Review of: "Towards a model-based approach: applications to historical demography and palaeodemography"

Pablo Álvarez-Caudevilla[1]

1 Universidad Carlos III de Madrid

Potential competing interests: No potential competing interests to declare.

The paper explains a methodology to understand the behaviour of the population using model-based analysis. First, we should mention it is written in a very personal way. However, it actually shows the importance of using modelization in analysing sophisticated populations behaviours. In particular this presentation goes through the way of modelling different processes via mathematical models focusing on demography and the prediction of them. So that we can actually predict events based on this analysis.

First, the author introduces the evolution of mathematical modelling in population dynamics from a historic point of view (from Euler, Lotka to Bourgeois-Pichat), explaining how the different models have been evolving with the introduction of new elements and assumptions. It is also explained how agent-based models are obtained from simulation derived from data in several sciences. Then, scientists can develop those models within the context of such specific sciences, using theoretical aspects of them but based on computer simulations. In this presentation, such models are focused on the understanding of complex biological models. Thus, from simple rules of behaviour the models can simulate the evolution of a biological system. Indeed, it is shown the importance of using the individual behaviour to simulate the evolution of the population. This individuals establish the rules to be applied theoretically by their behaviour.

The construction process of these models is split in three parts which are explained using several examples. First, we must assume that these models are intended to represent the importance and the impact of individual actions on the macrolevel pattern observed in a complex biological model. To do so, we used some data obtained by observation. Secondly, one must consider explicit decision-making theories, motivations, etc, to construct satisfactory models. And finally, the constructed agent-based models must be validated by the application of some procedures that will depend on the specific context. As explained in this paper, the precision of mathematical models in relation to empirical data is a completely unsolvable problem yet. However, model-based approaches still provide us with a sufficiently good insight in decision making for prediction problems. In that sense, mathematical approaches can reduce the number of parameters with an impact on the models. Simplifying somehow the models and, hence, their analysis.