ELSEVIER

Paternal Care by Genetic Fathers and Stepfathers II: Reports by Xhosa High School Students

Kermyt G. Anderson
Population Studies Center, University of Michigan, Ann Arbor, Michigan
Hillard Kaplan
Human Evolutionary Ecology Program, Department of Anthropology, University of New Mexico, Albuquerque, New Mexico
David Lam
Population Studies Center, University of Michigan, Ann Arbor, Michigan
Jane Lancaster
Human Evolutionary Ecology Program, Department of Anthropology, University of New Mexico, Albuquerque, New Mexico

In this article we present a biosocial model of human male parental care that allows relationship (mating) effort to influence male parental allocations. The model recognizes four classes of relationships between men and the children they parent: genetic offspring of current mates (combined relationship and parental effort), genetic offspring of previous mates (parental effort solely), step offspring of current mates (relationship effort solely), and stepchildren of previous mates (essentially no expected investment). We test the model using data on parental investment collected from 340 Xhosa high school students in Cape Town, South Africa. Six measures of paternal investment are examined: the amount of money men spent on students for school, clothing, and miscellaneous expenditures, respectively, and how often men spent time with children, helped them with their homework, or spoke English with them. The tests provide support for the roles of both parental and relationship effort in influencing parental care: men invest significantly more in their genetic offspring and in the children of their current mates. We also examine several proximate influences on parental care, specifically the age and sex of the child, and the percentage of the child's life the father figure coresided with him or her.

KEY WORDS: Paternal investment; Mating effort; Xhosa; South Africa.

Received January 12, 1999; revised July 31, 1999.

Address reprint requests and correspondence to: Kermyt G. Anderson, Population Studies Center, University of Michigan, 426 Thompson Street, Ann Arbor, MI 48106-1248, U.S.A. E-mail: kganders@umich.edu

Evolution and Human Behavior 20: 433–451 (1999)

655 Avenue of the Americas, New York, NY 10010
1090-5138/99/$–see front matter
PII S1090-5138(99)00022-7

Human males often provide substantial amounts of care and resources to children (Hewlett 1991a, 1992). In fact, the investment of time and resources in children (which we refer to more generally as parental care) is not always limited to the genetic offspring of men or even to genetically related individuals. As a result of divorce, separation, and death, men often form marital relationships with women who are parenting children from previous unions with other men (Hewlett 1991b; Hill and Hurtado 1996; Lancaster 1997), and they help provide care for those children (Anderson et al., in preparation a, in preparation b; Kaplan et al. 1998; Lancaster and Kaplan, in press). Such practices raise a number of important theoretical issues about the conditions that affect the amount of care men provide to children and about the fitness costs and benefits of such investments. This article presents a simple biosocial model of male parental care and tests the model with data collected among Xhosa high school students in Cape Town, South Africa. The companion article (Anderson et al., this volume) presents further results using reports from a sample of men living in Albuquerque, New Mexico, U.S.A.

THEORY

Fuller treatment of the theory underlying the model is presented in the companion article (Anderson et al., this volume). Here we will simply note that for humans and other species in which both sexes can provide investment to offspring, investment itself can be a basis for mate choice. Females can select males on the basis of their ability or willingness to provision offspring in addition to their genetic qualities. When this is the case, mating effort and parental effort become difficult to distinguish; care provided to offspring can function as mating effort in addition to or instead of parental effort. Thus, we can argue that, among humans (and some other organisms), individuals may select mates in part on their ability or willingness to provide parental care. Specifically, by providing care to the children of their mates—both their genetic and step offspring—men can influence the "quality" or the duration of their relationships with their mates, above and beyond the effects the care has on the wellbeing of the offspring themselves. *Male parental care can thus be a form of mating effort.*

Because human marital relationships involve economic and reciprocity issues in addition to solely reproductive considerations, we have adopted the phrase "relationship effort" as an expanded version of mating effort. *Relationship effort* includes all activities and expenditures that increase the probability of entering into or remaining in a marital (or marriage-like) relationship with another individual, or which increase the "quality" of that relationship. Relationship effort encompasses the traditional definition of mating effort (Low 1978; Trivers 1972), but the concept is expanded to include investments and allocations that are unlikely to directly affect an individual's future reproductive opportunities. In many contexts, relationship effort and mating effort are synonymous; we preferentially use the former term to acknowledge the importance of nonreproductive aspects of human marital relationships.

CLASSIFICATIONS OF MALE PARENTAL CARE

We have argued that male parental care is influenced by both relationship effort and parental effort. We will now specify how these forms of reproductive effort influence men's decisions to allocate parental care to the children they have parented. Table 1 presents four classes of male/offspring relationships, defined by the male's relatedness to the child and the male's relationship with the child's mother. Class 1 relationships involve a genetic offspring whose mother is the man's current mate. Men receive direct genetic benefits from investing in these offspring. In addition, because women are likely to prefer males who invest highly in their offspring—and will be more likely to leave men who do not—men also receive relationship ("mating") benefits from investing in these children. Class 2 offspring are genetic offspring whose mothers are now previous mates. Men receive genetic benefits from investing in these children, but no relationship benefits, because the relationship with the child's mother has terminated. Thus, care for these offspring can be considered parental investment only. Class 3 offspring are stepchildren through a man's current mate. Because these children are not genetically related to the man, investments in those children provide no kin or parenting benefits. However, investing in these children may improve the quality or increase the duration of the man's relationship with the child's mother; thus, care for these offspring is relationship investment solely. Finally, Class 4 offspring are stepchildren from previous relationships. Because men receive neither relationship nor parental benefits from providing care for these children, we expect to see virtually no investment in these offspring.

This simple framework clarifies the relationships between men and the children they have parented, and it provides insight into men's parental allocation decisions. For example, the model predicts that male investment in genetic offspring will decrease after divorce, in part because paternal care during the marriage was motivated not solely by the effects of the care on the child's well-being (or fitness), but also by its effect on the parents' relationship. Once the marriage has terminated, men may reallocate the relationship effort portion of the parental care they once provided to establishing new mating relationships, leading to a decline in parental investment in genetic offspring after divorce. The model predicts that genetic children of current mates will receive the highest levels of investment, because men obtain both parental and relationship benefits from doing so, whereas step offspring of previous mates will receive the least, because men receive neither form of benefit. To the best of our knowledge, no previous study has compared these two classes of off-

Table 1. Classifications of Male Parental Care

	Relationship with child's mother	
Relatedness to child	Current mate	Previous mate
Genetic	Parental and relationship investment (Class 1)	Parental investment (Class 2)
Step	Relationship investment (Class 3)	Minimal investment (Class 4)

spring. Whereas the model predicts that genetic children of previous mates and stepchildren of current mates will each receive decreased levels of investment relative to genetic children of current mates (see Amato 1987; Cooksey and Fondell 1996; Daly and Wilson 1981, 1988; Flinn 1988; Judge 1995; Marlowe 1999; Marsiglio 1991; Simpson 1997; Smith et al. 1987; Teachman 1991; Weiss and Willis 1985, 1993 for evidence in support of that prediction), we know of no previous investigators who compared investments between these two classes of children. The relative level each will receive is difficult to predict, as the effects of parental care on a male's parental or mating success will vary across cultures and ecological contexts. We expect that under a variety of circumstances, however, the care received by Class 2 (genetic offspring of previous mates) and Class 3 (step offspring of current mates) children will be similar to each other, and intermediate between what genetic offspring of current mates and step offspring of previous mates receive.

We now present a test of the predictions derived from the model, using interview data on male parental care provided to urban Xhosa high school students in Cape Town, South Africa. The companion article(Anderson et al., this volume) presents further tests using self-reported data from men living in Albuquerque, New Mexico, U.S.A.

METHODS

Study Population

Cape Town, one of South Africa's largest cities, is located at the southern tip of the African continent. Since 1994, the Republic of South Africa has been governed by a democratically elected government and a liberal, nonracial constitution. However, South Africa's sociopolitical history is dominated by themes of colonialism and racial inequality. Predominant among these was the policy of Apartheid ("separateness"), which the South African government adopted in 1948 with the goal of enforcing and increasing the de facto racial segregation that existed in the country. The law recognized four distinct racial groups: Africans, Asians (Indians), Coloreds (mixed African and European ancestry), and Whites. Legislation was passed dictating where individuals of each race could live, what jobs they could hold, whom they could marry, etc. The quality of employment, education, housing, and other opportunities varied greatly across racial groups, with whites having access to the best opportunities and blacks the worst. Although Apartheid laws were repealed by the early 1990s, their effects still linger on the sociopolitical and physical landscape. For example, the Group Areas Act of 1954 circumscribed members of each racial group to living within certain restricted areas of the country, as well as to certain regions of major cities. In Cape Town as well as other cities, Africans were restricted to townships, small ghettos that generally had inferior housing, utilities, public facilities, etc. Although Africans are no longer legally restricted to living in the townships, historical reasons as well as present-day poverty mean that most Africans in Cape Town live in concentrated pockets within the greater metropolitan area (Saff 1996).

South Africa contains diverse racial and ethnic groups, and the Constitution of the Republic of South Africa recognizes 11 official languages. In Cape Town, however, most Africans are of Xhosa descent. The Xhosa, traditionally a pastoralist people, have occupied the plains of the Transkei region, in the Eastern Cape of South Africa, for centuries (Mayer 1971). During the mid-20th century, poverty, unemployment, and other factors triggered an urban relocation of many Xhosa from the rural areas to Cape Town and other cities (Jones 1993; Thompson 1990; Younge 1982). The combination of urbanization and Apartheid affected nearly every aspect of Xhosa family life (Burman and van der Spuy 1996). For example, Apartheid legislation stipulated that African men could come to cities such as Cape Town on 1-year contracts only, and they were prohibited from bringing their wives and children with them (Jones 1993; Reynolds 1989). As a result, Xhosa men were often forced to live and seek employment apart from their wives and families. Zoning laws and poverty resulted in extreme housing shortages for Africans in Cape Town and elsewhere (Jones 1993; Younge 1982). In many families, women became de facto heads of household, especially among women who had moved to cities.

These changes marked a general shift among Africans from patrilocal to matrilocal or neolocal residence patterns (Pauw 1963; Simkins 1986; Wilson and Mafeje 1963) and to greatly increased complexity in household organization (Jones 1998; Niehaus 1994; Preston-Whyte and Zondi 1992; van der Vliet 1991). Additionally, cultural practices such as lobola (bridewealth) and traditional marriages have become increasingly rare in urban settings (Jones 1998; Moeno 1977). Divorce and nonmarital births have increased greatly in recent years (Burman and van der Spuy 1996; Simkins 1986; Thompson 1990). These changes in household structure had strong negative consequences on children's survival, health, and education (Burman 1986; Cherian 1994; Cock et al. 1986; Jones 1993). Although Apartheid legislation has been repealed, its historical effects linger in the urbanization, poverty, and altered family states of many African families.

The research presented in this article focuses on the township of Guguletu, one of the older African townships in Cape Town. From January through June 1998, Anderson, Kaplan, and Lam conducted research at the I.D. Mkize Secondary School, one of three high schools in Guguletu. Due to the legacy of Bantu education, the continuing inequities in the distribution of educational resources, the general poverty of the surrounding population, and the increasing presence of gangs in the townships, I.D. Mkize is regarded as one of the worst high schools in Cape Town. For example, in 1997 the pass rate for students in grade 8 (Standard 6) was 78%, and only 26% for students in grade 12 (Standard 10). It is widely acknowledged that these rates are much lower than those of formerly Colored and White schools; graduation rates for formerly white schools may approach 100%. Education is a right guaranteed by the South African constitution, but it is not free. Parents pay school fees ranging from 50 rands a year (about US $10) for a township school such as I.D. Mkize, to upwards of R5,000 (about US $1000) for quasi-public academies. In the post-Apartheid era, the better schools are more racially diverse than they once were, but fiscal realities (in addition to school fees, there are expenses for transportation, uniforms, etc.) restrict the educational opportunities of many African students.

Data Collection

The fieldwork proceeded in three phases. First, the research team met with faculty at the school, to establish a rapport and to obtain permission for performing the study. We conducted focus groups with several groups of teachers, to qualitatively explore their views on the educational system, the influence of parents on children's schooling, etc. Focus groups were held after school and generally lasted about 2 hours. We conducted half a dozen interviews with a total of 18 teachers over 3 weeks. As we became more familiar with the faculty at the school, we recruited approximately a dozen teachers to become part of our research team.

The second phase of the project consisted of qualitative interviews with students. We held eight focus groups of 4 to 11 individuals each, interviewing 60 students over several weeks. Topics of conversation included their attitudes about school, their parents, families, and living situations, male-female interactions, and their hopes and aspirations for the future. Focus groups were conducted after school in the school library. We employed Xhosa-speaking students from the University of Cape Town to act as interpreters for those students who were more comfortable speaking in their native language; thus, the interviews were conducted in a mixture of English and Xhosa.

The third phase of the project consisted of quantitative interviews with students, conducted in the classroom setting. The interview questionnaire was developed with input from the teachers who were working with us and was further informed by the ethnographic data gathered in the focus groups. We sampled 15 classes, covering all grades present in the school. Data were obtained through self-reported questionnaires that the students completed themselves, with assistance from teachers and hired assistants. (Each classroom had three to five assistants present during the interview.) Because many students (especially in lower grades) had rudimentary English literacy, the questionnaire was translated into and administered in Xhosa. Overhead transparencies were used by the class teacher to explain each section of the questionnaire. Administering the questionnaire took from 2 to 3.5 hours, with lower grades generally taking longer.

In total, we interviewed 603 students, or 89.3% of students enrolled for the classes sampled. This included 121 students in grade 8, 126 in grade 9, 91 in grade 10, 125 in grade 11, and 140 in grade 12. Students in township schools tend to be older than their American counterparts, due to beginning school later, higher failure rates at each grade level, and other disruptions to education. The average age of students sampled was 18.6 years (*SD* 2.54, range 13 to 26), and the sample included 261 males and 342 females, for a male/female sex ratio of 0.76.

Measurement of Variables

The interviews asked questions on the parental care the students received, as well as their residential histories with various relatives. In terms of the parent-offspring classes presented in Table 1, we obtained data on resident genetic fathers (Class 1), nonresident genetic fathers (Class 2), and resident stepfathers (Class 3) fathers. Because of time considerations, questions about Class 4 fathers (stepfathers who are

no longer in relationships with the children's mothers) had to be excluded from the instrument. We thus will restrict our analyses to the three classes of children in whom we expect to see significant parental investment from father figures. (See the companion article by Anderson et al., this volume, for analyses comparing all four father-offspring classes in a sample of American men.)

The questionnaire asked about two forms of parental care: time and monetary investment. Three measures of each type of care were obtained. For time, students were asked to rate how often over the past year an individual (mother, genetic father, stepfather, etc.) spent time alone with the child, helped the child with homework, and spoke English with the child. Helping the student with homework was selected for investigation because of research interests in parental involvement with children's education. Conversing in English was selected because both students and teachers identified English comprehension as an important skill for success in South Africa. English is widely used in business and higher education, and it is an important lingua franca for conversing with whites (who rarely speak African languages), as well as with Africans from other language groups. The student rated frequency of time interaction on a seven-point scale, ranging from never through almost every day. These frequencies were converted to number of interactions per year (ranging from 0 to 300); the converted frequencies are the measures of time interactions analyzed in this article.

For monetary investment, students were asked to estimate how much money an individual (mother, genetic father, stepfather, etc.) had spent on them over the previous year, for five specific categories: school books and supplies; school fees; clothing and shoes; gifts or presents; money for hobbies; and pocket money. Estimates were provided in rands, the South African currency; at the time of fieldwork, one U.S. dollar was worth approximately 5 rands. For analysis we have collapsed financial expenditures into three categories: expenditures on school (school books and supplies + school fees), expenditures on clothing, and miscellaneous expenditures (gifts or presents + money for hobbies + pocket money).

Other variables used in the current analyses include the student's sex (male or female), age (in years), and the percentage of the student's life he or she coresided with a biological father or stepfather. This last variable was obtained through a retrospective residential history and is calculated as the number of years the student reported living with an individual (father or stepfather) divided by the student's current age. Because men who live longer with a child might be expected to bond more closely with that child, we will treat this variable as a measure of the proximate influence of paternal bonding on parental care. Because of the prevalence of migratory labor patterns in South Africa, even students whose parents are still married often have not lived with both parents their entire lives. Those students who are currently living with their genetic fathers (Class 1) report that they had lived with them for an average of 80% of their lives, with 50% having coresided with their fathers for less than 100% of their lives. Students who are no longer living with their genetic fathers (Class 2) report living with them for an average of 19% of their lives. The low percentage of coresidence with nonresident fathers is due to the high percentage of students who have never lived with a biological father—fully 52% of students who do not currently live with a genetic father have never lived with him. Because genetic

fathers who formerly lived with their children may differ from those who never have—for example, because they have bonded more strongly with their children, or because they were self-selected to be better caregivers in the first place—we will subdivide our sample of Class 2 fathers into two groups, according to whether or not they ever coresided with the student. Students report coresiding with Class 2 fathers they used to live with for 41% of their lives. Students who are currently living with stepfathers (Class 3) report that they have lived with them for an average of 27% of their lives.

Several potential biases exist when using self-reported data by recipients of parental investment. First, the actual provider of the investment may not get proper credit for it if it is channeled through someone else. For example, if a father provides a child's mother with money, which the mother then spends on the child, the child may report that the mother rather than the father provided the investment. Thus, our measures of parental care may reflect student's perceptions of who provides care rather than the actual level of care provided by different parents.

Another potential bias with obtaining data from the recipients of investment is that they may be less accurate in providing data about the investors. Answers provided by students about the fertility, marital histories, employment, income, and education of their parents may be incomplete or inaccurate; this is more likely to be true for nonresident parents, especially genetic fathers whom they have never lived with. In this respect, obtaining data from the investors themselves might provide more accurate data on these variables. In the current study, however, this corroboration was not possible, as we were only able to interview students.

Sample Size

The 603 students we sampled live in a variety of household situations. For example, 42% of students live with older relatives such as aunts, uncles, or grandparents, in addition to or instead of their genetic parents. Fully 73% of children do not live with a genetic father, whereas 10% live with a stepfather. These results are consistent with the variation in modern urban South African families reported by other sources (Jones 1993; Niehaus 1994; Simkins 1986).

To eliminate the effect of maternal absence on paternal care, we have restricted our sample to 340 students who live with their mothers. This includes 138 students currently living with genetic fathers (Class 1), 99 with living genetic fathers they never dwelt with (Class 2a), 90 with living genetic fathers they used to dwell with (Class 2b), and 81 with stepfathers (Class 3). These numbers sum to more than 340 because 67 students residing with a stepfather also have a living nonresident genetic father. Because investments by nonresident genetic fathers and those by resident stepfathers are nonoverlapping categories, these children are present twice for some analyses. Future work will examine whether investments by nonresident fathers are different for children currently living with stepfathers versus those not living with stepfathers.

Because some students did not respond to some of the parental care questions, the sample size for each measure of parental care is smaller than the total number of men in each class (Table 2). The average response rate for questions on paternal

Table 2. Sample Sizes for Each Parental Care Measure, by Class of Father

	Genetic fathers, currently live with (Class 1)	Genetic fathers, never lived with (Class 2a)	Genetic fathers, once lived with (Class 2b)	Stepfathers, currently live with (Class 3)
Total number	138	99	90	81
Spent time with child	134	91	77	66
Helped child with homework	132	89	81	63
Spoke English with child	126	83	83	61
Financial expenditures on school	133	95	85	73
Financial expenditures on clothing	135	93	87	72
Miscellaneous financial expenditures	128	90	86	70

care by resident genetic (Class 1) fathers was 95%, whereas it was 91% for genetic fathers who never coresided (Class 2a), 92% for genetic fathers who used to live with the student (Class 2b), and 83% for resident stepfathers (Class 3). The lower response rate for Class 3 fathers could introduce bias into our measures of parental care, especially if children are likely to skip questions on parental care by stepfathers they are not close to, or with whom they have agonistic or abusive relationships.

RESULTS

Differences Between Classes of Fathers

Figure 1 presents the average annual time involvement with students for each class of men. Table 3 provides the results of pairwise post hoc comparisons of the differences in these values from analysis of variance. The mean differences are evaluated using Bonferroni comparisons, which adjust the observed significance for the fact that multiple comparisons are being performed simultaneously. The top row of the table presents the significance value for the entire model, i.e., whether or not there is any significant variation in time involvement between different classes of men. The cells in the lower part of the table give the estimated difference between different classes of men, and a significance value for this estimate. Thus, for example, panel A shows that different classes of men spend different amounts of total time with focal children ($F = 78.07$, $p < .001$). Relative to resident genetic fathers, nonresident genetic fathers who never lived with a child have about 194 fewer interactions per year with that child, nonresident genetic fathers who used to live with the child have about 179 fewer interactions, and resident stepfathers have about 84 fewer interactions, all differences that are highly significant ($p < .001$). Nonresident fathers who used to live with children have about 15 more interactions per year than nonresident genetic fathers who never lived with the child, but this result is not significant (p rounded upward to 1.000).

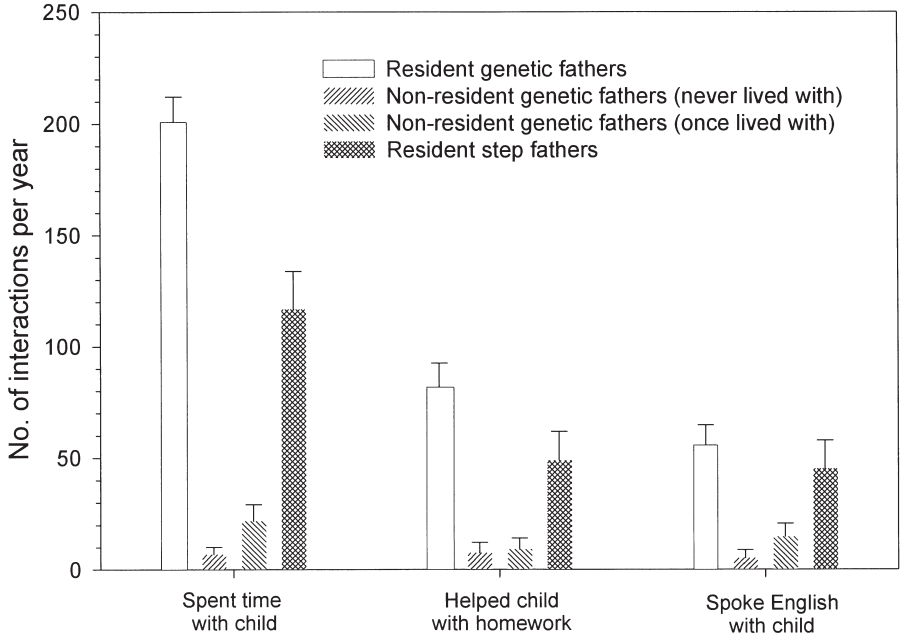

FIGURE 1. Xhosa male time interactions with children, by class (+ SE).

Overall, Table 3 shows that residence with children has a strong impact on time involvement: Class 1 and Class 3 fathers (resident genetic fathers and stepfathers, respectively) spend significantly more time with students for each measure of time involvement. However, genetic relatedness is also important: Class 1 fathers spend more time overall with students than Class 3 fathers. Among nonresident genetic fathers (Class 2), there are no significant differences between men who once lived with children and never-resident fathers.

Figure 2 presents financial expenditures on children by each class of men. Table 4 provides the corresponding post hoc comparisons and significance levels. Whereas physical proximity to children is an important factor in time allocation (Figure 1), it is not as important in monetary investments (Figure 2). Resident genetic fathers (Class 1) spend significantly more money than resident stepfathers (Class 3) for school expenditures, but they do not outspend formerly residential genetic fathers (Class 2b) in any category. (Note that for expenditures on clothing, there is no significant variation between men of different classes; model $p = 0.115$ in panel B of Table 4.) Resident step (Class 3) and never-resident genetic (Class 2a) fathers spend the least in several categories, although there is no significant difference between the two groups of Class 2 fathers.

Proximate Influences

To further understand the differences between the classes of fathers, we performed exploratory analyses of the effects of sex, age, and the percent of the child's

Table 3. Mean Differences (*p* Values) of Time Involvement by Different Classes of Men

	A. Spent time with child			B. Helped child with homework			C. Spoke English with child		
Model fit:	$F = 78.07$, $df = 367$, $p < .001$			$F = 16.36$, $df = 364$, $p < .001$			$F = 8.21$, $df = 352$, $p < .001$		
Pairwise comparisons	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers
Resident genetic fathers	−194.0 (0.000)	−179.0 (0.000)	−84.1 (0.000)	−74.4 (0.000)	−72.9 (0.000)	−33.2 (0.107)	−50.3 (0.000)	−41.0 (0.003)	−10.500) (1.000)
Nonresident genetic, never lived with		15.0 (1.000)	109.9 (0.000)		1.5 (1.000)	41.2 (0.038)		9.3 (1.000)	30.5 (0.025)
Nonresident genetic, once lived with			94.9 (0.000)			39.7 (0.059)			39.9 (0.166)

Note: This table presents significance values for comparisons of the time involvement by different classes of men plotted in Figure 1. Each cell in the lower part of the table presents the mean difference between the observed investment values for two different classes of men (e.g., between resident genetic fathers and resident stepfathers), along with a significance value for that difference. See text for further details.

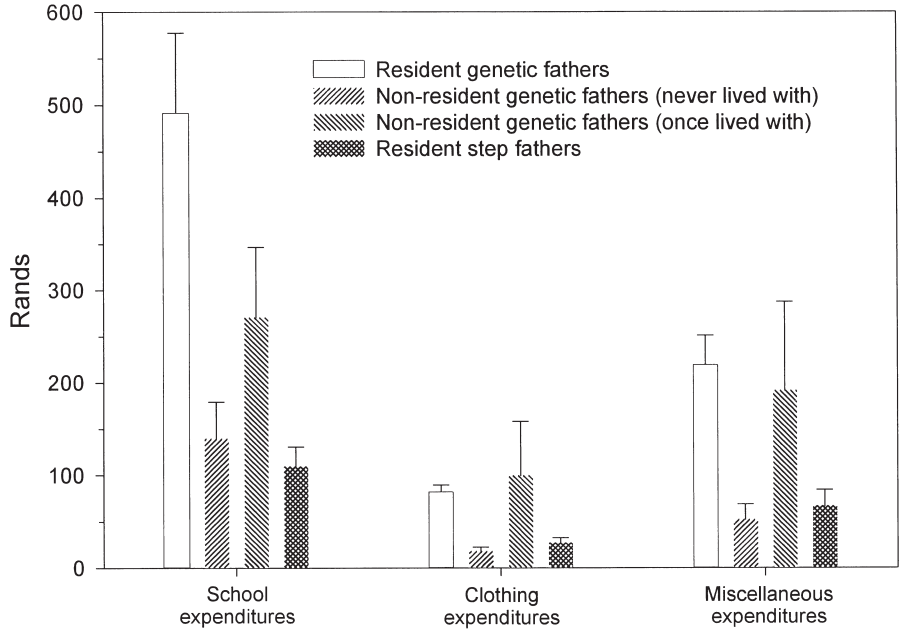

FIGURE 2. Annual financial expenditures on Xhosa children, by class (+ SE).

life they coresided on parental care. Marked sex differences in parental involvement and investment in children have been noted in many traditional African pastoralist cultures (Borgerhoff Mulder 1998; Cronk 1991; Mace 1996), and it is reasonable to assume that sex-biased investment exists among rural, more traditional Xhosa. In particular, we might expect fathers (and father figures) to spend more time with sons than with daughters. The effect of the child's age on investment is more difficult to predict. Older children typically are more expensive, but they may be able to offset their costs through independent earnings. Lastly, we examine the effects of coresidence history on parental care. If men bond more with children the longer they live with them, then we would expect positive correlations between the percentage of the child's life they lived together and the level of parental care a man provides. However, to the extent that relationship effort plays an important role in parental care, men who are currently in a relationship with a child's mother (Class 1 and Class 3 fathers) may not be influenced as strongly by years of coresidence.

We performed multivariate analyses using sex, age, and coresidence history as independent variables. Because we might expect the effects of these predictors to differ for each class of men, we restricted samples to each paternal class and repeated the models for each dependent variable and each class of men. (The percentage of the child's life coresided with the man was dropped for models restricted to Class 2 fathers who never lived with their children, because there is no variation in that variable for that subsample of students.) Of the 24 separate multivariate models performed, nearly all (21) were nonsignificant, with the model $p > .10$. This includes all models for Class 1 (resident genetic) and Class 2a (never resident genetic)

Table 4. Mean Differences (*p* Values) of Financial Expenditures by Different Classes of Men

	A. School expenditures			B. Clothing expenditures			C. Miscellaneous expenditures		
Model fit:	$F = 6.46$, $df = 385$, $p < .003$			$F = 1.99$, $df = 386$, $p = .115$			$F = 2.81$, $df = 373$, $p < .039$		
Pairwise comparisons	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers	Nonresident genetic, never lived with	Nonresident genetic, once lived with	Resident stepfathers
Resident genetic fathers	−350.4 (0.000)	−219.2 (0.165)	−380.4 (0.002)	−62.3 (0.523)	19.4 (1.000)	−53.2 (1.000)	−165.5 (0.093)	−26.5 (1.000)	−151.0 (0.244)
Nonresident genetic, never lived with		131.1 (1.000)	−30.1 (1.000)		81.6 (0.258)	9.0 (1.000)		139.0 (0.379)	14.5 (1.000)
Nonresident genetic, once lived with			−161.2 (0.946)			−72.6 (0.550)			−124.5 (0.712)

Note: This table presents significance values for comparisons of the monetary investment by different classes of men plotted in Figure 2. Each cell in the lower part of the table presents the mean difference between the observed investment values for two different classes of men (e.g., between resident genetic fathers and resident stepfathers), along with a significance value for that difference. See text for further details.

fathers. These results suggest that, in general, there are not significant effects of sex, age, or coresidence history on time or monetary investment by men in urban Xhosa high school students.

Only three models were statistically significant or marginally significant (model $p < .10$); these are presented in Table 5. For genetic fathers who used to live with children (Class 2b), men spent more time with children the longer they coresided. Coresidence history also predicts the frequency with which they help children with homework. Among resident stepfathers (Class 3), a significant model was obtained for financial expenditures on the child's schooling expenses. Stepfathers spend more money on daughters than sons, and their expenditures increase with the duration of the child's life they have coresided.

The lack of effects of age and sex (with the exception of stepfathers spending more money for school on daughters) is surprising, given the prevalence of age and sex biases in other African populations. However, the results do suggest that coresidence history is important for at least some men. The percentage of the child's life spent together had no effect on parental care by resident genetic fathers (Class 1). This result is unlikely to be due to lack of variation, because half of students report spending less than 100% of their lives with their Class 1 fathers, and 17% have spent less than half their lives with them. Nonresident genetic fathers who never lived with a child (Class 2a) are excluded from this analysis because there is no variation in the predictor variable. For formerly resident genetic fathers (Class 2b) we observe a strong effect of former coresidence on time involvement, although not monetary investment. This result is interesting because we expect relationship effort to play no role in parental behavior by this class of men; this is the group most strongly influenced by coresidence histories and presumably by level of bonding with the child herself, rather than by the relationship with the child's mother. One might predict that stepfathers also would be influenced by the extent to which they have coresided with, and thus bonded with and helped raise, a child. However, we found weakly significant effects of coresidence history on only one form of parental care by Class 3 fathers: financial expenditures on school.

Table 5. Significant Multivariate Regression Models Examining Proximate Influences on Paternal Care

	Formerly resident genetic fathers (Class 2b)		Formerly resident genetic fathers (Class 2b)		Resident stepfathers (Class 3)	
	Time spent with child		Time spent with homework		Expenditures on school	
	$F(3, 73) = 2.58$, $R^2 = .096$, $p = .060$		$F(3, 77) = 2.17$, $R^2 = .078$, $p = .099$		$F(3, 69) = 2.91$, $R^2 = .112$, $p = .041$	
Variable	Coefficient	p	Coefficient	p	Coefficient	p
Constant	−31.03	0.592	−3.04	0.939	−13.92	0.936
Sex (1 = male, 2 = female)	0.44	0.977	−13.39	0.195	94.86	0.025
Age	1.13	0.688	0.88	0.654	−3.45	0.701
Proportion of child's life coresided	78.79	0.008	40.98	0.050	140.74	0.088

DISCUSSION

We presented a biosocial model that incorporated a role for both relationship effort and parental (kin) investment in male parental care (Table 1; see also Anderson et al., this volume). Using a sample of self-reports on parental investment received by urban Xhosa high school students in Cape Town, South Africa, we found patterns of investment that were consistent with the model. We also found that the effects of a man's genetic relationship to the child and his coresidence with the child's mother varies with the type of investment. For time involvement with children, proximity plays an important role: resident father figures spend much more time with children than nonresident fathers (Figure 1 and Table 3). However, proximity is not the sole determinant of male involvement with children: resident genetic fathers (Class 1) spend more time overall with offspring than resident stepfathers (Class 3). These results also establish that stepfathers do spend time with their unrelated children, which we interpret as a form of relationship effort; the relative increase in time involvement by Class 1 fathers represents the combined relationship and parental benefits they receive. We found no difference in time involvement between nonresident genetic fathers who used to live with a child and nonresident genetic fathers who never lived with them.

For monetary investments in children, we find that relationship benefits and proximity may be less important than parental benefits and unobserved qualities of men. Resident genetic fathers (Class 1) spend the most on school expenditures, but are not statistically distinguishable from formerly resident genetic fathers (Class 2b) (Figure 2 and Table 4). Resident stepfathers (Class 3) and genetic fathers who never lived with children (Class 2a) provide similarly low levels of care. The prevalence of itinerant, short-term, or long-distance wage labor patterns among African men has resulted in the customary provisioning of money to family members from long distances, thus reducing the effect of proximity on financial expenditures. Although relationship effort appears less important for this form of investment, it is notable that stepfathers are providing nonzero levels of investment; in fact, they are providing equivalent levels of investments as genetic fathers who never resided with children, and approximately a third as much as genetic fathers who used to reside with children.

We also examined several proximate influences on paternal care (Table 5). The general lack of sex and age effects was striking. No general pattern is evident regarding age-biased investments, and the only class of men who appear to respond to sex is resident stepfathers, who spend more money for school on their stepdaughters. We examined the effect of the percentage of the child's life coresided with each type of father on parental care. Although there is variation among currently resident genetic fathers in this variable, it has no significant effect on their level of investment, suggesting that their parental benefits—and the effect of relationship effort—may outweigh the effect of bonding with the child. For genetic fathers who once lived with children (Class 2b), coresidence history has a significant effect on two of the three forms of time involvement, although not on financial expenditures. Whether this relationship is due to men who lived with children longer having

bonded with them more, or because higher providing men remained in relationships with the children's mothers longer, we cannot say. (In other words, this sample of men may be self-selected to include a high proportion of men who provided high levels of relationship effort while they were married.) Coresidence history has a significant effect on the school expenditures that resident stepfathers (Class 3) spend on children. As with formerly resident genetic fathers (Class 2b), it is unclear whether this is because these men have bonded more strongly with children, or because women prefer relationships with higher-investing males. This is an important question for future research to address.

The results presented here are comparable to those obtained for a very different population: parental investment by Anglo and Hispanic men living in Albuquerque, New Mexico, U.S.A. (see the companion article by Anderson et al., this volume). Among Albuquerque men, we found that men invested the most in the genetic children of current mates and the least in stepchildren of previous mates, with genetic children of previous mates and stepchildren of current mates receiving intermediate levels of investment. The higher investment in children of current mates could not entirely be ascribed to proximity to these children, as some analyses focused on investment in children attending college, who were unlikely to be living with the respondents. That similar results are found for such different cultures lends support to the underlying hypothesis that relationship effort is an important influence on male parental investment.

The discussion session of the companion article (Anderson et al., this volume) presents limitations of the relationship effort model and directions for future research. We will not reiterate these in detail here, but simply note that many questions remain about the role of relationship effort in parental care, as well as about the forms of relationship effort that are exhibited by older or long-standing couples. Do men increase their level of parental care for mates with higher reproductive value, holding the age of the child constant? Do men experience tradeoffs between reallocating relationship effort into new relationships following divorce, versus investing in their existing offspring? Are women more likely to leave men who invest less in their children, all else being equal? What is the nature of the proximate influences on male paternal care in the context of this model, and how important is male self-selection into the parental categories presented in Table 1? These are all important areas for further theoretical and empirical research.

We wish to reiterate that the biosocial model we present is not meant to represent men's conscious decisions. Men need not actively, consciously, or callously decide to invest in children as a way of improving their relationships with the children's mothers; they need merely behave as if such a decision had been made for the model to be accurate and insightful. Whereas the model does accurately describe the behavior of at least some men, this does not mean that all men pursue the strategy of parental care as a form of relationship effort; for example, only a minority of Albuquerque men ever become stepfathers at all (Lancaster and Kaplan, in press), and it is possible that some males do not decrease their investment in genetic children following divorce because relationship effort was not an important component of their

predivorce investment. Understanding which men pursue parental care as relationship effort, and why they do so, is another important question raised by this research.

CONCLUSION

We have presented a biosocial model of male parental care that incorporates the dual effect of relationship and parental benefits on male parental allocation decisions. Using a sample of urban Xhosa children in Cape Town, South Africa, we present results that are consistent with the model. The companion article (Anderson et al., this volume) presents further support using a sample of men living in Albuquerque, New Mexico. This model obviously does not address all influences on male parental care; such important factors as emotional bonding, for example, are outside of the scope of the current model. We hope the results presented here will spur further empirical investigation of the effects of relationship effort on paternal care, as well as further theoretical development of evolutionary models of parental care in humans.

We thank Matsidiso Semelink of the Western Cape Education Department and Mongezi Memani of I.D. Mkize Secondary School for granting permission to conduct research at the school, and for their overall facilitation of the project. We are indebted to Valerie Qobo for her invaluable assistance in coordinating the research project and translating the questionnaire. Mzonke Mpofana also assisted with the translation. We thank the many other teachers at I.D. Mkize Secondary School for their generous help with running the project. We thank the students themselves for cooperating with the research and allowing us a glimpse into their lives. Kim Hill and two anonymous reviewers provided helpful comments on the manuscript. Earlier versions of this paper were presented at the 1998 annual meeting of the Human Behavior and Evolution Society and the 1999 meeting of the Society for Cross-Cultural Research. Financial support for the research in South Africa was provided by a grant from the Mellon Foundation to the Population Studies Center at the University of Michigan.

REFERENCES

Amato, P.R. Family processes in one-parent, stepparent, and intact families: the child's point of view. *Journal of Marriage and the Family* 49:327–337, 1987

Anderson, K.G., Kaplan, H., and Lancaster, J.B. Paying for children's college costs: paternal care and relationship effort among Albuquerque men. (in preparation a).

Anderson, K.G., Kaplan, H., and Lancaster, J.B. Financial expenditures on children—an evolutionary perspective. (in preparation b).

Borgerhoff Mulder, M. Brothers and sisters: how sibling interactions affect optimal parental allocations. *Human Nature* 9:119–161, 1998.

Burman, S. The contexts of childhood in South Africa: an introduction. In *Growing Up in a Divided Society: The Contexts of Childhood in South Africa*, S. Burman and P. Reynolds (Eds.). Johannesburg: Ravan Press, 1986, pp. 1–15.

Burman, S., and van der Spuy, P. The illegitimate and the illegal in a South African city: the effects of Apartheid on births out of wedlock. *Journal of Social History* 29:613–635, 1996.

Cherian, V.I. Relationship between parental aspiration and academic achievement of Xhosa children from broken and intact families. *Psychological Reports* 74:835–840, 1994.

Cock, J., Emdon, E., and Klugman, B. In *Growing Up in a Divided Society: The Contexts of Childhood*

in South Africa, S. Burman and P. Reynolds (Eds.). Johannesburg: Ravan Press, 1986, pp. 66–92.

Cooksey, E.C., and Fondell, M.M. Spending time with his kids: effects of family structure on fathers' and children's lives. *Journal of Marriage and the Family* 58:693–707, 1996.

Cronk, L. Preferential parental investment in daughters over sons. *Human Nature* 2:387–417, 1991.

Daly, M., and Wilson, M. Abuse and neglect of children in evolutionary perspective. In *Natural Selection and Social Behavior*, R. Alexander and D.W. Tinkle (Eds.). New York: Chiron, 1981, pp. 405–416.

Daly, M., and Wilson, M. *Homicide*. New York: Aldine de Gruyter, 1988.

Flinn, M.V. Step- and genetic parent/offspring relationships in a Caribbean village. *Ethology and Sociobiology* 9:335–369, 1988.

Hewlett, B.S. Intimate Fathers: The Nature and Context of Aka Pygmy Paternal Infant Care. Ann Arbor: University of Michigan Press, 1991a.

Hewlett, B.S. Demography and childcare in preindustrial societies. *Journal of Anthropological Research* 47:1–37, 1991b.

Hewlett, B.S. (Ed.) *Father-Child Relations: Cultural and Biosocial Contexts*. Chicago: Aldine, 1992.

Hill, K., and Hurtado, A.M. *Ache Life History: The Ecology and Demography of a Foraging People*. New York: Aldine de Gruyter, 1996.

Jones, S. *Assaulting Childhood: Children's Experiences of Migrancy and Hostel Life in South Africa*. Johannesburg: Witwatersrand University Press, 1993.

Jones, S. Enacted marriages and fatherhood without jural paternity: signs of bilateral kinship among Xhosa in an Eastern Cape township. Paper presented at the annual meeting of the Association for Anthropology in Southern Africa, University of Stellenbosch, South Africa, 1998.

Judge, D.S. American legacies and the variable life histories of women and men. *Human Nature* 6:291–323, 1995.

Kaplan, H., Lancaster, J.B., and Anderson, K.G. Human parental investment and fertility: the life histories of men in Albuquerque. In *Men in Families: When Do They Get Involved? What Difference Does It Make?*, A. Booth and N. Crouter (Eds.). New York: Lawrence Erlbaum, 1998, pp. 55–111.

Lancaster, J.B. The evolutionary history of human parental investment in relation to population growth and social stratification. In *Feminism and Evolutionary Biology*, P.A. Gowaty (Ed.). New York: Chapman and Hall, 1997, pp. 466–489.

Lancaster, J.B., and Kaplan, H. Parenting other men's children: costs, benefits and consequences, In *Human Behavior and Adaptation: An Anthropological Perspective*, L. Cronk, W. Irons, and N. Chagnon (Eds.). (in press).

Low, B.S. Environmental uncertainty and the parental strategies of marsupials and placentals. *American Naturalist* 112:197–213, 1978.

Mace, R. Biased parental investment and reproductive success in Gabbra pastoralists. *Behavioral Ecology and Sociobiology* 38:75–81, 1996.

Marlowe, F. Showoffs or providers? The parenting effort of Hadza men. *Evolution and Human Behavior* 20:391–404, 1999.

Marsiglio, W. Paternal engagement activities with minor children. *Journal of Marriage and the Family* 53:973–986, 1991.

Mayer, P. *Townsmen or Tribesmen*. 2nd ed. Cape Town: Oxford University Press, 1971.

Moeno, N.S. Illegitimacy in an African urban township in South Africa: an ethnographic note. *African Studies* 36:43–47, 1977.

Niehaus, I.A. Disharmonious spouses and harmonious siblings: conceptualising household formation among urban residents in Qwaqwa. *African Studies* 53:115–135, 1994.

Pauw, B.A. *The Second Generation: A Study of the Family among Urbanized Bantu in East London*. London: Oxford University Press, 1963.

Preston-Whyte, E., and Zondi, M. African teenage pregnancy: Whose problem? In *Questionable Issue: Illegitimacy in South Africa*, S. Burman and E. Preston-Whyte (Eds.). Cape Town: Oxford University Press, 1992, pp. 226–246.

Reynolds, P. *Childhood in Crossroads: Cognition and Society in South Africa*. Grand Rapids: Wm. B. Eerdmans, 1989.

Saff, G. Claiming a space in a changing South Africa: the "Squatters" of Marconi Beam, Cape Town. *Annals of the Association of American Geographers* 86:235–255, 1996.

Simkins, C. Household composition and structure in South Africa. In *Growing Up in a Divided Society:*

The Contexts of Childhood in South Africa, S. Burman and P. Reynolds (Eds.). Johannesburg: Ravan Press, 1986, pp. 16–42.

Simpson, B. On gifts, payments and disputes: divorce and changing family structures in contemporary Britain. *Journal of the Royal Anthropological Institute* 3:731–746, 1997.

Smith, M.S., Kish, B.J., and Crawford, C.B. Inheritance of wealth as human kin investment. *Ethology and Sociobiology* 8:171–182, 1987.

Teachman, J.D. Contributions to children by divorced fathers. Social Problems 38:358–371, 1991.

Thompson, L. *A History of South Africa*. New Haven, CT: Yale University Press, 1990.

Trivers, R.L. Parental investment and sexual selection. In *Sexual Selection and the Descent of Man 1871–1971*, B. Campbell (Ed.). Chicago: Aldine, 1972, pp. 136–179.

van der Vliet, V. Traditional husbands, modern wives? Constructing marriages in a South African township. *African Studies* 50:219–241, 1991.

Weiss, Y., and Willis, R.J. Children as collective goods and divorce settlements. *Journal of Labor Economics* 3:268–292, 1985.

Weiss, Y., and Willis, R.J. Transfers among divorced couples: evidence and interpretation. *Journal of Labor Economics* 11:629–679, 1993.

Wilson, M., and Mafeje, A. *Langa: A Study of Social Groups in an African Township*. New York: Oxford University Press, 1963.

Younge, A. Housing policy and housing shortage in Cape Town: 1942–1980. *Africa Perspective* 21:9–28, 1982.