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Chapter XII

Simulating Crime Events and Crime Patterns in a RA/CA Model

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Abstract

This chapter presents an innovative approach for simulating crime events and crime patterns. The theoretical basis of the crime simulation model is routine activities (RA) theory. Offenders, targets and crime places, the three basic elements of routine activities, are modeled as individual agents. The properties and behaviors of these agents change in space and time. The interactions of these three types of agents are modeled in a cellular automaton (CA). Tension, measuring the psychological impact of crime events to human beings, is the state variable of the CA. The model, after being calibrated by using a real crime data set in Cincinnati, is able to

generate crime patterns similar to real patterns. Results from experimental runs of the model conform to known criminology theories. This type of RA/CA simulation model has the potential of being used to test new criminology theories and hypotheses.

Introduction

Many crime analyses attempt to model the relationships among various factors contributing to crime and measures of crime aggregated to an area units of analysis (Swartz, 2000). These types of analyses avoid modeling the processes of how individual participants' decisions give rise to crime events and how these events coalesce to form crime patterns. Although they are useful for describing aggregate crime patterns, they cannot reveal the underlying processes that generate crime patterns.

This chapter demonstrates an ongoing collaborative project started in 2000 on crime simulation between the Department of Geography and the Division of Criminal Justice at the University of Cincinnati. The goal of this project is to explore the possibility of simulating individual crime events and generating plausible crime patterns. It applies criminology theories and reasonable assumptions to explicitly model crime processes. These processes generate individual crime events, and the accumulation of these events then forms crime patterns. This project also aims to explore the potential of using this type of simulation models as a virtual laboratory for testing new crime theories and hypotheses and predicting future crime patterns based on different scenarios of policing and law enforcement strategies.

The RA/CA crime simulation model presented in this chapter is based on the integration of routine activities (RA) theory (Cohen & Felson, 1979), and cellular automaton (CA) simulation in GIS (Wu, 1999). Street robbery is used as an example to illustrate the characteristics of the model.

Modeling Crime with the Routine Activities Theory

The routine activities theory (RA), introduced by Cohen and Felson (1979) and expanded by Felson (1995), is a micro-level crime explanation theory that