Coevolution of synchronization and cooperation in costly networked interactions

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Despite the large number of studies on synchronization, the hypothesis that interactions bear a cost for involved individuals has been considered seldom. The introduction of costly interactions leads, instead, to the formulation of a dichotomous scenario in which an individual may decide to cooperate and pay the cost in order to get synchronized with the rest of the population. Alternatively, the same individual can decide to free ride, without incurring in any cost, waiting that others get synchronized to her state. The emergence of synchronization may thus be seen as the byproduct of an evolutionary game in which individuals decide their behavior according to the benefit/cost ratio they accrue in the past. We study the onset of cooperation/synchronization in networked populations of Kuramoto oscillators and report how topology is essential in order for cooperation to thrive. We display also how different classes of topology foster differently synchronization both at a microscopic and macroscopic level.