

## Chapter XII

# Characterizing the Spatio–Temporal Aspects of Routine Activities and the Geographic Distribution of Street Robbery

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### **ABSTRACT**

*It is widely recognized that the spatio-temporal components of human behavior strongly influence where and when people converge in space and time. Routine activity theory (Cohen & Felson 1979) ties the frequency of convergence to crime rates. This chapter builds on an earlier agent-based model (Groff, in press-a) by drawing on geographic theory to develop two additional versions of the model in which the agents have more fully developed activity schedules. A series of experiments are conducted which compare the spatial pattern of street robbery events from the original version of the model to the two new versions and to the empirical distribution of street robberies in Seattle, WA. The findings indicate temporally and spatially defined activity spaces have a significant impact on the spatial pattern of crime events produced by the model. The version with spatio-temporal activity spaces produces patterns most like the empirical distribution of street robberies.*

### **INTRODUCTION**

Researchers within geography and closely related disciplines have long recognized the importance

of considering space and time when examining human behavior (Chorley & Haggett, 1967; Engel-Frisch, 1943; Hägerstrand, 1970;1973; Harvey, 1969; Hawley, 1950; Horton & Reynolds,

1971; Sampson, 1993). In particular, sparked by theoretical developments during the 1970's and 1980's, many criminologists have begun to study how places influence when and where victims and offenders converge (Eck & Weisburd, 1995; Weisburd, 2002). Proponents of this view focus on the study of crime events rather than criminal motivation and rely on a set of "opportunity theories" of crime to explain why crimes occur in one place and not another.<sup>1</sup>

As the importance of place and time in criminological theory has gained recognition, so has the utility of applying a more process-oriented perspective to the study of crime (Sampson, 1993; Weisburd, Lum, & Yang, 2004). This approach recognizes that "social behavior occurs in particular times and places with particular social actors" (Sampson, 1993, p. 429). While the theoretical framework exists for such research, the collection of individual-level data to characterize human interactions in general and crime events in particular remains an on-going barrier to the empirical application of this perspective and one that is unlikely to change due to privacy concerns (O'Sullivan, 2004b).

In response to these challenges, some researchers have begun to consider simulation modeling as an alternative approach (Brantingham & Brantingham, 2004; Eck, 2005; Eck & Liu, 2004; Gilbert & Terna, 1999; Gilbert & Troitzsch, 1999; Gimblett, 2002; Liu, Wang, Eck, & Liang, 2005; Macy & Willer, 2002; Moss & Edmonds, 2005). A subset of these researchers are interested in crime and recognize the value of simulation modeling for: (1) understanding crime in its situational context; and (2) capturing the dynamic interactions taking place at the micro level and examining their relationship to macro level patterns (Brantingham & Brantingham, 2003; 2004; Brantingham & Groff, 2004; Eck & Liu, 2004; Gunderson & Brown, 2003; Wang, Liu, & Eck, 2004). In particular, the Brantinghams (2004) have clearly illustrated the important role of

agent-based models in formalizing the context in which a crime event occurs.

One recent study combines theoretical exploration with controlled experiments to study the crime of street robbery (Groff, in press-a). This was accomplished by implementing the assumptions of a theory, in this case routine activity theory (Cohen & Felson, 1979), in a simulation model and then testing them via controlled experiments to discover whether the theoretically-predicted outcomes match the model outcomes (Groff, Forthcoming-a). The model building process emphasized simplicity, focusing on the elements that were directly addressed by the theory (Macy & Willer, 2002) and relied on 'situating' simulation by combining agent-based modeling (ABM) with geographic information systems (GIS) to enable travel on a street network.

The study found support for routine activity theory's core proposition that shifts in routine activities away from home increase the incidence of street robbery. In addition, a spatial analysis demonstrated that the observed clustering in street robbery events is beyond the degree that would be expected based on the configuration of the streets alone. The approach taken in the study represented a middle ground for theory exploration between the verbal formulation of the theory and the testing of theory with empirical data (Eck, 2005); some characterize it as a way of "experimenting on theories" (Dowling, 1999).

This chapter extends Groff (in press-a) by incorporating routine activity spaces into agent behavior. This is accomplished by creating two new versions of the original agent-based model of street robbery; one adding defined temporal schedules and the other spatio-temporal schedules. Systematically adding complexity to the original model makes it possible to isolate the effects of time and space on the amount and spatial distribution of street robbery. The research then examines whether the changes in the structure of agent activity spaces significantly alter the spatial distribution of street robberies.

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