

Research Statement

I investigate how agents internally represent problems they face and solve problems. “How” entails three components. First, the unpacking of psychological rationality; that is, the implications of agents being consistent and transitive in their belief systems, which rarely fully specifies a representation. Second, drawing on the psychology and especially the cognitive science literature on how people represent problems in practice. Third, capturing essential elements from how social scientists represent problems.

All three of these aspects can be seen in my paper, “Causal Coherence.” This analysis implements a causal modeling framework of decision making. The framework has its roots in computer science and includes as a special case classic economic simultaneous equation models (and hence arguably represents how economists represent problems.) This causal modeling framework has empirical, laboratory support from cognitive science. It also provides a consistent and coherent (although perhaps incomplete) understanding of a problem, and therefore addresses psychological rationality as well. I have a formal representation in a decision theoretic context. I intend to further investigate causal models in a few ways. First, I intend to implement the framework as computer simulation algorithms (drawing on existing work in artificial intelligence) in order to have a programmable agent that would be appropriate for agent-based models in which agents represent problems using causal models. This will be a useful tool for investigating further economic implications of this framework. Second, this framework provides something of an alternative to pure associationalist models of human understanding and beliefs, which is an object of considerable debate in psychology but exists, under the guise of pure Bayesianism, virtually unopposed in economics. I hope to further investigate the alternative schools of thought in psychology and attempt to reconcile them with this model.

A second internal representation of problems and model of problem-solving I intend to investigate is one in which agents have essentially collections of scripts or algorithms to solve particular problems. These scripts could be tradable, and hence memes (that is, the spread of ideas). This representation will draw heavily on the computer science formal models of language. The space of algorithms is much less structured than the space of causal models in the framework above, and therefore less amenable to complete characterization. However, it is very appropriate for agent-based simulation, in which agents can evolve and mutate scripts.

Finally, I wish to extend the literature on decision making involving multiple selves. Starting (roughly) with Picoeconomics, there has been a flourishing literature on agents being represented by small societies of sub-agents with competing interests: often, a short-sighted and long-sighted self who battle over choice. Once again, an agent-based implementation of this framework can allow for an internal ecology of competing agents that is more subtle and may evolve over time. One area I hope to investigate merges this idea with that of the scripts, in which single scripts or concepts battle over agent control and strive to propagate themselves.

The goal of each of these representations is the same: to develop an arch-typical, general-purpose agent that fits each model. This takes two stages: a formal, precise, but simple investigation (like “Causal Coherence,”) and a more complex, but less precise computer simulation agent. The purpose of developing these agents is to investigate the implications of these models and provide a bigger toolbox for economists who would like more robust models of human behavior at their disposal for their models of economic phenomena. Hence the computer simulation is particularly useful, as those agents, once they are validated and understood, can be essentially modular with respect to others’ models of phenomena. In short, the ultimate goal is to set these agents in social situations of interest to further explain economic phenomena and provide the groundwork for others to do the same.