A Model of Match-based Heterosexual Online Dating

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Assume a fixed number $N$ of players, each with gender $G_i$ either +1 or -1. During each round (that is, at each time $t$), each player chooses at random a fraction $P_i(t)$ of the opposite sex. As a number, this is

$$n_i(t) = \text{round} \left( \frac{P_i(t)}{\sum_{j:G_j=-G_i}^N 1} \right)$$

(1)

A random bipartite graph is then generated with each node having degree $n_i(t)$. To keep $P_i$ between zero and one, we use a logistic map

$$P_i(t) = \frac{1}{1 + e^{-R_i(t)}}.$$  

(2)

$P_i$ is therefore an increasing function an underlying function $R_i$, which is governed by a simple linear feedback

$$dR_i(t) = \alpha(M_{0i} - M_i(t))$$

(3)

where $M_{0i}$ is the ideal number of matches for player $i$, $M_i(t)$ is the number of matches received in round $t$ (that is, the number of bidirectional edges from node $i$ in the random graph) and $\alpha$ is a constant. If the number of matches is inadequate, this forces $R_i$ upward, increasing the selection ratio $P_i$. Given an initial selection $P_i(0)$, the initial condition is just given by the inverse of Eq. 2

$$R_i(0) = \ln \left( \frac{1}{P_i(0)} - 1 \right)$$

(4)
After setting initial conditions $P_i$ and $M_{bi}$ for each player, the average evolution in the behaviour of women and men is then inferred from the average selection percentages

$$w(t) = 100 \frac{\sum_{j, G_j = 1}^{N} P_j(t)}{N_w}$$

and

$$m(t) = 100 \frac{\sum_{j, G_j = -1}^{N} P_j(t)}{N_m}$$

respectively.