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Homophilic replicator equations

Tags are conspicuous attributes of organisms that affect the behaviour of other organisms toward the holder, and have previously been used to explore group formation and altruism. Homophilic imitation, a form of tag-based selection, occurs when organisms imitate those with similar tags. Here we further explore the use of tag-based selection by developing homophilic replicator equations to model homophilic imitation dynamics. We assume that replicators have both tags (sometimes called traits) and strategies. Fitnesses are determined by the strategy profile of the population, and imitation is based upon the strategy profile, fitness differences, and similarity in tag space. We show the characteristics of resulting fixed manifolds and conditions for stability. We discuss the phenomenon of coat-tailing (where tags associated with successful strategies increase in abundance, even though the tags are not inherently beneficial) and its implications for group dynamics. We extend our model to incorporate mutations and invasions to explore their implications upon tag and strategy diversity. We find that homophilic imitation based upon tags significantly affects the diversity of the population, although not the ESS. We classify two different types of invasion scenarios by the strategy and tag compositions of the invaders and invaded. In one scenario, we find that novel tags introduced by invaders become more established with homophilic imitation than without it. In the other, total diversity decreases.