

# **Are men really that bad as fathers? The role of men's investments**

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### *Abstract*

Human pair-bonding and paternal involvement have long been attributed to the need for biparental rearing of altricial offspring with extended periods of dependency. More recently, researchers have focused on the fertility benefits that pair-bonding offers men and have re-conceptualized paternal care as a stratagem designed to curry favor with the recipient children's mother. These models, however, fail to explain a number of puzzling empirical findings, namely the lack of a significant and robust effect of father-presence cross-culturally, despite what appears to be true paternal involvement. I argue that the record is better explained by conceptualizing reproduction within unions as a joint venture, in which men's contributions are not simply lumped onto women's invariant levels of parental investment, but one in which men's involvement allows wives to reduce their own allocations to parental investment and increase those to fertility (fertility model), thereby maximizing the production of the union, not simply child survivorship.

## *Introduction*

Human pair-bonding and paternal involvement have long been attributed to the need for biparental rearing of altricial offspring with extended periods of dependency (Lovejoy, 1981; Lancaster and Lancaster, 1983). A number of empirical findings, however, have cast doubt on this well established tenet of human reproduction. The most formidable challenges come from the contentions that 1) the presence of fathers has little impact on offspring wellbeing (Blurton Jones et al., 2000; Sear and Mace, In press), and 2) men forgo opportunities to invest parentally in order to pursue mating and social benefits (Hawkes, 1991, 1993; Bleige Bird et al., 2001). Based on these observations, researchers have proposed alternative models of pair-bonding that emphasized the fertility benefits men gain from entering into long-term reproductive relationships (Hawkes et al., 1995; Blurton Jones et al., 2000), the resultant reduction of costly male-male competition (Blurton Jones et al., 2000; Hawkes et al., 2001a), and the possible protective advantages such relationships offer to women (Mesnick, 1997; Wrangham et al., 1999). In all of these alternatives, however, the benefits that men receive from entering long-term reproductive relationships are in the currency of access to women's fertility. In order to account for the conspicuous provisioning, care and devotion that fathers do exhibit, proponents of these models have often argued that the primary function of such investments is to aid in the winning and maintaining of sexual access to the mothers of the recipient children (van Schaik and Paul, 1996; Blurton Jones et al., 2000). These models produce clear and often contradicting predictions concerning the goal of men's familial involvement, the effects of such involvement and the degree to which men should differ in their behavior towards step-children versus biological children and those of current versus previous unions.

The goal of this paper is to review these models and test the veracity of their most direct predictions using the existing empirical record and research I took part in among the Tsimane forager-horticulturalists of central Bolivia. I then propose an alternative model that better accounts for the patterns of reproductive behavior and explore further predictions extrapolated from this model. In short, this model proposes that men's investments function primarily to allow women to reduce their own levels of parental investment, thereby increasing that which is available for further reproduction.

## *Theory*

### *1.1 Provisioning model*

According to the provisioning model, marriage evolved as a means of meeting the increased demands of human reproduction. The rearing of human offspring proves remarkably costly for a number of reasons. In order to pass through a pelvic girdle designed for bipedalism, infants are born cognitively underdeveloped and reliant on post-partum brain growth (Martin, 1983). Additionally, children remain dependent on their parents for an extended period of time and are typically unable to meet their own caloric demands until the late teens or early twenties (Kaplan and Lancaster, 2003). This extended juvenile period is associated with the uniquely human phase of childhood, during which offspring are weaned, yet still sexually immature and dependent on kin for survival. This childhood phase affords human mothers much shorter interbirth intervals by allowing for the simultaneous rearing of multiple dependents. Thus, human parents are faced with the challenge of raising progenies characterized by multiple offspring of varying levels of dependence, usually including helpless infants.

Proponents of the provisioning model suggest that marriage provided a solution to this problem, mainly by facilitating biparental care (Lovejoy, 1981; Lancaster and Lancaster, 1983). As paternal care became more needed, and hence more beneficial, men would have sought ways of ensuring paternity, and women ways of providing such assurance in order to garner male support. This scenario may just as well lead to relatively short relationships focused around the successful production and rearing of single offspring, a system seen in numerous bird species. Because of the unique structure of human progenies, however, extended relationships involving the birth and rearing of sequential children allowed men to invest in multiple offspring in various stages of development, all residing under the same roof. This not only increased the well of need that men could fill, but the number of dependents that could reap the benefits of non-depreciable investments as well. As biparental care provided ever increasing benefits, men and women would have sought solutions that maximized the returns of their investments. By tying their reproductive interests and thus reducing conflict, marriage allowed men and women to function more cooperatively in order to enhance total efficiency. This led to a division of labor roles, with women focusing on the direct care of children and other tasks conducive to such care (such as collecting, less labor-intensive garden labor, food processing, etc.), and men focusing on provisioning and other riskier, more labor intensive tasks (including hunting, large animal

herding, intensive garden labor, etc.) (Murdock, 1949; Brown, 1970; Lancaster and Lancaster, 1980).

### *1.2 Mating effort model*

A major critique of the provisioning model that has stirred much debate was put forth by Hawkes (1991; 1993). Hawkes' critique emanated from her contention that the tolerated theft model of food distribution best explained the patterns of meat sharing within hunter-gatherer populations. This model posits that distribution is directed not by the acquirer but by the more numerous and hungrier bystanders (Blurton Jones, 1987). Due to decreasing marginal returns to food consumption, at some point, the cost of defending food becomes greater than the benefit of consuming it, and it should then simply be ceded to others. If hunted game, the proposed mainstay of men's traditional contributions, is indeed distributed through tolerated theft, hunting would prove a terribly inefficient means of investing in one's children, as men would have no way of directing their food towards their family. The fact that men continue to pursue large game, instead of concentrating on plant resources and small game that may provide higher returns and are shared less extensively, suggested to Hawkes and colleagues that the goal of men's work was not to invest in their families, but to attain status through the display of their hunting prowess and the distribution of their kills (Hawkes, 1991; Bleige Bird et al., 2001; Hawkes et al., 2001a; Hawkes and Bleige Bird, 2002). If pair-bonded fathers are not investing in their families, it follows that men must enter pair-bonds in pursuit of a goal other than fostering a progeny in which they can invest. Many have argued that human marriage may have provided a solution to male-male competition, providing a means by which men could avoid costly contests that became increasingly expensive with the advent of weaponry and the need to maintain male-male cooperativeness in warfare and hunting (Hawkes et al., 1995; Blurton Jones et al., 2000; Hawkes et al., 2001a). Others have claimed that it developed primarily as a stratagem of women to maintain partners that could protect them from the sexual or infanticidal attacks (Smuts and Gubernick, 1992; Mesnick, 1997), time-wasting advances (Blurton Jones et al., 2000), or food theft (Wrangham et al., 1999) by other men. The one commonality in all of these models is that the benefits that men receive from entering into long-term unions are in the currency of access to women's reproduction.

Yet there is unequivocal evidence from many populations that men do parentally invest, not only through provisioning, but through direct care, protection and instruction (e.g. Flinn, 1992; Hewlett, 1992; Winking, 2005). How can this be reconciled with the contention that men forgo opportunities to efficiently provision offspring in order to show-off, or that men evolved a predisposition to long-term pair-bonding because fertility benefits it conferred? Actually, it is perfectly reasonable to posit that such behavior evolved as a means of enhancing offspring wellbeing after the practice of long-term pair-bonding had been established as the optimal means of acquiring women's fertility. There are numerous reasons why pair-bonding increases the efficiency of paternal care (see section 1.1). Many researchers, however, have noted that such care can also function as a means of currying women's favor, of securing and maintaining a wife (Smuts and Gubernick, 1992; van Schaik and Paul, 1996; Anderson et al., 1999a). Indeed, the offering of parental investment to non-biological children (i.e. step-parentage) has long been considered mating effort by evolutionists (Waynforth and Dunbar, 1995; Daly and Wilson, 1998; Rohwer et al., 1999; Lancaster and Kaplan, 2000). If the offering of care plays a definitive role in women's mating decisions, winning and maintaining access to a mate may provide the main motivation for men's parental behavior, even towards biological children. Under this guise, male reproductive behavior is fully stripped of any significant parental component, as men enter marriage and provide care solely to gain and maintain access to fertility (mating effort model).

### *1.3 Hypotheses of the models*

These models are clearly not wholly mutually exclusive, and men's reproductive behavior is most likely driven to some degree by the pursuit of the goals outlined in both models (Anderson et al., 1999a). However, if the pursuit of one goal dominates the motivation of men's reproductive behavior, as it has been proposed in the literature (e.g. van Schaik and Paul, 1996; Hawkes and Bleige Bird, 2002), then this should be evident in the empirical record. These models produce a number of hypotheses concerning men's behavior within marriages and the effects of such behavior on child wellbeing and the success of marriages. The first and perhaps most direct hypothesis derived from the provisioning model is that children with fathers should fare better than those without. Not only do these children receive investment from an additional biological parent, but the parents are able to attain a greater level of efficiency through high levels of complementarity and men might provide specific forms of care that are not

substitutable. Secondly, men should invest in their children in a way that shows sincere concern for their wellbeing (i.e. improving their fitness), and not simply a desire to impress their wives.

The mating effort model does not produce a clear prediction concerning the overall effect of men's care on child wellbeing, as the ultimate goal of men's care is not thought to be greater offspring fitness, but of maintaining sexual access. The model does predict that men should provide care in a way that best improves their reputations with their wives, and extending the logic, that the pursuit of this goal will be mediated by the amount of fertility the wife has to offer. Additionally, if the primary goal of men's care is to maintain a wife, there should be no difference between the care offered to biological versus step-offspring, and upon the dissolution of a marriage (and sexual access), men should cease investing in their ex-wives' children.

## **Empirical Record**

### *2.1 Father effect*

A number of recent studies have explored the value of men's parental investments by comparing various fitness outcomes of children raised with and without their biological fathers (Hurtado and Hill, 1992; Flinn et al., 1999; Blurton Jones et al., 2000; Sear et al., 2002; Leonetti et al., 2004; Borgerhoff Mulder, 2005; Winking, 2005). These follow a long history of inquiry into the effects of father presence on children in Western populations in the fields of psychology, sociology and family studies (for a review, see Lamb, 1997). A thorough investigation of such father effects was conducted by the author among the Tsimane of central Bolivia. The Tsimane are a forager-horticulturalist population in which fathers provide the bulk of family calories and marriages are remarkably stable (with roughly 80 percent ending in the death of a spouse). Using event history analysis on children up to the age of 10, father death was found to have no effect on child mortality (Winking et al., 2006). This finding is by no means unique. In an extensive review of the literature, Sear and Mace (In press) found that only 6 of 21 studies exploring effects of father presence on child mortality within natural fertility populations reported some significant negative effect (Table 1). This was in stark contrast to the 28 of 28 studies that found a significant negative effect of mother presence on child mortality, and even the 10 of 12 studies that found such an effect for the presence of maternal grandmothers. The studies that were reviewed varied widely in their methodologies, statistical analyses, ages of children examined

and sample sizes, precluding any formal meta-analysis, and there clearly is a dearth of studies exploring hunter-gatherer populations. Despite these drawbacks, however, the magnitude of the differences suggests that father's presence, at least among non-hunter-gatherer populations, may be less commonly a buffer to child mortality than that of mothers or even maternal grandmothers.

Mortality, however, is the grossest level of measurement of offspring wellbeing. Fewer studies have investigated more continuous measures, such as growth and morbidity. No significant differences between the height and weight of children living with biological fathers versus those living without were found among the Tsimane (Winking, 2005), Yanomamö (Hames et al., no date), or a rural Gambian population (Sear et al., 2000). Heights of British children were found to be negatively affected by parental divorce for a 1958 sample (Li et al., 2004), but not so for a 1991 sample (Li and Power, 2004). Yanomamö children of divorced or junior mothers were more likely to be found with ectoparasite infection (Hagen et al., 2001), although no other significant differences were found in morbidity levels (Hames et al., no date). Tsimane children without co-resident biological fathers were marginally more likely to be diagnosed with gastrointestinal illnesses (Winking, 2005). Flinn (1988) found that both sons and daughters that had lived with step-fathers had fewer children living to their first year than did children that only lived with both biological parents. Among the Tsimane, the number of years lived with father was a positive predictor of the men's completed fertility for age, but a negative predictor for women's completed fertility for age (Winking, 2005). Both studies, however, suffer from small sample sizes of children living without biological fathers.

The overall benefits of men's contributions to offspring fitness appear to be relatively weak and quite inconsistent cross-culturally. Few studies have explored the effects of intra-cultural continuous variation in paternal provisioning on offspring fitness (although see Hawkes et al., 2001a; Winking et al., 2006), again showing at best tentative evidence of an effect. While such tests may increase resolution, they fail to capture the full benefit that men receive from marrying and providing investment. Perhaps most lacking in the literature, is a significant body of work exploring the effects of fathers' care on the wellbeing, competitiveness and reproductive success of *adult* children. Reviewing the current body of literature as a whole, however, the contention that men enter pair-bonds and invest in order to enhance offspring fitness is only weakly supported.

## 2.2 Goals of men's reproductive behavior within marriage

If men are not receiving large dividends from entering marriage in the form of increased offspring fitness, why are men willing to enter such unions, forgoing alternative mating opportunities, and why do they provide investment within these unions? The mating effort model suggests that men marry and provide paternal care in order to win and maintain sexual access to the wife. This can account for the lack of a strong effect of father presence on child wellbeing. Any investment to children may be provided with the intent of improving the man's reputation with the wife and not specifically to increase child fitness. Could it all really be illusory?

Two tests were conducted by the author investigating the goals of men's family involvement among the Tsimane (Winking, 2005; Winking et al., In press). The first explored whether men were more likely to provide direct care (holding, feeding, playing, etc.) while the wife was present to view this care. Although direct paternal care was quite rare, such care represents a conspicuous signal of devotion and should therefore, according to the mating effort model, be biased towards when the wife is present to receive the signal. If, however, men are truly concerned with the wellbeing of their children, men should provide such care when the wife is absent, when the care is most needed. Analysis of time allocation data showed that men were more likely to be engaged in direct care when the wife was absent. This analysis included only those observations in which men were in the presence of a child under the age of four that was not being cared for by some other individual. These results are similar to those reported by Flinn (1988) who found that fathers of a rural Trinidadian village were more likely to act agonistically towards their stepchildren while their wives were absent, but no more likely to do so towards biological children.

The second study reviewed the goal of men's marital behavior by exploring the opposite of familial investment: extramarital affairs (Winking et al., In press). Such behavior represents both a disinvestment from a man's family as well as a potential cause of mate desertion, thus counteracting the goals proposed by the provisioning model and the mating effort model respectively. Predictions concerning extramarital behavior were therefore in the reversed direction: according to the provisioning model men should be *less* likely to pursue extramarital relationships when they have greater opportunity to invest in their children (when they have more dependents), and according to the mating effort model, they should be less likely to do so

when they risk losing access to a greater amount of fertility (when they have younger wives). Once again, the data supported the provisioning model (Figure 1); the number of dependents was negatively associated with the frequency of men's affairs, but the wife's age was not. Indeed, men's affairs were concentrated in the first five years of marriage, when the wife had the most to offer and the least to lose from deserting.

### *2.3 Marital status of parents and biological status of child*

Another test of the goals of men's familial involvement concerns their behavior after the dissolution of a marriage. According to the mating effort model, men should cease investing in children upon divorce, as there is no longer any reason to curry favor with the ex-wife. Any such investment would thus be considered "true" parental care as the only benefits would be in the form of increased offspring wellbeing. Numerous studies involving western populations (Amato, 1987; Teachman, 1991; Anderson et al., 1999a) and at least one involving an African population (Anderson et al., 1999b) have found that men do indeed continue to invest in children of previous mates, but that they do so at reduced levels. Anderson et al (1999) argued that the fact that many men continued investing but at reduced levels indicated that men receive benefits through the pathways outlined in both the mating effort model and provisioning model. Upon the dissolution of a marriage, the loss of mating effort benefits result in lower levels of investments as men are simply investing in offspring wellbeing. The fact that many men continue to invest at any level, however, implies that they have the psychological capacity for true parental concern.

Finally, the mating effort model predicts that there should be no difference between the care provided to step versus biological children. Many different studies covering numerous populations, however, have shown otherwise. Relative to biological children, fathers are more likely to abuse step-children (Daly and Wilson, 1985), murder them (Daly and Wilson, 1985, 1994), spend less time interacting with them (Marlowe, 1999), interact agonistically with them when they do (Flinn, 1988), less effectively supervise them (Tooley et al., 2006), and invest less resources in them (Anderson et al., 1999a). Clearly, claims that paternity is unimportant in the determination of levels of men's investments are unfounded (van Schaik and Paul, 1996).

## ***Discussion***

### *3.1 Assessment of the models*

Clearly, the empirical record is incomplete, and the general patterns reported here need to be tempered with the possibility that apparent trends may reverse with the accumulation of more cross-cultural data. If we assume that the true patterns lie somewhat close to those which have already been revealed, the empirical record poses somewhat of a conundrum. Under most circumstances, it appears that paternal investment is not mandatory for the successful rearing of children and actually seems less valuable than that provided by maternal grandmothers. Yet men's behavior suggests that enhancing offspring fitness is an important, if not the primary, goal of entering into pair-bonds and providing paternal care. Is the amount they are investing negligible? Men's contribution to overall diet is widely variable and largely dependent on ecological conditions, subsistence mode and cultural practices (Hiatt, 1974; Marlowe, 2000). While there has been criticism on the ostensibly exaggerated importance placed on men's provisioning (e.g. Dahlberg, 1981), among 10 foraging societies for which adequate data existed, Kaplan et al (2001) calculated that men account for 97 percent of the surplus calories available for reproduction. Indeed, men account for more than half of all calories in upwards of three-fourths of populations (Ember and Ember, 1983).

Men's contributions to diet, however, are not accurate measures of men's investments in their children, for, as Hawkes (1991; 1993) noted, such contributions may be diluted through their distribution, particularly among groups with high levels of food sharing. Among foraging populations, however, a growing body of evidence casts doubt on the pure tolerated-theft model of food sharing. Nuclear families, kin and neighbors typically receive larger shares of acquired food packages (Hawkes et al., 2001b; Gurven, 2004; Gurven and Hill, n.d.), and quantities received are often dependent on those given (Hames, 2000; Gurven et al., 2002; Ziker and Schnegg, 2005). These observations point to the fact that men have some control over the distribution of their acquired resources. Even among the Hadza, the group most intensively investigated by Hawkes, Marlowe (2003) tells of instances of men hiding food in the bush in order to sneak it to their families after nightfall. He further argues that Hadza women's reporting of hunting skill as the most important trait in potential husbands and their desire to keep their husbands from pursuing additional mates indicates that they must be receiving some benefit from their husbands' production.

It appears that even in foraging societies with widespread food sharing, men have the desire and some ability to invest directly in their families. So how can we account for the

apparent lack of a substantial and robust father effect on offspring wellbeing? One possible explanation is that others are frequently willing to compensate for the loss of a father by boosting their own investments in the children. While boosting parental investment upon the loss of the father may not always be the optimal solution (Trivers, 1972; Chase, 1980), there is some evidence that this occurs. Tentative evidence of this was found for the Tsimane, in which transfers from grandparents to daughters' families and those from mothers to children are slightly higher if there is no husband, although sample sizes are too small to attain statistical significance or to draw any firm conclusions (Figure 2). In the U.S., mothers are the most common primary care takers of children after divorce (Cancian and Meyer, 1998), despite experiencing a more substantial drop in income following divorce than men (Holden and Smock, 1991). Divorced women compensate for the loss by working more hours and targeting higher paying jobs, while remarriage is again associated with less labor participation (Peterson, 1989). In urban U.S. populations, grandmothers have been shown to be particularly involved in the rearing of children of their single daughters (Burton, 1990; Pearson et al., 1997). Indeed, Delaire and Kalil (2002) found that the presence of a grandparent in the home eliminated the negative effects of father absence on child developmental outcomes.

Proponents of the mating effort model, however, correctly contend that such compensation should be included in the calculation of men's optimal decisions, as they pay no cost for the compensation and should only be concerned with the final outcome. Although compensation may provide an explanation for the apparent lack of a substantial father effect despite men's investments, it fails to account for why men stay within relationships and provide investment when it ultimately has little effect on offspring quality (Maynard Smith, 1977).

### *3.2 Fertility model*

The question of why men stay in unions despite others' willingness and ability to provision offspring stems from the presumption that true paternal investments (i.e. those designed to enhance offspring fitness) can only result in benefits via a net increase in offspring fitness. Simply rephrasing the compensation argument, however, leads to the prediction that because of a father's presence and investments, others are free to *reduce* their levels of investment. The resources made available from these reductions could be converted to increased fertility within a union. By taking on the role of resource provider (among others), men free

women to focus their energy on other tasks involved in reproduction—gestation, lactation, childcare, etc. This is not to say that women do not participate in resource production, or even that they do not provide the majority of calories, but simply that any investment from the husband is something that the wife need not acquire. Although high levels of complementarity would result in higher optimal levels of investment per offspring, and some forms of male care may be non-substitutable (e.g. protection), the main effect of men's investments may be in the form of higher reproductive rates. This contention is supported by the finding that men's contributions to the diet among foraging populations are strongly correlated with women's average total fertility rates but not so for infant or juvenile mortality (Marlowe, 2001).

In the scenario described above (fertility model), men should provide investment with the goal of enhancing offspring fitness despite the fact that others may be willing and able to fulfill such a role in their absence, because it is what maximizes the production of the union. A few researchers have already explored the idea that men's investments function to increase women's fertility, but such investments are usually labeled family or mate investments (Hawkes et al., 1995; Marlowe, 2001). As I have argued, however, such an effect is possible independent of mate provisioning. This idea is not new in the animal literature (e.g. Maynard Smith, 1977; Gwynne, 1984; Wolf et al., 1991; Ketterson and Nolan Jr., 1994; Koenig, 1995; Bales et al., 2001), particularly in studies of male parental care in birds. For paternal care to have an effect on mate fertility in birds, however, the female must be capable of laying a second clutch, or the effect on female condition must carryover to subsequent breeding seasons during which the pair must reunite. In humans, the fact that women continue reproduction while previous children are still dependent on parental provisioning makes such an effect much more straightforward.

The fertility model not only answers the question of why men stay, but also why, given the little benefit to offspring fitness that men's investments appear to offer, do women desire husbands. If women can raise children as single parents, promiscuity would allow them to shop for the highest genetic quality partners, diversify their progeny or trade sexual access for immediate resources. But it appears that in all but the most accommodating environments, the value of men's investments supersedes these benefits.

Extending the logic further leads to revealing insights concerning women's mate preferences and courtship behavior. The fertility model suggests a greater degree of conflict between the sexes during the courtship period. The less necessary fathers are for the successful

rearing of children, the more latitude men gain to pursue short-term or sequential-mate strategies. A population in which uniparental care is sufficient and yet men invest to subsidize women's fertility in long-term bonds is vulnerable to a philandering strategy (Ratnieks, 1996). The only way in which it is stable is if women can accurately assess a suitor's intent. If we make the reasonable assumption that a suitor intending to engage in a long-term relationship benefits more from the woman's acceptance than one pursuing a short-term sexual relationship, the situation provides ideal conditions for the development of costly signaling (Zahavi and Zahavi, 1997). Such signaling is kept honest through differential costs of the signal or differential benefits to the acceptance of the signal depending on the "level" of honesty of the signal (Grafen, 1990; Godfray, 1991). This may explain the myriad facets of courtship that involve time and resource wasting displays—abstinence until marriage, engagement rings, bride prices, etc. Note that these may not simply be signals of a man's ability to provide resources, but his *willingness* to do so—men solely interested in a sexual liaison may be less disposed to incur such large costs. Finally, such demands for costly signals of intent would result in a reduction in the returns to short-term mating effort, and hence an increase in men's optimal levels of investment. There are, however, a number of reasons why the philandering strategy may persist at reduced rates. Because women must incur some cost during assessment, there would be an optimal level of assurance for women that would be less 100 percent and dependent on the frequency of philanderers in the population. Additionally, the optimal level of assurance may be lowered if the man has more to offer in superior genes or resource holdings. And finally, men of high genetic quality may be targeted by women as extra-marital partners (Gangestad and Thornhill, 1997).

### *3.3 Further Predictions of the Fertility Model*

The fertility model proposes an alternative pathway through which men's paternal investments bring fitness benefits, namely through increasing the fertility of the wife as opposed to the fitness of the children (provisioning model) or the likelihood of mate retention (mating effort model). Variation in levels of men's investments should thus be correlated with the fertility of marriages. A number of studies have revealed a positive association between men's hunting success and men's fertility in foraging populations (see Smith, 2004). Such an effect can be realized through a number of alternative pathways, however, such as better hunters having more wives, more extra-marital partners, marrying younger or higher-quality wives, etc.

Although none of these studies tested if men's resource contributions to their families were directly impacting the fertility of their wives, a number of them indicated that the fertility benefits are being realized through greater fertility within the marital union (Marlowe, 1999; Weisner, 2002; Gurven and von Rueden, In press). Such effects may be driven by physiological mechanisms that mediate women's fecundity, but also by psychological mechanisms that mediate women's desire to have children. Thus women's family size preference could also be measured and tested against their husbands' levels of investment.

From a cross-cultural perspective, there exists great variation in women's ability to raise children successfully on their own. In the most benevolent environments, women may be able to acquire all of the nutrients required to support their children *and* maintain high levels of fertility. Under these circumstances, the mating effort model may best capture men and women's reproductive behavior. Women may benefit most from men's protective role, while men compete for sexual access through offerings of immediate resources or displays of their genetic quality or abilities as bodyguards. On the other extreme, in which biparental care is obligatory for offspring success, the provisioning model may prove most accurate. Short-term sexual relationships should be rare and not pursued by men or women. Courtship should be characterized by men's displays of resource holding or acquiring abilities and men's investment levels should be highly correlated with both women's fertility and offspring fitness. In the wide middle ground of this spectrum, in which male investment is not obligatory yet still functions to subsidize women's fertility, lie conditions in which the fertility model should best characterize men and women's reproduction. Courtships should be long and costly and correlated with men's devotion (less extra-marital behavior, lower risk of desertion, etc.), and provisioning should be most strongly correlated with mate's fertility.

In order to test these predictions, a good measure of the importance of men's investments to the successful rearing of children *and* women's fertility must be devised. The use of the difference in child outcomes between children with and without fathers (e.g., see Hurtado and Hill, 1992; Blurton Jones et al., 2000) is problematic due to possible variation in levels of compensation, as argued above. Perhaps a better measure would rely on women's understanding of the importance of men's investments to their children and their fertility. Such a measure might include the proportion of children born to single women or some measure of socio-sexual

orientation (in non-contraceptive populations). Both would measure the risk that women are willing to take with regards to having to raise children without men.

### *Conclusion*

A number of models have been proposed to account for humans' unique reproductive strategy, and it seems clear that all of the proposed pathways through which benefits can be realized must play some part in humans' decisions in certain contexts. The debate has truly been one of magnitude and is something that must be settled empirically. The most direct predictions of both the provisioning model and the mating effort model, however, fail to hold up to empirical scrutiny. In general, biparental care does not seem to be necessary for the successful rearing of children, yet men appear to be genuinely concerned with improving the wellbeing of their biological children. Furthermore, men's contribution to diet is unrelated to population-level offspring mortality rates, but is correlated with total fertility rates (Marlowe, 2001). I argue that these seemingly contradictory findings can be reconciled if the main effect of men's parental investments is to allow wives to reduce their own allocations to parental investment and increase those to fertility (fertility model). Following the desertion or death of a father, children may fair equally as well if the mother and other interested parties increase parental investments to compensate for the loss. A system in which the loss of a father's investments can be compensated for by increases in others' investments is vulnerable to a philandering strategy, as there is no cost to immediate desertion for men. I argue that humans' extended and costly courtships may have developed as an honest signal of men's intent, given the assumption that men interested in a long-term relationship have more to gain by being accepted than those interested in a short-term sexual liaison. The fertility model is in agreement with the mating effort model in that men enter into long-term reproductive relationships primarily because of the associated fertility benefits, yet it allows for the obvious paternal investment and male parental concern outlined in the provisioning model that are so apparent in men's behavior around the globe. Like the provisioning model, the fertility model emphasizes the cooperative nature of human pair-bonds, but does not eliminate the possibility of sexual conflict within these unions. Marriages are comprised of two individuals pursuing selfish strategies that just happen to overlap a great deal due to shared genetic interests in the production and rearing of their common

children. The fertility model simply forwards an alternative pathway through which couples may best exploit this overlap.

This model was largely developed as a framework to account for the existing (often puzzling) empirical record, and the additional predictions that were derived from the model have yet to be formally tested. Future research should focus on testing the effects of continuous variation in levels of male provisioning on the reproductive rates of wives (fertility model), the survivorship and reproductive success of children (provisioning model), and the probability of divorce (mating effort model). Additionally, much needs to be learned concerning the function of the courtship period and its role in the assessment of genetic and bodyguard quality, cooperative compatibility, resource prospects and intent.

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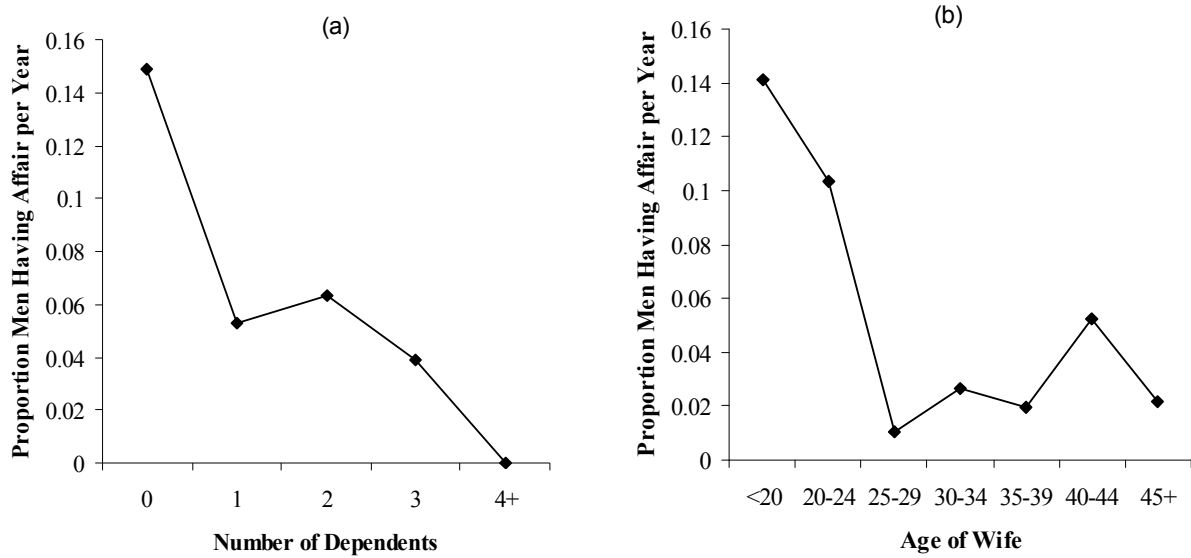
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Table 1. Studies finding significant negative effects of kin presence on child mortality

	Hunter-gatherer			Horticultural / Agricultural / Pastoral			All
	Statistically Valid	Supplementary	Total	Statistically Valid	Supplementary	Total	
Fathers	1 of 1	0 of 2	1 of 3	5 of 13	0 of 5	5 of 18	6 of 21
Mothers	1 of 1	1 of 1	2 of 2	15 of 15	11 of 11	26 of 26	28 of 28
Mat Grandmothers	0 of 0	0 of 0	0 of 0	8 of 10	2 of 2	10 of 12	10 of 12

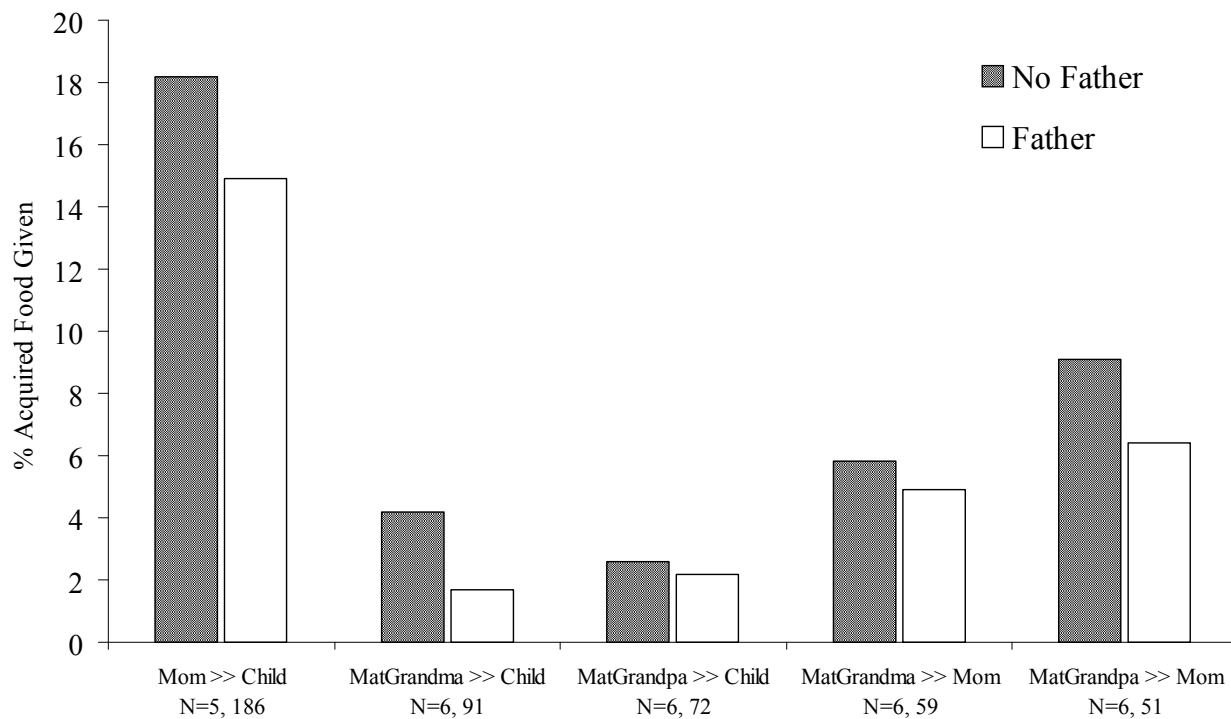
From Sear and Mace (In press) with addition of non-significant Tsimane result for fathers (Horticultural / Agricultural / Pastoral—Statistically Valid). “Statistically Valid” refers to studies that utilized appropriately controlled multivariate analysis, while “Supplementary” studies are those that employed univariate or no statistical techniques.

Figure 1. Proportion of men having affairs per year by number of dependents (a) and age of wife (b).



From Winking (In press). N=500 risk years of marriage over 34 men. Generalized estimating equations analysis, after controlling for age of marriage and age difference (measure of man's age after controlling for woman's age), reveals number of dependents is marginally significant ( $B=-0.385$ ,  $Z=-1.95$ ,  $p=0.051$ ), log age of wife also marginally significant ( $B=-1.796$ ,  $Z=-1.83$ ,  $p=0.067$ ), but in opposite direction predicted by mating effort model.

Figure 2. Distribution of food based on presence of father.



Values calculated as number of eating hits in which recipient is consumer and provider is the acquirer divided by all instantaneous eating hits in which provider is acquirer. Eating hits were weighted by nutritional density (kCal/kg). Cases were excluded unless provider was listed as acquirer in at least 10 instantaneous eating hits.