



MATING-EFFORT IN ADOLESCENCE: A CONDITIONAL OR ALTERNATIVE STRATEGY*

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Summary—Mating-effort was defined as the psychological effort put forth to obtain and guard short-term mates. Hypotheses were derived that contrasted two views of high mating-effort. In the conditional strategy view, social failure would occur first and lead directly to individuals' adopting high mating-effort tactics. In the alternative strategy view, heritable dispositions would lead individuals to adopt high or low mating-effort tactics. The findings were that (i) social failure could not account for the co-variation of mating-effort and delinquency; (ii) perceived mate value was related to mating-effort only weakly; (iii) high mating-effort individuals were more, not less, sexually active; and (iv) mating-effort was familial. Although not definitive, on the whole these findings favored an alternative strategy over a conditional strategy interpretation of the choice of mating tactics among middle-class adolescents. © 1997 Elsevier Science Ltd

INTRODUCTION

Delinquent behavior has been historically ascribed to a variety of causes. One general view is that delinquency is the result of a cognitive or emotional deficit or disorder that causes the afflicted person to behave maladaptively within society so as to predictably come in conflict with it. For example, the person may be constitutionally incapable of, or resistant to, the aversive conditioning to punishment presumed to keep normals from committing antisocial acts. Such deficits could be the result of an unfortunate combination of heritable behavioral characteristics, drawn from a pool of otherwise normal personality factors, where a chance combination of extreme scores on several of these factors results in an 'antisocial personality disorder'. An antisocial combination of otherwise normal traits is therefore just an accidental product of the regular genetic and environmental mechanisms generating the broad spectrum of human personality (Eysenck, 1976, 1977; Eysenck & Gudjonsson, 1989). Another form of the general view that crime is a disorder invokes a single cause: a specific deficit in impulse control (Gottfredson & Hirschi, 1990).

An alternative view on the origins of delinquency is that antisocial behavior is an evolved adaptive strategy (Rowe, 1996). In this view, characteristics such as the lack of a conscience are not viewed as a deficit, but instead as an advantage in the context of an exploitative reproductive strategy. To propose that any behavior constitutes an evolved adaptive strategy bears the special onus of demonstrating that the behavior is specifically shaped by natural selection towards a particular adaptive function (Williams, 1966): that it is 'teleonomic' (Mayr, 1984). This is not an easy task, and it is further complicated by the fact that there are several plausible mechanisms of behavioral development by which evolved adaptive strategies are produced in a variety of different species (e.g. Thornhill, 1987). Testing these theories involves deriving contrary predictions from them and evaluating the rival hypotheses in light of any empirical evidence that can be brought to bear (Chamberlin, 1897; Platt, 1964).

We focus on the choice of reproductive tactics used by different individuals of the same species. Applications of Darwinian theory provide two contrasting mechanisms for the development of individual adaptive strategies within a population (Crawford & Anderson, 1989). The first one is the 'conditional strategy' mechanism in which individuals may be genetically identical in the relevant nervous system characteristics, but where their responses may be environmentally contingent. A

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second mechanism for generating behavioral variability is the 'alternative strategy', in which pre-existing genetic variation creates different behavioral dispositions among individuals. This study is an attempt to integrate behavioral genetics with evolutionary theory. To accomplish this task, however, we must reconcile the terminology used by these different research traditions in order to avoid semantic traps. The classic distinction between 'genetic' variance and 'environmental' variance does not capture the full interplay between genetics and environment that is required by the definition of an adaptation. It is important to recognize that, if the theory of evolution by natural selection is correct, genetic information is ultimately shaped by the environment. Furthermore, environmental effects cannot be treated as a catch-all residual term (variance 'not otherwise explained'). For an evolved adaptive strategy to work, the organism must adaptively modulate its behavior by responding systematically to 'specific' environmental cues that signal critical contingencies of survival and reproduction. Thus, an alternative strategy is more than just a behavior that is high in 'heritability' and a conditional strategy is more than one high in unspecified 'environmentality'. Behaviors may be genetically or environmentally determined without being strategic. It is the special burden of evolutionary theorizing to show a clear link between the observed behaviors and their hypothesized functions.

Reproductive effort can be roughly partitioned into two complementary components: Mating-effort and Parental-effort. Mating-effort is that portion of the total reproductive effort that is invested in the initial acquisition of mates as sexual partners. Mating-effort may also include some degree of short-term guarding of mates from rival males. Such short-term mate guarding should not be interpreted to mean lifelong commitment; for example, in many species, the period of mate-guarding is on the order of several days. Thus, the word 'mating' is used here somewhat euphemistically, as the duration of the male-female association may not exceed that necessary for insemination. Parental-effort, on the other hand, is that portion of the total reproductive effort that is invested in the rearing and defense of offspring. This often involves the male provisioning of the mother, and thus, the establishment of a long-term pair-bond with the female. Because any individual must allocate limited resources between these two components of reproductive effort, there is expected to be an inverse relationship between high parental-effort and high mating-effort strategies. Thus, high parental-effort is usually associated with low mating-effort, and *vice versa*, although it might be possible for an unusually resource-rich male to pursue a mixed strategy combining certain elements of both. For the average male, however, the choice is usually more constrained. In the following discussion, it will be important to keep in mind the technical definitions of these terms because the intuitive connotations of expressions like 'mating-effort' might be construed to include the various actions that might be taken by either an ardent suitor or a dedicated husband to initiate and/or perpetuate a lasting monogamous union with a single female, whereas nothing could be further from the current scientific usage.

For human males, a conditional strategy model can be used to explain the choice of high or low mating-effort tactics (e.g. Belsky, Steinberg & Draper, 1991; Figueredo & McCloskey, 1993; Thornhill & Thornhill, 1983). The high mating-effort male would seek multiple mating opportunities and jealously guard any current mate. The high mating-effort individual would not remain loyal to a particular mate, nor invest heavily in any children that may be born. According to a conditional strategy explanation, high mating-effort would follow after social failure, which is its conditional environmental trigger. This is because the parental-effort strategy requires control of the social and material resources required for the provisioning of both females and offspring, which, in our species, is normally achieved by some degree of success in social competition. Barring that, a high mating-effort strategy might be the only feasible alternative for less successful individuals.

Why should promiscuous mating tactics follow after social failure and not be highly attractive in-and-of-themselves? One explanation is that such tactics carry many social costs. Some forms of high mating-effort are either illegal (e.g. adultery, bigamy) or discouraged by their ordinary social costs (e.g. a partner's sexual jealousy). Therefore, a life-history less costly in terms of physical, psychological, and legal hazards would be to secure resources with which to attract one stable mate—a choice made against sexual promiscuity. On the other hand, after social failure the first option of a stable partnership is closed because too few resources (e.g. both income and prestige) would be available with which to attract and retain a long-term mate. The less attractive behaviors of sexual promiscuity and the use of coercion or deception to attract short-term mates then would

be taken. Although these young men may not be attractive to women as long-term mates, some women may accept them as short-term partners where that might be consistent with their own sexual strategies. (cf. Gangestad & Simpson, 1990).

The conditional tactics could extend beyond seeking mates to other forms of delinquency (Daly & Wilson, 1983, 1988). Criminal activity is a rapid and effective method of gathering resources with which to attract a mate. As Daly and Wilson (1983) observed, "Men are certainly not poorer than women, yet they help themselves to other people's property more often and are readier to use violence to do so... the chronic competitive situation among men is ultimately responsible for a greater felt need for disposable—as opposed to subsistence-resources" (p. 301).

The strategic explanations differ on whether genetic variability can produce different behavioral strategies. The conditional strategy either assumes one common genotype, or, at least, does not require more than one genotype to implement. The nervous system produced by this genotype can be identical in all individuals. Nonetheless, this neural programming would permit environmentally contingent responses that vary depending on social context (i.e. social success vs failure).

The alternative strategy explanation assumes different genotypes produce different behavioral strategies (Rowe, 1996). In the simplest example, the *SRY* genetic switch that determines genetic maleness or femaleness has many consequent effects on behavioral differences between men and women. Less overtly, polygenic variation may operate through quantitative effects on personality and cognition (e.g. Moffitt, Caspi, Belsky & Silva, 1992). From an alternative strategy view, some males would be genetically predisposed to strong mating-effort tactics and delinquency, whereas others would be genetically resistant to the same behaviors. This explanation changes the position of the proverbial 'chicken and egg' with regard to social failure. Rather than determining mating-effort (or delinquency), social failure would be the developmental outcome. Individuals who devote substantial psychological energy to mating-effort and crime, especially those who persist beyond late adolescence, would be likely to fail at gaining entry into well-paying occupations; they could fail because their attention and energy have been placed elsewhere. In addition, they would incur the various associated social costs mentioned above.

Although conditional and alternative strategy explanations lack logical contradiction (i.e. behavior could result from both processes; see Figueredo, 1995), we treat them as contrasting explanations of mating-effort and delinquency. We present four hypotheses that assume mating-effort is a conditional strategy, each followed by a brief rationale. Hypothesis 1 is that the partial correlation of mating-effort and delinquency is zero, once social failure has been controlled statistically. This hypothesis assumes that social failure determines both types of behavior so that their co-variation results from a common cause. Hypothesis 2 is that individuals with low mate value will be more likely to resort to strong mating-effort tactics (or crimes) than ones with high mate value. Mate value refers to qualities desired in a mate, primarily income-earning potential, willingness to invest in children, and physical attractiveness, for reasons elaborated in the evolutionary psychology literature (Buss, 1994). Hypothesis 3 is that less sexually successful individuals will be more likely to adopt high mating-effort tactics. Presumably, they would be potential social failures in the domain most relevant to reproduction—that of finding a mate. They could contingently respond by increasing their mating-effort. The fourth and last hypothesis is that mating-effort is not a familial trait—that it should not 'run' in families because heritable variation would be irrelevant to it.

Of course, some social and intellectual disadvantages are inherited, although others may be acquired from (or aggravated by) a poor environment. Because a long-term strategy of parental investment requires the acquisition of status and resources unavailable to competitively disadvantaged individuals, both high mating-effort reproductive strategies and delinquent social strategies might be developed secondarily from these prior biasing factors. Such disadvantages would also be likely to degrade mate quality and impair both social and sexual success.

Of course the alternative strategy explanation assumes that heritable mating-effort disposition is associated with delinquency. However, there are at least two forms of this hypothesis. In the first, or 'weak', form of this principle, reproductive strategy biased towards Mating-effort, rather than Parental-effort, is what is inherited. The short-term nature of this strategy is highly consistent with the short-term nature of the payoffs associated with delinquency. Thus, it is not necessary to inherit any tendency towards criminality, *per se*, and a parsimonious explanation would be that what is inherited is a reproductive strategy that biases development towards socially delinquent pathways.

Similarly, conventional social success would most likely be damaged as a consequence because of the nearly universal prevalence of social sanctions against both Mating-effort and delinquent behaviors. Sexual success is also likely to be impaired if there is widespread and systematic discrimination in female mate choice against this phenotype. This relative deficit will show up in various indicators of mate quality.

A second, or 'strong', form of this principle is that the alternative phenotype is characterized by a fully co-adapted genome that contains everything appropriate to the social niche of a 'cheater': high Mating-effort, high delinquency, and high mate quality. Conventional measures of social success are irrelevant to this coherent exploitative strategy, and not necessarily significant correlates, but early sexual success is paramount (due to inherent risks) and, thus, to be expected in this model. Thus, there might be two parallel avenues of reproductive success to consider and our conventional measures of 'social success' only capture the forms that are generally approved by the society.

The hypotheses are evaluated using data from adolescent siblings in a southwestern city of the United States. We should state in advance that the evidence presented here is not sufficient to determine conclusively which of these developmental models is ultimately superior, but might be used to sort out which of these alternative representations are at least more likely than the others. Although the theoretical development of the hypotheses has focused on mating-effort in males, a corresponding mating-effort trait in females will be examined. In light of Bateman's (Bateman, 1948) well-known rule that the sex with the greater parental investment in offspring is the less promiscuous one, we anticipated less mating-effort and delinquency in females than in males. Other specific predictions, however, were not advanced for females.

METHODS

Subjects

The sample consisted of same-sex, birth-order adjacent sibling pairs ($N=116$ pairs), which were part of a 3-year follow-up effort on an earlier sample of 418 sibling pairs in the Arizona Sibling Relationship Study. The follow-up was completed in a mid-size, southwestern city in the United States (see Rowe & Gulley, 1992 for a detailed description of the initial sample). Ss were selected on the basis of drinking and delinquency histories of the older sibling at time 1. Drinking and delinquency variables were standardized and then summed separately for males and females. About half of the sibling pairs were selected from the upper extreme on the composite variable; about half from the lower extreme. This sampling procedure was chosen to increase the statistical power of a relatively small sibling sample. Because of the selection of extremes, intercorrelations involving alcohol use or delinquency may be stronger in this sample than in the general population.

Participants (two siblings and the mother) were primarily from two-parent families. Letters were sent to qualifying families (sample $N=168$) inviting them to participate. Some families were lost for various reasons (e.g. 17% moved away; 14% refusals). The final sample consisted of 60 brother and 56 sister sibling pairs. The mean age of these adolescents was 16.8 years (age ranged from 13 to 20). They came mainly from middle-class homes, as the mean years of mothers' education was 14.7 years, and they came from all geographic sections of the southwestern city. The findings of this study might not generalize to circumstances of severe environmental deprivation, such as among the urban or rural poor. Thus, this largely limits the scope of this study to partially heritable causes of social failure.

Procedures

After initial phone contact, families were contacted to arrange interview times. Two interviewers visited each home and administered a questionnaire to both siblings and to the mother; in a few cases, where the mother was not available, the father completed the survey. Only the children's self-reports were used in this study. Parents signed consent forms at the time of the interview; adolescents that had passed their 18th birthday completed their own consent forms. Interviewers made sure that each participant had a 'private' place to complete the questionnaire, which on average required approximately 30 minutes. Following the paper-and-pencil survey, each child completed two verbal scales (vocabulary and information) of either the WAIS-R or the WISC-3, depending on their age.

Participants were paid immediately upon completion of the interviews. In some cases, one sibling was unavailable at the time of the interview; therefore, a few surveys had to be mailed to the research office upon completion. Families received a \$50 payment for taking part in the study.

Measures

Mating-effort. The mating-effort scale was an experimental measure designed specifically for this study and contained 10 items. Table 1 presents these items. A scale score was obtained by summing responses ranging on a scale of 1 = strongly disagree to 5 = strongly agree. Reliability estimates were adequate for males, but lower for females who tended not to endorse items in the mating-effort direction (Cronbach's alpha = 0.79 and 0.63, respectively). As expected, the mean score of male respondents was greater than that of the females (M of males = 27.2, s = 6.5; M of females = 22.2, s = 4.7).

Mate value. This scale was also experimental and specifically designed to capture three dimensions of mate value: wealth potential (four items), child-centered potential (three items), and physical attractiveness (one item). Respondents were asked to rate how well each trait described him/her (1 = slightly, 2 = partially, 3 = mostly, and 4 = completely). Wealth potential was measured by items such as "Want to get ahead in life" and "Able to earn lots of money (now or in the future)"; child-centered potential by "Caring for young children", "Caring in relationships", and "Faithful in relationships". Finally, physical attractiveness was measured by the single item "attractive/good looking".

Delinquency. Items on the delinquency scale were repeated from the study's round 1 (Rowe & Gulley, 1992; see also Rowe, 1985). The scale had 20 items, which can be classified as vandalism and trespassing (six items), aggression (seven items), shoplifting and theft (four items), lying, speeding, and non-compliance to an adult (one item each). Ss were asked to rate each statement on a four-point Likert scale (1 = no/never, 2 = one time/once, 3 = several times, and 4 = very often). The delinquency score was computed by summing the 20 items; the scale's Cronbach alpha reliability was satisfactory 0.93 for males and 0.81 for females. Males reported three times the rate of delinquent acts as females (M for males = 14.6, s = 11.1; M for females = 5.4, s = 5.2).

Social failure. Social failure was measured in three ways. First, Ss indicated the average grades they received overall, in English, mathematics, sciences, and in art/music. Ratings were made on an eight-point Likert scale ranging from 1 = A to 8 = below D. An overall 'school grade' variable was computed by averaging the five variables. Second, Ss rated three items on 'school attitudes': "I am involved in many school clubs", "Having lots of school spirit is important to me", and "Getting good grades in school is important to me". Finally, a 'life events failure scale' was derived based on the Psychiatric Epidemiology Research Interview Life Events Scale (Dohrenwend, Krasnoff, Askenasy & Dohrenwend, 1978). Six items were selected to specifically measure common life-event failures. Items included "Recently, I failed an exam or received a failing grade at school," "... broke up with my boyfriend/girlfriend", and "had trouble at work with my boss". A count of all endorsed items was obtained as a global measure of recent life event failures. Although none of these 'failures' were necessarily fatal to one's later success, it has been shown that academic performance is a very good predictor of later outcomes (Jencks, 1972).

Sexual activity. The adolescents answered items about the frequency of sexual intercourse and the number of sexual partners; each item was rated as follows: 1 = no/none, 2 = once/one, 3 = 2-4,

Table 1. Mating-effort Scale (MES) for male respondents

1.	When I see an attractive girl with her boyfriend, I might try to get her attention.
2.	I would rather date several girls at once than just one girl.
3.	I think girls find me naturally attractive.
4.	I like girls more for their good looks than for their companionship.
5.	I would get back at someone who looked at my girlfriend in the wrong way.
6.	I would start a relationship with another girl before ending one with my current girlfriend.
7.	My friends respect me because they know I'm a little wild and crazy.
8.	If other guys think I am attractive to girls, they will stay away from my girlfriend.
9.	Other guys respect me because they know I have a lot of friends who would support me.
10.	If other guys think I am 'tough', they will stay away from my girlfriend.

Table 2. Predicting delinquency from failure and mating-effort

Males	
In equation	R^2
Failure	0.26
Failure + Mating-effort	0.43
R^2 Change	0.17
Females	
Failure	0.16
Failure + Mating-effort	0.30
R^2 Change	0.14

Note. All R^2 values are statistically significant.

4 = 5–7, and 5 = more than 7. Of the boys, 34% reported non-virginity, whereas 28% of the girls reported the same status. Of the sexually active teenagers, the males reported an average of 2.9 partners, the females, 2.6. Although the sex difference in reported sexual activity may reflect differential response bias, such biases in no way compromise within-sex comparisons.

RESULTS

The first hypothesis was tested by a multiple regression analysis. A block of three variables represented social failure: school grades, attitudes toward school, and life-event failures. The respondents' age was put into the equation as a covariate (i.e. delinquency tended to increase with age). The first regression step was to predict delinquency from the three failure variables and age. In the second step, mating-effort was added to the regression equation. The difference of multiple correlation coefficients, $R^2_{\text{step2}} - R^2_{\text{step1}}$ respectively, would indicate the amount of variance uniquely shared between delinquency and mating-effort, controlling statistically for social failure and age.

Table 2 summarizes the regression findings for males and females separately. Each equation explained substantial variation in delinquency. The change in R^2 was statistically significant in males and females ($R^2 = 0.17$ and 0.14 , respectively). Thus, the conditional strategy hypothesis failed because delinquency and mating-effort retained common variance after social failure was accounted for statistically.

The second hypothesis asserted that low mate value would correlate with greater mating-effort. This hypothesis was contradicted by a general lack of statistically significant correlations. Nonetheless, two correlation coefficients reached statistical significance ($P < 0.05$). In males, greater physical attractiveness was associated with mating-effort ($r = 0.24$). In females, less desire to invest in children was associated with greater mating-effort ($r = 0.23$). The first correlation was inconsistent in direction with the social failure hypothesis. Failure should lead unattractive males towards greater mating-effort. Although the second correlation supported a conditional strategy explanation, it appeared only in females and accounted for just 5% of the variance in mating-effort.

The third hypothesis was that less sexual experience would be found among adolescents high in mating-effort. Contrary to this hypothesis, males' number of sexual partners and frequency of sexual intercourse correlated positively with mating-effort ($r = 0.38$ and 0.34 , respectively, $P < 0.05$). In females, neither correlation was statistically significant ($r = -0.13$ and -0.17 , respectively).

The fourth hypothesis was that mating-effort and delinquency would show no familial aggregation. Table 3 presents the brother's and sister's correlations. Inspection of the table indicates that this hypothesis was not supported by the data. In brothers, the younger sibling's delinquency correlated, 0.46 with the older's and 0.29 with the older's mating-effort ($P < 0.05$). The younger sibling's mating-effort correlated 0.29 with the older's delinquency ($P < 0.05$). The sibling correlation on mating-effort was 0.16. Although the sister's correlations were generally weaker than the brother's, their overall pattern was similar. Therefore, contrary to the fourth hypothesis, the traits were correlated across family members as well as within individuals.

A more exacting model of the traits is that they may reflect the influence of common genetic and/or common family environmental determinants. As shown in Fig. 1, this position can be tested by a LISREL model (Joreskog & Sorbom, 1989). The use of LISREL modeling permitted the construction of latent variables for each sibling's behavioral disposition. This latent trait is a

Table 3. Correlations and model-residuals on mating-effort and delinquency

Males					
	Younger mating-effort	Younger delinquency	Older mating-effort	Older delinquency	
Y-Mating E.	1.0	-0.01	-0.01	0.01	
Y-Delinquency	0.55	1.0	-0.01	0.00	
O-Mating E.	0.16	0.27	1.0	0.01	
O-Delinquency	0.29	0.46	0.56	1.0	
Females					
	Younger mating-effort	Younger delinquency	Older mating-effort	Older delinquency	
Y-Mating E.	1.0	0.01	-0.05	-0.06	
Y-Delinquency	0.37	1.0	0.09	0.01	
O-Mating E.	0.04	0.27	1.0	-0.02	
O-Delinquency	0.12	0.41	0.35	1.0	

N = 60 males and 56 females.

disposition toward both delinquency and mating-effort. It was estimable from the loadings of delinquency and mating-effort (*a* and *b*, respectively). Following the conventions of behavior genetics, the genetic correlation (r_g) of the older and younger child was set to 0.50. This assumption does not mean that the sibling correlation on the latent trait was entirely genetic in origin. This sibling research design cannot rule out family environmental influences or sibling effects (the latter were important for delinquency in one round of the data collection of this sample, but not in the present round, see Rowe & Gulley, 1992). Rather, the 0.50 coefficient simply allowed the sibling's latent traits to be correlated. Further assumptions must be made to interpret it in genetic terms.

The LISREL restrictions were as follows: the diagonal of the matrix ϕ was set to 1.0, and the first off-diagonal element was set to 0.50 (the genetic correlation of siblings); in the matrix λ - x , loadings were freed and set equal; and finally, the error matrix θ - δ was set to be free and diagonal. This LISREL model gave an excellent fit to the male and females' correlation matrix. Where a lower χ^2 indicates a more satisfactory fit, the males' had a small χ^2 relative to the degrees of freedom ($\chi^2 = 0.04$, d.f. = 4, $P > 0.90$). The estimated values of *a* and *b* were 0.58 and 0.96, respectively. Similarly, the statistical fit of the females was also satisfactory ($\chi^2 = 1.2$, d.f. = 4, $P > 0.90$). Their *a* and *b* estimates were 0.40 and 0.90, respectively. The quality of these LISREL-model fits can be appreciated by inspecting the model-residuals shown in Fig. 1 (values above the diagonal in the correlation matrices). Most residuals were zero or close to zero.

LISREL can be extended to compare the similarity of statistical structure in multiple groups. The males and females can be compared by restricting the parameters *a* and *b* to equality across them. When this was done by fitting correlation matrices, the fit was satisfactory ($\chi^2 = 3.0$, d.f. = 10, $P > 0.90$). However, the males and females do not fit a single model when covariance matrices were substituted for the correlation matrices. First, three error terms in θ - δ had to be set to 0.001 to

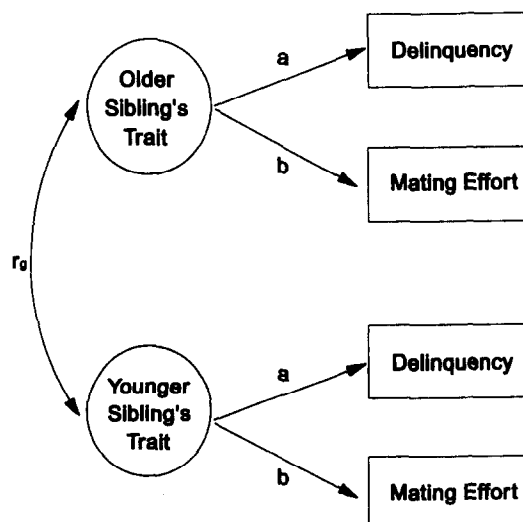


Fig. 1. LISREL model of mating-effort (r_g = genetic correlation, *a* = factor loading of delinquency, *b* = factor loading of mating-effort).

make them positive. Second, the model was statistically rejected ($\chi^2 = 50$, d.f. = 13, $P < 0.05$). In standardized units, the familial and within-person correlations on mating-effort and delinquency had similar structures; males and females were alike. In raw units, males had a higher mean level on mating-effort and delinquency than females. The mating-effort means were 27 and 22 for males and females, respectively ($P < 0.05$). Males also were more variable in mating-effort ($s^2 = 43$ vs 24) and delinquency ($s^2 = 11.1$ vs 5.4) than females. Hence the common LISREL model based on raw-score covariance matrices was rejected.

DISCUSSION

In this study we compared conditional and alternative strategy explanations of adolescents' mating-effort. In general, the alternative strategy explanation received greater empirical support. First, mating-effort and delinquency correlated strongly despite statistical controls on social failure. This finding tends to rule out failure as a common cause of both mating-effort and delinquency. Second, lower mate value did not strongly predict greater mating-effort. Instead, associations between mating-effort and mate value were weak. One correlation here was contrary to our conditional strategy hypothesis: mating-effort was greater in more physically attractive males. Third, higher mating-effort males were more sexually experienced than ones lower in mating-effort. Fourth, both mating-effort and delinquency were familial traits.

The alternative strategy interpretation can unify these findings. The association of mating-effort (or delinquency) and social failure can be regarded as partly an influence in the direction from mating-effort to social failure, rather than the opposite. The lack of association of mate value with mating-effort can be explained if different mechanisms underlie them. Wealth potential may reflect heritable traits influencing social success (e.g. IQ, see McCall, 1977), child centeredness may reflect heritable non-intellectual personality traits (e.g. Loehlin, 1992), and physical appearance may reflect heritable bone and tissue structures. Unless genetic pleiotropy occurs, the genes influencing these different traits would assort independently. Hence, we would expect a lack of statistical association among them. In addition, environmental effects on mate value (e.g. past exposure to infectious disease) also may affect the traits differentially—for example, disease harming physical appearance more than personality traits. High mating-effort males also had greater sexual 'success' with females. This empirical link follows if putting more time and energy into finding female partners, more often than not, can yield some success. Other research indicates that sexually aggressive males were not deficient in sexual opportunities; if anything, they had greater desire for sex and found more sexual outlets than non-aggressive males (Kanin, 1985; Muehlenhard & Falcon, 1990).

One limitation of the study is that it failed to establish directly a heritable component to either mating-effort or delinquency. Common environmental exposures, as well as shared genes, can make siblings alike in behavior. It is well-established that delinquency in the teenage years is socially influenced by peers, although social selection of similar friends also occurs (Moffitt, 1993; Rowe & Osgood, 1984). In this sample, sibling influence effects on delinquency were found in round 1 (when mean age of the siblings was 13.5 years; Rowe & Gulley, 1992), whereas they were not found in round 2 (mean age 16.8) from which these data were drawn. Nonetheless, genetic inheritance also affects most behavioral traits. Indeed, for the majority of traits studied, family resemblances would be entirely or mainly the result of shared genes (Rowe, 1994). In light of the large body of evidence in favor of heritable influences on delinquency (see Raine, 1994) and on related personality traits (Eysenck & Gudjonsson, 1989), a postulate of a genetic etiology to variation in mating-effort is reasonable.

A second limitation is that the respondents were not economically impoverished, intellectually retarded, or otherwise at the extreme of social and personal failure. Although low grades in school, and dissatisfaction with school may predict many kinds of serious social failure, most of these adolescents had not yet failed profoundly in their jobs or marriage choices. Perhaps severe failure would conditionally trigger high mating-effort strategies such that some low-mating-effort adolescents would switch strategies if they had later failed. On the other hand, delinquency and related forms of antisocial conduct are known to be fairly stable life traits (Farrington, 1990; Olweus, 1979), and it is often exhibited strongly in adolescence before life failures can accumulate. Although some

degree of prediction of social failure might be inferred by individuals from their parents' social status, little reliable information about their future chances as individuals can be gleaned from this knowledge. We believe that our conclusions are most firm for middle-class adolescents; new studies must be done to test their generality to other populations.

A third limitation is that this study cannot uncover the evolutionary mechanisms producing heritable variation in mating-effort. Frequency-dependent selection, variable environments, and pathogen driven co-evolution are all possible sources of genetic variability in humans. Although in the context of race differences as well as individual differences, it has been suggested that sexual restraint (i.e. low mating-effort) would evolve under predictable environments, *K* selection, rather than under unpredictable environments, *r* selection (Rushton, 1985, 1988, 1990; for contrasting views, see Silverman, 1990 and Zuckerman & Brody, 1988). Another position is that the ability of females to fully provision their own children may drive the evolution of a genetic alternative of greater mating-effort (Harpending & Draper, 1988). If women are able to provision children without help from their male partners, then men can engage in male–male competition because it would not impose risks on the survival and health of their children. Another source of genetic variability may be the evolution of cheater behavioral strategies, which could exist in a game-theoretic equilibrium with co-operator strategies (MacMillan & Kofoed, 1984). Analytic methods are needed to resolve hypotheses about the evolutionary origin of genetic variation within populations, which at present can be given many explanations.

One interesting finding was not specifically predicted. Although mating-effort was expressed less in females than in males, it had many of the same familial correlations in the two sexes. Why should mating-effort predict delinquency in females? Why should mating-effort in one sister correlate with delinquency in the other? One possibility is that, whereas hormonal effects can modulate the expression of certain traits in males or females, they do not eliminate the underlying genetic variability. Males and females are more physiologically similar than they are different: nature is conservative. Genes that increase mating-effort in a male may have exactly the same effect in a female despite the reduction of its magnitude through a hormonal regulation of gene expression. Gangestad and Simpson (1990) suggested a possible evolutionary basis for greater female mating-effort (in their terminology, 'sociosexuality'). It is that females may gain if their promiscuous matings lead to the birth of sons of greater genetic quality. Thus, some selective forces may oppose the total elimination of high mating-effort behavioral strategies in females.

An interesting case to examine would be brother–sister sibling pairs. They can be used to determine whether the same genetic and common environmental etiologic influences are expressed in the two sexes; if so, the brother–sister correlation on mating-effort behaviors should about equal that on sisters or brothers. In addition, these mixed-sex sibling pairs could be used to search for different behaviors in females that express the same underlying trait as mating-effort in males. It would be interesting to write different items for females than males, for instance, ones about enhancing physical attractiveness or using flirtatious gestures, which may constitute female-specific expressions of mating-effort.

The hypotheses tested in these models were based on fairly traditional interpretations of social success and failure. Social success was deemed to be measured by predictors of favorable future prospects in the acquisition of social status and financial resources, such as good grades in school and prosocial behavior. Similarly, sexual experience was used as a convenient proxy for success in sexual competition and, thus, for genetic fitness. However, in adolescence, the data do not seem to reflect this pattern in that our measures of social success appear to correlate negatively with our measures of sexual success, which does not fit neatly into a permanent distinction between mating-effort and parental-effort. Based on the overall pattern of results, however, another interpretation becomes more compelling.

If there are two distinct and heritable phenotypes, associated with high and low mating-effort strategies, respectively, then the appropriate measures of success for the divergent strategies might be entirely different. Although the ultimate quantity measured must be lifetime genetic fitness, there are different instrumental ways to achieve that result. For the low mating-effort strategists, we would expect the traditional measures of social success to be valid because they serve to support a life history of long-term pair-bonding and parental investment, for which social status and resources are essential. For the high mating-effort strategists, these characteristics would be less relevant, but

sexual attractiveness paramount. Furthermore, high mating-effort strategists would be expected to succeed, not fail, in making the most of their immediate sexual opportunities and therefore gaining the most sexual experience early in life. This would be consistent with a life-history of early and exhaustive reproduction and with the higher age-specific risks of mortality associated with delinquent careers.

Low mating-effort strategists, on the other hand, being more predisposed towards monogamy than promiscuity, would be more likely to defer sexual gratification until later in development and then pursue it within the context of more committed relationships, thus effectively reducing their relative number of youthful sexual contacts. The work of Perusse (1993) and others also suggests that this payoff might also be supplemented by the availability of extra-pair copulations and/or the initiation of second families with younger women much later in life. Thus, a better set of labels for these divergent phenotypes might be 'short-term' vs 'long-term' sexual strategies.

In short, reliance on a single set of criteria for either social or sexual success may be a major error in this area of research. This error may be more reflective of a male fantasy of 'having it all' than of the payoffs to be realistically expected from any single life-history strategy. Similarly, the characterization of those adapted to the mainstream competition as 'successes' and of those adapted to deviant social niches as 'failures' may be more reflective of a bias in our societal norms than a dispassionate Darwinian evaluation. The alternative strategy perspective suggests that each are successes in their own respective social niches, though perhaps failures in others, possessing co-adapted genomes that are well-suited to the functional requirements of their disparate evolved adaptive strategies. Therefore, although not uniquely determinative, this evidence is most consistent with the 'strong' form of the alternative strategy hypothesis.

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