

COST MP0801 Physics of Conflict & Competition

Working group 4

April 15-17, [Institute of Advanced Study](#), Durham University

Anthropology and physics: prospects & challenges

In the last decade, physics-based models of interacting particles (or network nodes) have provided significant insights into modeling collective interactions in social systems, from Internet communities to pedestrian and vehicle traffic, and economic markets. The analogy between people and particles has been so consistent that a recent popular review was appropriately titled *The Social Atom* (Buchanan 2007).

By definition, particles cannot act with purpose and intent. Nor do they have the ability to learn and hence adapt their decisions on the basis of the outcomes of previous decisions, ‘taken’ either by themselves or by other particles. We might usefully speak of human agents postulated to behave in this way as having ‘zero intelligence’ (ZI) (Farmer, Patelli and Zovko, *PNAS*, 2004).

In contrast, the ‘null model’, as it were, of social science - deriving from economics - ascribes considerable intelligence to agents in the decision making process, both in terms of the information they gather and the rules they use to process it. Even in models, for example, in which agents have incomplete information (Akerlof, *Quart. J. Econ.* 1970), the decision making rule is still based upon the rational principle of maximizing i.e. taking the optimal decision on the basis of the information available.

So it is perhaps not surprising that, despite the empirical success of ZI models in understanding emergent macro-phenomena in social and economic systems, they have met with resistance amongst social scientists in general. At the very least, we can safely assert that they are not widely accepted.

Economists (of almost all persuasions) and physicists do, however, have a common belief in the advantages of having parsimonious models. This view is not necessarily shared within anthropology ((Johnson & Omland, *Trends in Ecology and Evolution*, 2004).

Anthropologists and economists unite in their willingness to work with data which from a physics perspective is very sparse and very noisy. The ‘odd one out’ of the trio this time is physics. Much of the work with ZI models carried out by physicists is in contexts where there is a plentiful supply of high quality data.

The focus of the workshop is to explore, with specific focus on the mathematical-anthropological understanding of collective human behaviour, these three key issues:

- How far can the particle model be used to illuminate anthropological questions, and in what ways and how far do we think it may need to be modified?
- How parsimonious can models be in this context?
- How can models be validated in areas such as this where data is almost by definition sparse and noisy?