



<http://i80.photobucket.com/albums/j198/horschj/bwreflections.jpg>

# Agent-Based Modeling of Urban Society and Interactions

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*TJHSST Computer Systems Lab, 2009-2010*

# Problem

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- ❖ Agent-based modeling allows tests that can't be performed in reality
- ❖ Topics such as epidemics can be studied in depth
- ❖ Relies on a simulation that correctly emulates the real world

# Project Overview

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- ❖ Create an agent-based simulation of a city
- ❖ Give agents “personalities” and schedules that guide their motions
- ❖ Allow interaction between agents
- ❖ Grow agents' social networks
- ❖ Explore “spread” scenarios:
  - ❖ Introduce virus to study effects on population and effectiveness of quarantine methods
  - ❖ Observe the spread of specialized knowledge through the community, and its effect on the emergent behavior of the entire society

# The Program

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- ❖ Loads a single file with pointers to all the key pieces
- ❖ Enables modularity to produce a variety of diverse simulations
- ❖ Keeps scenario-dependent code separate from the main program

# Agents

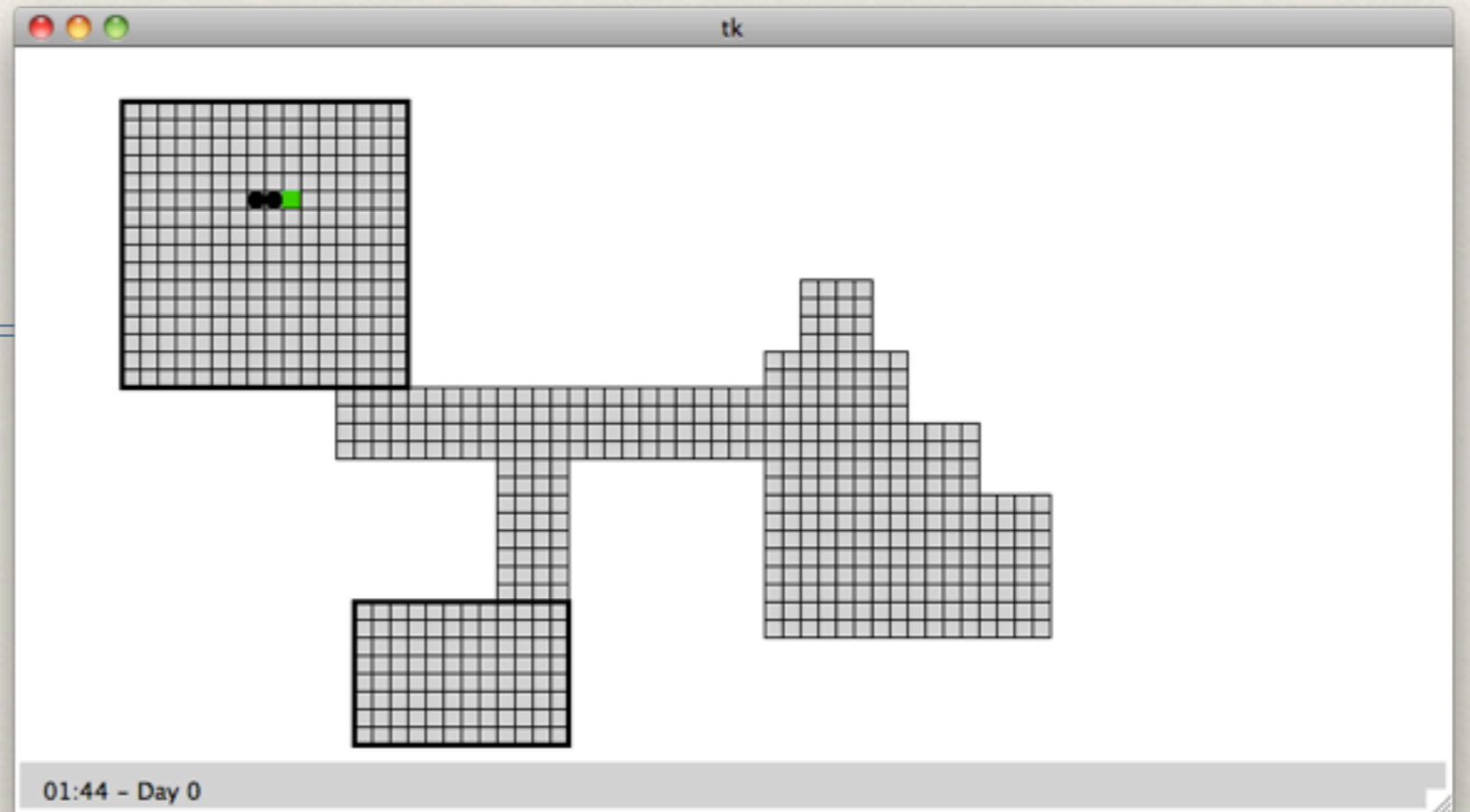
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- ❖ Know who they are, what they like, and where they should be
  - ❖ Identity
  - ❖ Personality characteristics
  - ❖ Schedule
  - ❖ Unique knowledge (locations of special buildings, etc.)
- ❖ Interact with each other and with items and places on the map

# World

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- ❖ Provides places for agents to travel
- ❖ Contains different types of terrain
  - ❖ Roads
  - ❖ Buildings
  - ❖ Seating places
  - ❖ Custom terrain



# Schedules

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- ❖ Unique for each agent
- ❖ Specify where agents need to be at different times
- ❖ Can define a specific set of coordinates or a building to travel to
- ❖ Repeated with each new day

# Sample Schedule

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-8:00 OFFICE-A

At 8:00 AM, the agent heads to work at OFFICE-A

-12:00 RESTAURANT

At noon, the agent heads out to lunch at RESTAURANT

-13:00 OFFICE-A

At 1:00 PM, the agent heads back to work

-15:00 OFFICE-B

At 3:00 PM, the agent heads to a meeting at OFFICE-B

-16:00 OFFICE-A

At 4:00 PM, the agent heads back to OFFICE-A

-17:30 STORE

At 5:30 PM, the agent leaves work for the STORE

-18:00 BUILDING-ZZ

At 6:00 PM, the agent heads home to BUILDING-ZZ

-20:00 BUILDING-W

At 8:00 PM, the agent heads to a party at BUILDING-W

-22:00 BUILDING-ZZ

At 10:00 PM, the agent heads back home.



# Simulation

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- ❖ Loads a map and a set of agents
- ❖ Internally acknowledges which parts of the map are specified as buildings
- ❖ Initializes agents and places them on the map
- ❖ Runs the model, updating agents with each time step

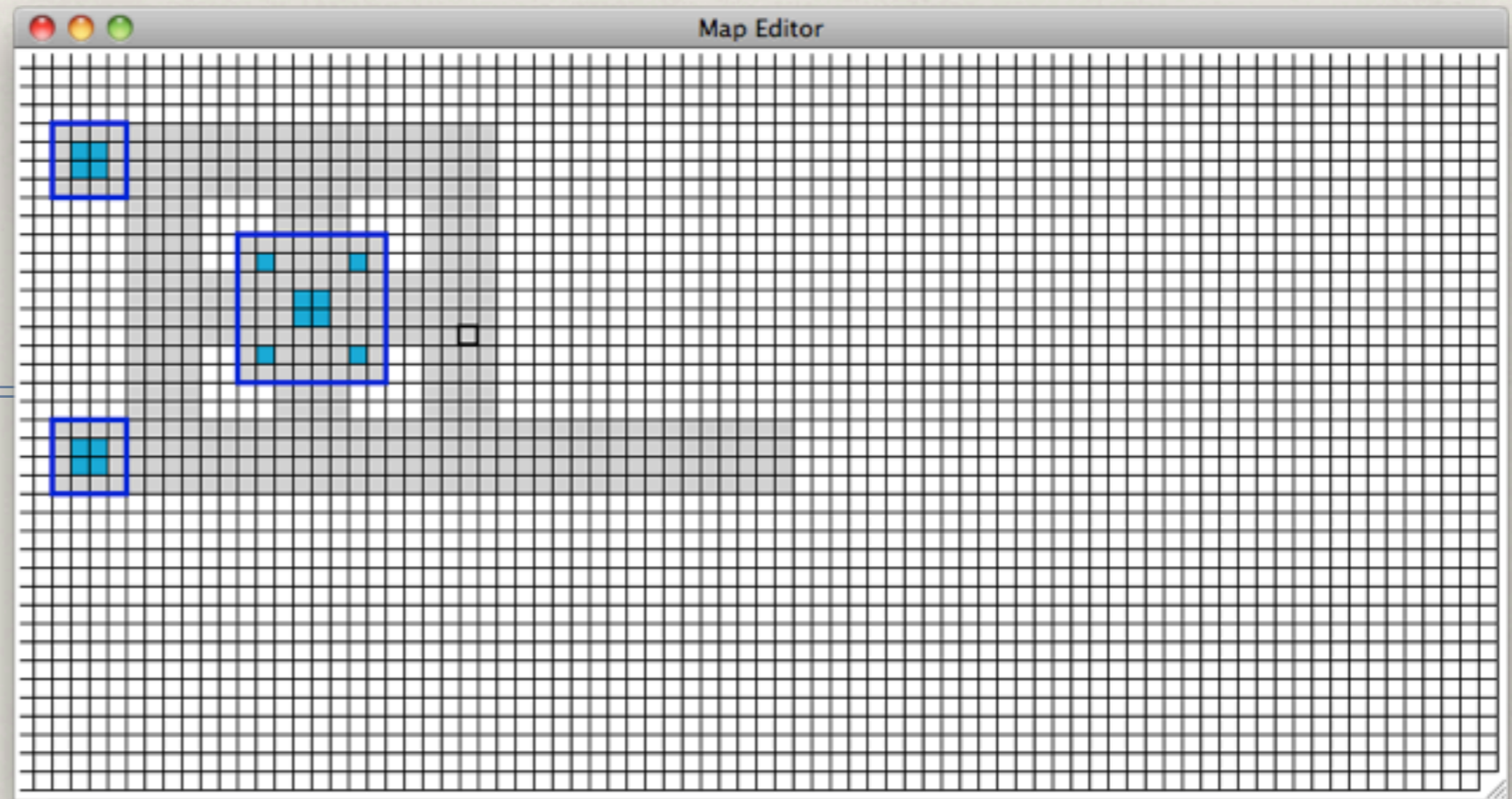
# The “Secret Building” Test

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- ❖ Agents were given schedules that told them to go to a secret building at noon each day
- ❖ However, agents did not know where this building was located
- ❖ One individual was given the location of the building, and the ability to tell others about it
- ❖ Knowledge of the building’s location spread, creating a “secret society” of agents who were in-the-know
- ❖ Separated society in the same way a viral infection does

# Map Editor

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- ❖ Allows the creation of worlds with buildings and various terrain types
- ❖ Includes saving, loading, and printing of maps

# Experiments

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- ❖ Interaction-limiting experiments
- ❖ Compared the impacts of quarantine methods versus self-containment
- ❖ Found that the instinct for self-preservation was just as effective as part-time quarantines in limiting the spread of a virus