Agents ruling and ruled, rules and meta-rules: does the world belong to anarchists?

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We propose a framework within which to investigate three topics: first, how enterprises and organizations arise, behave, and fall; second, how they interact; and finally, how we can improve them. The tool that we introduce here to help us in this research effort is a large agent-based simulation framework which is able to reproduce the enterprise context in a detailed way.

The basis is an agent based computational experiment on rules and rule emergence - named AESOP (Agents and Emergencies for Simulating Organizations in Python) – to uses actions, agents (acting and deciding people) and the scheduling of events into an agent based framework. Agents may use fixed rules but they can also learn to improve these rules in a changing environment. They can also be modeled so as to be aware of the consequences of their behavior. In the simulator, single agents can also be modeled as neural networks, so that the system appears as a "net of neural networks". Alternatively, it is possible to introduce Bayesian learning processes in our models.

The core of the simulator is the capability to reproduce, in detail, the decision making process of organizations, firms and individual agents. The basis of the method is the reconstruction of the investigated phenomenon via the action and interaction of minded or no-minded agents. We can integrate both no-minded agents - agents capable of just performing tasks they are ordered to carry and minded ones - agents capable of taking decisions within the model.

Rules are not static here and can be modified by special agent, via meta-rules, creating highly complex environments, useful to investigate both actual and abstract economic context and their implication for economics.

The simulator employs two independent components to build a description and representation of the world. Our simulated organizations or firms have both production units that perform the different steps of the production process and orders to accomplish the production. The orders are described by recipes that contain the “What to Do” (WD) component of the process; the production units represent the “which is Doing What” (DW) component of the same process. A third formalism relates to the time sequence of the events (the orders to be executed) that occur in the environment we are simulating; this is the “When Doing What” (WDW) component.

The simulator is currently based on Swarm (www.swarm.org) as basic layer. The Swarm protocol is a ”classical” reference in the relatively young world of the agent-based simulation, mainly for social sciences. The Swarm project, born at Santa Fe Institute, has been originally developed with an emphasis on three key points: (i) Swarm defines a structure for simulations, a framework within which models are built; (ii) the core commitment is to a discrete-event simulation of multiple agents using an object-oriented representation; (iii) to these basic choices Swarm adds the concept of the "swarm," a collection of agents with a schedule of activity.

The AESOP simulator is now under implementation as a Python (www.python.org) layer upon SLAPP (Swarm-Like Agent Protocol in Python, http://eco83.econ.unito.it/terna/slapp/), to use the easiness of Python and its openness, together with the clarity of the Swarm protocol. Python is connected here to the R statistical system (R is at http://cran.r-project.org/), via the rpy library, at http://rpy.sourceforge.net/).