Algorithm Structure for the Coevolution of Parochial Altruism and War
Choi and Bowles, Science, 2007

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The simulation algorithm is as follows.

A. Create 20 groups and 26 agents in each group.

   a. Initially, all the agents are TN (i.e., the initial seed for A is zero and for P is zero).

B. Group interaction (see Figure 1)

   a. If the interaction is hostile (which occurs with probability $h^{ij}=1-f_i^T f_j^T$)

      i. A war occurs with probability $|\Delta_{ij}|$, where $\Delta_{ij} = f_i^{PA} - f_j^{PA}$. The group with more PAs wins with probability ½+½Δ_{ij} and a war ends in a draw with probability ½ - ½Δ_{ij}.

      ii. With probability δ_f, each PA in both groups dies in the war (in case of a draw and of a decisive outcome).

      iii. With probability $\delta_c \times |\Delta_{ij}| = \delta_c \times |f_i^{PA} - f_j^{PA}|$, each individual (including surviving fighters) in the losing group who has not died as a fighter is killed.

      iv. The individuals killed according to ii and iii above are replaced by an offspring of two randomly drawn members from the winning group using the recombination process described in D-ii below (migration scenario used in the results shown).

      v. For the mating scenario (mentioned in the text, results shown only in Figure S.2) surviving PAs (fighters) from the winning group are randomly selected to mate with random mates of the survivors of the losing group (sufficient to restore the group size of the losing group) using the recombination process described in D-ii below. In the mating scenario we set δ_c = 2.0 as our benchmark. If all of the losing group would be eliminated by this process (which occurs rarely in the simulations), we select one randomly to survive and to parent the offspring of the winners.

b. If the interaction is non hostile (with probability 1- h^{ij})

    i. Each T in the group receives intergroup benefits (see Table 1 and Figure 1)

C. Within-group interaction (Public goods game, described in Table 1)

D. Within-group updating

    i. In each group, for each member of a new generation, parents are chosen with a probability equal to the individual's share of the group's total payoffs.

    ii. If one parent has genotype {i, j} where i ∈ {A, N}, j ∈{P, T}, and the other parent has {I, J} where I ∈{A, N}, J ∈{P, T}, the offspring genotype is {i with probability 0.5 or I with probability 0.5, j with probability 0.5 or J with probability 0.5}.

    iii. Random updating by mutation occurs at the A/N and P/T loci and is a random draw from the two.

E. Migration

a. Migrants equal in number to 25% of each group are drawn randomly to form a migrant pool from which they are randomly selected to repopulate each group.

F. Repeat B-E 50,000 times.