# Chapter IX
# Foundations of Social Modelling

## INTRODUCTION

A model is an abstract representation of reality. It can be an object, a system or an idea. In general terms, one could say that a model is a simplification of reality. Modeling is a fundamental and quantitative way to understand complex phenomena and systems. Modelling make up a scientific approach that can be applied to analyse a wide range of physical and social problems. Modelling of complex systems is becoming increasingly a common practice in virtually different disciplines, giving rise to active fields of studies such as mathematical modelling, econometrics, social modelling, computational physics, chemistry, mechanics, and biology, to name just a few. Through modeling one can readily cross over from one discipline to another, the basic concepts and techniques are relatively the same. Computational models are useful tools for representing abstractions and concrete realities. Computational models are intended to provide knowledge about social and technical aspect of systems and their users.

Scientists often create computational models to imitate a set of processes observed in the natural world in order to gain an understanding of these processes and to predict the outcome of natural processes given a specific set of input parameters. On the analytical level, computational models are expressed as conceptual and theoretical modeling with sets of algorithms, which are implemented as software programs. Computational models are capable of providing computer systems designers and research analysts with rich insights to build processes, procedures and tools to support systems operations in order to adapt these operations to peoples'

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technology needs. On the theoretical level, computational models provide researchers and scientists with the ability to investigate and develop new theoretical knowledge necessary for building systems, tools and processes.

This chapter presents an overview of computational modelling. It provides examples of computational models types and how they are currently used to inform our understanding of issues connected to users and computer systems. The goal of the chapter is to present the reader with the background knowledge necessary for understanding the Bayesian computational approach presented in this book and to draw their attention to think about ways in which modelling can be used to analyse and understand problems in other social systems.

## FOUNDATION OF COMPUTATIONAL MODELLING

Modelling is a procedure for knowledge representation and sometimes with the purpose of understanding complex problems in many domains. Modelling involves a systematic and logical representation of a theoretical construct or a body of knowledge. Science or what is considered scientific knowledge is based on the notion of theories, hypothesis, deductions, inductions and predictions. To examine theory formulation in general and its relationship to computational models, a distinction between the real world and the abstract world must be clearly made. The real world in this scrutiny is represented by the knowledge of concrete things, such as people, cars, relationships and indeed all the things that we can concretely see, touch and feel. The abstract world is the concrete representations of these realities achieved through the help of scientific principles and tools. The bridge between the abstract world and the real world is a scientific model.

A computational model or a scientific model for that matter has primarily three goals to achieve, the first goal is to understand what is observed in the real world and translate these observations to abstractions. The second goal is to be able to relate and predict events of observations or abstractions and the third goal is to control the behaviour or aspects of the real world. For example, how can a meteorologist know about the conditions of the weather? How can an Economist accurately predict economic recession? How can a Neurologist study brain reasoning patterns? These are valid questions, which are frequently addressed through the help of computational models.

A computational model comes in various types, forms, sizes and representations and they are either descriptive or predictive. Descriptive models use metaphor to describe, analyze and illustrate social or natural phenomenon. Predictive models on the other hand use mathematical and statistical equations to illustrate relationships among variables or components of a system. It is convenient to think of models

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