

Mathematically general approaches to the evolution of cooperation

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The evolution of cooperation is a question of great importance to a wide range of fields. Mathematical modeling has identified a number of mechanisms that can promote the evolution of cooperation. However, the efficacy of these mechanisms can in some cases hinge on seemingly minor details of the evolutionary process. How are we then to develop a robust, general theory for the evolution of cooperation that applies across models? One approach is to mathematically rewrite the outcomes of natural selection so that a particular framework—such as inclusive fitness theory or multilevel selection theory—appears to be validated. I will show, however, that this approach can lead to misinterpretations, and does not answer the questions we are most interested in as scientists. I will argue instead for an alternative approach in which evolution is represented as a Markov process subject to general yet precise assumptions.

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