

# Toward Constraint-Sensitive Agents

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## Abstract

In recent years, significant progress has been made in social research based upon agent simulation methods. A baseline domain space in which agents with directly-defined deterministic and probabilistic capabilities has been extensively explored, and computational tools to support such modeling and design have been developed. Simulation based on this approach has been able to generate intuitive aggregate-level outcomes in a variety of research domains and, in various cases, have created higher-level patterns of emergence. Thus, the initial insights and potential of social simulation have created a rising research paradigm.

Notwithstanding early achievements, the new paradigm has much unrealized potential as well. Social processes are subtle and complex, observably fluid and volatile. Algorithms, exogenous rules and mean field approaches are unable to capture their creativity, innovation and unpredictability. The use of tag-based functions to model cultural processes is a suggestive example of the limitations of discrete models of social dynamics.

To realize the potential of agent models in social research, it is important to construct agent capabilities based on higher-order computational processes. There are various ways in which this might be incorporated into model design. First, chaotic models might be incorporated as a direct aspect of agent capabilities. Second, some combination of deterministic, probabilistic and/or chaotic computation can be used to construct second or higher-order possibilities. One higher-order computational model that can be used is constraint modeling. The prospective implications of using constraint modeling to build agent models is considered in the present paper.

The use of constraint programming originated as a way of solving optimization problems. Many social patterns originate as actors intending, acting or interacting under constraint. Examples include ecology, social structure, mutually constituted intelligibility, maintenance of the social self, reflexive accountability and/or multiple intentionality states and, of course, these are not exhaustive. Underlying such constraint mechanisms is the possibility that they are endogenous as well as exogenous, i.e., that relevant agents are not only shaped by exogenous constraints but also, by their communications and actions, they shape the constraints under which subsequent events occur.

Toolkits designed to support constraint models will require special components and features. The presentation will conclude by identifying prospective tool desiderata.