Miguel, Amblard, Barceló & Madella (eds.) Advances in Computational Social Science and Social Simulation
Barcelona: Autònoma University of Barcelona, 2014, DDD repository <http://ddd.uab.cat/record/125597>

Robustness of cooperation to movement patterns in a Hunter-Fisher-Gatherer model

María Pereda
INSISOC. Universidad de Burgos.
Edif. "La milanera". C/ Villadiego, s/n.09001. Burgos. Spain.
mpereda@ubu.es
Jorge Caro
Departament de Sociologia. Universitat Autònoma de Barcelona. CASES. GSADI.
Edifici B. Campus de Bellaterra
08193 Cerdanyola del Vallès (Barcelona). Spain.
Débora Zurro
Dept. d'Arqueologia i Antropologia. IMF-CSIC. CASES.
IMF-CSIC. C/ de les Egipcíaques, 15. 08001, Barcelona. Spain.
Myrian Álvarez
CONICET-CADIC.
Bernardo Houssay, 200. 9410. Ushuaia. Argentina.
Ivan Briz i Godino
Researcher on Archaeology and Ethnoarchaeology. CONICET-CADIC.
Bernardo Houssay, 200. 9410. Ushuaia. Argentina.
ICSE-UNTDF Ushuaia. Argentina.
Dept. of Archaeology. University of York. York. UK.
José Manuel Galán
INSISOC. Universidad de Burgos.
Edif. "La milanera". C/ Villadiego, s/n.09001. Burgos. Spain.
José Ignacio Santos
INSISOC. Universidad de Burgos.
Edif. "La milanera". C/ Villadiego, s/n.09001. Burgos. Spain.

1. Context of study

Most societies often face social dilemmas in which there can be contradictions between individual interests versus those of the community as a whole.

Hunter-fisher-gatherer societies can be considered as paradigmatic examples of these phenomena. The fact that many of these societies tend to live permanently disaggregated produces a specific need for maintaining the social tissue as well as for reproducing social and economic knowledge and values that depend on individual behaviour. Therefore, aggregation events are of special relevance as they represent the optimal occasion to deal with specific social aspects that in these cases need extraordinary circumstances to be held.

Our case of study is focused on cooperative processes developed by historical hunter-fisher-gatherer-societies from the Beagle channel (Tierra del Fuego), that developed their existence mainly through an economy focused on the exploitation of coastal and maritime resources. Yamana households moved across the territory in their canoes in search for needed resources. In spite of this, Yamana society has different ways to strength social cohesion: visiting each other or because of the celebration of different types of ceremonies. Initiation ceremonies were of special relevance, and the need for maintaining the group meanwhile these rituals were being developed became essential. The finding of a beached whale, and the subsequent aggregation event that took place through a public call, created the ideal context for the development of economic and social processes in a cooperative way.

Together with the enormous amount of meat, blubber and raw materials provided by the whale, this finding gave the possibility to invest most of the day in communal life for a long period.

2. The WWHW Model

The Whale When Hale Whale (WWHW) is an agent-based model oriented to allow the exploration of the emergence and resilience of cooperation in hunter-fisher-gatherer societies (Briz i Godino et al, in press), such as the Yamana.

In the model there are two types of agents, the whales and the people. The whales are an enormous valuable perishable food resource that appears from time to time (according to a certain probability). The whales can only be seen within a certain range. The people represent household/canoes. They walk around the environment where they have a chance to find beached whales. In the model, we have implemented two patterns of movement: random walk and Lévy flight, in order to explore whether the type of movement influences the emergence of cooperation.

When a people agent finds a beached whale, she has to face the dilemma whether to make a signal to call other people and share the resource, having an aggregation event and so cooperating; or to exploit the resource by herself (defecting). If the people agent decides to make a public call to share the whale, an aggregation is celebrated. People travel where the whale is beached to share the resource. These aggregation events are considered a great opportunity to exchange social capital, improve work skills, celebrate rituals and ceremonies, etc. As a result of these aggregations, the people agents increase their stock of meat and social capital. These two variables are used to calculate the success (fitness) of the strategy of the agent (the strategy of the agent is given by a probability of cooperation). The relative importance of social capital over meat is modulated by a parameter that allows us to investigate the influence that these two variables have in the evolution of cooperation.

Moreover, a mechanism of reputation is implemented, which rewards the cooperative behaviours (call to share a whale) and punishes any public defection, i.e. whenever an agent is seen defecting. This reputation variable conditions the social capital a people agent can achieve in an aggregation, penalizing defective behaviours over cooperative ones.

An evolutionary mechanism leads the strategy selection of the agents. Every generation (a generation is a parameterizable number of discrete time steps), the people can imitate the most successful strategies of other people. We have implemented two strategy selection alternatives: random-tournament and roulette wheel. A person will imitate other person strategy if the fitness of the strategy of the other person is higher than her own. There is also a probability of making a mistake in imitating or to explore new strategies.

3. New experiments

We have conducted a set of new experiments in order to explore the influence of the movement pattern of the people in the emergence and resilience of cooperation. We have implemented the two movement patterns mentioned before: the simple random walk pattern and the Lévy flight pattern.

The model seems robust to changes in the movement pattern of the people agents. The Lévy flight pattern is said to be a more efficient resource search pattern than the random

walk for sparse resources that are distributed randomly (Viswanathan et al., 1999). But the fact that all the population is beneficed of this search improvement could be responsible for its smooth influence, resulting in no impact of the movement pattern on the dynamics of the cooperation.

However since these findings have not been verified for a wide range of parameter combinations, further research is required.

4. References

Briz i Godino, I.; Santos, J.I.; Galán, J.M.; Caro, J.; Álvarez, M.; Zurro, D. (in press). Social Cooperation and Resource Management Dynamics among Late Hunter-Fisher-Gatherer Societies in Tierra del Fuego (South America). Journal of Archaeological Method and Theory, doi: 10.1007/s10816-013-9194-3

Viswanathan, G. M.; Buldyrev, Sergey V.; Havlin, Shlomo; da Luz, M. G. E.; Raposo, E. P.; Stanley, H. Eugene (28 October 1999). "Optimizing the Success of Random Searches". Nature 401 (6756): 911–914. doi:10.1038/44831.