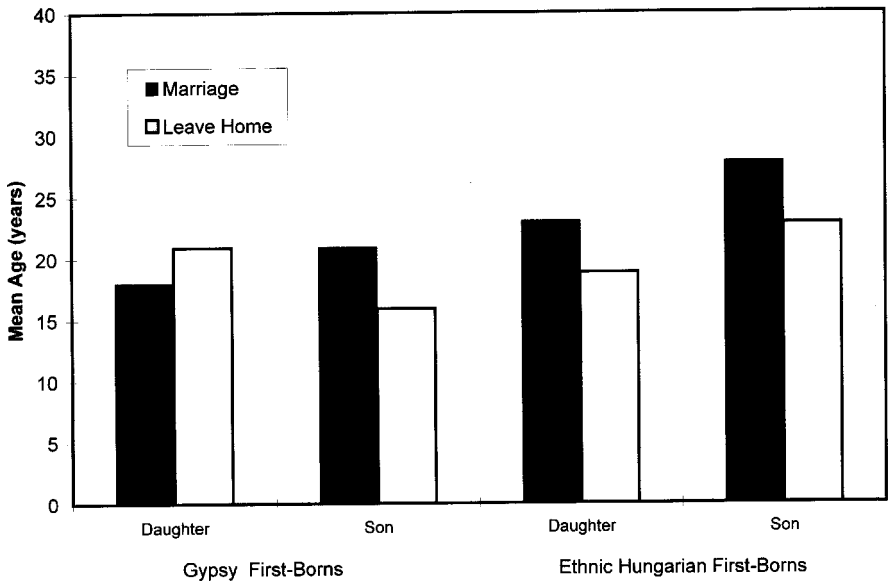


FIG. 3. *Mean age of marriage and mean age of leaving home for Gypsy and non-Gypsy children.*

choices that individuals make are highly contingent on circumstances.

One common counterargument against the helping-at-the-nest model is that people prefer sons and therefore produce as many children as necessary to obtain a son. Hence, having had a daughter first, they are more likely to continue reproduction for longer in order to be sure of getting a son. This argument is difficult to refute on demographic data alone. However, our results suggest that female-biased sex ratios among the Gypsies are not a by-product of a preference for sons; they genuinely prefer daughters and invest more heavily in them. Investment differentials were demonstrated in respect of higher abortion rates after daughters, longer breast-feeding, and longer periods of education for daughters in both urban and rural communities (Bereczkei and Dunbar 1997). If sons were considered more valuable, these differences in direct and indirect parental care would have shown the reverse pattern.

Daughters thus seem to be the focus of Gypsies' fertility in both urban and rural communities. This may be one of the reasons first-born Gypsy children still frequently inherit the mother's name rather than the father's as is otherwise the norm in Hungary and elsewhere in Europe. The influential role that Gypsy girls and women play in family life may be reflected in the fact that Gypsies are frequently cited as a society based on a form of "matriarchy."

Finally, it is worth emphasizing that one inevitable reason late-born Gypsy daughters engage in relatively little helping-at-the-nest is that they have less opportunity to benefit from enhancing their mothers' fertility because their mothers are already approaching menopause. Although late-born daughters should have the same beneficial effect on the mother's time and energy budgets by relieving her of child care for younger siblings, the fitness payoff that accrues to the mother from producing a late-born daughter relative to that for producing a late-born son is much lower because the mother has fewer future reproductive opportunities to offer. On average, the Gypsy mothers in the sample produced their third-born child at age 25.5 and their fourth-born child at age 27.5; mothers would thus be in their late 30s and already approaching the end of active reproduction by the time these offspring were old enough to help with child care (10–12 years of age). Since these will, on average, be second-born daughters, later-born daughters are likely to be too young to have a significant impact on the mother's reproductive output; they are therefore more likely both to resist requests to provide child care and to pursue their own interests. At the same time, mothers will have less to gain from their help and are therefore likely to be less willing to engage in conflict with their daughters.

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