Chaitanya S. Gokhale and Arne Traulsen
Research Group for Evolutionary Theory, Max-Planck-Institute for Evolutionary Biology, August-Thienemann-Str. 2, 24306 Plön, Germany
e-mail: gokhale@evolbio.mpg.de

Multiplayer evolutionary games: from selection to mutation

Evolutionary game theory is an abstract and simple, but very powerful way to model evolutionary dynamics. Even complex biological phenomena can sometimes be abstracted to simple two player games. But often, the interaction between several parties determines evolutionary success. In these cases, one can resort to multiplayer games. Public goods games are a special class of multiplayer games which have been studied in great detail. A general approach to multiplayer games has although has remained limited [3]. We extend the replicator analysis to general d player games with n strategies and comment on the maximum number of equilibria possible. Moving on to finite populations we provide general conditions for a strategy to be favoured by natural selection in a d player game with two strategies [4]. Another important evolutionary force is mutations, which has only recently yielded to analytical methods [1, 2]. We derive the composition of a d player, n strategy system in the mutation-selection equilibrium [5]. The average frequencies of the strategies at this equilibrium are obtained via recursions using coalescence theory [6]. Multiplayer multi strategy games offer the generality which helps us to apply them to diverse entities like from alleles to behavioural strategies.

References

[1] T. Antal, H. Ohtsuki, J. Wakeley, P. D. Taylor, and M. A. Nowak. Evolution of cooperation by phenotypic similarity. *Proc. Natl. Acad. Sci. USA*, 106:8597–8600, 2009a.

[2] T. Antal, A. Traulsen, H. Ohtsuki, C. E. Tarnita, and M. A. Nowak. Mutation-selection equilibrium in games with multiple strategies. *J. Theor. Biol.*, 258:614–622, 2009b.

[3] M. Broom. The use of multiplayer game theory in the modeling of biological populations. *Comments on Theoretical Biology*, 8:103–123, 2003.

[4] C. S. Gokhale and A. Traulsen. Evolutionary games in the multiverse. *Proc. Natl. Acad. Sci. U.S.A.*, 107(12):5500–5504, 2010.

[5] C. S. Gokhale and A. Traulsen. Mutation-selection equilibrium in evolutionary games with multiple players and multiple strategies. *Submitted*, 2011.

[6] J. F. C. Kingman. Origins of the coalescent. 1974-1982. *Genetics*, 156(4):1461–1463, 2000. ISSN 0016-6731 (Print).