

# Rebuilding New Orleans: An Agent-Based Modeling Approach

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# Questions:

- How do you jump-start an urban economic system that has had its supply of housing devastated?
- And, how do you build an adequate urban housing supply if the economic and job-base that supports it has been destroyed?

# Big Issue:

- Since a city that is in the early stages of development or re-development consists of structures that generate path dependent behavior, the decisions made today will determine how the city will look in the future.

# So:

- Use agent-based modeling (ABM) to examine policies aimed at rebuilding New Orleans.
- Especially the idea of utilizing an organization such as Habitat for Humanity to run an Employer of Last Resort (ELR) program to build houses.

# Characteristics of ABM:

- Bounded rational agents (e.g., people, households, businesses, institutions, government entities) follow simple rules and interact with each other and their environment.
- Both the agents and the environment can adapt due to their interactions.

# Characteristics of ABM:

- The resulting behavior of an ABM is:
  - emergent
  - path dependent
  - nonergodic
- Spatial implications are also important

# Katrina Model

- Currently under development
- Two types of agents:
  - Households
  - Habitat for Humanity workers

# Katrina Model

- Factors taken into account by household agents:
  - Are the levees fixed?
  - Was my house damaged?
  - Is my house insured?
  - Are any of my former neighbors rebuilding their house?
  - Do I have a job?
  - Am I willing to work for Habitat for Humanity?

# Katrina Model

- Habitat for Humanity agents can:
  - Rebuild a house regardless of the percent of near-by houses that have been rebuilt
    - This option enables the city to overcome the unwillingness of displaced residents to return & rebuild unless others have returned and rebuilt
  - Rebuild a house that is uninsured
  - Hire unemployed citizens and put them to work building houses

# Katrina Model

- Overall New Orleans employment is assumed to increase at 5% per year once 40% of the housing stock has been rebuilt
- This effect feeds back to the housing sector as displaced residents will return if they have employment opportunities

# Scenario 1

- Habitat for Humanity builds houses for those who are uninsured
- Households will return to New Orleans if:
  - The have employment
  - The levees have been fixed
  - A significant percentage of their neighbors have returned and rebuilt

# Scenario 1

Import Map    setup    go

number-of-houses 318

number-of-damaged-hous... 286

percent-with-insurance 50

percent-willing-to-return 50

percent-employed 50

percent-ELR-willing 50

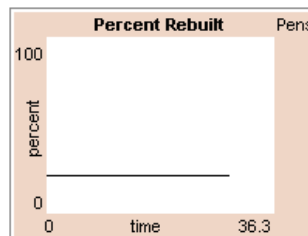
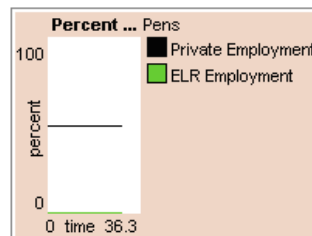
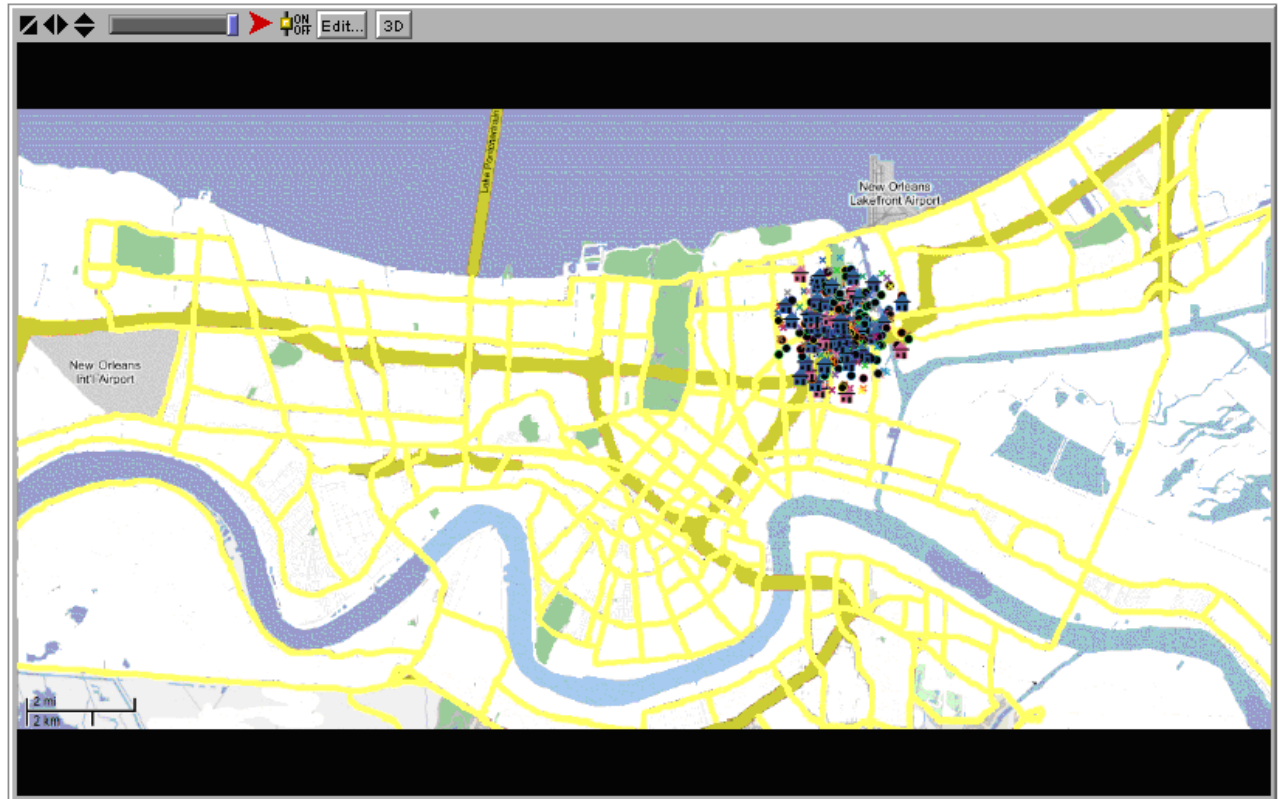
number-of-habitat-agents 50

number-of-city-agents 0

percent-I-want-fixed-nearby 50

On  Off habitat-builds-actively

On  Off habitat-acts-as-ELR



# Scenario 1 - Results

- 21% of the houses are rebuilt
  - Insured houses that are rebuilt are shown in blue
  - Uninsured houses that are rebuilt are shown in pink
- Employment remains at its initial value of 50% b/c the threshold for redevelopment is not reached.

# Scenario 2

- Same as scenario 1 except that Habitat for Humanity builds houses regardless of the percent nearby that have been rebuilt

# Scenario 2

Import Map   setup   go

number-of-houses 318

number-of-damaged-hous... 286

percent-with-insurance 50

percent-willing-to-return 50

percent-employed 50

percent-ELR-willing 50

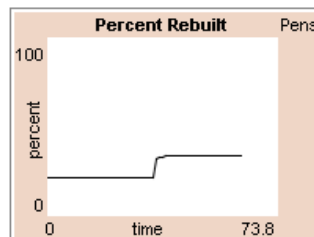
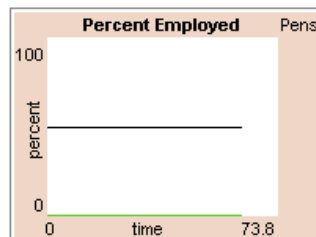
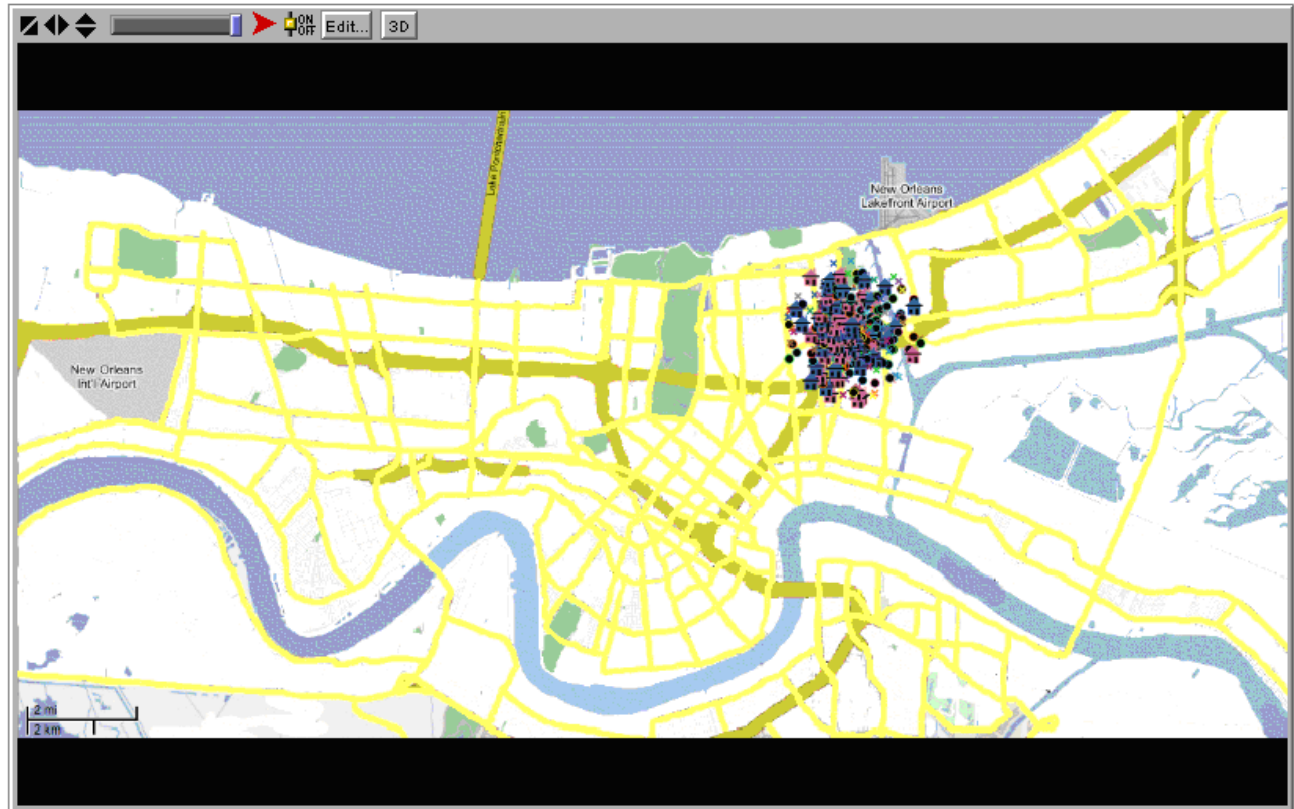
number-of-habitat-agents 50

number-of-city-agents 0

percent-I-want-fixed-nearby 50

On  
 Off   habitat-builds-actively

On  
 Off   habitat-acts-as-ELR



# Scenario 2 - Results

- Redevelopment ceases when 34% of the damaged houses have been repaired
  - There is insufficient insurance, willingness to return, and employment to kick-off the redevelopment multiplier

# Scenario 3

- Same as scenario 2 except that Habitat for Humanity is allowed to act as an employer of last resort
  - A significant percentage of households agree to work as homebuilders for Habitat for Humanity

# Scenario 3

Import Map   setup   go

number-of-houses 318

number-of-damaged-hous... 286

percent-with-insurance 50

percent-willing-to-return 50

percent-employed 94

percent-ELR-willing 50

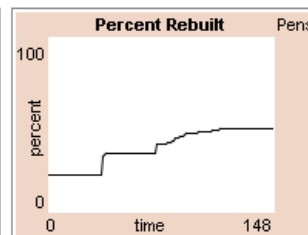
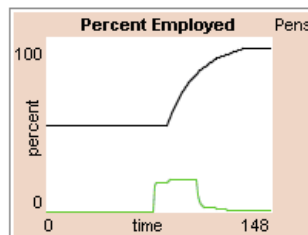
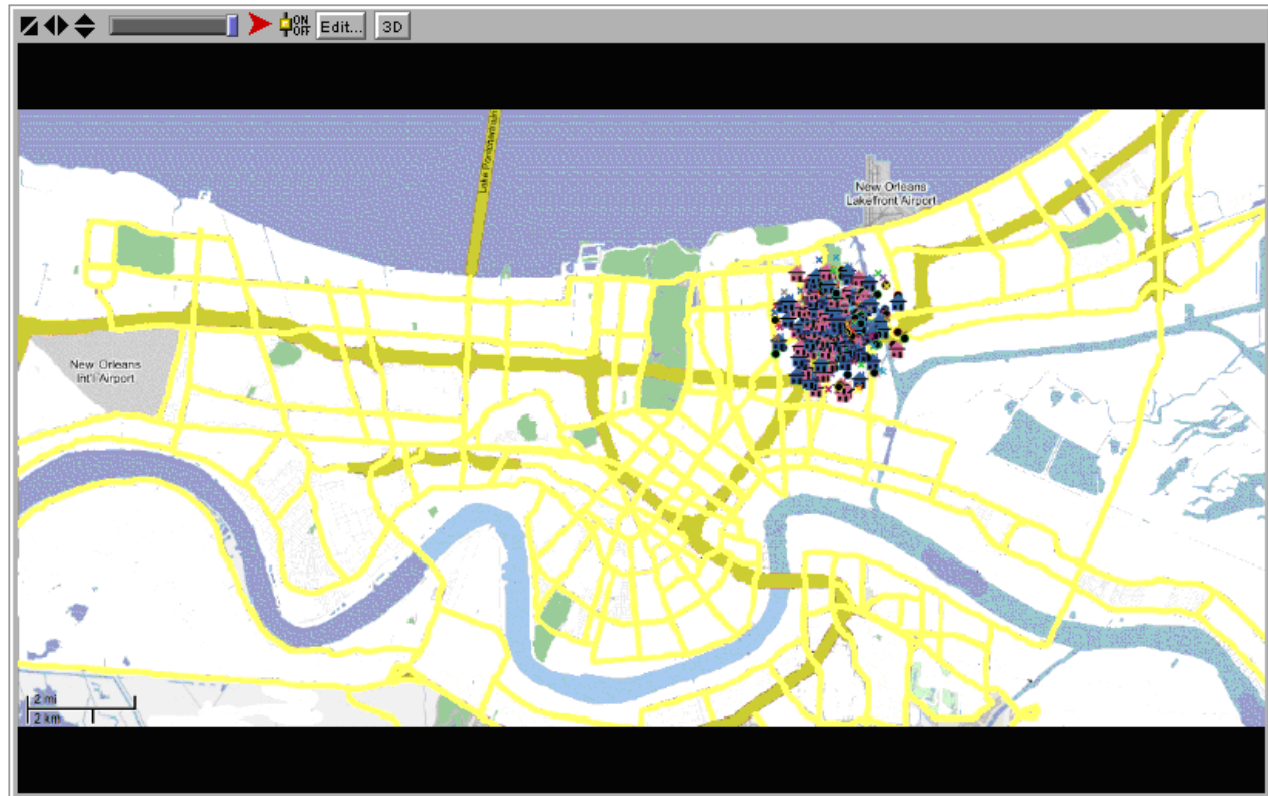
number-of-habitat-agents 50

number-of-city-agents 0

percent-I-want-fixed-nearby 50

On    Off   habitat-builds-actively

On    Off   habitat-acts-as-ELR



# Scenario 3 - Results

- ELR policy increases redevelopment, thereby generating sufficient demand to increase employment and spur further demand
- ELR program employment eventually declines as the private sector hires workers away
- Redevelopment is total as model assumed only 50% of displaced residents were willing to return

# Preliminary Conclusions

- Initial conditions matter:
  - Willingness to return (levees)
  - Degree of damage
  - Insurance coverage
  - Job opportunities

# Preliminary Conclusions

- The distribution of initial city attributes matters:
  - The distribution of the damaged houses
  - The distribution of the damaged houses that are insured

# Preliminary Conclusions

- Limiting factors and thresholds matter
  - Percent of near-by houses that must be rebuilt before households return
  - Amount of redevelopment necessary before employment multipliers kick-in

# Preliminary Conclusions

- Habitat for Humanity cannot jump-start urban redevelopment by simply rebuilding uninsured houses. It must also run an ELR program.

# Future Research

- Parameterize the model with actual New Orleans data
  - Interface with GIS
- Add "entrepreneur agents"
- Richer decision making structure for household agents
  - Interviews; Surveys
  - Realistic expectation structures

# Future Research

- Household agents look for “kindred spirits” and form groups before rebuilding
- Add “local government agents” who will make public infrastructure and public service location decisions
- Put model on web & ask for feedback