1 Introducion

Incompleteness and uncertainty of the historical and archaeological record lead to historical interpretation inferred only from indirect data sometime very far from the social or cognitive process that originated it (Madella et al., 2014).

In this paper, we argue that *formal modelling* and computer simulation are valuable tools to overcome such limitations. We first show how evolutionary biologists have successfully embraced this approach and why their work is close to what archaeologists and historians do. We then defend how those M&S are a good heuristic tools in science in general and we finished by introducing an interdisciplinary research setting, where the previous points can be exploited in a meaningful way to investigate historical questions.

The goal of evolutionary biologists is to understand the mechanisms at the origin of the living world as we can observe it. Assuming the theory of evolution, they characterise the succession of past events that constitute this history. Starting with Gould (1989), several biologists and philosophers have argued that the nature of this research activity is historical (Ereshefsky, 1992, Beatty, 1995): the actual biological world does not depend *only* on biological rules, but on the uniqueness of the succession of events.

To encompass the issues raised by such historicity, evolutionary biologists use, at least since the Modern Synthesis, formal models to figure out different possible successions of events and the likelihood of such possible historical paths, and they test it against the available data.

This suggest that (i) the problems encountered by evolutionary biologists are close to those archaeologists and historians have to face (ii) the way inferences are made about the history of living beings and the history of human societies fall into a similar epistemological framework and (iii) mathematical and computer models are good candidates to infer, in a statistically plausible and transparent way, missing data and complex hypotheses in both enterprise.

This use of computer simulation and modelling is not restricted to evolutionary biology. It is now widely spread in all branches of Science. People in Artificial Life (Bedau et al. 1998, 2000, Paolo et al. 2000, ...) argue that computer simulation are powerful heuristic tools that combine the exploratory power of thought experiments and the logical strength of mathematics. They allow to test quickly a lot of possible "opaque though experiment" that would be impossible to execute mentally. Moreover, in complex systems where the interactions of every subcomponent are multiple, the global dynamics are difficult to predict analytically, which make simulation and modelling one of the best suitable tool to explore and study those mechanisms.

We see here that computer simulation is a good heuristic tool perfectly suited to study complex system. Those two properties make it again a very good candidate to study past social activities.

But building computational simulations that give us valuable knowledge about the modelled object still remains a difficult task. Computer scientists have to be aware off every assumptions they could implicitly made and historians have to formulate their hypotheses in an epistemological framework yet not clearly specified and far away from the one they have been used to. The communication is thus primordial, as knowledge here does not lie in the mathematical models neither in the historical data, but emerges from the well articulation of both side (Winsberg 2009).

Here we provide examples from the EPNet project, where the emphasis is on providing historians with computational tools for understanding the political and economical implications behind food production and distribution along the Roman Empire.

The computational infrastructure of the EPNet project takes the form of a "Virtual Research Environment" offering: (i) a conceptual layer (ontology) driving the access to datasets stored into fragmented, heterogeneous and distributed digital repositories; (ii) a platform for sharing of expert knowledge on characterisation, typology and dating of Roman Empire artefacts; (iii) dedicated data visualisations and analytics tools, such as statistical inference and computer-based simulation. By taking into consideration the design and development of such a computational infrastructure, the EPNet epistemological framework is aiming to address three main problems: (i) structuring and making accessible large collections of data through the Web, (ii) providing a formally defined, unambiguous, framework for analysing the data and exporting them in a way that can be further manipulated by computer simulation algorithms and complex network analysis, and (iii) making each collection of data integrable with other complementary data sources.