This version is compatible with NetLogo 6.0.2

WHAT IS IT?

This model simulates the Hawk-Dove game as first described by John Maynard Smith, and further elaborated by Richard Dawkins in "The Selfish Gene". In the game, two strategies, Hawks and Doves, compete against each other, and themselves, for reproductive benefits. A third strategy can be introduced, Retaliators, which act like either Hawks or Doves, depending on the context. All three strategies are described below:

Doves: These agents are not aggressive. When competing over a resource, Doves “display,” performing some sort of seemingly ritualized behavior, such as strutting with their tail feathers held high. When both opponents display (Dove vs. Dove), one of them randomly eventually gives up the reward to the other; they both pay a small cost for wasting time. If their opponent is aggressive (such as a Hawk), they always retreat rather than fight.

Hawks: These agents are aggressive and fight with opponents that do not retreat (Hawk vs. Hawk) until one of them is seriously injured; the other one gets the resource. Hawks always win against Doves because Doves retreat.

Retaliators: These agents begin by displaying (like a Dove) but become aggressive if their opponents are aggressive. Therefore, they behave as a Dove when confronted with a Dove or another Retaliator, but as a Hawk when they encounter another Hawk.

You can choose which types of strategies play against each other, and what the payoff structure is for their encounters.

HOW IT WORKS

Upon initialization, agents of each strategy are created, depending upon the population parameter settings. At each time step, agents move about randomly. If they encounter another individual, they play a "game" to determine a winner. The winner is determined by the types of strategies being played. The reward for winning and the cost for losing are determined by the payoff parameter settings.

HOW TO USE IT

PARAMETERS

SETUP: returns the model to the starting state.
GO: runs the simulation.
STOP-AT: if set to greater than zero, this defines when the simulation stops

INITIAL-NUMBER-HAWKS: initial number of individuals created with the hawk strategy

INITIAL-NUMBER-DOVES: initial number of individuals created with the dove strategy
INITIAL-NUMBER-RETALIATORS: initial number of individuals created with the retaliator strategy

WIN-GAIN: value gained by winner of a contest
LOSS-COST: value lost by the loser of a contest
INJURY-COST: value lost by the loser of a physical contest
TIME-COST: value lost by the loser of a display contest

MONITORS & PLOTS

CARRYING CAPACITY: the maximum amount of individuals allowed in the simulation
HAWKS: the number of hawks present
DOVES: the number of doves present
RETALIATORS: the number of retaliators present
HAWKS / TOTAL: ratio of hawks to total individuals present
DOVES / TOTAL: ratio of doves to total individuals present
RETALIATORS / TOTAL: ratio of retaliators to total individuals present

THINGS TO NOTICE

An evolutionarily stable strategy (ESS) is one that cannot be invaded by another strategy. Which strategy or strategies are an ESS?

HOW TO CITE

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