A Review for the Validation of Social Simulation on Artificial Social Organization

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ABSTRACT

Social simulation on artificial social organization, which uses computer simulation to construct artificial society to research social organization, has been becoming popular. Validation of simulation can improve the accuracy, credibility and applicability in the modeling and simulation, and is the key step to apply social organizational model. In this paper, the current research of simulation validation is reviewed, the category of social simulation is defined, and philosophical perspective of simulation validation is analyzed. Implementations of simulation validation in various models, including framework, level, type and technology, are introduced as well. Then, the validation in social simulation, including features, existing problems, framework and techniques, is analyzed in particular. Finally, the further work for the simulation validation is announced.

Keywords: Agent-Based Simulation, Artificial Society, Computational Organization, Credibility Evaluation, Social Simulation, Validation, Verification-Validation & Accreditation

1. INTRODUCTION

Computer simulation has been widely used in various fields such as military industry, mechanical engineering, and aircraft design. Nowadays, it also becomes popular as one of the methods in Complex Research in the fields such as Sociology, Economics, Management, etc. The validation of simulation models plays a key role in improving reliability, accuracy, and applicability of models to ensure the credibility of simulation models. Currently, most studies of simulation validation focus on natural science rather social science. Although the achievements of these studies in natural science (see the review by Balci, 1994), can be referred in the simulations in social science (social simulation) as well, it is still difficult to figure out a suitable validation in social simulation (Carley, 2009).

In social simulation, building the model is the first step, following computational experiments and analysis of results in the second and...
third step, respectively. The goals of modeling are various, mainly including explanation, illuminating core dynamics, offering crisis options in near-real time, training practitioners, etc (Epstein, 2008). To attain these goals, the models should reflect the real world in some senses. However, it is not so absolute, because the simple local rules can emerged into the complex dynamics at the global level and the accurate alignment with real world is much hard. Actually, as a complex adaptive system, social system becomes difficult to understand because of human interactions from individual levels to organizational levels. Unstructured information in social decision increases the uncertainty to make simulation validation much difficult. To simulate what is also needed to be thought over during social simulation, and simulating scientific problems (some comes from the real world) has first to say what science is (Collins, 2011). The model cannot be analyzed through pure reductionism due to the complexity of social system, and should be gone through from the perspective of system (Epstein & Axtell, 1996). Between the real system and artificial system built in computers, a kind of parallel control can be used to coordinate them: artificial system simulates the real system and finds the efficient solution for practitioners, and furthermore, the difference between real and artificial system will be recorded to generate the signal for the feedback to articulate artificial system (Wang, 2010). Therefore, validation and verification can be enhanced through the recursive feedback, optimization and control accordingly. However, not all the models in social organization should be validation, in general, the purpose of the model should drive validation (Burton & Obel, 1995).

In this paper, we review the applications of validation on social simulation, not only including the description of social simulation, but also including the summary of validation methods. In the following, Section 2 summarizes the basic concepts of simulation validation. Section 3 reviews the current status in the research of simulation validation, and especially introduces the relevant researches in China. Sections 4 and 5 reviews the work in social simulation and list the characteristics of social organizational model, respectively. Section 6 analyzes the difficulties of validation in social simulation. In Section 7, a framework for the verification and validation of Social Organization Simulation is proposed. Section 8 discusses the validation from the Philosophical viewpoint. Section 9 is about the levels of simulation validation, and Section 10 summarizes the methods in simulation validation. Then, Section 11 gives some examples in the validation of social simulation. In Section 12, we present a case study that builds a social organizational model on IT adoption & diffusion, verified through empirical study and validate it through curve-fitting at the macro-level. Finally, Section 13 draws the conclusions.

2. BASIC CONCEPTS OF SIMULATION VALIDATION

In the theory of simulation validation, VV & A is a specialized vocabulary widely accepted, representing the Verification, Validation, Accreditation respectively. These terms are easily confused. Sargent (2004), referring to the definition given by the IEEE and the U.S. Department of Defense Modeling and Simulation Office (DMSO), defined the VV & A:

1) Verification: Verification ensures that the simulation model accurately reflects the developer’s conceptual description and the process of technical requirements. Verification aims to solve the problem of “Whether the simulation model works in accordance with the pre-requirements.” Verification focuses on the inspection of the modeling process, which is to check whether the simulation model code and logic are correct and accurately accomplish the predicted function of the simulation system. Verification will ensure the simulation system with a more complete demand, better defined conceptual model and a more thorough and correct design, as well as clear simulation with fewer defects.
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