

Patterns, Protocols, And Predictions: Agent-Based Modelling As A Multi-Scope For Analysing Complex Systems

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Systems comprised of decision-making agents such as ecosystems or financial markets are complex. Nevertheless, they generate patterns in structure and dynamics which can be observed at different hierarchical levels and scales. Modellers, though, often focus on only one pattern, which usually is not sufficient to select among alternative model formulations. Therefore, pattern-oriented modelling (POM) has been developed as a general strategy for using multiple observed patterns for the multi-criteria design, selection and calibration of models of complex systems. Instead of using models as a ‘micro-scope’ focussing on individuals, or ‘macro-scope’ focussing on systems dynamics, POM uses agent-based models as ‘multi-scopes’ to capture the interaction between the whole system and its building blocks.

I will present examples from ecology and other domains. I will demonstrate that models developed according to POM usually have a high level of structural realism, i.e. a high chance of capturing the internal organization good enough to make robust predictions of system responses to new conditions. Still, POM models are often tied to specific systems and observations.

To proceed to a more general theory of agent-based complex systems, the ODD protocol for communicating agent-based models can be used to systematically relate the structure and processes of models to broad classes of patterns, or stylized facts, observed in different systems.