
Complexity in Mate Choice

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Fisherian "good taste" arguments on populations with mate choice are based on the development of a correlation between consistently choosing preferences and their preferred traits (Kirkpatrick, 1987). This correlation indirectly confers an advantage to such preferences. The effect increases with the consistency of choice. We argue that some level of complexity in the way preferences evaluate traits may favor choice-consistency and thus be advantageous for them.

In our model, an individual bears (1) traits which are represented by an N -dimensional binary vector and (2) preferences, represented by (a) an N -dimensional binary *preference-vector* and (b) a *preference-landscape* function P defined over N -dimensional binary vectors and with values in $[0,1]$. When a preference-vector i evaluates a trait-vector j , these vectors are "xor-ed" and the result is inputted to i 's P -landscape to obtain the overall mate-value $p_i(j)$. In this paper, two kinds of P -landscapes are considered constructed according to the NK model (Kauffman, 1993): P_S -landscapes ($K=0$), which are smooth and single peaked and P_C -landscapes ($K=N-1$), which are very rugged and have a high number of peaks. We consider a population of sexual individuals (but without genders); the probability biasing their choice is directly related to the mate-value an individual has for another; no cost is associated to mate-choice and the choice they make does not influence their survival or fecundity; a choice is followed by mating (refusal is not possible). We assume that trait-vectors in the population are concentrated (Hamming-distance) in a small region of trait-space. For preferences with P_S -landscapes all trait-vectors have nearly the same value, resulting in low discrimination and thus in low preference-trait correlations. Some ruggedness in preference landscapes allows for greater local "contrast" and for discrimination in a small region of trait-space. Thus P_C -landscapes should be favored over P_S -landscapes. To test this hypothesis, a population of 70 individuals, with $N=16$,

was evolved from an initial state where (1) all traits are similar¹; (2) two different randomly generated preferences with P -landscapes of the different kinds (P_S and P_C) are assigned, in equal proportions, to the individuals of the first generation². At each step, every individual i chooses from a "choice-group" of size 8; the group composition and the final choice are biased by i 's preferences³. Reproduction follows. Individuals are haploid and decoding from genes is trivial (identity). Traits and preferences are on distinct chromosomes⁴. P -landscapes are not affected by mutation, but trait- and preference-*vectors* are mutated with a rate of 0.001 per locus. Natural selection forces are absent.

With the help of the effects of drift, one preference-system will get fixed after some steps. This event determines the halting point of a run. 1000 runs have been carried out; in 569 of them, preferences with P_C -landscapes became fixed (bias statistically significant).

References

- Kauffman 1993: *Origins of Order*, Oxford Univ. Press.
Kirkpatrick 1987: Sexual selection by female choice in polygynous animals, *Ann. Rev. Ecol. Syst.* 18.

¹An "original" trait-vector is randomly generated and mutated clones of it are produced (mutation rate per basis: 0.02) to create the traits for the first generation.

²The two "concurrent" P -landscapes are randomly chosen from a set of 1000 different ones.

³Two tests with a biased-coin (with probability $p_i(j)$) are performed to decide whether or not an individual j in the population is added to the choice-group; only individuals passing both tests are included. From this choice-group, two individuals are first chosen with a probability that is proportional to the value individual i assigns them in a "roulette-wheel" selection fashion. A mate is finally chosen among them by repeating this very last procedure, this time with those two individuals as choice-group. (These repetitive tests allow for a high expression of preferences.)

⁴Recombination is allowed at this level, but there is no intrachromosomal recombination.