



Chapter VIII

Simulation Modelling within Collaborative Spatial Decision Support Systems Using “Cause-Effect” Models and Software Agents

Raja Sengupta, McGill University, Canada

Abstract

Solutions to spatial environmental problems often require the integration of dynamic simulation models within GIS to create spatial decision support systems (SDSS) that can generate responses to theoretical “What if?” scenarios. Extending this paradigm to a collaborative spatial decision support system, however, faces significant challenges. This includes the inability of computationally intensive models to provide real-time results, and the inability of novice end users to effectively parameterize the models. Effective solutions to these problems proposed here include the use of “cause-effect” models to link inputs to outputs for a limited number of scenarios, as well as utilizing software agents that assist novice users in

determining the correct input parameters for the models. Examples from the St-Esprit watershed SDSS serve to elucidate the proposed solutions.

Introduction

Sprague (1980) defined decision support systems (DSS) as computer software that are: (a) designed to solve the kinds of semi- and unstructured problems that upper level managers often face; (b) able to combine analytical models with traditional data storage and retrieval functions; (c) user-friendly and accessible by decision makers with minimal computer experience; and (d) flexible and adaptable to different decision-making approaches. Extending this definition, Armstrong, Densham, & Rushton (1986) used the term spatial decision support systems to refer to computer programs that help decision-makers solve semistructured spatial problems through the integration of analytical models, spatial data, and traditional geoprocessing software (such as GIS). Therefore, an SDSS supports the spatial decision-making process by providing access to models that help users assess the impact of alternative solutions on stakeholders in collaborative environments (Armstrong, 1994).

Several spatial decision support systems (SDSS) implementations have been proposed or demonstrated in literature that incorporates analytical modeling with traditional GIS software packages for decision support. For example, the NELUP DSS was developed to study the impact of policy changes (at a global, European, national, regional, county, or local level) on the rural landscape, agriculture, and environment using economic, hydrologic, and habitat models (Watson & Wadsworth, 1996). Another SDSS, which relocated supply stores for school districts, was developed to find the optimal number of regions and service locations within each region to serve a dispersed geographical pattern of demand (Armstrong, Rushton, Honey, Dalziel, Lolonis, De, & Densham, 1991). The “WaterWare” DSS was developed as a comprehensive SDSS to support the development of an integrated river basin management plan to resolve conflicting uses such as recreation, agriculture, water supply, and the environment (Jamieson & Fedra, 1996). And finally, faunal habitat and landscape ecology models are being increasingly integrated with GIS to support decision making at the landscape level (McGarigal & Marks, 1993; Larson & Sengupta, 2004; Zhu, Healey, & Aspinall, 1998).

However, current SDSS often act as a basic interface to complicated models, leaving the end user to figure out model input parameters on their own. Therefore, the execution of such models in the SDSS in real time creates three hurdles for end users of the SDSS:

14 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/simulation-modelling-within-collaborative-spatial/6656

Related Content

The Effects of Adoption of 3D Printing Technology on the Operational Performance of the Companies of Cross Border Entrepreneurs: An Empirical Study

Muath Surakji, Hani H. Al-dmourand Rand H. Al-Dmour (2018). *International Journal of 3-D Information Modeling* (pp. 28-48).

www.irma-international.org/article/the-effects-of-adoption-of-3d-printing-technology-on-the-operational-performance-of-the-companies-of-cross-border-entrepreneurs/238826

Extending Objects to Model Agents: A Collaborative Group Design Framework Using the Agent UML Extension

Shivanand Balramand Suzana Dragicevic (2006). *Collaborative Geographic Information Systems* (pp. 121-133).

www.irma-international.org/chapter/extending-objects-model-agents/6655

Development of a Web-Based Intelligent Spatial Decision Support System (WEBISDSS): A Case Study with Snow Removal Operations

Ramanathan Sugumaran, Shriram Ilavajhalaand Vijayan Sugumaran (2007). *Emerging Spatial Information Systems and Applications* (pp. 184-202).

www.irma-international.org/chapter/development-web-based-intelligent-spatial/10131

Mechatronics of Recent Advances of Sensors for Assistive Technologies

Rapelang Marumo (2018). *Handbook of Research on Geospatial Science and Technologies* (pp. 230-238).

www.irma-international.org/chapter/mechatronics-of-recent-advances-of-sensors-for-assistive-technologies/187730

3D City Modeling and Visualization for Smart Phone Applications

Juha Hyypä, Lingli Zhu, Zhengjun Liu, Harri Kaartinenand Anttoni Jaakkola (2013). *Geographic Information Systems: Concepts, Methodologies, Tools, and Applications* (pp. 1011-1052).

www.irma-international.org/chapter/city-modeling-visualization-smart-phone/70490