

Sim-I-Space: An Agent-Based Modelling Approach to Knowledge Management Processes

Max Boisot¹, Ian MacMillan², Kyeong Seok Han³, Casey Tan⁴, and Si Hyung Eun⁵

¹ Universitat Oberta de Catalunya, Barcelona, Spain,
boisot@attglobal.net

² The Sol Snider Entrepreneurial Research Center, The Wharton School,
University of Pennsylvania, Philadelphia, PA, USA,
macmillan@wharton.upenn.edu,

³ Soongsil University, Seoul, 156-743, Korea,
kshan@ssu.ac.kr

⁴ Singapore Airlines, Singapore,
case_tan@hotmail.com

⁵ The Sol Snider Entrepreneurial Research Center, The Wharton School,
University of Pennsylvania, Philadelphia, PA, USA,
silver92@empal.com

Abstract. In the chapter we offer a verbal description of Sim-I-Space, an agent-based model that operationalises key features of a conceptual framework: the Information-Space (I-Space). The I-Space relates the speed and extent of information flows between agents to how far their messages have been structured through acts of codification and abstraction. The more structured a message, the faster and more extensively it diffuses to other agents—intentionally or not.

Following a brief introduction, the paper divides into two sections. Section 2 describes the models architecture, the agents, the nature of the knowledge assets that they create, articulate, and trade in, and the types of the interactions—trading, licensing, joint-venturing, merging and acquiring—that agents can engage in. Section 3 presents the main components of Sim-I-Space, namely, agent characteristics, agent knowledge, and agent interaction. Two appendices—A and B—describe the model variables and provide a more detailed model specification.

1 Introduction

In this paper we offer a verbal description of the Sim-I-Space simulation model. The model is designed to operationalise some of the main features of the Information Space or I-Space [Boi98].

The paper is structured into two main parts as follows. In the first part we look at the overall architecture of Sim-I-Space that brings together three components:

- agents,
- knowledge assets, and
- agent interactions.

In the second part we examine in more detail each of the model components. There are two appendices. In Appendix A we describe the variables used in the model and identify the input parameters used in the model. In Appendix B we provide a more detailed specification of the model, with illustrative examples.

2 Model Architecture

Sim-I-Space is a multi-agent simulation characterized by mixture of competition and collaboration. Although built in part on a Swarm platform, in the limited number of time periods it runs, and given that agents make their decisions at random—i.e., they do not learn—it only exhibits limited elements of evolutionary behavior. Survival is the aim of individual agents in the simulation. The rents that agents earn provide them with the means to survive. If agents run out of money they are ‘cropped’. They can quit while they are still ahead. The overall value of a given simulation run is the sum of the rents earned by all agents during the run. The social welfare generated by the simulation is the sum total of all knowledge created in the course of the simulation and then diffused out to ‘society’. Note that ‘society’ is located outside the simulation. The price paid by ‘society’ for this social welfare is the cumulative rent earned by the agents inside the simulation, i.e., the price paid by ‘society’ turns out to be the value of the simulation.

How does Sim-I-Space implement and embody the concepts of the I-Space? The I-Space is a conceptual framework for analyzing the nature of information flows between agents as a function of how far such flows have been structured through processes of codification and abstraction. Such flows, over time, give rise to the creation and exchange of knowledge assets. Where given types of exchange are recurrent, they will form transactional patterns that can be institutionalized. In Sim-I-Space, we focus on the creation and exchange of knowledge assets alone without concerning ourselves with the phenomenon of recurrence and institutionalization. In later versions of the model, recurrence will become our central concern.

Sim-I-Space is populated with agents that carry knowledge assets in their heads. Each of these knowledge assets has a location in the I-Space that changes over time as a function of diffusion and obsolescence processes as well as of what agents decide to do with them. These have the possibility of exchanging their knowledge assets in whole or in part with other agents through different types of dealing arrangements.

Natural selection is at work in Sim-I-Space at two levels. At one level, agents survive by learning to make good use of their knowledge assets. They can make use of these assets directly to earn rents, or they can make indirect