Chapter II
Realistic Spatial Backcloth is not that Important in Agent Based Simulation:
An Illustration from Simulating Perceptual Deterrence

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ABSTRACT

This chapter considers whether it is worthwhile and useful to enrich agent based spatial simulation studies in criminology with a real geographical background, such as the map of a real city? Using modern GIS tools, such an enterprise is in principle quite feasible, but we argue that in many cases this course is not only not producing more interesting results, but in fact may well be detrimental for the real reason of doing criminal simulation studies, which is understanding the underlying rules. The argument is first outlined in general, and then illustrated in the context of a given example of the ThESE perceptual deterrence simulation model (Van Baal, 2004), a model that actually is using a simple checkerboard as its spatial backcloth.

INTRODUCTION[1]

In this chapter we reflect about the status of the use of detailed geographical context within agent based simulation work. We challenge the idea that such simulation studies are making much progress by means of importing real life geography, and make a plea for being content with very modest artificial spatial backgrounds instead. The argument is largely based on rethinking our position

after having finished a project in perceptual deterrence simulation (Van Baal, 2004). We asked ourselves, is the natural next step in the research program to implement a real life geographical background? Pondering that question, we realized that the scientific status as well as the aims of simulation work is sometimes rather unclear. Reviewing a number of recent simulation studies in criminology, we realized that many simulation projects restrict themselves to just developing a simulation environment and illustrating eloquently how well it works. Often these efforts do not lead to a concise research program in which the built simulation environment is exploited. The "lean back and think again"-modus of the present chapter dictates its character a bit: we refrain from discussing and criticizing individual simulation work, because these individual projects often produce impressive results. However, on a more abstract level, we feel a need to think about where all this ingenious work is leading to. In a sense, most simulation programs seem to breed a dayfly. What we urgently need is a better exploitation of the promising simulation environments that are already out there. It is our conviction that simulation work would gain most from exploiting existing simulation models in depth, instead of making new ones. Importing ever fancier geographical detail into existing or new simulations does not seem the wisest option here.

WHAT IS AGENT-BASED SIMULATION ALL ABOUT?

The agent based simulation approach in behavioral research can be seen as a relentless pursuing of the wish to find answers to "*what if*"—questions. What happens *if* "acts" ("behavior") of a number of "agents" are fully governed by certain "law like processes"? These law-like processes specify completely which specific act an agent will perform, in a given situation in which that actor finds itself ("state of the actor"). Usually these law like processes are specified by means of a decision rule in the form of a mathematical formula—possibly, but not necessarily with probabilistic elements—that tells us what act will be performed by that actor, given his situation, a situation that often is characterized by the availability of other actors, themselves governed by equal or different law like processes. Moreover, the environment may be changing according to a related law like process as well. We constrain our discussion here to agent-based models with fixed rules, not mentioning adaptive models in which during simulation the rules may change (under the influence of higher order rules for adapting), such as learning models, neural network models.

Simple problems of this type, with not too many actors, not too many different situations, and not too complex law like processes, sometimes can be analytically solved through mathematical analysis. For instance, current probability theory is powerful enough to predict what will happen with a gambler possessing a given amount of money, who plays roulette against the bank, and has as strategy to set an equal amount of money each round on the outcome "red".

However, simulation becomes indispensable as soon as the complexity of the problem defies our mathematical skills, for example what is happening when 30 gamblers play roulette, all with a different start capital and different (though fully specified) gambling strategies. It may be that the outcome is after all probabilistically determined, but the necessary analysis to find that outcome is too difficult as yet. A well-known characteristic that increases complexity considerably is when the various agents are located in geographical space. The old maxim "*processes occurring in two-dimensional space are four times as difficult to understand*" comes to mind. Simulation may be used then to observe *what* happens *if* those agents are governed by those analysis-defying rules. As such simulation may be seen as continuation of analytical mathematical work with other means.