A Model of Two-sided Mate Choice with Multiple Cues

David Ramsey
Department of Mathematics and Statistics
University of Limerick
Plassey
Limerick
Ireland
e-mail: david.ramsey@ul.ie

Abstract

Much work has been done on mate choice based on one cue, but models based on multiple cues are in their infancy. We consider a model in which choice is based on two measurable, discrete cues named attractiveness and character. We consider a steady state model in which the distributions of attractiveness and character in the mating pool are constant over time and known to the participants.

Attractiveness can be observed immediately and it is assumed that preferences with respect to attractiveness are common, i.e. all the members of a particular sex agree on the attractiveness of a member of the opposite sex. Character cannot be observed immediately, but may be observed by means of a mating ritual (dating). The preferences of individuals with respect to character are assumed to be homotypic i.e. everyone prefers a mate with a similar character to themselves. The vector \((x, y)\) composed of the attractiveness, \(x\), and the character, \(y\), of an individual will be called the individual’s type.

Each individual meets a sequence of prospective mates (the time horizon is assumed to be infinite). The \(n\)-th potential mate is observed at stage \(n\). On meeting, a male and female play the following game, which may be described in extended form. Firstly, the male decides whether to offer the female a date based on his type and the attractiveness of the female. Secondly, if a female is offered a date, she decides whether to accept it based on her type and the attractiveness of the male. If the offer of a date is accepted, then the pair date and observe each other’s character. Finally, the pair must decide whether to mate or not. Mating only occurs by mutual choice. Since they both now have perfect information on the type of the other, it may be assumed that they both make the decision on whether to mate or not simultaneously. Once an individual has found a mate, he/she ceases searching. The reward obtained by a male of type \((x_m, y_m)\) from mating with a female of type \((x_f, y_f)\) at stage \(n\) after being on \(k\) dates is assumed to be

\[
r_m = u(x_f, |y_m - y_f|) - c_1 n - c_2 k,
\]

where \(u\) is increasing in \(x_f\) and decreasing in \(|y_m - y_f|\). The function \(u\) defines the reward from mating. The coefficients \(c_1\) and \(c_2\) denote
the search costs and dating costs, respectively. Analogously, the reward obtained by a female of type \((x_f, y_f)\) by mating with a male of type \((x_m, y_m)\) is

\[
    r_f = u(x_m, |y_m - y_f|) - c_1 n - c_2 k.
\]

The sum of the final two terms will be called the total costs.

We look for a Nash equilibrium profile in which each individual offers/accepts dates when the attractiveness of the female/male is above a threshold that depends on the type of the individual and accepts a partner after a date when the reward from mating is greater than the individual’s expected reward from future search given that the population are using that Nash equilibrium profile. Such profiles can be split into four subprofiles: a) the offer profile of thresholds (this determines which females are offered dates by which males), b) the acceptance profile of thresholds (this determines which females accept dates from which males), c) the male mating profile (this determines which females are finally accepted by which males), d) the female mating profile (this determines which males are finally accepted by which females).

It should be noted that the fact that males invites females for dates means that the game is by definition asymmetric. For example, at equilibrium male preferences may be revealing or non-revealing. Male preferences are non-revealing when the thresholds used in the offer profile do not depend on the character of the male. In this case given that a male has offered a date, the posterior distribution of the character of the male is simply the prior distribution of his character. Hence, a male’s offer of a date does not transfer any information regarding his character. However, this is not true when the thresholds used in the offer profile are dependent on a male’s character. At equilibrium the female rule is responsive to any information that is contained in the offer of a date.

Some general results are given on the form of a Nash equilibrium. An algorithm for finding equilibria based on policy iteration is described and it is shown that multiple equilibria may exist.