

Day 3- April 5, 2006

Introduction to Modeling - Charles Macal, Director, Center for Complex Adaptive Agent Systems Simulation, Argonne National Laboratory

Macal provided an introduction to computational social science modeling. He suggested that modeling is helpful because human beings are constrained by linear thinking, and we cannot imagine all possibilities, foresee the full effect of cascading events, or foresee novel events. We model, then, for insights and explanations. The notion that modeling can help us make qualitative or quantitative predictions about the future is problematic in the decision making context. Modeling, however, can aid in decision making efforts. Modeling approaches range from being descriptive to being social process-oriented. The continuum could contain the following: accounting, statistics, social network analysis, dynamic social networks, system dynamics, and agent based modeling and simulations. Descriptive approaches (not really models) rely on inductive inference and are data-driven. These include text processing, probabilistic inferencing (Bayesian approach), and data mining to see structural relationships (i.e. Indasea's Cultural Simulation Model). Macal proceeded to suggest that investment in network science is both a strategic and urgent national priority.

Rational choice economic models and agent based models are examples of models that look at social processes. A small model can take into account essential elements of the real world, while a larger, complex model looks at as many characteristics as possible. Macal suggests that the best technique for dynamic multi-level cultural modeling is through the agent-based approach. Agents, which have individual attributes and decision mechanisms, interact with one another. An example of this approach is found in Ed Mackerrow's MAS Model, funded by DTRA/ASCO.

Macal then highlighted the essential importance of validation and verification. Verifying a model is making sure that it works as intended (i.e., that the code is not buggy) while validation involves seeing whether the model accurately reflects the empirical realities of the phenomenon under investigation. Argonne National Laboratory and The University of

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Chicago are currently conducting several efforts in this area, the Argonne Validation Sciences Initiative (VSI) being such an effort. He highlighted several possible elements of a validation framework for computational social science models (case studies, e-laboratory, use of multiple models, and use of subject matter experts).