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In which currency are paid payoffs in evolutionary games?

In the standard approach to evolutionary games and replicator dynamics, differences in fitness can be interpreted as an excess from mean malthusian growth rate in the population. In the underlying reasoning, related to the analysis of "costs" and "benefits", there is a silent assumption that fitness can be described in some kind of "units". However, in most cases these units of measure are not explicitly specified. Then the question arises: are these theories testable? How can we measure "benefit" or "cost"? It would be useful to describe and justify strategic "costs" versus "benefits" reasoning in the terminology of demography, because basic events that shape outcomes of natural selection are births and deaths. In our talk, we will present the consequences of such an explicit analysis of births and deaths in an evolutionary game theoretic framework.

We will investigate different types of mortality pressures, their combinations and the possibility of trade offs between mortality and fertility. We will show that within this new approach it is possible to model how strictly ecological factors, which seemed neutral in classical theory, can affect outcomes of the game. For example we will show that density dependence, affecting the mortality of newborns, can seriously change the outcome of the game.

We will illustrate this in the case of an example game, the Hawk-Dove Game. Reformulated in terms of our new approach, this game shows new details and produces new biological predictions. The solutions of the new model are less abstract; instead of the condition that "cost" should exceed "benefit" we obtain results in terms of the fractions of dead (that can be interpreted as probability of death) individuals and per capita number of newborns, which can be easily estimated from data. We show that in the classical approach to tradeoff analysis, "cost" caused by increased mortality, can in some cases depend on the value of expected benefit interpreted as an increase in fertility.

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