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701 E. Chocolate Avenue, Suite 200, Hershey PA 17033-1240, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com

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Chapter III

Computational Intelligence as a Platform for a Data Collection Methodology in Management Science

Kristina Risom Jespersen, Aarhus School of Business, Denmark

Abstract

With an increased focus in management science on how to collect data close to the real world of managers, we consider how agent-based simulations have interesting prospects that are usable for the design of business applications aimed at the collection of data. As an example of a new generation of data collection methodologies, this chapter discusses and presents a behavioral simulation founded in the agent-based simulation life cycle and supported by Web technology. With agent-based modeling the complexity of the method can be increased without limiting the research as a result of limited technological support. This makes it possible to exploit the advantages of a questionnaire, an experimental design, a role-play and a scenario, gaining the synergy of a combination of these methodologies. At the end of the chapter an example of a simulation is presented for researchers and practitioners to study. [1]

Introduction

As the complexity of problems and the speed of changes increase for companies, the accuracy of management science relies on measuring behavior as close to the real world as possible. The methodological tradition in management science has been the self-administered questionnaire and case analysis. Though these are valid research strategies, the retrospective nature of the collected data is a weakness, because the accuracy of respondents' recollection of events can be questioned. Recent reviews of various research fields of the social sciences have pointed to the need for more interactive data collection methods (Englis & Solomon, 2000; Zaltman, 1997). It is here computational intelligence, specifically agent-based simulations, has a great deal to offer researchers in the design of business applications for the collection of data.

The use of computers for data collection is well known. The first computerized experiment was launched as early as the 1970s. Within the field of decision-making, experiments have been computer-interactive from quite early on (Connolly & Thorn, 1987). For research purposes the computational intelligence available through the Web is still by and large an unexplored territory in management science (Birnbaum, 2000; Englis & Solomon, 2000; Jespersen, 2004; Klassen & Jacobs, 2001; Reips, 2000; Stanton, 1998). Images are presented or exchanged with ease, and communication is taking place without the significant delay that comes through other mediums, such as film. Complex structures in search machines or on home pages present a simple interface to users. These exciting developments in Web technology bring with them new ways of investigating scientific questions, by offering the opportunity to extend traditional data collection methods into behavioral simulations. Extensions of data collection methodologies can learn from and build on agent-based simulations developed within the field of computational intelligence. An advantage of computational models of human behavior is that, like humans, agents are able to learn in the simulations, and hence the models exhibit computational intelligence (Boer, Ebben, & Sitar, 2003; Potgieter & Bishop, 2002; Wahle, Bazzan, Klügl, & Schrenkenberg, 2002). Therefore, with simulations it is possible to collect data on how decision-makers operate in companies. One such interactive data collection methodology is a Web-based behavioral simulation, which monitors the actions of human agents in a virtual decision process as known from computer games (Jespersen, 2005).

The purpose of this chapter is to demonstrate that computational intelligence can aid the collection of data through the design of a Web-based behavioral simulation. Specifically, an agent-based simulation can be a vehicle for the collection of real-time data concerned with managerial decision-making. The chapter begins with a discussion of the platform used in agent-based simulations and the benefits of Web technology. This is followed by a discussion of the agent-based simulation life-cycle as a data collection vehicle and an example of such a business application. Finally, implications and future challenges are presented.