

# 'Situating' Simulation for Theory Testing

**UCGIS Research Workshop on Computation & Visualization for the Understanding of Dynamics in Geographic Domains**

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# Motivation and Challenges

- Model human behavior and dynamic interactions involved in street robbery event
  - Micro/Situation and Macro/Societal levels
- Identify:
  - Modeling tool able to accommodate:
    - Heterogeneous individuals
    - Autonomous decision-making
    - Dynamic interactions
    - Impact of environment on behavior
  - Individual-level data

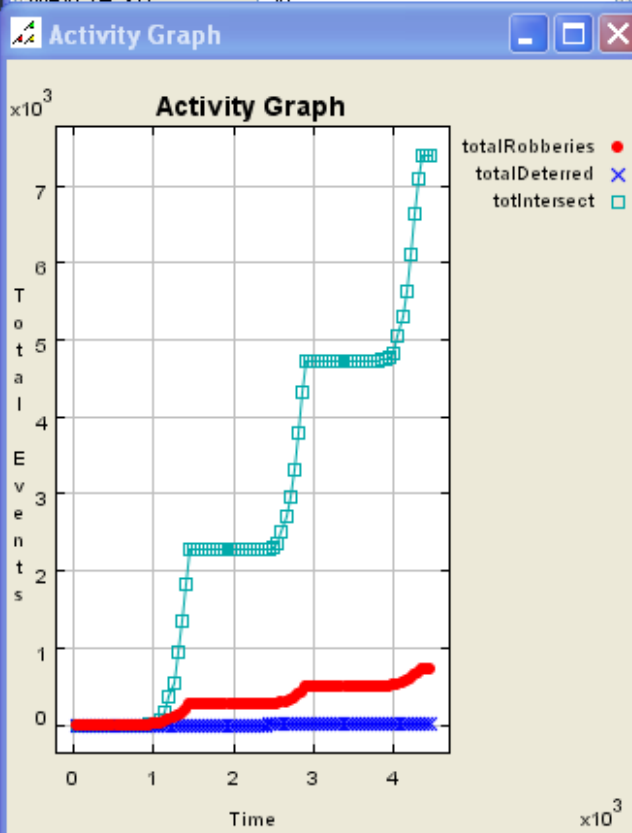
# Approach

- Use simulation – agent-based modeling
- Focus is not for prediction
  - Elaborating on the theory (Albrecht, 2005; Eck, 2005; Macy and Willer, 2002)
  - Artificial society based on theoretical assumptions
  - Do model-produced outcomes match theoretically-predicted outcomes?
  - Systematically vary one aspect, examine outcome
- Identify core elements and relationships in two main components:
  - Decision to commit a crime (Cohen and Felson, 1979; Clarke and Cornish, 1985)
  - Represent routine activity spaces of individuals (Hägerstrand 1970:1975; Huisman and Forer 1998; Kwan 1998; and Miller 1991)

# 'Situating' Simulation

- Role of space is typically overlooked in ABM (Brown et al, 2005; O'Sullivan and Hacklay, 2000)
  - Run on artificial landscapes
- Answer: Agent Analyst
  - Combines
    - ArcGIS
      - Organizes spatial data and spatial operations
    - RepastPy
      - Rapid application development environment
      - Organizes temporal data, individual decision-making
- Integration of ABM/GIS
  - Agent movement on vector network
  - Development of empirically-based activity spaces

Parameters		Custom Actions	Repeat Actions
Model Parameters			
AGENTS:	1000		
COPS:	200		
Cops:	DefaultGroup		
MAX_GUARDIANSHIP:	2		
MAX_SUITABILITY:	1		
MIN_GUARDIANSHIP:	-2		
MIN_SUITABILITY:	-1		
NUM_PLACES:	16035		
REPEAT:	60		
SOCIETAL_TIMEAWAY:	0.3		
WEALTH_MEAN:	50		
WEALTH_SD:	20		



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### Layers

- strnodes2
  - totalRob
    - 1 - 2
    - 3 - 5
    - 6 - 9
    - 10 - 14
    - 15 - 28
- strnodes2
  - totalVisit
    - 1 - 271
    - 272 - 917
    - 918 - 2043
    - 2044 - 3724
    - 3725 - 5832
    - 5833 - 7996
    - 7997 - 9999
- Criminals
  - crimStart
    - 1
- Citizens
  - citiStart
    - 1
- Cops
  - copStart
    - 1
- nodes
  - 1
- strnodes2\_bu
  - 1
- a527emonodesoath

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# Conclusions

- Method enables:
  - Investigation of how 'real' environments affect behavior
  - Controlled, repeatable experiments in virtual laboratory
  - Tests that would be unethical with humans
  - Replication and sharing of models
- Contribute to strengthening of theories prior to expensive empirical experiments
- Workshop Specific: Method applicable to other research questions
  - Can use it if you have ideas about how the world works but no empirical data about human behavior

# Thanks!

- Questions? Comments?

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