Men's Reproductive Investment Decisions

Mating, Parenting, and Self-perceived Mate Value

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Using questionnaire data completed by 170 men, we examine variation in paternal investment in relation to the trade-off between mating and parenting. We found that as men's self-perceived mate value increases, so does their mating effort, and in turn, as mating effort increases, paternal investment decreases. This study also simultaneously examined the influence on parental investment of men's mating effort, men's perception of their mates' fidelity, and their perceived resemblance to their offspring. All predicted investment. The predictors of investment are also tested independently for men who are still in a relationship with the mother of their children and those that are separated from her. Finally we examine how self-perceived mate value affects how men respond to variation in paternity confidence. Men with a self-perceived low mate value were less likely to respond to lowered mate fidelity by reducing their parental investment compared with men with a self-perceived high mate value.

KEY WORDS: Mate value; Mating effort; Paternity confidence; Parental investment; Reproductive strategies

By mammalian standards, human males contribute substantially to the care of their young (Clutton-Brock 1991; Alexander and Noonan 1979), although considerable variation exists in the amount of care they provide both within (Draper and Harpending 1982) and between (Hewlett 1992; Marlowe 2000) cultures. This variation has been explained in part by the trade-off between parenting and mating—between being cads and dads (Draper and Harpending 1982, 1988).

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Trivers defined parental investment as "any investment by the parent in an individual offspring that increases the offspring's chance of surviving (and hence reproductive success) at the cost of the parent's ability to invest in other offspring" (Trivers 1972:139). This definition assumes that reproductive effort is finite and that an increase in mating effort results in a consequential decrease in parenting effort. Therefore, as life history theory posits, individuals face decisions on how best to allocate their time and energy so as to maximize their reproductive success. Since males are typically the less-investing sex in terms of producing offspring, and have a higher potential rate of reproduction as compared with females, they can often gain more by seeking and obtaining additional mates at the expense of parenting (Clutton-Brock and Vincent 1991; Maynard Smith 1977; Trivers 1972).

Optimal allocation of reproductive effort is thought to be contingent on variables that influence the reproductive returns for either type of effort, such as father's effect on offspring survival and quality, whether the father and child are genetically related, and the probability of the father gaining additional matings (Hurtado and Hill 1992; Maynard Smith 1977). This paper deals with the latter two variables.

Losses in fitness for men who invest in a child that is not their own may be considerable. Cuckolded men risk having both their own and their mate's efforts being directed to a child that is not genetically related to them, and they also suffer from mating opportunity costs (see Buss 2002 for review of costs associated with cuckoldry). Mating opportunity costs result when men invest resources and effort into a child that is not their own when they could have been used to gain alternative matings. For these reasons, it is expected that males should invest less in children that are not their own. Indeed, a number of studies have found that stepchildren receive less care compared with genetic children (Anderson et al. 1999; Flinn 1988; Marlowe 1999), and some avian studies report a relationship between reduced care and reduced paternity confidence (for review see Sheldon 2002; Wright 1998).

The likelihood of a male gaining additional matings should vary depending on the availability of fertile females, or more specifically the operational sex ratio (OSR) (Mitani et. al. 1996) and the phenotypic quality of the male. Some avian studies report a decrease in the amount of time males spend in their own territory as the number of fertile females in neighboring colonies increases (Pitcher and Stuchbury 2000; Westneat 1988). When comparing the Ache and Hiwi, two hunter-gatherer cultures in Paraguay and Venezuela, respectively, Hurtado and Hill (1992) found that the Ache had higher rates of divorce and extramarital promiscuity despite the fact that paternal abandonment in the Ache is associated with higher child-mortality risks. These patterns were explained by the increased mating opportunities available to Ache men as compared with the Hiwi, who have limited mating opportunities owing to a surplus of men. A similar pattern is described by Guttentag and Secord (1983), who argue that higher rates of singlehood and divorce and lower levels of paternal care are associated with periods of female-biased sex ratios in the United States. Similarly, among both Hadza and !Kung hunter-gatherers, divorce rates are associated with a higher number of "fertility units" per male (a measure

comparable to the operational sex ratio) (Blurton-Jones et al. 2000). Finally, in the Hadza, paternal investment declined as the absolute number of fertile women and the ratio of women per men in camps increased (Marlowe 1999).

Phenotypic quality of the male is also likely to play a role in whether males are successful in gaining access to mates. In Ache males, adept hunters acquire a greater number of matings and have more illegitimate children (Hill and Kaplan 1988). Heath and Hadley (1998) report that high-quality Mormon males, as measured by wealth, in the Utah territory during the nineteenth century were able to gain access to more mates and thus pursued a mating strategy, whereas poor males made the best of a bad job by pursuing a parenting strategy. Modern Canadian men of high social status also acquire more mating partners than low social status men (Pérusse 1994). Finally, facial symmetry in men, which is thought to serve as an honest marker of genotypic and phenotypic quality (for review see Thornhill and Møller 1997) was found to be associated with a greater number of previous sexual partners in a sample of U.S. college students (Thornhill and Gangestad 1994), a greater number of sex partners in a sample of Mayan men (Waynforth 1998), and was found to be a good predictor of the number of times a man is chosen as an extra-pair partner by women (Gangestad and Thornhill 1997).

High-quality males are expected to enjoy higher mating success, and because females are typically a limited resource, these males enjoy this greater success at the expense of other males (Wade 1995; Wade and Shuster 2002). As a result it is expected that men adopt conditional reproductive strategies that result in the highest fitness returns in accordance with their value as a mate. Thus, highly desirable men should increase their mating effort at the expense of parenting more so than their less-desirable counterparts (Burley 1988). Waynforth (1999) found that more facially attractive men (as rated by females) from rural Belize spent more time engaged in mating effort (time spent in situations where they are likely to encounter females) and less time in nepotistic effort (time spent with family and kin) as compared with less-attractive men.

Although paternal care has been correlated with many factors (for review see Geary 2000), few studies have attempted to examine their effects simultaneously. This study investigates whether men's self-perceived mate value influences their reported mating effort, and in turn, whether mating effort predicts their reported parenting effort. This analysis also expands on previous findings (Apicella and Marlowe 2004) which reported that men's perception of their mate's fidelity and their perceived resemblance to their offspring, two possible proxies of paternity confidence, predicted men's investment in children. Using the same data, this study simultaneously examines the influence of men's mating effort, perceived mate fidelity, and paternal resemblance to child on men's parental investment in that child. Since mating effort and parenting effort are not always easily distinguished, in that some child care may be a form of mating effort (Hawkes et al. 1995; Smuts and Gubernick 1992), this study also examines the differences between men who are still in a relationship with the mother of their children and men who are separated

from the mother of their children. We assume that it is less likely that men engage in mating effort with their former mates.

Men who decrease their investment in their offspring may suffer from losses in fitness if in fact that child is actually their own *and* if their investment is critical to the survival and reproductive success of the offspring. In addition, they may also lose access to their mate's future reproduction. However, as mentioned earlier the costs associated with cuckoldry can be considerable. Consequently, men should be expected to reduce their parental effort in relation to paternity when the returns from engaging in mating effort are greater than those gained from parenting effort (Westneat and Sherman 1993; Whittingham and Dunn 1998). We expect that men with a high mate value are more likely to experience greater fitness returns by decreasing their parental investment in relation to lowered paternity confidence and investing more in mating effort as compared with men with a low mate value because they should have more mating opportunities. Men with a low mate value may still benefit from investing in a child that is not their own if it helps them maintain access to their current mate's future reproduction. In this situation, continued investment may be more beneficial than desertion when the likelihood of matings with other women is low. We therefore predicted that men with higher perceived mate value are more likely to reduce parental investment in relation to self-perceived mate fidelity and perceived resemblance as compared with men with a lower self-perceived mate value.

METHODS

Participants

Participants were recruited from Heathrow Airport and the general population in Northampton, England (n = 170). Men who were alone and reported that they had biological children were asked to complete an anonymous survey. Their ages ranged from 21 years old to 62 years old (mean = 42.33, s.d. = 8.15) and the majority (93%) identified themselves as white. Most subjects (67.1%) reported residing in the UK, although 17 different countries outside the United Kingdom were also reported. All men surveyed reported they had been in a relationship with the mother of their children for at least 2 years. However, 22.4% of the subjects reported that they were no longer in a relationship with the mother of their children. Only the oldest child was chosen for analyses to avoid pseudoreplication. Children's ages ranged from 3 weeks of age to 26 years old (mean = 12.32, s.d. = 7.31). 51.5% of the children were male and 48.5% were female. See Apicella and Marlowe (2004) for a more comprehensive explanation of data collection and sample description.

Measures

Fathers were asked to respond to a number of statements using 5-point Likert scales ranging from "strongly agree" to "strongly disagree." Points for each item

were summed together in order to obtain a single score for the independent and dependent measures.

Perceived mate value was measured by the following two statements: *I believe that women find me attractive* and *I receive a lot of attention from females.* A coefficient of reliability of .82 (Cronbach's α) was obtained for these two measures. Men's mating effort was measured by the following statement: *I spend a lot of time flirting with females.*The amount of perceived resemblance between a father and his offspring was measured by men's responses to the following statements: *I believe that my child looks more like me than its mother, I think my child shares similar personality traits with me,* and *Most people think my child looks like me.* A Cronbach's α of .79 was obtained for these measures of resemblance. Men's perception of the fidelity of the mother of their children was measured by their responses to the following statements: *The mother of my child is/was trustworthy* and *I believe the mother of my child is/was faithful to me.* A Cronbach's α of .85 was obtained for these three measures. The following statements were designed to measure men's parental investment: *I believe I give my child a lot of attention* and *I spend a lot of time with my child.* A Cronbach's α of .87 was obtained for these three measures.

Statistical Analyses

A Spearman's correlation was used to examine the relationship between perceived mate value and mating effort. Multiple regressions were then employed to test the effects of mating effort, paternal resemblance, and mate fidelity on paternal investment. In all regression analyses, we controlled for the age of the subject, the child's age and sex, the father's relationship status (whether or not he is still with the child's mother), total number of children, and number of hours worked per week. To test whether men with self-perceived low mate value are less likely to reduce parental investment in relation to lowered mate fidelity and lowered paternal resemblance compared with men with a self-perceived high mate value, we performed two different types of analyses. First, we performed moderated regressions to test for interactions between mate value and fidelity and resemblance. Typically, the use of moderated regressions with Likert-type scale data is regarded as inappropriate because scale data can be too coarse for detecting true interactions owing to significant loss in power (Russell and Bobko 1992). In fact it has been reported that the use of continuous scales, as opposed to discrete Likert scales, increases moderated regression effect sizes on average by 93% (Russell and Bobko 1992). Although our variables of interest are composed of at least two items, thus providing more range and discrimination than a single Likert item, the range and variation is still restricted. This is especially true for the predictor variable of interest, mate value (s.d. = 1.45, range = 6). For these reasons, we decided it was necessary to proceed with additional tests of this hypothesis. Therefore, we performed a median split to dichotomize men into two different categories: self-perceived high and low mate value.

We then performed separate multiple regression analyses for low vs. high mate value men to test whether mate fidelity and paternal resemblance equally predict parental investment in both groups by comparing beta coefficients (for a review of this method see Jaccard, Turrisi, and Wan 1990). If the beta coefficients are similar, there is no interaction effect. In addition, partial correlations were also conducted to examine the extent to which parental investment is associated with fidelity and resemblance in high and low mate value men. These partial correlations were computed separately for both groups of men, and the same variables that were controlled for in the regression models were included as controls in the partial correlations. A *Z*-test was then used to determine whether the correlations between parental investment and fidelity and resemblance were significantly different between high and low mate value men. Although dichotomizing variables also leads to reduced power, we don't think the loss of power will be substantial in this case since there is already little variation in the scores for perceived mate value.

RESULTS

A fairly moderate positive correlation between self-perceived mate value and mating effort ($r_s = .470, p < .0005$) was obtained. Mate value, however, was not found to be significantly related to parental investment ($r_s = -.132, p = .087$), even after controlling for mating effort ($r_s = .05, p = .533$). To examine the effects of mating effort on men's parental investment, we conducted a multiple regression analysis. The analysis revealed a significant effect for mating effort as a predictor of men's parental investment in the predicted direction ($\beta = -.272, p < .0005$, Table 1). That is, as mating effort increased, men's parental investment decreased (controlling for all other variables). This model explained about 23% of the variance in paternal investment (Table 1).

To explore the combined effects of mating effort, perceived paternal resemblance and mate fidelity on investment, we conducted another multivariate regression analysis. Significant effects were found for mating effort ($\beta = -.212, p = .003$), paternal resemblance ($\beta = .237, p = .001$), and mate fidelity ($\beta = .191, p = .036$). This model accounted for 30% of the variance in parental investment (Table 2).

Separate regressions were run for men in a relationship with the mother of their children and those separated from her (Table 2). In men still in a relationship with the mother of their children, mating effort ($\beta = -.261, p = .002$) and paternal resemblance ($\beta = .227, p = .005$) were both found to predict paternal investment in the expected direction. However, mate fidelity ($\beta = .130, p = .112$) was not a significant predictor of investment. In separated men, mating effort ($\beta = .034, p = .845$) and mate fidelity ($\beta = .149, p = .358$) were not significant predictors of investment, but paternal resemblance was a strong predictor ($\beta = .496, p = .013$). As reported in Apicella and Marlowe (2004), men in a relationship provided significantly more investment in their offspring compared with men who are separated from the mother of their children ($z = -3.82$; $p < .0005$, equal variances not assumed). In addition,

Table 1. Standardized Betas from Regressions of Investment onto Mating Effort and Control Variables

Variables	β
Age of subject	.045
Age of child	–.316**
Sex of child (male = 1, female = 2)	.172*
Relationship status (separated = 1, in a relationship = 2)	.172*
Number of children	.020
Number of hours worked	–.116
Mating effort	–.272***
Adj. R^2 = .232	
F = 8.182	
p = .000	

* $p < .05$; ** $p < .01$; *** $p < .001$

separated men had lower perceived mate fidelity compared with men in a relationship ($z = -7.53$; $p < .0005$, equal variances not assumed).

No significant moderating effects of mate value on the association between fidelity and parental investment ($\beta = .128$, $p = .087$) and resemblance and parental investment ($\beta = .024$, $p = .735$) were found. However, when the mate value scale

Table 2. Standardized Betas from Regressions of Investment onto Mating Effort, Paternal Resemblance, and Mate Fidelity

Variable	Entire Sample	In Relationship	Not in a Relationship
Age of subject	.099	–.045	.210
Age of child	–.324**	–.284	–.292
Sex of child (male = 1, female = 2)	.199**	.191	.109
Relationship status (separated = 1, in a relationship = 2)	.005		
Number of children	.028	–.006	.205
Number of hrs worked	–.105	–.186	.248
Mating effort	–2.12**	–.261**	.034
Paternal resemblance	.237**	.227**	.496*
Mate fidelity	.191*	.130	.149
Adj. R^2	.303	.253	.203
F	8.87	6.30	2.18
p	.000	.000	.06

* $p < .05$; ** $p < .01$; *** $p < .001$

was dichotomized in order to run separate multiple regression analyses on low and high mate value men, mate fidelity was found to predict investment in high mate value men ($\beta = .576$, $p = .000$) but not low mate value men ($\beta = .005$, $p = .962$). Paternal resemblance was found to significantly predict parental investment in both high ($\beta = .258$, $p = .033$) and low ($\beta = .213$, $p = .018$) mate value men. After controlling for age of the subject, the child's age and sex, the father's relationship status, total number of children, and number of hours worked per week, significant positive correlations were found between men's perceived resemblance to their offspring and their reported level of parental investment in both men with a self-perceived high ($r = .371$, $p = .009$) and low ($r = .236$, $p = .017$) mate value. Although the relationship between resemblance and investment was stronger in men with a high mate value as compared with men with a low mate value, the difference was not significant ($z = -.82$, $p = .41$). The relationship between men's perceived fidelity of their mate and their reported parental investment was found to be significant in men with a high mate value ($r = .54$, $p < .001$) but not in men with a low mate value ($r = .012$, $p = .902$). The difference in the strength of the relationships between fidelity and parental investment in men with a high mate value compared with low mate value men was significant ($z = -3.25$, $p < .01$).

DISCUSSION

Although studies have found that self-perception influences mate preference and selection (e.g., Bereczkei et al. 1997; Buston and Emlen 2003; Little et al. 2001; Waynforth and Dunbar 1995), this study represents one of the first attempts to examine how self-perception affects men's reproductive strategies more generally. The results are consistent with predictions derived from parental investment theory. We have found that as men's perceived mate value increases, so does their reported mating effort, and in turn, as mating effort increases, paternal investment decreases. However, mate value itself was not directly correlated with parental investment even after controlling for mating effort. This suggests that other factors in addition to mate value influence the amount of parenting and mating effort in which men engage (e.g., operational sex ratio).

When simultaneously examining the effects of mate value, fidelity, and paternal resemblance on men's parental investment, we found that all three variables predicted men's reported parental investment, and overall they provide a useful model for predicting paternal investment. However, when we examined how well this model predicted investment in those men who were still in a relationship with the mother of their children compared with those who were no longer in a relationship, we found different results. Fidelity no longer predicted investment in either group, and although mating effort and paternal resemblance were significant predictors of investment in men who are still in a relationship, only paternal resemblance was a significant predictor of investment in separated men—and its effect became stronger. When men are compared separately by relationship status, sample sizes are

reduced, and this could have led to a type II error. We speculate that the reduced variation in men's fidelity scores for men still in a relationship (s.d. = 1.13, range = 5) compared with the whole sample (s.d. = 1.95, range = 8) and separated men (s.d. = 2.31, range = 8) likely contributed to the finding of fidelity having an insignificant effect on investment for men still in a relationship. Men in a relationship with the mother of their children largely viewed her as having high fidelity whereas separated men largely viewed her as having low fidelity. Apicella and Marlowe (2004) posit that because perceived mate fidelity was decreased in the separated men (and infidelity could be one reason for the separation), separated men should rely more heavily on other cues, such as resemblance, to estimate their paternity.

It is less clear why mating effort does not predict paternal investment in separated men. It may be that mating effort conflicts more with parenting effort in men who are in a relationship with the mother of their children and are likely living with their children, as compared with separated men. Therefore, the trade-off is greater in men still in a relationship. In fact, we found that men who are in a relationship with the mother of their children report significantly higher levels of investment in their children as compared with separated men.

Our prediction that men's perceived mate value will affect the degree to which men vary their investment in relation to changes in resemblance and fidelity was not supported when testing this prediction using moderated regressions. However, as previously discussed it is difficult to detect true interactions using moderated regressions with range-restricted data. For this reason many researchers advocate raising the type I error rate to .10 to compensate for low power. If we had chosen to do this we could have concluded that mate value significantly moderates the relationship between fidelity and investment. Instead, we chose to conduct alternative analyses in which participants were dichotomized into two groups of mate value (high and low) so that separate regressions for each group could be conducted. We anticipated that perceived mate fidelity and resemblance would both be stronger predictors of investment in men with a self-perceived high mate value compared with men with a self-perceived low mate value. In support of our prediction, we found that fidelity only significantly predicted investment in men with a self-perceived high mate value. In addition, the partial correlation between fidelity and parental investment was also significantly higher for men with a high mate value as compared with men with a low mate value. This suggests that men with a self-perceived high mate value react more to their mate's infidelities by lowering their investment in their children as compared with men with a self-perceived low mate value.

Although we found that resemblance was a stronger predictor of parental investment in men with a self-perceived high mate value as compared with men with a self-perceived low mate value, the beta coefficients for resemblance were remarkably similar for both groups. In addition, the partial correlations between resemblance and parental investment were not significantly different for high and low mate value men. These findings, coupled with the results from the moderated re-

gression, suggest that there is likely no interaction effect between mate value and resemblance. Therefore, we conclude that resemblance is an important predictor of investment in both high and low mate value men.

While men with a self-perceived high mate value will reduce their investment in relation to lowered mate fidelity and paternal resemblance, low mate value men only reduce their investment in response to lowered resemblance. This suggests that men with a self-perceived low mate value may be more likely to tolerate unfaithful mates and continue to invest in their children unless other cues to paternity, such as resemblance, indicate that the child is not theirs.

Interestingly, post hoc analyses reveal that men with a low mate value actually report higher mate fidelity ($z = -2.63$, $p = .009$) as compared with men with a high mate value. One explanation for this finding may be that higher-quality men mate with higher-quality women, and those high-quality women have more chances of being unfaithful than low mate value women. On the other hand, it may be that men's perception of their mate's fidelity does not correspond to their mate's actual fidelity. Low-quality men may benefit from believing that their mates are faithful and/or high-quality men may benefit from believing their mates are unfaithful. More work is needed to determine the relationship between male quality and female infidelity.

This study provides some very preliminary support for the theory that men allocate their reproductive effort in accordance with their perceived value as a mate and thus in ways that may best maximize their reproductive payoff. Some interesting future research directions include examining the accuracy of both men's self-perceived mate value and their perceptions of their mate's fidelity. In addition, it would be useful to examine how factors that affect mate value such as men's income or degree of facial symmetry directly influence men's reproductive decisions. Finally, other variables such as a father's effect on child survivability and/or quality and the operational sex ratio should also be included in future models that attempt to predict how men allocate their reproductive effort.

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