

Assortative Pairing and Life History Strategy A Cross-Cultural Study

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Abstract A secondary analysis was performed on preliminary data from an ongoing cross-cultural study on assortative pairing. Independently sampled pairs of opposite-sex romantic partners and of same-sex friends rated themselves and each other on Life History (LH) strategy and mate value. Data were collected in local bars, clubs, coffeehouses, and other public places from three different cultures: Tucson, Arizona; Hermosillo, Sonora; and San José, Costa Rica. The present analysis found that slow LH individuals assortatively pair with both sexual and social partners more strongly than fast LH individuals. We interpret this phenomenon as representing (1) an adaptation for preserving coadapted genomes in slow LH strategists to maintain high copying fidelity genetic replication while producing a lower number of offspring in stable, predictable, and controllable environments and (2) a bet-hedging adaptation in fast LH strategists, favoring the genetic diversification of a higher number of offspring in unstable, unpredictable, and uncontrollable environments.

Keywords Assortative mating · Life history strategy · Mate value · Bet-hedging · Genetic similarity theory

Genetic diversification of offspring represents a bet-hedging strategy that evolved as an adaptation to unpredictable environmental contingencies and when environmental cues that might otherwise selectively trigger developmentally plastic changes are relatively unreliable or invalid (Figueredo et al. 2006a; West-Eberhard 2003). Although sexual recombination is a common means of genetic diversification, the evolution of sexual reproduction remains one of the great mysteries of evolutionary biology (Hamilton et al. 1990). The apparent costs of reproducing sexually are huge. In a sexual reproducing species, for example, offspring carry only half of the

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individual parent's genes. Given differential parental effort, the sex that invests more bears a disproportional cost of sexual reproduction, producing selective pressure against sexual reproduction.

In contrast, sexual recombination of genetic material increases resistance to environmental fluctuations (Hamilton et al. 1990). In facultatively sexual species, for example, sexual reproduction appears under conditions of high population density. In the cladoceran *Moina macrocopa*, switching from asexually to sexually reproducing generations is triggered by a reduction of ingestion rate, a cue presumably reflecting food availability (D'Abramo 1980). In the rotiferan *Bronchionus plicatilis*, changes in salinity and food level affect the number of sexual vs. asexually reproducing members of a given population (Snell 1986).

Sexual recombination also helps remove deleterious mutations (Kondrashov 1988; Smith 1978). Following the Chernobyl power plant disaster, Tsytsugina and Polikarpov (2003) found that the severity of cytogenetic damage in the Oligochaeta earthworm population correlated with the number of individuals switching to sexual reproduction.

These three species (of *Cladocera*, *Rotifera*, and *Oligochaeta*) can switch between sexual and asexual reproduction in response to such environmental changes. We propose that the *degree* of sexual recombination can be adaptively modulated to achieve similar results even in obligately sexual species as a result of the same selective pressures.

According to life history (LH) theory (Charnov 1993; Ellis et al. 2009; Roff 1992, 2002; Stearns 1992), unstable, unpredictable environments that are *uncontrollable* by genetically influenced developmental processes with predominantly *extrinsic* sources of mortality select against slow LH strategies. These environmental conditions lead to highly variable population densities, which support this selective effect. In contrast, stable, predictable environments that are *controllable* by genetically influenced (and hence evolvable) developmental processes with predominantly *intrinsic* sources of mortality select against fast LH strategies. These environmental conditions lead to highly stable population densities, which support this selective effect.

Therefore, consistent with certain evolutionary biological theories regarding the origin and function of sexual reproduction (e.g., Maynard Smith 1978), conditions favoring faster LH strategies (unstable, unpredictable, and uncontrollable environments) put a selective premium on higher rates of genetic recombination and hence *exogamy*. This is because short-term stochastic variations in environmental conditions that result in widely varying levels of juvenile and adult mortality favor the evolution of both diversified bet-hedging and faster LH strategies (Ellis et al. 2009; Murphy 1968; Roff 2002); the diversification of offspring genotypes (*genetic bet-hedging*) makes it more likely that at least some proportion of them will survive under unpredictable conditions if a sufficiently large number of offspring is produced, because they are under a faster LH strategy. In contrast, conditions favoring slower LH strategies (stable, predictable, and controllable environments) put a selective premium on lower rates of genetic recombination and hence *endogamy*, to preserve the integrity of locally well-adapted and perhaps coadapted genomes. It follows that the assortative mating coefficients on heritable traits will be greater for slower LH strategists than for faster LH strategists.

Whereas assortative mating has been defined as “sexual choice for traits similar to one’s own” (Miller 2000), assortative pairing is a more general term denoting the tendency to select friends or lovers who possess traits similar to one’s own (Rushton 1989). These preferences may be based on the detection of genetic similarity; selecting individuals similar to oneself may result in greater altruism toward partners (whether social or sexual) as well as potential offspring (Rushton 1989). We therefore included same-sex friends in this analysis based on inclusive fitness theory (Hamilton 1964, 1970, 1971), whereby genetic replication can be accomplished indirectly by means of altruism that is preferentially directed toward genetically related or similar individuals as well as directly by personal reproduction. Slow LH strategists should therefore be higher on assortative pairing with social as well as sexual partners.

Another theoretical consideration is currently being proposed (Wolf and Figueredo 2009). Since offspring produced by diploid sexual reproduction only contain half of an individual’s genome, the chances of any one gene being shared between a parent and a single offspring is 50%. However, this estimate assumes *panmixia*, which is random mating without regard to degree of genetic relatedness among the parents.

Although LH strategy, like most other heritable traits, is probably controlled polygenically by a number of different genes, the mathematical model of transmissibility and selection is based (for simplicity of presentation) on following the fate of a single LH gene (possibly a regulatory gene) that influences the development of fast or slow LH strategies.

It follows that the probability of transmission to the next generation for a single gene is a function of the total number of diploid sexual offspring produced, as represented by Eq. 1:

$$c = 1 - r_{po}^n \quad (1)$$

where r_{po} is the coefficient of relatedness between parent and offspring and n is the total number of offspring produced. Equation 1 describes this increase where c is the percent certainty that any given gene will be represented in the following generation. Another way to think of this is the likelihood of transmitting that percentage of one’s total genome to the next generation.

Under the presumption of exogamy, where r_{po} is equal to 0.5, this reduces to Eq. 2:

$$c = 1 - 0.5^n \quad (2)$$

This formula’s curve is plotted in Fig. 1. Each additional offspring increases the probability that any given gene in an individual’s genome will be represented in the next generation; however, there is never absolute certainty that the gene will be represented in the following generation. Thus, by the time an individual produces four offspring, each of its genes have a 93.75% chance of being represented in the subsequent generation, and by the time the carrier of this gene produces 6 offspring, any further production of offspring only increases the probability of the gene in the subsequent generation by fractions of a percent.

Under conditions of endogamy, however, the number of sexually produced diploid offspring required to meet this same criterion will be lower. This is because the coefficient of relatedness between parent and offspring (r_{po}) will be higher as a

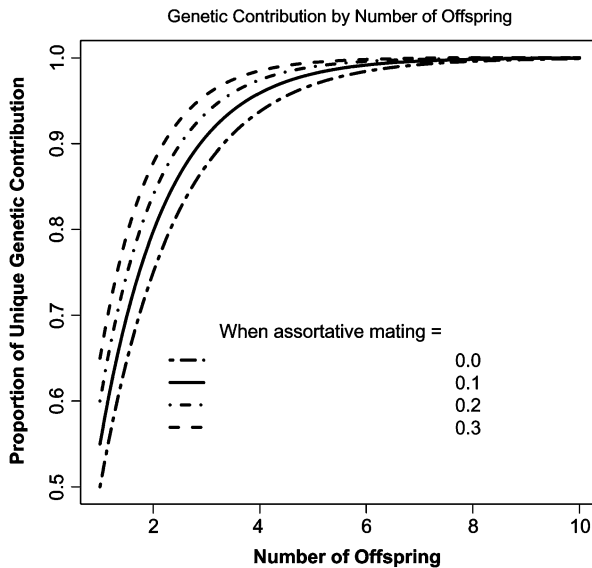


Fig. 1 Minimum number of offspring required to achieve genomic coping fidelity

function of the coefficient of relatedness between the two diploid parents (r_{pp}), as given by Eq. 3:

$$r_{po} = (0.5) + (r_{pp}/2) \quad (3)$$

where r_{pp} is the coefficient of relatedness (genetic similarity) between the two diploid (endogamous) parents. The total number of offspring required to achieve a transmission probability of c is therefore given by Eq. 4:

$$c = 1 - [(0.5) + (r_{pp}/2)]^n \quad (4)$$

For example, if the coefficient of relatedness among parents is 0.1, the four offspring will yield a transmission probability of 95.90% rather than the 93.75% we obtained by setting r_{pp} to 0.0. This means that endogamy permits a smaller number of offspring to transmit an equivalent portion of one's entire genome or a higher fidelity in the transmission of a single LH gene. Figure 1 also plots the proportion of unique genetic contribution transmitted against minimum number of offspring needed under varying coefficients of relatedness (r_{pp}) between diploid sexual parents.

A logical implication of this model is that a potential parent organism possessing a slow LH, for whatever other reason, would be able to avail itself of an endogamous mating strategy to achieve high fidelity of genetic transmission with a smaller number of offspring. We would therefore predict that slow LH strategists should be biased toward endogamy for this reason as well as the reasons given above. On the other hand, the cost of this endogamous mating strategy would be in the reduced genetic diversity of offspring, which is a cost that would figure most prominently under the unpredictable environments that would normally favor fast LH strategists.

Limits on Assortative Mating

Although endogamy through assortative mating is one possible behavioral mechanism consistent with evolving a slow LH strategy, increasing coefficients of relatedness with sexual partners may actually decrease fitness by increasing offspring homozygosity for potentially deleterious mutations. This adaptive problem, however, may also have an evolvable solution.

According to Fitness Indicator Theory (Miller 2000), many traits that serve as components of perceived *mate value*, or sexual attractiveness at the proximate level, are ultimately *fitness indicators* that signal a reduced genetic load of deleterious mutations. Such fitness indicators advertise that the individuals displaying them are relatively free of deleterious pleiotropic mutations. Thus, conspecifics are selected to find these cues sexually attractive in mate choice because they serve as honest signals of genetic quality.

It follows that if a trait is in fact a reliable and valid signal of how few deleterious mutations a potential partner carries then the signal could serve as a cue to how much assortative mating is genetically safe in maintaining the genetic quality of offspring. Essentially, if a genetically similar individual carries few deleterious mutations, it will be safer to assortatively mate with that particular partner. Therefore, the same conditions that favor slow LH strategy and therefore high endogamy should also favor the evolution of preferences for mating with individuals that display reliable and valid fitness indicators.

The main empirical prediction from this theoretical consideration is that slow LH strategists should attend more to fitness indicators in mate choice than fast LH strategists. Since slow LH strategists should be assortatively mating with other slow LH strategists, both potential partners should be following this same mate choice decision rule. From this consideration, it follows that slow LH strategists should display higher assortative mating on mate value than fast LH strategists. Furthermore, because sexual selection theory predicts that preference for a trait should, over evolutionary time, become genetically correlated with the trait itself, this theory also predicts that slow LH strategists should also have been sexually selected (by each other) to be generally higher in mate value than fast LH strategists.

One might ask why fast LH strategists should not attend equally to fitness indicators given that any individual should gain reproductive fitness by selecting a mate of higher genetic quality, meaning a reduced mutation load. To understand this, one must recall that a “deleterious” mutation might only reduce fitness in certain environments but might actually be beneficial in others. The implication is that in stable and predictable environments in which slow LH strategists evolve, a currently deleterious mutation is likely to remain that way. On the other hand, in the unstable and unpredictable environments in which fast LH strategists evolve, a currently deleterious mutation might not remain deleterious for very long: the reliability and validity of fitness indicators over evolutionary time is therefore compromised. It therefore follows that fast LH strategists should not attend to fitness indicators as much as slow LH strategists because the fitness of a gene is only constant in an invariant environment. Furthermore, owing to reduced parental investment and a higher total number of offspring, the loss of any given offspring resulting from homozygosity for a recessive mutation is less costly for fast LH strategists. Finally, the risk of homozygosity for any allele whatsoever should be reduced by the

increased exogamy that we are predicting for fast LH strategists. Our predictions that slow LH strategists should display both higher assortment for mate value and generally higher mate value as a consequence of mutual mate choice are therefore consistent with LH theory.

Testing the Predictions of the Model

The present paper presents a secondary analysis of an ongoing, uncompleted cross-cultural study on assortative pairing (Figueredo 2007). The principal focus of this ongoing cross-cultural study is to determine whether assortative pairing on several traits of interest, including LH strategy, is stronger in romantic or in social partners. For example, previous studies both within the United States (Weiss et al. 2004) and cross-culturally (Egan et al. 2005), supported the hypothesis that sensational interests serve as a form of sexual display by showing that they were significantly correlated with mating effort across different cultures. By systematically comparing social to romantic partners, the aim of this study was to determine whether these displays functioned intrasexually among same-sex friends or intersexually (epigamically) among opposite-sex lovers. The present secondary analysis uses these data to test whether the degree of assortative pairing in both friends and lovers on both LH strategy and mate value is proportional to the average speed of LH strategy in both members of the pair.

Methods

Research Participants

To test these theoretical predictions, we used data from a cross-cultural study on assortative pairing of both friends and lovers (Figueredo 2007). This study sampled from three different cultures: Tucson, Arizona (104 pairs of lovers, 103 pairs of friends); Hermosillo, Sonora (147 pairs of lovers, 113 pairs of friends); and San José, Costa Rica (101 pairs of lovers, 122 pairs of friends). Independent samples of pairs of opposite-sex romantic partners and pairs of same-sex friends were collected in local bars, clubs, coffeehouses, and other such public places.

Procedures

Independently sampled pairs of opposite-sex romantic partners and same-sex friends rated both themselves and each other on the following four traits: life history strategy (Mini-K), mate value (MVI), sensational interests (SIQ-R), and delinquency (D-20). Because sensational interests and delinquency were only of interest to the original goals of the study, and not to the present hypotheses, they were omitted from this secondary analysis.

Measures

The Mini-K life history strategy short form (Figueredo et al. 2006c) is a 20-item short form of the Arizona Life History Battery (ALHB), a battery of cognitive and

behavioral indicators of LH strategy compiled and adapted from various original sources. These self-report psychometric indicators measure graded individual differences along various complementary facets of a coherent and coordinated LH strategy, as specified by LH theory, and converge on a single multivariate latent construct, the K-factor. The component scales are scored directionally to indicate a “slow” (high-K) LH strategy on the “fast-slow” (r-K) continuum. The Mini-K correlates (0.77) with the full ALHB, and the 20-item survey questions use a seven-point Likert scale, which ranges from -3 (disagree strongly) to $+3$ (agree strongly).

The Mate Value Inventory (Kirsner et al. 2003) is a 17-item self-report scale that asks participants to rate themselves on 17 traits theoretically deemed important in mate attraction (e.g., attractiveness, financial security, emotional stability) using a seven-point Likert scale ranging from -3 (extremely low on this characteristic) to $+3$ (extremely high on this characteristic) scale. These traits were sampled from both the evolutionary and social psychological literature on mate value.

Statistical Analyses

Statistical analyses were performed using SAS version 9.1. We correlated the mean Mini-K score among pairmates (friends or lovers) with the squared differences between the Mini-K scores of pairmates as well as with the squared differences between the MVI scores of pairmates. The squared difference between pairmates is an individual-level inverse indicator of assortative mating that was used because correlation coefficients could not be computed separately for each couple. In the aggregate, it functions statistically as a variance parameter: a higher squared difference between pairmate scores indicates a lower degree of assortative pairing. We used multiple regressions to control statistically for both length of relationship (aggregated over both pairmate reports) and mean age of pairmates (because longer relationships might partially be a proxy for older people) to adjust for the longer-term relationships generally favored by slow LH strategists. We also used multiple regressions to test interactions of both the Mini-K and the MVI with the nature of the relationships (social or sexual) and the three cultures sampled (USA, Mexico, and Costa Rica), as well as with the interactions of relationship and culture. Because short forms were used in this field study, we used estimated “true scores,” disattenuated for unreliability, using the specific sample means and sample reliabilities for each measure, culture, and relationship.

Results

Psychometric Properties

The preliminary findings of the cross-cultural comparisons, testing entirely different hypotheses, have been reported elsewhere (e.g., Figueredo 2007) and will be reported in greater detail when the larger international study is complete. Suffice it to state for present purposes that the psychometric properties of our measures were extremely similar across all three cultures included in this secondary analysis. For the sake of brevity, we report only the aggregated psychometric properties of the

measures when collapsed across all three cultures. Because the social, as opposed to the romantic, partners sampled were of the same sex, one member of each pair was randomly designated as friend A and the other as friend B for these analyses. This was done to empirically determine whether any observed differences in these psychometric parameters between opposite-sex romantic partners would be larger than those between randomly designated same-sex friends. Generally, the observed differences between opposite-sex romantic partners were quite comparable to those between the randomly designated same-sex friends, indicating that the former should probably not be interpreted as systematic sex differences between romantic partners and are probably no more than stochastic fluctuations.

Inter-item Consistencies The Cronbach's alpha reliabilities of the self-reported LH strategies (Mini-K) were acceptable for male romantic partners ($\alpha=0.76$), female romantic partners ($\alpha=0.73$), randomly designated same-sex friend A ($\alpha=0.75$), and randomly designated same-sex friend B ($\alpha=0.74$). The Cronbach's alpha reliabilities of the self-reported mate values (MVI) were acceptable for male romantic partners ($\alpha=0.82$), female romantic partners ($\alpha=0.75$), randomly designated same-sex friend A ($\alpha=0.74$), and randomly designated same-sex friend B ($\alpha=0.77$). These alpha reliabilities indicate good inter-item consistencies for all self-reports.

Inter-rater Reliabilities The bivariate correlations between the partner-reported and self-reported LH strategies (Mini-K) were substantial and statistically significant for male reporting on female romantic partners ($r=0.42, p=0.0001$), female reporting on male romantic partners ($r=0.51, p=0.0001$), randomly designated same-sex friend A reporting on B ($r=0.43, p=0.0001$), and randomly designated same-sex friend B reporting on A ($r=0.53, p=0.0001$). The bivariate correlations between the self-reported and partner-reported mate values (MVI) were substantial and statistically significant for male reporting on female romantic partners ($r=0.42, p=0.0001$), female reporting on male romantic partners ($r=0.47, p=0.0001$), randomly designated same-sex friend A reporting on B ($r=0.39, p=0.0001$), and randomly designated same-sex friend B reporting on A ($r=0.35, p=0.0001$). These inter-rater reliabilities indicate a substantial degree of agreement between partners, whether social or romantic, regarding the possession of these traits. This is an important point because it supports the validity of self-reports for these socially and sexually desirable traits.

Perceived Assortative Pairing Coefficients The bivariate correlations between the self-reported LH strategy (Mini-K) of one partner and that same partner's report of the LH strategy (Mini-K) of the other partner were substantial and statistically significant for male reporting on female romantic partners ($r=0.37, p=0.0001$), female reporting on male romantic partners ($r=0.42, p=0.0001$), randomly designated same-sex friend A reporting on B ($r=0.53, p=0.0001$), and randomly designated same-sex friend B reporting on A ($r=0.57, p=0.0001$). The bivariate correlations between the self-reported mate value (MVI) of one partner and that same partner's report of the mate value (MVI) of the other partner were substantial and statistically significant for male reporting on female romantic partners ($r=0.50, p=0.0001$), female reporting on male romantic partners ($r=0.58, p=0.0001$),

randomly designated same-sex friend A reporting on B ($r=0.46$, $p=0.0001$), and randomly designated same-sex friend B reporting on A ($r=0.47$, $p=0.0001$). These perceived assortative pairing coefficients indicate that both members of each pair, whether social or romantic, were seemingly cognizant of their positive assortment on these traits with those of their partner. This is an important point because both social and romantic partners must perceive their similarity for active mechanisms of assortative pairing to operate.

Actual Assortative Pairing Coefficients The bivariate correlations between the self-reported LH strategy (Mini-K) of one partner and the self-reported LH strategy (Mini-K) of the other partner were substantial and statistically significant for both opposite-sex romantic partners ($r=0.26$, $p=0.0001$) and same-sex friends ($r=0.38$, $p=0.0001$). The bivariate correlations between the self-reported mate value (MVI) of one partner and the self-reported mate value (MVI) of the other partner were substantial and statistically significant for both opposite-sex romantic partners ($r=0.42$, $p=0.0001$) as well as same-sex friends ($r=0.32$, $p=0.0001$). These actual assortative pairing coefficients indicate that the members of each pair, whether social or romantic, actually displayed substantial positive assortment on these traits with those of their partner, as indicated by the convergence of their independent self-reports. This is an important point because our hypotheses would be moot if some degree of assortative mating were not actually occurring on these traits in the general population.

Assortative Pairing on Life History

The overall pooled correlation between the pairmate means and the squared differences between pairmates on LH strategy (Mini-K) was significant and negative ($r=-0.27$, $p<0.0001$, $n=689$), as predicted by LH theory. As noted above, a higher squared difference between pairmate scores indicates a lower degree of assortative pairing. A negative correlation with this within-couple variance therefore indicates *higher* degree of assortative mating. This finding thus confirms that slower LH strategists do indeed practice systematically higher degrees of assortative pairing than faster LH strategists.

When we controlled for the length of relationship and the mean age of pairmates, we lost a few subjects owing to missing values for ages and relationship lengths but the results were virtually unchanged ($r=-0.26$, $p<0.0001$, $n=669$). Furthermore, a multiple regression showed that this correlation was statistically equivalent across *all three cultures* and across *both friends and lovers*, as well as across the (non-significant but theoretically plausible) *interactions of relationship and culture*. The difference in the squared multiple correlations between a multiple regression with all of these additional predictors and interaction terms, including the length of relationship and the mean age of pairmates, and the bivariate regression with the pairmate means on LH strategy (Mini-K) alone was not statistically significant ($F_{12, 655}=1.005$, $p=0.4424$). This indicates that the difference between slow and fast LH strategist on assortative pairing is statistically identical across cultures and social and sexual relationships.

Because the mean mate value (MVI) of partners was significantly correlated with the pairmate means on LH strategy (Mini-K), we also ran a series of multiple regressions in which all mean pairmate mate values, as well as their interactions with relationship and culture and relationship by culture, were used to predict the squared differences between the Mini-K scores of pairmates. However, it was again only the mean couple LH strategy (Mini-K) that was both necessary and sufficient to predict the squared differences in LH strategy (Mini-K). The difference in the squared multiple correlations between a multiple regression with all of these additional predictors and interaction terms, including the length of relationship and the mean age of pairmates, and the bivariate regression with the pairmate means on LH strategy (Mini-K) alone was not statistically significant ($F_{18, 648} = 1.011, p = 0.4447$). This indicates that assortative pairing for LH strategy was not even partially an indirect effect of assortative pairing on mate value. These findings disconfirm the plausible alternative hypotheses that assortative pairing on LH strategy might have been an indirect effect of assortative pairing on mate value.

Assortative Pairing on Mate Value

Conversely, the correlation between the adjusted pairmate means on LH strategy (Mini-K) and the adjusted squared differences between pairmates on mate value (MVI), when controlled for the length of relationship and the mean age of pairmates, was significant and negative ($r = -0.12, p < 0.0021$), as predicted by our application of fitness indicator theory. This indicates that slow LH strategists do indeed practice systematically higher degrees of assortative pairing on fitness indicators, as indicated by perceived mate value, than fast LH strategists.

Furthermore, the adjusted pairmate means on mate value (MVI) were significantly predicted, when controlled for the length of relationship and the mean age of pairmates, by both the adjusted squared differences between pairmates on mate value (MVI; $\beta = -0.25, p = 0.0001$) and the adjusted pairmate means on LH strategy (Mini-K; $\beta = 0.52, p = 0.0001$). This indicates that individuals who are more assortatively paired on mate value actually possess higher mate values than those who are less assortatively paired on mate value, and that slow LH strategists also generally possess higher mate values than fast LH strategists in addition to the gains achieved by their assortative pairing on mate value. These results are consistent with our predictions regarding the relationship of LH to fitness indicator theory under conditions of endogamy.

Discussion

Slow LH strategists assortatively mate with sexual partners and assortatively pair with social partners on LH strategy more strongly than fast LH strategists. We interpret this phenomenon as representing (1) an adaptation for preserving coadapted genomes in slow LH strategists, permitting them to maintain high copying fidelity genetic replication while producing a lower number of offspring in stable, predictable, and controllable environments and (2) a bet-hedging adaptation in fast LH strategists, favoring the genetic diversification of a higher number of offspring in unstable, unpredictable, and uncontrollable environments.

Furthermore, slow LH strategists assortatively mate with sexual partners and assortatively pair with social partners on mate value (fitness indicators) more strongly than fast LH strategists and also generally possess generally higher mate value, perhaps because they have been sexually selected for higher mate value by mutual mate choice (Miller 2000). We interpret this phenomenon as representing a coadaptation for endogamy in slow LH strategists, which reduces the risk of reduced offspring fitness resulting from homozygosity on potentially deleterious pleiotropic mutations.

Limitations of the Study

The obvious potential limitation of our interpretation is the presumption that mate value, as measured by the MVI, indirectly indicates a reduced genetic load of deleterious pleiotropic mutations. This inference is based on Fitness Indicator Theory (FIT; Miller 2000) but is not evident from an examination of the scale itself, which is just an inventory of sexually attractive traits that have been validated in the social and evolutionary psychology literature. Nevertheless, there is converging evidence that the MVI does indeed represent an index of phenotypic quality, as predicted by FIT. A recent study by Wenner et al. (2005, 2009) found a correlation of 0.29 ($p < 0.0001$) between the MVI and the SF-36, which is a well-validated index of mental and physical functioning developed by the Rand Corporation (Ware and Sherbourne 1992). The Rand 36-item health survey (SF-36) is a global index of physical and emotional health composed of eight subscales: physical functioning, bodily pain, role limitations owing to physical health problems, role limitations owing to personal or emotional problems, emotional well-being, social functioning, energy/fatigue, and general health perceptions. Another basic question, however, is whether we also have independent evidence that slow LH strategists either possess enhanced genetic fitness or disproportionately prefer sexual partners with the same.

Fortunately, the answer is yes. Previous studies (e.g., Figueredo et al. 2004, 2007), using large and nationally representative samples, have reported both phenotypic ($r = 0.54$) and genetic ($r = 0.69$) correlations between a latent multivariate slow LH factor (the “K-factor”) and a latent multivariate “Covitality” factor, consisting of various indicators of both physical and mental health. The high genetic correlation in particular constitutes evidence that slow LH strategists do in fact have a higher genetic predisposition toward better physical and mental health. According to Fitness Indicator Theory, this condition indicates a reduced genetic load of deleterious pleiotropic mutations. Given the statistically significant assortative mating coefficients that we have just reported for LH strategy, as well as the enhanced assortative mating coefficients among slow LH strategists in particular, this implies that slow LH strategists are at least indirectly assorting on increased physical and mental health. The present results also demonstrate that slow LH strategists are assorting disproportionately on an entire inventory of well-documented high mate value traits which are generally presumed to be fitness indicators. We therefore believe that our argument is reasonably well grounded and converges well with independent empirical evidence.

Another limitation of the present study is the unanswered question of whether the positive assortative mating that we found on either LH or mate value is an active

process of behavioral preference for phenotypically (and perhaps genetically) similar friends or lovers or a passive process generated by market forces. In the latter view, individuals are seeking the highest mate-value (or slowest LH) social and romantic partners that they can obtain and retain, rather than actively seeking partners similar to themselves, and only wind up paired with partners similar to themselves because they are rejected by potential partners with higher mate value (or slower LH) than themselves who are following the same decision rule (because the latter can do better in the mating market by the same logic; see Kirsner et al. 2003). Unfortunately, there is no way that the present data can answer this important question. Consequently, we have initiated a follow-up study in the same three cultures to determine whether individuals will be positively assorted with their self-reported *ideal* social and romantic partners, as opposed to just the *actual* social and romantic partners documented in the present study. The results of a similar study on the ideal romantic partner *personality* (Figueredo et al. 2006b) would suggest that individuals profess to seek partners who are similar to but slightly more attractive than themselves, indicating a combination of these two conceptually distinct strategies.

A similar alternative hypothesis is that slow LH individuals are not seeking other slow LH social or romantic partners for the genetic reasons that we theorized, but instead because they are seeking long-term and high-investment reproductive and social alliances. This alternative hypothesis, however, would not predict assortative mating on LH per se, which is *relative* to one's own value, but rather an *absolute* preference on the part of slow LH individuals for slow LH social and romantic partners. Although this pattern is not what is indicated by our present analyses, we must acknowledge that the proposed mechanism could conceivably produce similar quantitative results which might be difficult to distinguish from the present findings because, as we have just demonstrated, slower LH strategy is indeed correlated and therefore partially confounded with a higher assortative mating coefficient.

Fortunately, after showing that the shared variance in LH strategy among romantic partners predicts 75% of the variance in romantic relationship satisfaction in a cross-sectional Structural Equations Model (Olderbak and Figueredo 2009a), a follow-up longitudinal analysis is currently underway in our laboratory which will pit these two alternative hypotheses against each other using a different set of data (Olderbak and Figueredo 2009b). Structural Equation Models are being developed and compared which will test whether the absolute differences in LH between couples (as indicated by the mean LH scores of different couples) or their relative degrees of assortative mating (as indicated inversely by the squared differences within couples) are better predictors of romantic relationship satisfaction over time (using growth curve parameters obtained by Hierarchical Linear Modeling). We hope that this follow-up longitudinal study will help address this important question.

General Conclusions

These findings and the theoretical underpinnings they support may have profound implications for the continuing sexual as well as natural selection of individual variation in LH strategies among modern humans. The theory does not predict directional selection in either a fast or slow LH direction, but rather that there should

be a range of reproductive strategies which suitably replicate individual genomes given the adaptive problems posed by the environment and their natural variability. Because either slow or fast LH strategies can be fitness-enhancing, depending on the situation, we should observe a normal distribution of a range of LH strategies more often than the pure reproductive strategies usually described more typologically in the literature. These normal distributions are exactly what we have observed empirically in our samples.

The lower boundaries for the reduced fecundities that are characteristic of slower LH strategies should therefore be set by the theoretical framework proposed by Wolf and Figueredo (2009), based on maximizing the certainty of copying fidelity for the slow LH strategist's genome. Assortative mating both on LH strategy and on reliable and valid fitness indicator traits (as cues to a reduced genetic load of deleterious pleiotropic mutations) can therefore serve as coadaptations for a low-fertility, slow LH strategy.

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