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Comment

Learning dynamics: A fundamental building block in social models Comment on "Collective learning modeling based on the kinetic theory of active particles" by D. Burini et al.

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In the last several years there has been an increasing interest in the development of mathematical tools to study a vast number of social phenomena. The recent paper by Burini, De Lillo and Gibelli [7] constitutes a novel and valuable contribution on the modelling of learning dynamics over networks. In the spectrum of social sciences, this approach will surely provide new and useful tools for the progress of this field of interdisciplinary science.

Game theory was originally developed to study human behaviour and economic decisions. Consequently, after its birth, it was mainly used to model and explain social phenomena. Then, this theory evolved to the so-called evolutionary game theory, that considers populations of players interacting in a game [9,12,13]. More recently, these tools were further combined with methods of the kinetic theory [5] with concrete applications in social contexts like the onset and evolution of criminality [2], wealth distribution [8], political competition [4] and opinion formation [10], getting us closer to the goal in the research of a general mathematical theory for social systems.

In this context, I find really wise that authors correctly observe that learning is a key aspect to be introduced in a realistic social model. Indeed, following the reasonings by Nowak [12], I personally claim that learning should be considered as a basic building block in evolutionary dynamics, while some well-known types of learning, such as social learning [1] and population thinking [11], shall be taken into account in almost any formulation of social models.

In moving forward with this research agenda, some perspectives can be formulated. Many real world applications suggest that distribution of particles over space may be essential, and that interaction among nodes can induce – for instance – transport, diffusion or migration phenomena. Other hints that are accurately posed by the authors are the multiple learning of different abilities [3] and the introduction of mutations and adaptation [6]. The first one is crucial when modelling opinion formation within a set of topics and leads to a multidimensional model; while the latter is important in some cases in which the time scale is long enough in relation to the studied phenomena. In the case of humans, for instance, cultural evolution or behavioural economics are examples in which acquired information is incorporated over many generations.

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In summary, there are lots of open problems and research perspectives in the field, and it becomes clear that interdisciplinary approaches are needed, agreeing with this global trend in the development of science in general and applied Mathematics in particular. I feel comfortable to state that the model, case-studies and simulations provided by Burini et al. represent a long step in the way to this goal.

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