Paternal Care by Genetic Fathers and Stepfathers I: Reports from Albuquerque Men

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

We present a biosocial model of human male parental care that allows male parental allocations to be influenced not only by changes in the fitness (welfare) of the recipient offspring, but also by their effects on the man's relationship with the child's mother. The model recognizes four classes of relationships between males 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 investments collected from adult males living in Albuquerque, New Mexico, U.S.A. Four measures of paternal investment are examined: the probability that a child attends college (2,191 offspring), the probability that a child who attends college receives money for it ($N = 1{,}212$), current financial expenditures on children ($N = 635$), and the amount of time per week that men spend with children ages 5 to 12 years ($N = 2{,}589$). The tests are consistent with a role for relationship effort in parental care: men invest more in the children of their current mates, even when coresidence with offspring is not a confounder.

KEY WORDS: Paternal investment; Mating effort; Stepfathers.

Men's involvement with and investment in their offspring figures prominently in many models of human evolution (e.g., Alexander and Noonan 1979; Belsky et al. 1991; Benshoof and Thornhill 1979; Draper and Harpending 1982, 1988; Strassmann 1981; Symons 1979;

Received January 19, 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: 405–431 (1999)

655 Avenue of the Americas, New York, NY 10010
1090-5138/99/$–see front matter
PII S1090-5138(99)00023-9

Turke 1984, to list but a few). Furthermore, male parental care has important effects on children. In modern societies, for example, variation in male coresidence with or investment in children has been shown to influence such disparate outcomes as the children's educational accomplishments, their involvement with criminal or delinquent activities, drug and tobacco use, mental illness, poverty in childhood and adulthood, adolescent out-of-wedlock fertility, and marital instability (Bane and Ellwood 1989; Brook et al. 1985; Cooksey and Fondell 1996; Davidson 1990; Goodyer 1990; Harris and Marmer 1996; Haveman and Wolfe 1994, 1995; Isohanni et al. 1991; McLanahan and Bumpass 1988; Mutzell 1994; Newman and Denman 1970). On a financial level, billions of dollars are spent in the U.S.A. alone to help support families with noninvesting fathers, or to enforce the payment of child support obligations by nonresident fathers (Freeman and Waldfogel 1998). Thus, understanding the patterning and determinants of men's investments in children has important practical and theoretical implications.

Men's investment of time and resources in children (which we refer to more generally as parental care, with the understanding that such care usually, although not always, carries a cost to the investing parent; see Clutton-Brock 1991) is not always limited to their genetic offspring 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 1991; Hill and Hurtado 1996; Lancaster 1997), and they do 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 preliminary attempt to extend the biosocial perspective of human male parental behavior, using data on male parental care collected from men living in Albuquerque, New Mexico, U.S.A. The companion article presents further results gathered from Xhosa high school students living in Cape Town, South Africa.

THEORY

Most evolutionary approaches to male parental care begin with the notion that organisms must allocate reproductive effort among two competing forms of investment: parental effort (the summed investments in offspring that increase their fitness) and mating effort (the summed investments that increase future fertility) (Low 1978; Trivers 1972). In most sexually reproducing species, males allocate more of their reproductive budget to mating effort than females, whereas females allocate more to parental effort (Brunton 1988; Trivers 1972). This approach assumes that parental effort and mating effort trade off against one another, in the sense that increases in parental effort necessarily decrease allocations to mating effort and vice versa, if reproductive effort is held constant (Smith 1995; Whittingham 1993).

Although this tradeoff approach has been very productive (see, for example, Borgerhoff Mulder 1992; Clutton-Brock 1991; Davies 1991; Hewlett 1992; Hurtado and Hill 1992), it has an important limitation in that it does not allow forms of investment that both increase an existing offspring's fitness and increase the future fertility of the provider. Under the simple model, all forms of care directed toward offspring that carry a cost to the provider are considered parental effort. However, for species (such as humans) 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, the mutual exclusivity of mating and parental effort that is fundamental to or implicit in many life history models may be violated.

The possibility that mating and parental effort overlap has received serious consideration in analyses of parental care in insects (Alexander and Borgia 1979; Simmons and Parker 1989; Wedell 1993; Wickler 1985), fish (Kraak and Van den Burghe 1992), birds (Freeman-Gallant 1997; Rohwer 1986), and nonhuman primates (Smuts and Gubernick 1992; van Schaik and Paul 1996). In many insect species, for example, males offer a "prenuptial gift" to females before mating. These gifts have long been viewed as mating rather than parental effort (Alexander and Borgia 1979; Simmons and Parker 1989; Wickler 1985), a position that has received support from a recent study of wartbiters showing that nutrients in the gifts are not incorporated into the eggs the male fertilizes (Wedell 1993). For many vertebrates, paternal care is no longer considered to be an indicator of paternity or probable paternity (van Schaik and Paul 1996). Among mammals, male caregivers often are unrelated to the offspring they care for (Woodroffe and Vincent 1994). Among olive baboons, males carry and share food with infants who are unlikely to be their offspring; these males gain increased sexual access to the infants' mothers (Smuts 1985; Smuts and Gubernick 1992). Vervet males display more affiliative behavior toward unrelated infants when the infants' mothers are in view, and they behave more agonistically toward infants when they cannot see the mothers (Keddy Hector et al. 1989).

The mating implications of parenting behavior among humans have been noted in passing by several authors (Borgerhoff Mulder 1992; Flinn 1988; Gangestad 1993). La Cerra (1994) found some support for mating effects of parental behavior; female subjects reacted positively to pictures of men interacting positively with a baby and negatively to men ignoring a crying baby, whereas male subjects were indifferent to each situation. However, the overlap between human mating and parental behavior has not yet been investigated in great detail.

MALE PARENTAL CARE AS RELATIONSHIP EFFORT

The standard evolutionary model of male parental care needs to be expanded for humans, because of the variation in the relationships between men and the children to whom they provide care. In addition to the so-called "traditional" human family form in which a husband and wife both provide care for their common genetic offspring, men often provide care to unrelated offspring—specifically, to stepchildren, i.e., offspring conceived during a mate's previous relationship. Many studies have demonstrated that stepchildren receive lower levels of care than resident genetic offspring, and are at greater risk for abuse and neglect (Amato 1987; Cooksey and Fondell 1996; Daly and Wilson 1981, 1988; Flinn 1988; Judge 1995; Marlowe 1999; Marsiglio 1991; Smith et al. 1987). Nonetheless, human males are distinguished by the high levels of care they provide to step offspring, relative to the resources they provide to unrelated children in the general population. In contrast, care for stepchildren is relatively rare among nonhuman animals (Rohwer 1986). Providing care for step offspring can be considered a form of mating effort if it increases the probability that the male will remain with the child's mother or otherwise increases the "quality" of their relationship. All else being equal, females should prefer males who bond with, and are willing to provide care for, the offspring who were sired by previous mates, and they should avoid males who are unwilling to invest in, or are blatantly hostile toward, such children.

A second unusual feature of human male parental care, related to the extended period of investment that is characteristic of human offspring, is that it does not necessarily terminate with the end of a reproductive union between two partners. Among birds and mammals that exhibit paternal care, mate desertion is equivalent to the cessation of paternal investment (Davies 1991). Human males, however, may continue to invest in their genetic offspring following divorce or parental separation. Many studies have shown that paternal investment in genetic offspring decreases following divorce (Amato 1987; Simpson 1997; Teachman 1991; Weiss and Willis 1985, 1993). Decreased proximity to offspring often entails decreased ability to invest in them; for example, a male in a hunting and gathering society can readily share hunted game with an offspring who lives in his band, but may not easily do so with an offspring who resides in another camp. Nevertheless, male investment in children following marital dissolution is common, often considerable, and, in some cases, enforced legally.

We thus 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 well-being of the offspring themselves. *Male parental care thus can be a form of mating effort.*

The definition of mating effort as used by biologists stresses the reproductive aspects of such behavior—specifically, its effect on an individual's future reproductive opportunities (Davies 1991; Low 1978; Trivers 1972). Yet human relationships often involve women who are postmenopausal, or whose future reproductive opportunities are extremely limited. In this article, we will use data on parental investment in older offspring to support the hypothesis that parental care has a component of mating effort. Critics (both commentators at professional conferences and anonymous reviewers) have objected to the suggestion that male parental care for the children of older mates may be mating effort, on the grounds that older women cannot produce future offspring; therefore, by definition, the behavior cannot be mating effort.

Our response to this objection is twofold. First, the criticism that male parental care for the children of older women cannot be mating effort implies, by extension, that *men do not allocate any mating effort to older mates.* This is an empirical and theoretical question that, to the best of our knowledge, has not been adequately addressed from an evolutionary perspective. Most of the evolutionary literature on mating effort focuses on short-term relationships or on the initiation of long-term relationships; the investigation of mating investment in older long-term relationships has not been a topic of interest. Folklore, however, suggests that spouses who forget to observe important events such as birthdays and anniversaries are liable to offend their partners, no matter how longstanding the relationship. We contend that, even in long-term relationships, individuals do perform some sort of mating effort. We hope to challenge others to further explore this issue from an evolutionary perspective.

Our second response to this criticism is that although human evolutionary biologists focus primarily on such obviously fitness-related outcomes such as fertility and fecundity, human relationships are motivated by more than solely reproductive considerations. Several researchers have noted that marriage is acknowledged as a reproductive contract among all cultures (Buckle et al. 1996; Daly and Wilson 1988), and we do not dispute the importance of reproduction to human mating behaviors. Yet individuals often remain married past the wife's menopause; they may remain together after their children have grown up and become self-sufficient, or even if they have not had children together or do not have grandchildren to invest in. We do not need to resort to special pleading to argue that human marriages should have dimensions beyond the purely reproductive; it is an empirical fact that they do.

Although the evolutionary literature emphasizes the fecundity aspect of mating effort, there are other reasons why men might pay costs to remain in relationships with women. Economic specialization and reciprocity exchange relationships may be two important reasons for people to remain married even when future reproduction may not be likely. Because humans are characterized by long lifespans (relative to other mammals their size), and because they form long-term marital relationships that often outlast their reproductive careers, we must expand the narrow biological definition of mating effort when discussing human relationships. The long-term aspect of human mating relationships suggests that economic considerations such as reciprocity may be important to understanding cooperation between spouses, and between parents and offspring. An individual may perform an altruistic act for his partner (such as investing in her child), with the understanding that she will later reciprocate by performing an altruistic act that benefits him. Perhaps this is one reason why being married is associated with lower levels of stress and disease in both men and women (Bloom et al. 1978; Goodwin et al. 1987). Of course, there are additional reasons to remain with a postmenopausal mate, the proximate pleasures of companionship and sex being among the foremost. However, the prevalence of the sexual division of labor within households in all human societies lends support to the idea that spouses negotiate bargains with each other that include reciprocity and specialization in sex-specific human capital (Bergstrom 1996; Kaplan 1996).

Because human marital relationships involve economic and reciprocity dimensions 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 now will 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/child 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, providing care for 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 Class 4 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),

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)

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 offspring. 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.

PROXIMATE INFLUENCES ON MALE PARENTAL CARE

The model as we have articulated it does not directly address the proximate mechanisms by which men bond with children or choose to invest in them. This is not necessarily the fatal flaw that one reviewer implied: one can legitimately analyze the outcomes of men's decision-making processes without necessarily fully understanding the psychological mechanisms that informed and influenced those processes. These decisions are not consciously made by men, nor are these decisions made in an analytical vacuum that is uninfluenced by proximate causes. To begin with, men self-select into these relationships with children; for example, all else being equal, men who naturally bond with unrelated children, and who enjoy spending time with and resources on them, should be more likely to become stepfathers. The biosocial framework we present is not mutually exclusive from a model emphasizing proximate influences on male parental care, and we hope future work will better integrate these separate approaches.

We now present a test of the model, using reports of parental investment provided by men living in Albuquerque, New Mexico, U.S.A. Much of the presentation in this article is graphical in nature (for full, detailed models, see Anderson et al., in preparation a, in preparation b). The companion article (Anderson et al., this volume) presents further tests using reports of parental investment gathered from urban Xhosa high school students in Cape Town, South Africa.

METHODS

The Albuquerque Men Data Set

The data we use to test our hypotheses are derived from a sample of men from Albuquerque, New Mexico, U.S.A., collected by Kaplan and Lancaster from 1990 to 1993. Two complementary interviews were administered to participants recruited at the Bernalillo County (New Mexico) Motor Vehicle Division (MVD). The short interview took about 7 minutes to administer; approximately 7,100 participants were given this interview in a private area at the MVD. All men who appeared to be over 18 years of age were considered eligible for initial contact. This sampling procedure produced a sample of men that is comparable to the population of greater Albuquerque, as determined by data from the U.S. Census Bureau (Kaplan et al. 1995).

On the basis of information obtained in the short interview, eligible participants were invited to participate in the long interview. The criteria for eligibility were (1) being age 25 years or over, and (2) having come to the MVD for the purpose of license origination, renewal, or for a photo ID. If the subject agreed to participate in the long interview, an appointment was made to conduct the interview either in a mobile office vehicle, in an office at the University of New Mexico, or at the subject's home. Interviews were conducted in private by trained student interviewers. Approximately 1,325 men participated in long interviews, for which they were paid $30 each. The long interviews took from 2 to 6 hours to administer. (For further details on the long interview methodology, see Kaplan et al. 1998).

The long interview was designed to collect data on, among other things, each respondent's employment, marital, and reproductive histories. Men were asked about their reproductive behavior in the context of legal and common-law marriages, and in living-together relationships. Men also provided parenting histories, listing each putative genetic offspring they had fathered as well as any unrelated children they had ever parented. For the current article, we restricted the sample of unrelated children to stepchildren (i.e., the children of men's mates from previous relationships). Children who were not the putative genetic descendent of either the respondent or of his wife (e.g., adopted children, other relatives such as nieces and nephews, etc.) are excluded from the present analysis.

Measures of Parental Care

The current article analyzes four measures of parental care from the Albuquerque Men data set: college attendance, financial support for college, other financial expenditures on offspring ages 0 to 24 years, and time involvement with children ages 5 to 12 years. A brief overview of these variables is presented below (for further details, see Anderson et al., in preparation a, in preparation b).

The first variable, *college attendance*, is a bivariate retrospective measure of whether or not an offspring who was age 21 or older at the time of interview had attended more than 1 year of college. The probability that a child attends college may be considered a measure of the effects of parental care and, as such, is an indirect measure of parental care. Paternal involvement with, and investment in, offspring has positive effects on children's grades and educational accomplishments (Cooksey and Fondell 1996; Haveman and Wolfe 1995); these effects are expected to be cumulative throughout the life course (Kaplan 1996). Thus, whether or not a child attends college is dependent in part on the cumulative paternal investment she received throughout her life. Additionally, a child's decision to attend college may be influenced by the parent's willingness to provide financial support for it; college attendance and parental support for college are to some extent jointly determined. Whereas we can observe parental support for children who attend college, we cannot directly gauge whether or not a parent would have provided support for a child who does not attend college.

According to the biosocial framework depicted in Table 1, genetic offspring of current mates will be the most likely to attend college, both because they will have received the highest levels of investment throughout their lives and because they can expect the greatest levels of support while in college. Similarly, stepchildren of previous mates should be the least likely to attend college, because they will have received the lowest cumulative levels of care and they can expect the least support for college. The Albuquerque Men data set contains 2,191 offspring of all classes who were age 21 or older at the time of interview (average age 33.6) and were considered at risk of attending college. In total, 1,169 (53.4%) of these offspring attended more than 1 year of college. In terms of the offspring classes depicted in Table 1, there are 1,487 genetic offspring of current mates, 460 genetic offspring of previous mates, 152 step offspring of current mates, and 92 step offspring of previous mates.

The second variable, *financial support for college*, is a retrospective bivariate measure of whether or not respondents provided any money for tuition or living expenses for their children (of all classes) who attended college. This is a rather straightforward binary variable: either a respondent provided a child with money for college, or he provided no money. (For an analysis of the actual amounts of money provided, see Anderson et al., in preparation a.) The data set contains 1,212 children age 18 or older who are known to have attended at least 1 year of college; in total, 844 (69.6%) of them received some money for college from respondents. This sample contains 925 genetic offspring of current mates, 207 genetic offspring of previous mates, 66 step offspring of current mates, and 14 step offspring of previous mates.

The third variable, *financial expenditures on offspring,* is a cross-sectional measure of the amount of money men spent on children the year prior to being interviewed. Respondents were asked how much money they had spent over the last year on each child they had parented for a number of specific categories: the child's education (tuition, materials, books, etc.), clothing, hobbies (e.g., sports, ballet, collections, lessons, etc.), allowance ("pocket money"), medical expenses, and gifts. These categories were summed to create an aggregate estimate of the respondent's financial expenditures on each of his offspring. We have restricted the sample to 635 children age 24 or less. Expenditures on young offspring may be constrained by legal requirements and thus not fully reflect parental preferences (i.e., a parent may not be able to spend very little on a child without potentially inviting criminal charges of neglect). Thus, we have subdivided our sample into two age classes. There are 419 children ages 0 to 17 (average expenditure = $2,103), including 282 genetic offspring of current mates, 102 genetic offspring of previous mates, 38 step offspring of current mates, and 24 step offspring of previous mates; and 216 offspring ages 18 to 24 (average expenditure = $2,670), including 99 genetic offspring of current mates, 65 genetic offspring of previous mates, 20 step offspring of current mates, and 32 step offspring of previous mates.

The fourth variable, *time involvement with a child,* is a retrospective measure of the number of hours per week the respondent spent with each child when the child was between the ages of 5 and 12. Respondents were asked about two kinds of time involvement: one-on-one interactions, and interactions in a group with other children or adults. The frequency of each type of interaction was rated on a scale of 1 (never), 2 (0 to 2 hours), 3 (3 to 5 hours), 4 (6 to 15 hours), or 5 (16 or more hours a week). These rankings were converted to number of hours of involvement per week (1 = zero hours, 2 = 1 hour, up through 5 = 18) for each variable. These two time measures were summed to produce an estimate of men's total time involvement with each child, on a continuous scale from 0 to 36 hours and above. The data set contains time involvement data on 2,589 offspring, all of whom were age 6 or older at the time of interview. On average, men report spending 18.9 hours per week with each child they had parented.

Because this measure of parental involvement covers 8 years of middle childhood, some children will change relationship classes due to their mothers divorcing from respondents (e.g., change from being the genetic child of current mate to the genetic child of former mate, or the stepchild of current mate to the stepchild of former mate). Because this is a retrospective measure, we cannot be sure if respondents are answering the question for the period they lived with the child, for the period after they lived with the child, or for some average of the two. In fact, how they respond may depend in part on what portion of that age period they coresided with the child. Men who divorced when the children were young may respond for the period they lived apart, whereas men who divorced when the children were older may respond for the period they lived together. Because this variable is difficult to interpret for children whose parents divorced during the period covered by the variable, we have restricted the sample to children who did not change relationship classes during middle childhood. The data set contains 1,989 genetic offspring who lived with their mothers and the respondents throughout ages 5 to 12 (or their current age) (Class 1 throughout middle childhood), 148 genetic offspring whose parents separated before age 5 (Class 2 at the start of middle childhood), and 118 stepchildren whose mothers were the respondents' current mates when the children were age 12 (or their current age) (Class 3 throughout middle childhood). Stepchildren whose mothers had divorced respondents before age 5 (Class 4 by the start of middle childhood) are not included in this analysis due to small sample size ($N = 6$).

Proximate Mechanisms: Coresidence Histories

We noted earlier that the model does not emphasize proximate psychological influences on male parental care, although it does not deny their importance. The Albuquerque Men data set contains relatively little data on proximate mechanisms, such as measures of male-offspring bonding or attachment security. One variable that is available and that is likely to correlate with the degree to which men have bonded with children is the age of the child when the man either started or stopped coresiding with him or her. This is not a perfect measure of the degree to which men bond with children, but it is commonly thought that men who cease or begin living with children earlier in their children's lives will bond with them less or more, respectively, in ways that will influence their subsequent investment in them.

For nonresident genetic children, the predictor variable is the child's age when the respondent ceased living with the child. In the child support compliance literature, never-married fathers (which includes men who never lived with their offspring) are less likely to pay child support than ever-married men (Beller and Graham 1986), whereas men who were highly involved with their children before divorce (and presumably more closely bonded with them) are more likely to pay child support (Peters et al. 1993). In the Albuquerque Men data set, the average age that genetic children of former mates ceased to live with respondents was 2.0 years (range 0 to 5) for the middle childhood time investment sample, and 10.4 (range 0 to 17) for the college sample. For stepchildren, the nature of men's bonds, and the effect of these bonds on children's development, are still poorly understood (Hawkins and Eggebeen 1991; Mott 1990; Van Ijzendoorn and De Wolff 1997). However, it is reasonable to assume that men who begin living with stepchildren earlier become more closely bonded to them. In the Albuquerque Men data set, the average age that men began living with the stepchildren of their current mates was 5.9 years (range 0 to 12) for the childhood time involvement data set, and 8.5 years (range 0 to 17) for the college attendance data set.

RESULTS

Table 2 presents descriptive statistics for each measure of male parental care, by class of father-child relationship. The table shows that, not controlling for education, income, ethnicity, or other socioeconomic variables, male investment does vary across the four classes of offspring presented in Table 1. For each measure of

Table 2. Measures of Parental Care, by Children's Relationship to Respondent

	Genetic children of current mates (Class 1)	Genetic children of previous mates (Class 2)	Stepchildren of current mates (Class 3)	Stepchildren of previous mates (Class 4)
Percent who attend college	61% (1.3%)	43% (2.3%)	39% (4.0%)	13% (3.5%)
Percent attending college who receive money for it	75% (1.4%)	55% (3.5%)	52% (6.2%)	29% (12.5%)
Amount of money currently spent on children ages 0–17 (1990 dollars)	$2,570 (169)	$1,888 ($206)	$1,861 ($435)	$156 ($93)
Amount of money currently spent on children ages 18–24 (1990 dollars)	$4,293 ($465)	$1,535 ($406)	$1,828 ($686)	$483 ($318)
Time involvement with children ages 5–12 (hours per week)	20.1 (0.18)	9.5 (0.95)	16.2 (0.78)	—

Values are given as average (standard error).

investment, genetic children of men's current mates receive the highest levels of investment, whereas stepchildren of previous mates receive the least, consistent with our predictions. We now present the results of multivariate analyses for each outcome variable that control for potential confounders.

College Attendance and Financial Support for College

For college attendance and financial support for college, multivariate logistic regression models were run with each of those variables as the dependent variable. The models controlled for the offspring's sex and age, the respondent's ethnicity and income, whether or not the respondent ever legally married the child's mother, and the education of the respondent and the child's mother. A child's class was represented by three dummy variables: the child was a genetic offspring of a current mate (Class 1), a step offspring of a current mate (Class 3), or step offspring of a previous mate (Class 4). Genetic offspring of former mates (Class 2), the omitted category, represent the baseline against which the other three categories are evaluated. The parameter estimates for the children's class dummy variables were converted into odds ratios, which represent the likelihood that a child of given class will attend college or receive money for college, relative to a Class 2 offspring, all else being equal. (For a fuller treatment of these measures, including presentation of multivariate regression output, see Anderson et al., in preparation a).

The results from these analyses are presented in Figures 1 and 2. Figure 1 shows that, relative to Class 2 offspring (the omitted category), Class 1 offspring

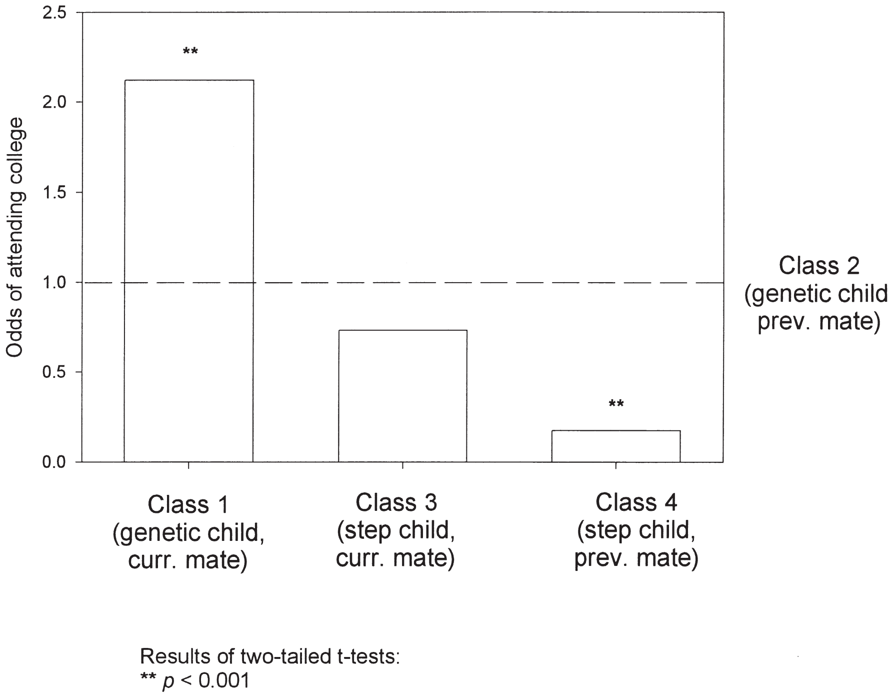


FIGURE 1. Odds ratio of attending college, relative to genetic offspring of previous mates.

(genetic offspring by current mates) are over twice as likely to attend college, whereas Class 4 children (stepchildren by former mates) are about one fifth as likely. Both of these results are statistically significant. This presumably reflects both the cumulative level of paternal investment children of different classes receive over their lives, as well as the levels of parental support they expect to receive should they attend college. Class 3 offspring (stepchildren by current mates), on the other hand, are not statistically more or less likely to attend college than genetic offspring of former mates.

Figure 2 presents odds ratios for receiving money for college for those children who attend college. Relative to Class 2 offspring, genetic offspring of current mates are 2.75 times as likely to receive money, whereas step offspring of former mates are only one fourth as likely. Both effects are highly statistically significant. As with college attendance, there is no statistical difference between the likelihood of genetic offspring of previous mates and step offspring of current mates who attend college receiving money for college.

Figure 3 presents the effects on college attendance of the age at which men stopped living with their genetic children by previous mates (Class 2 offspring). For genetic children of former mates ($N = 460$), the number of years they lived with their father has a marginally significant effect on their probability of attending college, all else being equal (partial $p = .07$). The values for this figure were obtained by taking the model used to generate Figure 1, restricting the sample to genetic off-

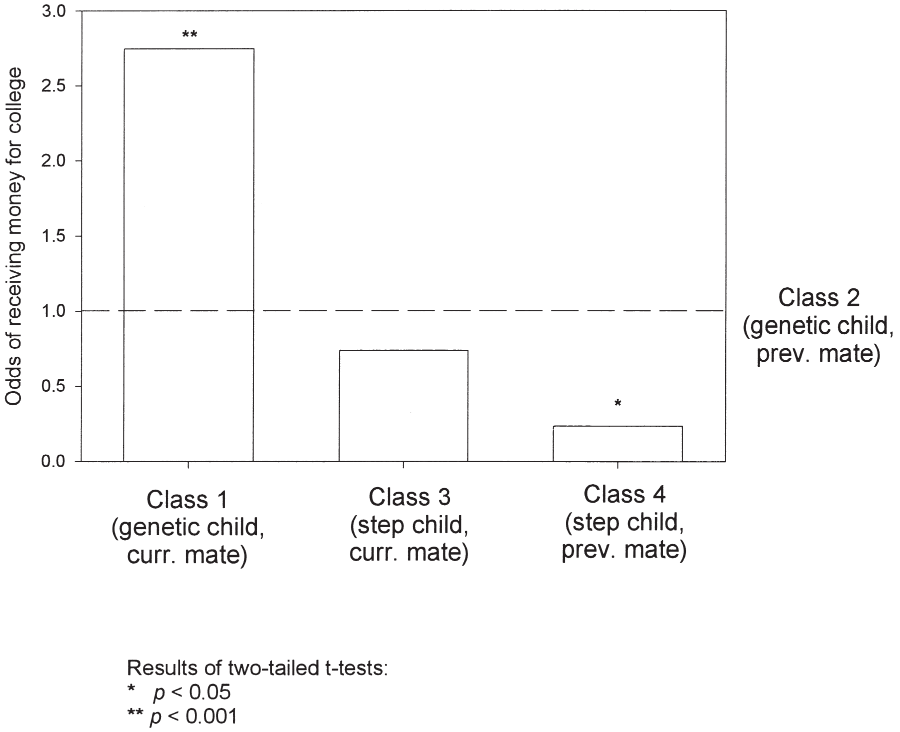
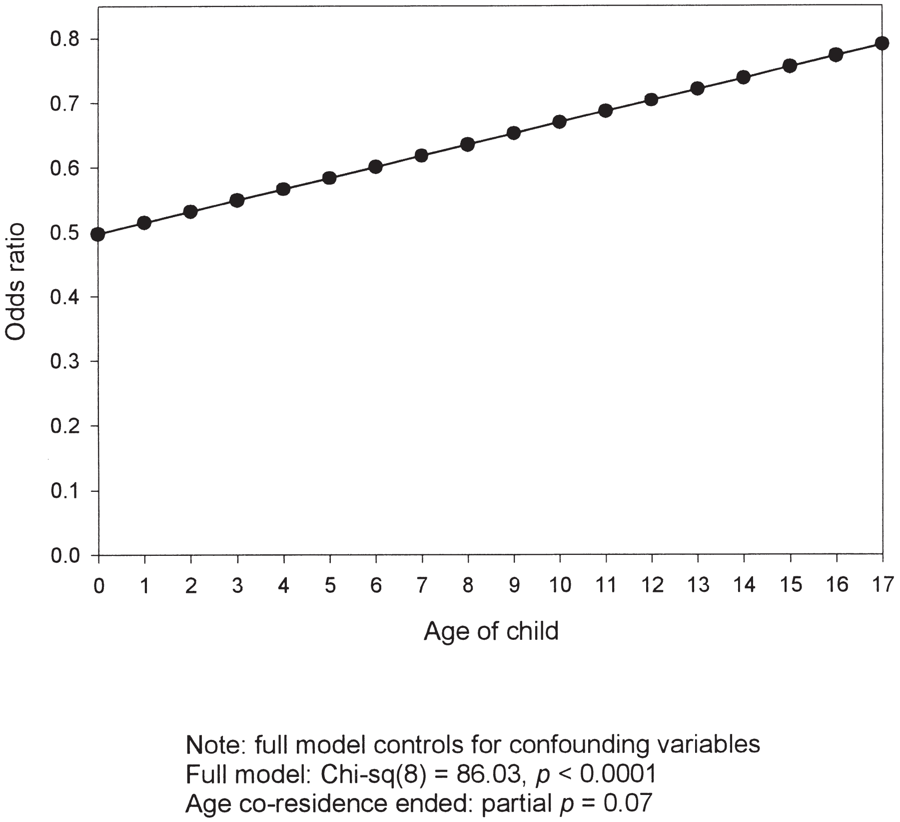


FIGURE 2. Odds ratio of receiving money for college, relative to genetic offspring of previous mates.

spring of previous mates, and adding the child's age at which the respondent ceased to live with that child. The other variables in the multivariate model then were set to the average value for the sample, allowing us to plot the effects of coresidence age on the odds of attending college. As shown in Figure 3, the probability of a genetic child of a former mate attending college increases about 1.7% with each additional year he lives with his genetic father, when all else is equal. For stepchildren of current mates ($N = 152$), there is no additional effect beyond the other predictors in the model of the age at which they began living with respondents on their likelihood of attending college (partial $p = .43$). (Analyses on the probability of children who attend college receiving money from respondents are not included here because the decreased subsample sizes—207 genetic children of previous mates and 66 stepchildren of current mates—could not produce statistically significant models of the probability of obtaining money for college, even with reduced numbers of regressors.)

Cross-Sectional Financial Expenditures on Offspring

To analyze current financial expenditures on children, we ran separate multivariate ordinary least squares regression models for each age group (0 to 17 and 18 to 24),



Note: full model controls for confounding variables
Full model: Chi-sq(8) = 86.03, $p < 0.0001$
Age co-residence ended: partial $p = 0.07$

FIGURE 3. Odds ratio of attending college for genetic children of previous mates, by the age at which coresidence with the genetic father ceased.

with financial expenditures as the dependent variable. The models controlled for the offspring's sex and age, the respondent's ethnicity and income, whether or not the respondent ever legally married the child's mother, the education of the respondent and the child's mother, and (for older offspring) whether or not the child attended more than 1 year of college. The residuals (the difference between the actual expenditures and the expenditures predicted by the statistical model) from each model were saved and analyzed by class. The average residual across all children will, by definition, be zero; thus, the average residual for a particular father/child class reflects how much more or less money that class of offspring receives relative to the "typical" child. Genetic offspring of current mates are predicted to have positive residuals (because they receive higher levels of expenditures than the average offspring), whereas step offspring of former will have negative residuals (because they receive lower expenditures than the average child). (For a fuller treatment of these measures, including presentation of multivariate tobit regression output, see Anderson et al., in preparation b).

Figures 4 and 5 plot the average residuals by class for each age group. Table 3 presents the results of analyses of variance with post hoc pairwise comparisons,

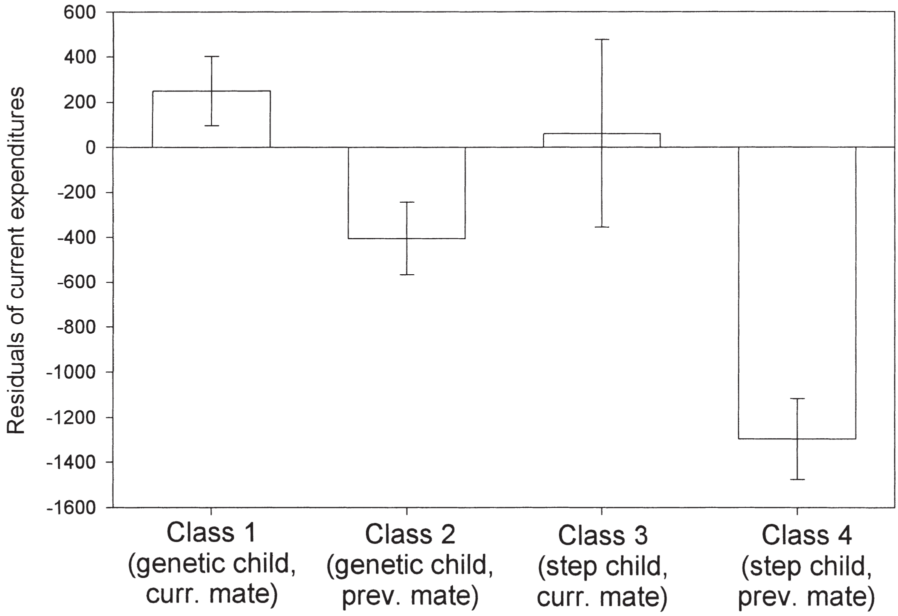


FIGURE 4. Residuals of financial expenditures on offspring ages 0 to 17, by class (± SE).

FIGURE 5. Residuals of financial expenditures on offspring ages 18 to 24, by class (± SE).

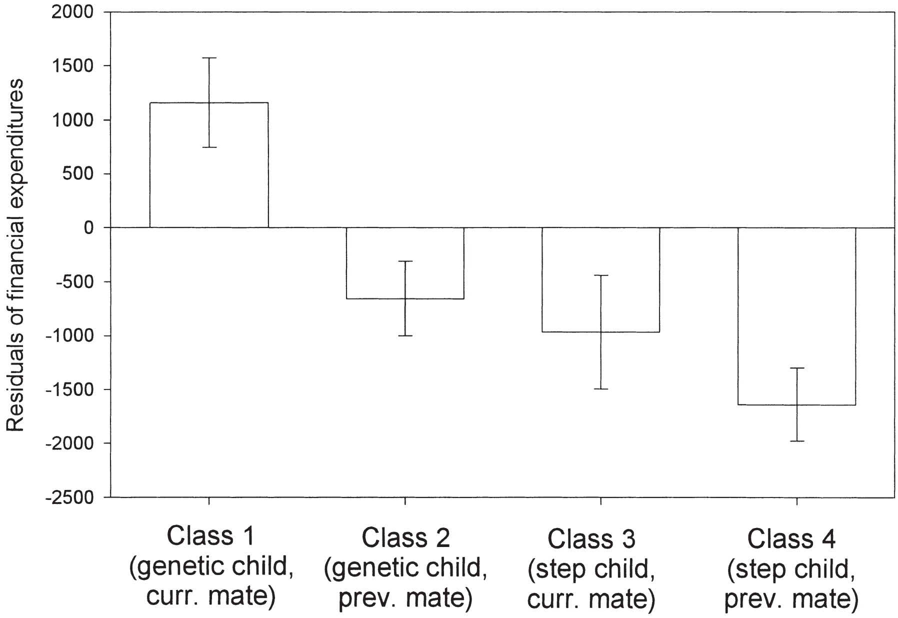


Table 3. Pairwise Comparisons of Mean Differences (*p* Values) of Residuals of Financial Expenditures on Children

		Ages 0–17 [*F*(3, 442) = 4.66, *p* = .003]			
		Genetic children, current mates	**Genetic children, previous mates**	**Stepchildren, current mates**	**Stepchildren, previous mates**
Ages 18–24 [F(3, 312) = 5.51 *p* = .001]	Genetic children of current mates (Class 1)	—	**−655.6** **(0.088)**	**−188.8** **(1.000)**	**−1546.2** **(0.011)**
	Genetic children of previous mates (Class 2)	1264.1 (0.092)	—	**466.8** **(1.000)**	**−890.6** **(0.541)**
	Stepchildren of current mates (Class 3)	1722.3 (0.187)	458.2 (1.000)	—	**−1357.5** **(0.150)**
	Stepchildren of previous mates (Class 4)	2388.9 (0.002)	127.9 (0.665)	666.7 (1.000)	—

Note: These pairwise comparisons evaluate the differences between the average residuals plotted in Figures 4 and 5. The residuals represent expenditure on a child in the column category minus expenditure on a child in the row category, after controlling for potential confounders in a multivariate regression. *F*-statistics present significance for an analysis of variance evaluating whether there is any difference in financial expenditures across different types of fathers for each age group. See text for details.

Results for ages 0–17 are above the diagonal and bold; results for ages 18–24 are below the diagnonal and not bold.

comparing residuals across classes of offspring; ages 0 to 17 are presented above the diagonal and are bold, whereas ages 18 to 24 are below the diagonal and are not bold. The mean differences of residuals by class are evaluated using Bonferroni comparisons, which adjust the observed significance for the fact that multiple comparisons are being performed. Each cell of the table presents a pairwise comparison between two classes of offspring. Thus, for example, genetic children of previous mates (ages 0 to 17) receive about $655.6 less than same-aged genetic children of current mates when all else is equal, but this difference is only marginally significant ($p = .088$). In contrast, stepchildren of previous mates (ages 0 to 17) receive about $1546.2 less than genetic children of current mates, a highly significant difference ($p = .011$).

Figure 4 and Table 3 show that genetic offspring by current mates (Class 1), ages 0 to 17, receive significantly more money than those of former mates (Class 2) and stepchildren through former mates (Class 4), but do not receive more than stepchildren through current mates (Class 3). As expected, Class 4 offspring receive less money than any other class of offspring. Class 2 and Class 3 children are statistically indistinguishable.

Figure 5 and the lower half of Table 3 present results for children ages 18 to 24. Because these children are not necessarily dependent on their parents, and because they often do not live at home, we expect expenditures on this group of offspring to more closely reflect actual parental preferences. The results are similar to those for ages 0 to 17; Class 1 offspring receive higher levels of expenditures than most classes, with the exception of stepchildren of current mates.

Analyses were performed to examine effect of the age coresidence with children ceased (for 167 genetic offspring of previous mates) or began (for 57 stepchildren of current mates) on financial expenditures. To increase subsample size, children of all ages 0 to 24 were collapsed into each subsample. The overall models (which include the additional control variables used in previous models) provided statistically significant fits, but the age of coresidence cessation/initiation had no additional effect (partial $p = .83$ for genetic offspring of previous mates; $p = .57$ for stepchildren of current mates).

Time Involvement

The treatment of time involvement during middle childhood (average number of hours spent weekly with the child between the ages of 5 and 12) is similar to that of financial expenditures on offspring. We ran a multivariate ordinary least squares regression model with total time spent with the child as the dependent variable. Each model controlled for the child's sex, the respondent's ethnicity, the respondent's age and income when the child was 13, whether or not the respondent ever legally married the child's mother, and the education of the respondent and the child's mother. Residuals were saved from the model, and, using analysis of variance with post hoc pairwise comparisons, we will compare the average residual of each class of offspring to detect biases in men's time allocation to children.

Figure 6 and Table 4 present the results for men's time involvement with a child. All else being equal, men spend the most time with their coresident genetic offspring. They spend significantly less time (about 3 fewer hours per week) with coresident stepchildren, and they spend the least amount of time (about 8 hours less than average) with nonresident genetic offspring.

Using the same model that generated the results presented in Figure 6, we divided the sample into two subclasses (genetic children of previous mates and stepchildren of current mates) and added the age at which coresidence with the child began or ended, respectively. For the 145 genetic children whose parents had divorced by age 5 (Class 2), the age at which men ceased to live with them had no additional effect on the amount of time spent with the child from ages 5 to 12 (partial $p = .115$). However, among 118 stepchildren whose mothers were the respondents' current mates when the children were age 12 (Class 3), men spend significantly less time with stepchildren who were older when coresidence began (partial $p = .013$). Figure 7 plots the residuals of time involvement with stepchildren of current mates. All else being equal, men spent approximately four tenths of an hour less per week with each stepchild for each additional year their coresidential relationship was delayed. On average, men spent about 2.3 hours less with current stepchildren than what the average child (irrespective of class) received (Figure 6). Stepchildren who began living with men before age 6 received more time involvement than the average stepchild, whereas those who began living with men at age seven or later received less than average (Figure 7).

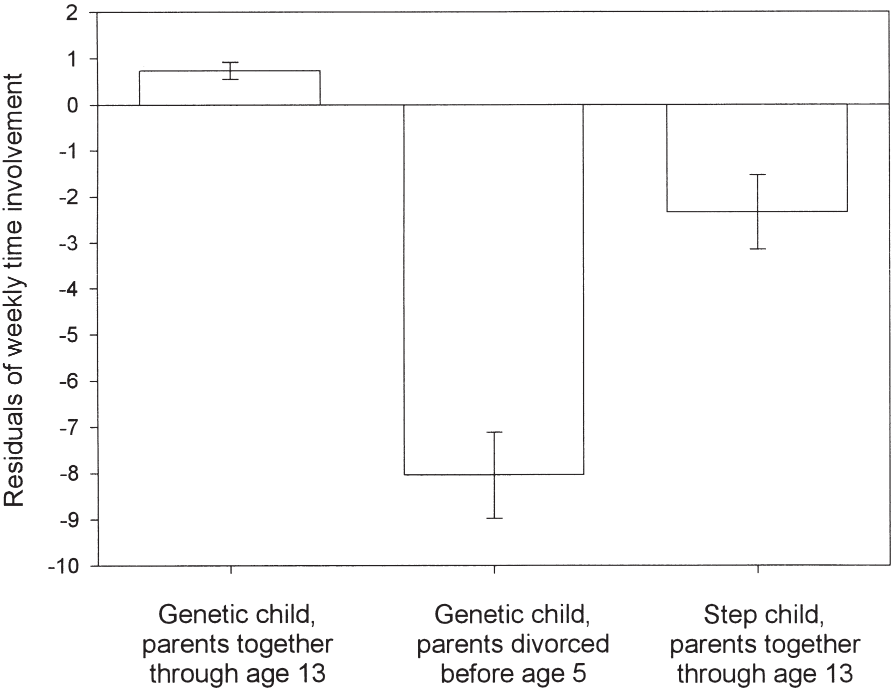


FIGURE 6. Residuals of men's time involvement with offspring ages 5 to 12, by class (± SE).

In general, the time allocation results presented in Table 4 and Figure 6 show that residency and genetic relatedness are both important influences on time allocation. Men are more likely to spend time with children who live with them than children who do not; among residential children, they bias their time involvement towards genetic offspring. The age at which men ceased to live with children has no strong effect on time involvement with genetic children after divorce, whereas the age at which they began to live with children has a significant effect on time involvement with stepchildren of current mates.

Table 4. Pairwise Comparisons of Mean Differences (*p* Values) of Residuals of Time Involvement with Children Ages 5–12 after Controlling for Potential Confounders in a Multivariate Regression

	Genetic child, parents separated before age 5 (Class 2)	Stepchild, parents still together (Class 3)
Genetic child, parents still together (Class 1)	−8.78 (0.000)	−3.08 (0.000)
Genetic child, parents separated before age 5 (Class 2)		5.70 (0.000)

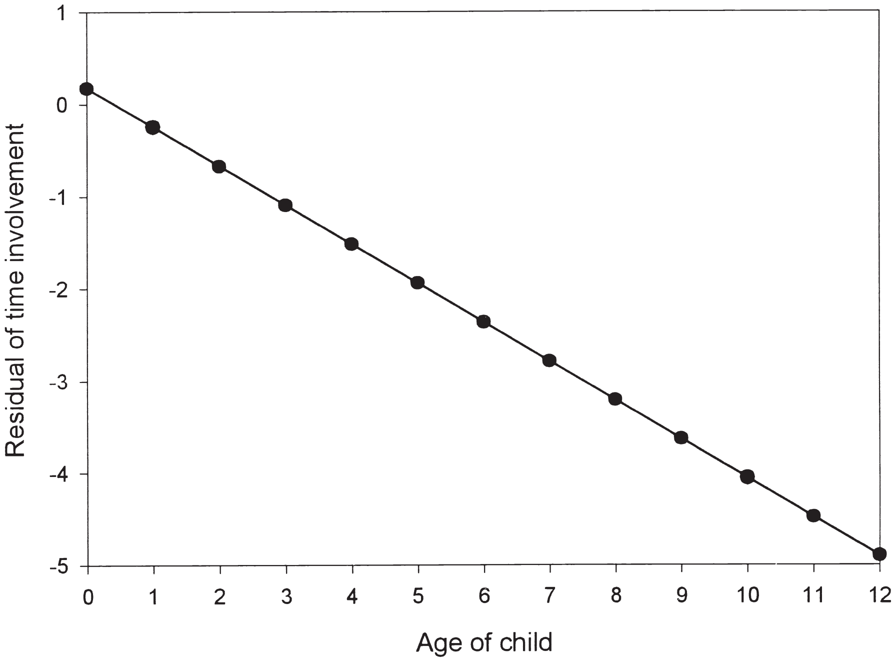
Note: These pairwise comparisons evaluate the differences between the average residuals plotted in Figure 6. $F(2, 2252) = 81.64$, $p < .0001$.

DISCUSSION

The pattern presented by these results is similar for each measure of parental care and conforms to the model presented in Table 1. In general, genetic offspring of current mates receive the highest levels of investment, step offspring of former mates receive the least, and genetic offspring of former mates and step offspring of current mates receive similar levels of investment, allowing for the effects of coresidence.

To the best of our knowledge, no other investigators compared children in all four cells of Table 1 at once. However, our results replicate other studies showing that genetic offspring whose mothers are men's current mates receive greater levels of investment than genetic offspring whose mothers are separated or divorced (Amato 1987; Simpson 1997; Teachman 1991; Weiss and Willis 1985, 1993) and stepchildren whose mothers are their current mates (Amato 1987; Cooksey and Fondell 1996; Daly and Wilson 1981, 1988; Flinn 1988; Judge 1995; Marlowe 1999; Marsiglio 1991; Smith et al. 1987). The results are similar to our comparison of investments by Class 1, Class 2, and Class 3 fathers in Xhosa high school students in Cape Town, South Africa (Anderson et al., this volume).

FIGURE 7. Residuals of time involvement with stepchildren of current mates, by the age coresidence with the child began.



Note: full model controls for confounding variables
Full model: F[8,109] = 2.19, p = 0.033
Age co-residence began: partial p = 0.013

Although the general pattern of male investment in offspring conforms with our predictions, it varies in the details in interesting and important ways. First, residency has an important confounding effect for time involvement and financial expenditures on younger offspring. Men spend more time with and money on resident offspring, regardless of relatedness. For financial expenditures on residential offspring, there is a trend towards greater investment in genetic than stepchildren, but these differences are not significant (Table 3). Among younger residential children, men do bias time involvement towards genetic offspring (Table 4).

The biosocial model underlying our hypotheses does not explicitly focus on proximate influences on paternal care. However, we have been able to examine one proximate variable that is likely to correlate with the extent to which men bond with the children they have parented: the age at which they ceased to live with genetic offspring (Class 2), or the age at which they began to live with step offspring (Class 3). In general, we did not find strong significant effects of these variables on paternal care, although these results should be interpreted with caution as they could be due to insufficient statistical power in certain reduced subgroups. We did find that genetic children whose parents have divorced are marginally more likely to attend college the longer they coresided with their fathers (Figure 3). Additionally, men spend significantly more time with their stepchildren the earlier they began living with them (Figure 7). The fact that proximate measures correlated with psychological decision-making mechanisms may be significant predictors of paternal investment does not negate or detract from the underlying evolutionary model, but adds a more fully integrated and richer picture of male parental decision-making.

We believe this increased investment in resident children attests to the importance of relationship effort in male investment decisions. However, there are additional reasons why men might invest more in resident offspring, regardless of relatedness. First, there is greater opportunity to invest, simply because the child is encountered more frequently. Second, there is a lower cost to investing; a nonresident male must travel (perhaps great distances) to spend time with a child, which costs both time and money. There is also a cost to not investing; a male might have to go to great lengths to avoid spending time with a child who lives with him, and a parental figure who invests too little in a resident child risks being charged with neglect or abuse. Our analyses of financial expenditures on older offspring (ages 18 to 24), as well as on the probability of children attending college and receiving money for college, show the roles of both genetic relatedness and the relationship with the child's mother (relationship benefits). Controlling for the relationship with the child's mother, genetic offspring receive more investment than stepchildren. Yet, stepchildren whose mothers are men's current mates also receive relatively high investments, and this cannot be due solely to coresidence with these children. Even though most of these children are no longer living at home, men nonetheless invest as much in college-aged or college attending stepchildren through current mates as they do in same-aged genetic offspring by former mates (Figures 1, 2, and 5). This lends further support to the role of relationship effort in male parental care.

In addition to reducing the effect of residency, examining parental investment in older offspring has another advantage: it avoids the confounder of maternal control of paternal resources. Weiss and Willis (1985, 1993) posit that male care for genetic children after divorce (Class 2) may be less than what genetic offspring of current mates (Class 1) receive because many forms of male care, such as child support payments, are channeled through the child's mother. Because the mother is able to reallocate the resources for other purposes, men may consequently decrease their investments in their genetic children by former mates. Our model predicts that men decrease investments in genetic offspring after divorce because an important component of investments in genetic children of current mates is actually relationship effort, which will be reallocated to other avenues once the relationship with the child's mother has dissolved. Because investments in older offspring—especially those attending college—are likely to be made directly to the offspring or to the child's school, rather than to the child's mother, our tests of expenditures on older offspring provide support for our model that is not accounted for by Weiss and Willis' model.

Standard social science and evolutionary models of male care assume that men invest in children because of the effects the care has on the children's well-being or fitness—i.e., for parental benefits solely. Our model posits that men also invest in children because of the effects of the care on their relationships with the children's mothers—i.e., for relationship benefits. It should be noted, however, that the impact of the man's relationship to the child's mother may be broader and more complex than simply its implications for future reproduction (as in the technical definition of mating effort). Men and women who live together negotiate a large array of rights and duties, involving both goods and services. Time and monetary investments in children are part of that negotiation. For example, the man's investment in a child may increase the woman's investment in other children, free her to do household labor, or shift her allocation to more time spent in the workforce and earning money. The codependence between men and women that is part of coresidence suggests that a man's investment in children may be affected by many factors, not just its impact on the probability of future reproduction with the child's mother. A bargaining approach to investment in children is likely to be especially productive (Bergstrom 1996).

Understanding why men choose to invest (or not) in offspring has great practical benefits in a society such as ours in which government support (and taxpayers' dollars) is commonly used to offset decreased male investment in children. For example, over the past 3 decades, the federal and state governments have passed increasingly strict laws to enforce the collection of child support obligations in the U.S.A. Despite these actions, however, child support compliance has remained steady or decreased for most groups over the same period (Freeman and Waldfogel 1998; Hanson et al. 1996; Robins 1992). The phenomenon of "deadbeat dads" is well known, yet many questions remain about why some men choose not to pay child support (Dubey 1995). Although men's ability to provide child support has an effect on child support compliance (Bartfeld and Meyer 1994), some estimates suggest that noncustodial fathers can afford to pay several times what they currently do (Garfinkel and Oellerich 1989). In determining child support levels, 35 states now require noncustodial parents to share the same proportion of their income with their children as they would have shared had they remained living with them (Hanson et al. 1996). In other words, men are required to pay their genetic children by former mates the same amount as they would pay genetic children of current mates. According to our model, this requires men to direct a significant portion of their mating effort budget into nonmating relationships, decreasing their ability to attract or maintain subsequent mates. This may be an important reason why, despite increasing legislative penalties, men are proving so resistant to paying their child support obligations in full. This explanation is not provided as an excuse for the behavior of “deadbeat dads.” Rather, we propose this suggestion from the perspective that understanding the motivations of men’s parental behaviors (or lack thereof) is an important first step to explaining and possibly altering the behaviors themselves.

Needless to say, the results presented here are but a preliminary step, and much work remains to be done to develop and test the role of relationship effort in parental care. The results show that male parental investment in a contemporary industrial society conforms to the pattern presented in Table 1. Much work remains to be done, however, to elucidate the role of relationship effort in male parental care. For example, if mating effort is an important part of relationship effort, it would follow that male parental care should be positively correlated with the reproductive value of a man’s mate. One way of testing this might be to compare the care men provide to same-aged young children of younger and older women, controlling for differences in men’s ages and socioeconomic status. The Albuquerque Men data set contains too few offspring in the appropriate subsamples to make this comparison, but future work with larger data sets may be able to address this question.

We will briefly mention three other predictions that follow from the hypothesis that investment in offspring of current mates is at least partially relationship effort. All else being equal, a woman should be more likely to divorce a man who is a low investor in her children; this raises the possibility that the decreased investments in genetic children by men after divorce may be as much a cause as a result of divorce. We know of no study that has examined this issue, but proper tests would require longitudinal data sets. Second, men who invest highly in children after divorce should experience tradeoffs in their ability to obtain and keep additional mates. Bloom et al. (1996) report that men who pay full child support are less likely to remarry and have additional children than men who pay less than full child support; further research in this area should be performed. Third, single mothers should be more likely to enter into and remain in relationships with men who interact well with their children and who invest willingly in them. La Cerra (1994) found that female subjects react positively to images of men interacting affiliatively with babies, but we are not aware of any research on how women with small children (and their potential mates) actually behave.

CONCLUSION

We present a biosocial model of male parental care that incorporates the dual effect of mating and parental benefits on male parental allocation decisions. Using several measures of parental care by men living in Albuquerque, New Mexico, U.S.A., we present results that are consistent with the model: men invest more in the offspring of their current mates, even when residency is not an important influence. We also report that although stepchildren of current mates generally receive lower investments than resident genetic offspring, they receive levels of care comparable to genetic offspring of previous mates. Investment in these children is significant, suggesting that male investment in stepchildren is an important mating strategy for at least some males. The companion paper (Anderson et al., this volume) presents further support for the model using reports of parental care provided by Xhosa high school students in Cape Town, South Africa. We hope these results will spur further investigation of the effects of mating effort on paternal care, as well as further theoretical development of evolutionary models of parental care in humans.

Funding for the Albuquerque Men project on male fertility and parenting was provided by the National Science Foundation (#BNS-9011723 and #DBS-911552) and the William T. Grant Foundation (#89135089 and #91130501), as well as by the University of New Mexico Research Allocations Committee and the University of New Mexico Biomedical Research Grant. Kermyt Anderson was supported during part of the writing of this paper by a National Science Foundation Graduate Research Fellowship. Martin Daly, Phil Ganderton, Kim Hill, Joanna Scheib, Troy Tucker, Margo Wilson, and several anonymous reviewers provided invaluable comments on earlier drafts of this paper. We would also like to thank the many undergraduate and graduate students at the University of New Mexico who worked on collecting and managing the Albuquerque Men data set. Earlier versions of this paper were presented at the 1997 meeting of the Human Behavior and Evolution Society, the 1997 meeting of the Economic Science Association, and the 1999 meeting of the Society for Research in Child Development.

REFERENCES

Alexander, R.D., and Borgia, G. On the origin and basis of the male-female phenomenon. In *Sexual Selection and Reproductive Competition in Insects,* M.S. Blum and N.A. Blum (Eds.). New York: Academic Press, 1979, pp. 417–440.

Alexander, R.D., and Noonan, K.M. Concealment of ovulation, parental care, and human social evolution. In *Evolutionary Biology and Human Social Behavior: An Anthropological Perspective,* N. A. Chagnon and W. Irons (Eds.). North Scituate, MA: Duxbury Press, 1979, pp. 436–453.

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).

Bane, M.J., and Ellwood, D.T. One fifth of the nation's children: why are they poor? *Science* 245:1047–1053, 1989.

Bartfeld, J., and Meyer, D.R. Are there really deadbeat dads? The relationship between ability to pay, enforcement, and compliance in nonmarital child support cases. *Social Service Review* 68:219–235, 1994.

Beller, A.H., and Graham, J.W. Child support awards: differentials and trends by race and marital status. *Demography* 23:231–245, 1986.

Belsky, J., Steinberg, L., and Draper, P. Childhood experience, interpersonal development, and reproductive strategy: an evolutionary theory of socialization. *Child Development* 62:647–670, 1991.

Benshoof, L., and Thornhill, R. The evolution of monogamy and concealed ovulation in humans. *Journal of Social and Biological Structures* 2:95–106, 1979.

Bergstrom, T. Economics in a family way. *Journal of Economic Literature* 34:1903–1935, 1996.

Bloom, B.L., Asher, S.J., and White, S.W. Marital disruption as a stressor: a review and analysis. *Psychological Bulletin* 85:867–894, 1978.

Bloom, D.E., Conrad, C., and Miller, C. Child Support and Fathers' Remarriage and Fertility. Working Paper 5781.Cambridge, MA: National Bureau of Economic Research. 1996.

Borgerhoff Mulder, M. Reproductive decisions. In *Evolutionary Ecology and Human Behavior*, E.A. Smith and B. Winterhalder (Eds.). New York: Aldine de Gruyter, 1992, pp. 339–374.

Brook, J.S., Whitehead, M., and Gordon, A.S. Father absence, perceived family characteristics and stage of drug use in adolescence. *British Journal of Developmental Psychology* 2:87–94, 1985.

Brunton, D.H. Sexual differences in reproductive effort: time-activity budgets of monogamous killdeer, Charadrius vociferus. *Animal Behaviour* 36:705–717, 1988.

Buckle, L., Gallup G.G. Jr, and Rodd, Z.A. Marriage as a reproductive contract: patterns of marriage, divorce, and remarriage. *Ethology and Sociobiology* 17:363–377, 1996.

Clutton-Brock, T. The Evolution of Parental Care. Princeton: Princeton University Press, 1991.

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* 58:93–707, 1996.

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.

Davidson, N. Life without father: America's greatest social catastrophe. *Policy Review* 51:40–44, 1990.

Davies, N.B. Mating systems. In *Behavioural Ecology: An Evolutionary Approach*, J.R. Krebs and N.B. Davies (Eds.). London: Blackwell Scientific, 1991, pp. 263–294.

Draper, P., and Harpending, H. Father absence and reproductive strategy: an evolutionary perspective. *Journal of Anthropological Research* 38:255–273, 1982.

Draper, P., and Harpending, H. A sociobiological perspective on the development of human reproductive strategies. In *Sociobiological Perspectives on Human Development*, K.B. MacDonald (Ed.). New York: Springer-Verlag, 1988, pp. 340–372.

Dubey, S.N. A study of reasons for non-payment of child-support by non-custodial parents. *Journal of Sociology and Social Welfare* 22:115–131, 1995.

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

Freeman, R.B., and Waldfogel J. Dunning delinquent dads: the effects of child support enforcement policy on child support receipt by never married women. Working Paper 6664. Cambridge, MA: National Bureau of Economic Research, 1998.

Freeman-Gallant, C.R. Parentage and paternal care: consequences of intersexual selection in Savannah sparrows? *Behavioral Ecology and Sociobiology* 40:395–400, 1997.

Gangestad, S.W. Sexual selection and physical attractiveness. *Human Nature* 4:205–235, 1993.

Garfinkel, I., and Oellerich, D. Noncustodial fathers' ability to pay child support. *Demography* 26:219–233, 1989.

Goodwin, J.S., Hunt, W.C., Key, C.R., and Samet, J.M. The effect of marital status on stage, treatment, and survival of cancer patients. *Journal of the American Medical Association* 258:3125–3130, 1987.

Goodyer, I.M. Family relationships, life events and childhood psychopathology. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 31:161–192, 1990.

Hanson, T.L., Garfinkel, I., McLanahan, S.S., and Miller, C.K. Trends in child support outcomes. *Demography* 33:483–496, 1996.

Harris, K.M., and Marmer, J.K. Poverty, paternal involvement, and adolescent well-being. *Journal of Family Issues* 17:614–640, 1996.

Haveman, R., and Wolfe, B. *Succeeding Generations: On the Effects of Investments in Children*. New York: Russell Sage Foundation, 1994.

Haveman, R., and Wolfe, B. The determinants of children's attainments: a review of methods and findings. *Journal of Economic Literature* 23:1829–1878, 1995.

Hawkins, A.J., and Eggebeen, D.J. Are fathers fungible? Patterns of coresident adult men in maritally disrupted families and young children's well-being. *Journal of Marriage and the Family* 53:958–972, 1991.

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

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.

Hurtado, A.M., and Hill, K. Paternal effect on offspring survivorship among Ache and Hiwi hunter-gatherers: implications for modeling pair-bond stability. In *Father-Child Relations: Cultural and Biosocial Contexts*, B.S. Hewlett (Ed.). New York: Aldine de Gruyter, 1992, pp. 31–55.

Isohanni, M., Moilanen, I., and Rantakallio, P. Determinants of teenage smoking, with special reference to non-standard family background. *British Journal of Addiction* 86:391–398, 1991.

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

Kaplan, H. A theory of fertility and parental investment in traditional and modern human societies. *Yearbook of Physical Anthropology* 39:91–135, 1996.

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.

Kaplan, H., Lancaster, J.B., Johnson, S.E., and Bock, J.A. Does observed fertility maximize fitness among New Mexican men? A test of an optimality model and a new theory of parental investment in the embodied capital of offspring. *Human Nature* 6:325–360, 1995.

Keddy Hector, A.C., Seyfarth, R.M., and Raleigh, M.J. Male parental care, female choice and the effect of an audience in vervet monkeys. *Animal Behaviour* 38:262–271, 1989.

Kraak, S.B., and Van den Berghe, E.P. Do female fish assess paternal quality by means of test eggs? *Animal Behaviour* 43:865–867, 1992.

La Cerra, M.M. Evolved mate preferences in women: psychological adaptations for assessing a man's willingness to invest in offspring. Unpublished Ph.D. dissertation. Department of Psychology, University of California, Santa Barbara, 1994.

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.

Marlowe, F. Showoffs or providers? The parenting effort of Hadza men. *Evolution and Human Behavior* 20:393–406,1999.

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

McLanahan, S., and Bumpass, L. Intergenerational consequences of family disruption. *American Journal of Sociology* 94:130–152, 1988.

Mott, F.L. When is a father really gone? Paternal-child contact in father-absent homes. *Demography* 27: 499–517, 1990.

Mutzell, S. Mortality, suicide, social maladjustment and criminality among male alcoholic parents and men from the general population and their offspring. *International Journal of Adolescence and Youth* 4:305–328, 1994.

Newman, G., and Denman, S.B. Felony and paternal deprivation: a socio-psychiatric view. *The International Journal of Social Psychiatry* 17:65–71, 1970.

Peters, E.H., Argys, L.M., Maccoby, E.E., and Mnookin, R.H. Enforcing divorce settlements: evidence from child support compliance and award modifications. *Demography* 30:719–735, 1993.

Robins, P.K. Why did child support award levels decline from 1978 to 1985? *Journal of Human Resources* 27:362–379, 1992.

Rohwer, S. Selection for adoption versus infanticide by replacement "mates" in birds. *Current Ornithology* 3:353–395, 1986.

Simmons, L.W., and Parker, G. A. Nuptial feeding in insects: mating effort versus paternal investment. *Ethology* 81:332–343, 1989.

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, H.G. Experimental demonstration of a trade-off between mate attraction and parental care. *Proceedings of the Royal Society of London (Series B)* 260:45–51, 1995.

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

Smuts, B.B. *Sex and Friendship in Baboons*. Hawthorne, NY: Aldine, 1985.

Smuts, B.B., and Gubernick, D.J. Male-infant relationships in nonhuman primates: paternal investment or mating effort? In *Father-Child Relations: Cultural and Biosocial Contexts*, B.S. Hewlett (Ed.). New York: Aldine de Gruyter, 1992, pp. 1–30.

Strassmann, B.I. Sexual selection, paternal care, and concealed ovulation in humans. *Ethology and Sociobiology* 2:31–40, 1981.

Symons, D. *The Evolution of Human Sexuality*. New York: Oxford University Press, 1979.

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

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.

Turke, P. Effects of ovulatory concealment and synchrony on protohominid mating systems and parental roles. *Ethology and Sociobiology* 5:33–44, 1984.

Van Ijzendoorn, M.H., and De Wolff, M.S. In search of the absent fathers—meta-analyses of infant-father attachment: a rejoinder to our discussants. *Child Development* 68:604–609, 1997.

van Schaik, C.P., and Paul, A. Male care in primates: does it ever reflect paternity? *Evolutionary Anthropology* 5:152–156, 1996.

Wedell, N. Mating effort or paternal investment? Incorporation rate and cost of male donations in the wartbiter. *Behavioral Ecology and Sociobiology* 32:239–246, 1993.

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.

Whittingham, L.A. Effects of nestling provisioning on the time-activity budgets of male red-winged blackbirds. *The Condor* 95:730–734, 1993.

Wickler, W. Stepfathers in insects and their pseudo-parental investment. *Zeitschrift fur Tierpsychologie* 69:72–78, 1985.

Woodroffe, R., and Vincent, A. Mother's little helpers: patterns of male care in mammals. *Trends in Ecology and Evolution* 9:294–297, 1994.