THE ROYAL SOCIETY

Impact of market value on human mate choice decisions

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Mate choice strategies are a process of negotiation in which individuals make bids that are constrained by their status in the market place. Humans provide an unusual perspective on this because we can measure their explicitly expressed preferences before they are forced to make any choices. We use advertisements placed in newspaper personal columns to examine, first, the extent to which evolutionary considerations affect the level of competition (or market value) during the reproductively active period of people's lives and, second, the extent to which market value influences individual's willingness to make strong demands of prospective mates. We show that female market value is determined principally by women's fecundity (and, to a lesser extent, reproductive value), while male market value is determined by men's earning potential and the risk of future pairbond termination (the conjoint probability that the male will either die or divorce his partner during the next 20 years). We then show that these selection preferences strongly influence the levels of demands that men and women make of prospective partners (although older males tend to overestimate their market value).

Keywords: mate choice; humans; fecundity; age; personal advertisements

1. INTRODUCTION

Mate choice is an issue of considerable interest to evolutionary biologists for three reasons. First, it has a direct bearing on the patterns of gene flow within populations, and thus directly influences the future structure of the gene pool (and hence the species' evolutionary history). Second, when actively engaged in mate searching, individuals use signals to advertise their quality as mates and to signal interest in other individuals, thus raising questions about the role and effectiveness of honest signalling. Third, mate selection is a decision problem that requires individuals to make choices under constraint, with optimal foraging theory often being an appropriate theoretical framework. Our concern in this paper is with the third of these themes.

The process of mate choice in any species is essentially one of negotiation: individuals make bids that are designed both to advertise their own characteristics and to signal their own requirements, but the final choice of mate will usually be a trade-off between the demands that an advertiser would like to make and the expectations and demands of the pool of potential mates. In highly competitive markets, those with weak bargaining hands may be forced to adjust their demands downwards (i.e. become less selective), while those in strong bargaining positions may be able to adjust their demands upwards (i.e. become more selective). The similarities between these processes and the mechanisms of conventional markets have been explicitly discussed by Noë & Hammerstein (1995) who coined the term 'biological markets' to describe the general phenomenon whereby individuals of one class (in this case, sex) compete among themselves to exchange resources (including gametes) or services with members of another class.

Despite the fact that mate choice is inevitably a two-way process, most theoretical and empirical studies have identified one sex as being choosier and have then focused on its mate choice behaviour (e.g. Janetos 1980; Real 1990; Deutsch & Reynolds 1995). Although a number of theoretical studies have attempted to grapple with the more difficult problem of mutual mate choice (e.g. Parker 1983; Real 1991; Johnstone *et al.* 1996), attention has mainly focused on the costs of choosiness and the search costs involved in locating potential partners. However, models developed by Johnstone *et al.* (1996) show that, when parental investment by the two sexes is more or less equal, both sexes should be choosy. As a result, the mate searching tactics of one sex will necessarily be influenced by those of the other sex.

There have been few attempts to study the trade-offs that individuals make during this process, partly because of the difficulty in ascertaining exactly what it is that individuals aspire to; in most cases we can study only the outcome of the decision process once the individual has compromised on its own criteria in the face of the local market's demands. However, humans offer an opportunity to study the intervening processes in more detail because they sometimes engage in forms of mate searching that force them to state more or less explicitly what it is they are looking for. The most overt form in which this currently occurs is in the personal advertisements columns of many newspapers and magazines. These advertisements take the form of small vignettes in which advertisers specify a

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number of their own traits and then state the kinds of traits they require in a prospective mate.

Previous studies of personal advertisements have demonstrated (i) that advertisers adjust their bids in the light of their perceived status in the market place (Waynforth & Dunbar 1995), and (ii) that male advertisers are largely concerned with traits that reflect women's fecundity, while female advertisers emphasize wealth (also an age-related trait) and commitment in prospective male partners (Wiederman 1993; Greenlees & McGrew 1994; Waynforth & Dunbar 1995; Bereczkei & Csanaky 1996; Bereczkei *et al.* 1997). Studies of actual mating behaviour demonstrate a close correlation between these preferences and the final outcome of the decision (Kenrick & Keefe 1992; Perusse 1994).

In this paper, we examine advertisements of this kind in order to determine: (i) the preference patterns that one sex exhibits for members of the other sex; (ii) whether we can predict these preference patterns from evolutionary first principles; and (iii) whether the preference patterns of the opposite sex in turn influence individuals' willingness to be demanding in their own advertisements. The trait we focus on is age, since this is of considerable functional significance: in females, fecundity and reproductive value are both a function of age, while age correlates positively with wealth and negatively with life expectancy in males.

2. METHODS

The data in this sample are personal advertisements from eight issues of the *Observer* newspaper published during winter 1995 and spring 1996. Full details of the database are given in Pawłowski & Dunbar (1998). For the present analyses, we considered only those advertisements that specified heterosexual relationships. Because the sample sizes for advertisers aged under 20 and those aged 60 and above were very small (1 and 11, respectively), we limited our analyses to those advertisers whose ages were between 20 and 59, inclusive.

Advertisers usually specify their own age in one of four ways: by giving their exact age; by giving an approximate age (e.g. early, mid- or late 40s: these were coded as 42, 45 and 48, respectively, following Greenlees & McGrew 1994); by decade (e.g. '40s'); or by not giving any indication of age at all. Since the proportion of advertisers who do not declare their ages varies across the age range under consideration (Pawłowski & Dunbar 1998), ignoring these may introduce significant biases into the data. However, we can estimate the ages of advertisers who do not declare their own ages because the age of the partner sought correlates very closely with the advertiser's declared age (females, $r^2 = 0.87$; males, $r^2 = 0.71$, Pawłowski & Dunbar 1998). We therefore used the regression equations between these two variables to estimate the probable age of advertisers who specified an age sought in a partner but did not declare their own ages. A small number of advertisers who gave only decadal ages were, however, discounted. This yielded a final sample of 445 males and 454 females.

Advertisers typically specify age sought as a range (e.g. '...seeks 35–45-year-old...' or '...seeks partner in 30s...'). Following conventional practice in the analysis of personal advertisements (e.g. Greenlees & McGrew 1994; Waynforth & Dunbar 1995), we coded the mid-point of the age range sought by advertisers. A small number of advertisers who specified only a lower or an upper limit to the preferred age of partner were discounted from this analysis. Advertisers typically list both a number of words to describe themselves and a number of traits that they seek in a prospective partner. A total count was made of all traits sought (i.e. demanded of any prospective mate) that have previously been identified as being of evolutionary significance (see Thiessen *et al.* 1992; Waynforth & Dunbar 1995). These include all trait terms for age, physical attractiveness, resources, commitment and social skills (for detailed definitions, see Waynforth & Dunbar 1995; Pawłowski & Dunbar 1998).

Age-specific values of mean weekly income, survivorship, fecundity and divorce rates for five-year age cohorts were obtained from the most recent UK census statistics (OPCS 1993, 1995, 1996, 1997). Since most of the advertisers in the *Observer* newspaper are likely to be middle class, we restricted the data on income to that for non-manual workers. All other statistical data are for the UK population as a whole. Data on survivorship and fecundity were used to calculate Fisher's reproductive value for females; in doing so, we assumed that the UK population is stationary ($r = 0$), which is a reasonable approximation for the last decade.

We calculated a market value for each cohort by dividing the proportion of advertisers seeking individuals of a given age (the demand for individuals of that age) by the proportion of advertisers of that age in our sample (the supply). The ratio of these two is thus a measure of the relative selection pressure placed on individual age cohorts, in the same sense that selection ratios are used in foraging ecology (Krebs 1989). In calculating a market value for males, we restricted our analysis to advertisements made by females in the reproductive period (20–44 years of age) since (i) our concerns are with the reproductive interests that drive behaviour and (ii) it is, in any case, this age group that male advertisers are principally interested in (Kenrick & Keefe 1992; Greenlees & McGrew 1994; Waynforth & Dunbar 1995; Bereczkei *et al.* 1997). Women in the post-reproductive period typically advertise for older men, but these men advertise for much younger women. Considering the advertisements of women of all ages tends to inflate the demand for older men relative to the males' own interests.

3. RESULTS

Figure 1 plots the market value of males and females against age. While exhibiting the same inverted-U shape, the two differ in the location of their peaks, with female market value peaking during the late 20s and that of males in their late 30s. The most likely determinants of female market value are either fecundity (m_x) or Fisher's reproductive value (v_x). Though both are a function of age, they are not necessarily monotonically related to each other (figure 2), so we can separate out their effects. A multiple regression indicates that both variables independently contribute to the variance in female market value:

$$\mathrm{MV}_{\mathrm{female}} = 0.301 + 0.021 b_x - 0.549 v_x$$

($p[m_x] < 0.0001$, $p[v_x] = 0.002$), where $\mathrm{MV}_{\mathrm{female}}$ is the female market value, b_x is the age-specific birth rate per year and v_x is the age-specific reproductive value. However, fecundity appears to be the more important variable: on its own in a bivariate analysis, it explains 92% of the variance in female market value (figure 3) whereas reproductive value explains only 47%.

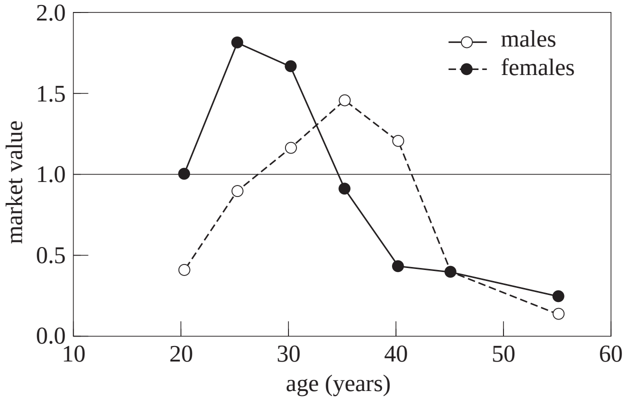

Figure 1. Market value of males and females plotted against age. Market value is a selection ratio reflecting advertisers' preference for each age class relative to the number of individuals available in that age class in the advertising population. Advertisers' preferences are those expressed by reproductive age individuals (defined as 20–44 years in the case of females, 20–59 years in the case of males) (see text for details). The horizontal line at a market value of 1.0 defines the point at which preferences balance availability.

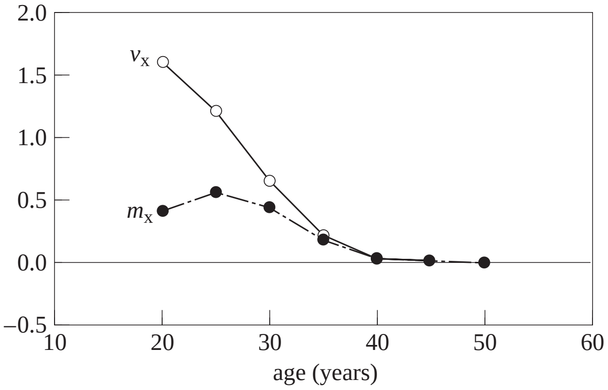

Figure 2. Age-specific fecundity and Fisher's reproductive value for the contemporary cohort of UK women, based on data for the decade 1984–94. Reproductive value is calculated assuming a stationary population (source: OPCS 1996). To show fecundity and reproductive value on the same scale, we plot fecundity as the number of births per female during each five-year age interval.

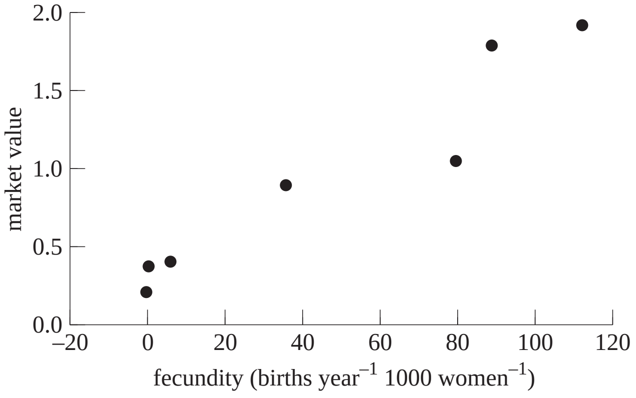

Figure 3. Age-specific market value for women plotted against fecundity.

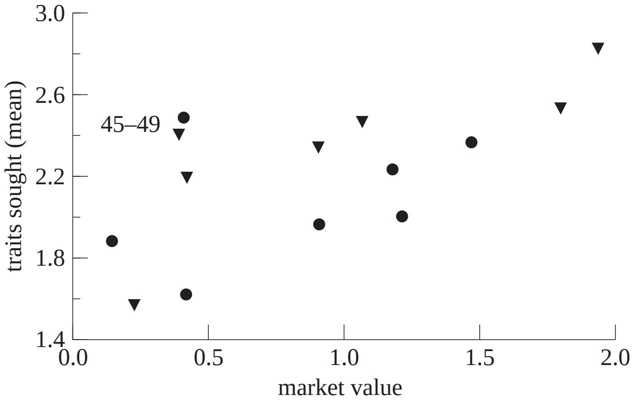

Figure 4. Mean number of traits sought in a partner for males (circles) and females (triangles), plotted against age-specific market value. Indexed traits sought include all those that relate to evolutionarily relevant categories (age, physical attractiveness, wealth and status, committment and social skills). Each data point represents one five-year age class. The 45–49-year-old cohort for males and females are indicated.

Male market value is most likely to be determined by two considerations. One is income (mean weekly income; OPCS 1995) and the other is the probability that the male will still be married to the female 20 years later (i.e. at the end of the main period of parental investment). The latter variable has two components: the probability that the male will die before the end of the period of interest and the probability that the male will be divorced during that time. Both of these variables are age-specific. With these two variables determined from the UK national census statistics (OPCS 1993, 1997), we calculated the conjoint probability that a male of a given age will neither be divorced nor die within the next 20 years.

A multiple regression analysis yields strongly significant effects for both male income and the probability that the male will still be married after 20 years:

$$\mathrm{MV}_{\mathrm{male}} = -7.38 + 7.944 p_{\mathrm{marr}} + 0.0034\ \mathrm{Inc}$$

($r^2=0.87$; $p[p_{\mathrm{marr}}]=0.007$, $p[\mathrm{Inc}]=0.039$), where $\mathrm{MV}_{\mathrm{male}}$ is the male market value, p_{marr} is the age-specific probability of still being married and Inc is mean age-specific weekly income (in £).

We now ask whether advertisers are sensitive to their market value in terms of the extent to which they impose demands on prospective mates. One simple measure of this is the number of traits sought in a mate. Figure 4 plots the mean number of traits sought by advertisers in each age class against the sex-specific market value. Overall, males appear to show no evidence of sensitivity to market value. However, this is largely due to a single data point (that for males aged 45–49 years) which appears to be radically out of line with data for the other age classes. If we exclude this point, there is a significant linear relationship between mean number of traits sought and market value for males (linear regression: $b=0.42$, $F_{1,4}=7.76$, $r^2=0.66$, $p=0.049$). Females also appear to be well attuned to their market value, with traits sought increasing linearly with market value across all age classes (linear regression: $b=0.46$, $F_{1,5}=9.50$, $r^2=0.66$, $p=0.027$). As with males, females in the 45–49-year age group also appear to overestimate their market value.

4. DISCUSSION

We have shown that, for humans, an individual's market value as a mating partner is determined in a relatively straightforward way by age-specific factors that influence fitness (fecundity in the case of females and survivorship and income in the case of males). In addition, we were able to show that market value in turn directly determines advertisers' willingness to impose strong demands in their mate search criteria: individuals who have a low market value are less demanding.

Aside from the trivial demonstration that evolutionary principles govern human behaviour as much as they do that of other animals, the most important implication of these findings is the extent to which individuals fine-tune their mate search strategies in response to the frequency-dependent effects imposed by the market. It seems likely that this degree of flexibility may explain many cross-cultural differences in behaviour. For example, in traditional societies, females often marry earlier and males marry later than in contemporary western cultures. This difference may reflect the fact that in traditional societies the peaks in the market values of the two sexes diverge more than is the case in the contemporary UK. In cultures (or ecologies) where women normally begin to reproduce earlier (e.g. natural fertility populations such as hunter gatherers and other traditional societies), the peak in female market value is shifted leftwards, while the peak in male market value will be shifted rightwards when male mortality (from hunting or combat) is high in the younger cohorts. Marrying a young male may be a risky strategy because he may die before the end of the period of parental investment. Older males may not only be safer bets (they are less likely to engage in risky activities), but survival to middle age may itself be an indicator of genetic quality (although recent theoretical analyses cast some doubt on this latter claim; Hansen & Price 1995).

We might ask why both males and females in modern industrial societies are prepared to wait so long before reproducing. Mace (1996, 1998) provides what is perhaps the most cogent answer: when offspring are costly to rear (as they are in modern societies where investment in education leads to improved socio-ecomonic status and thus, ultimately, higher fitness), it pays individuals to reduce family size dramatically. A reduction in family size is invariably associated with a delay in the age of first reproduction (resulting in a rightwards shift in the peak in the fecundity curve; Landers 1995; Ní Bhrolcháin 1995; Alam & Casterline 1984), perhaps because it pays females to delay reproduction in the hope of being able to find the best possible mate (Voland 1999). Voland (1999) has shown that, in an historical European population, women's age at marriage was negatively correlated with the level of competition they faced in the marriage market. The smaller completed family sizes preferred by contemporary populations may reduce the pressure to marry earlier, while the value of economically better quality males may make a longer search period advantageous.

The delay in reproduction imposed on males must inevitably have a cost, however. Males who marry late may find themselves constrained in terms of fitness maximization compared to males who marry young (not least because younger males may have more opportunity to start and complete several families). These costs may find expression in the criteria by which males judge the market value of prospective partners. Younger males, for example, may be able to afford to adopt a longer perspective and may therefore place greater emphasis on reproductive value, whereas older males whose opportunities to reproduce may be greatly constrained by their increased risks of future mortality may prefer to focus on current fecundity in order to maximize fitness. The existence of these alternative tactics may explain why both fecundity and reproductive value appear as determinants of female market value. Unfortunately, our sample sizes are not large enough to allow us to undertake separate analyses for different male age cohorts to test this hypothesis.

The fact that female estimates of a male's market value are so influenced by males' current income may seem surprising, especially as accumulated wealth and/or future financial prospects might be thought to be more important. This is all the more surprising given that variance in both income and wealth within age cohorts is almost certainly greater than the variance between age cohorts. Unfortunately we have no way of measuring the former, and it may be that women seeking partners are in no better position to do so until they have actually spent time with an individual male. In the absence of any such information, current income may simply be a better index of a male's earning potential than anything else. More importantly, it may be a better index of disposable income (which is probably more important in terms of parental investment capabilities).

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