Agent Analyst

An agent-based modeling extension for spatial environments

Java

```java
public class Main {
  public static void main(String[] args) {
      System.out.println("hello world");
    }
}
```

Python

```python
print("hello world");
```

https://belitsoft.com/java-development-services/java-vs-python-tried-and-true-vs-modern-and-new

What is an agent?

- A discrete, individual element (i.e. person, animal, water, delivery truck, tree, etc.)
  - Has properties and take actions/makes decisions in the model
  - Constraints placed on action ability (e.g. physical surroundings, social structures, or resources)

- Input data as point, polygon, or raster

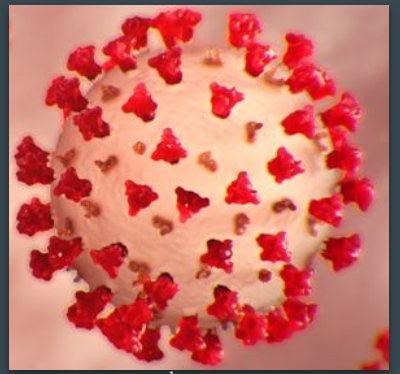
Agent-based modeling, a bottom-up approach

- Identify causes behind patterns
  - via aggregation of actions from individual agents
- Assumes that agents act in bounded rationality with local information
  - Surroundings or databases to serve as libraries
- Environmental Factors
  - Physical, social, etc.
- Chronological factors
  - Synchronous/asynchronous

Possible Uses with Spatial Data

- Animal migration and movement
- Crime occurrence or responses
- Response to natural disaster (fire, flood)
- Land-use or land-cover changes
- Demographic distribution and segregation
- Pathogen spread
- Optimize operations such as timber harvest
- Traffic analysis, air-traffic controls
- Utility/service distribution flows
- and on and on...

https://en.wikipedia.org/wiki/Piranga



cdc.gov

The modeling with Agent Analyst

- First step is to identify agents
  - represent the phenomenon and contribute uniquely

- Second is to have agents take action
  - parameters are defined in fields which looks much like an attribute table
  - most relevant possibilities need to be assessed for the model

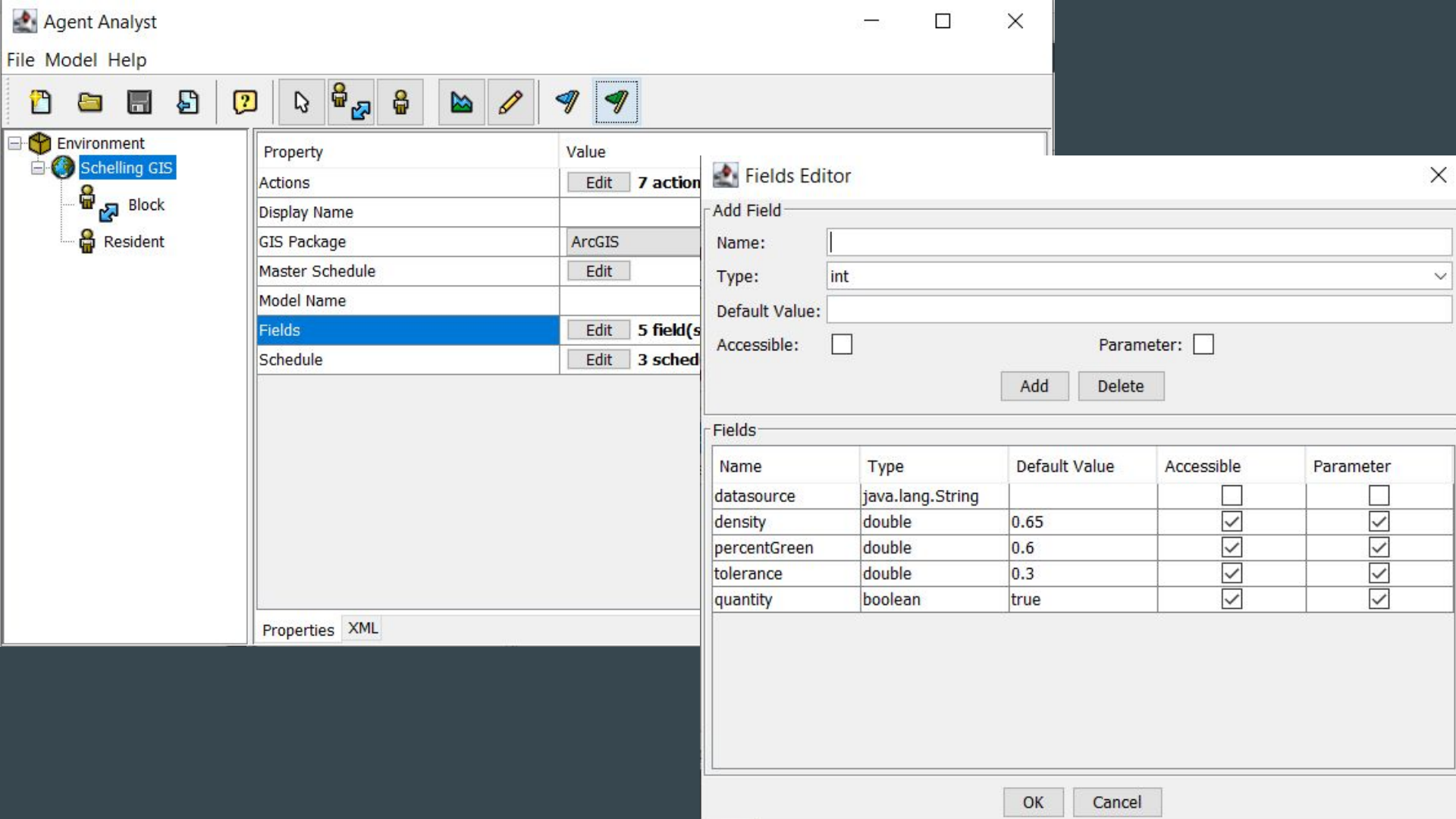
The modeling with Agent Analyst

- Each action/decision is made during a chronological interval, Time Step
  - Each time step, an action is taken by the agent

- Accessed via geoprocessing environment (toolbox, model builder, or programming script)

ArcMap steps

- Have layer files that will be used in the model
- Create an arcmap mxd file for the project
- Add a toolbox to contain the model
- Create the Agent Analyst Model within the toolbox
- Edit the model parameters
- Run the model


Agent Analyst
File Model Help
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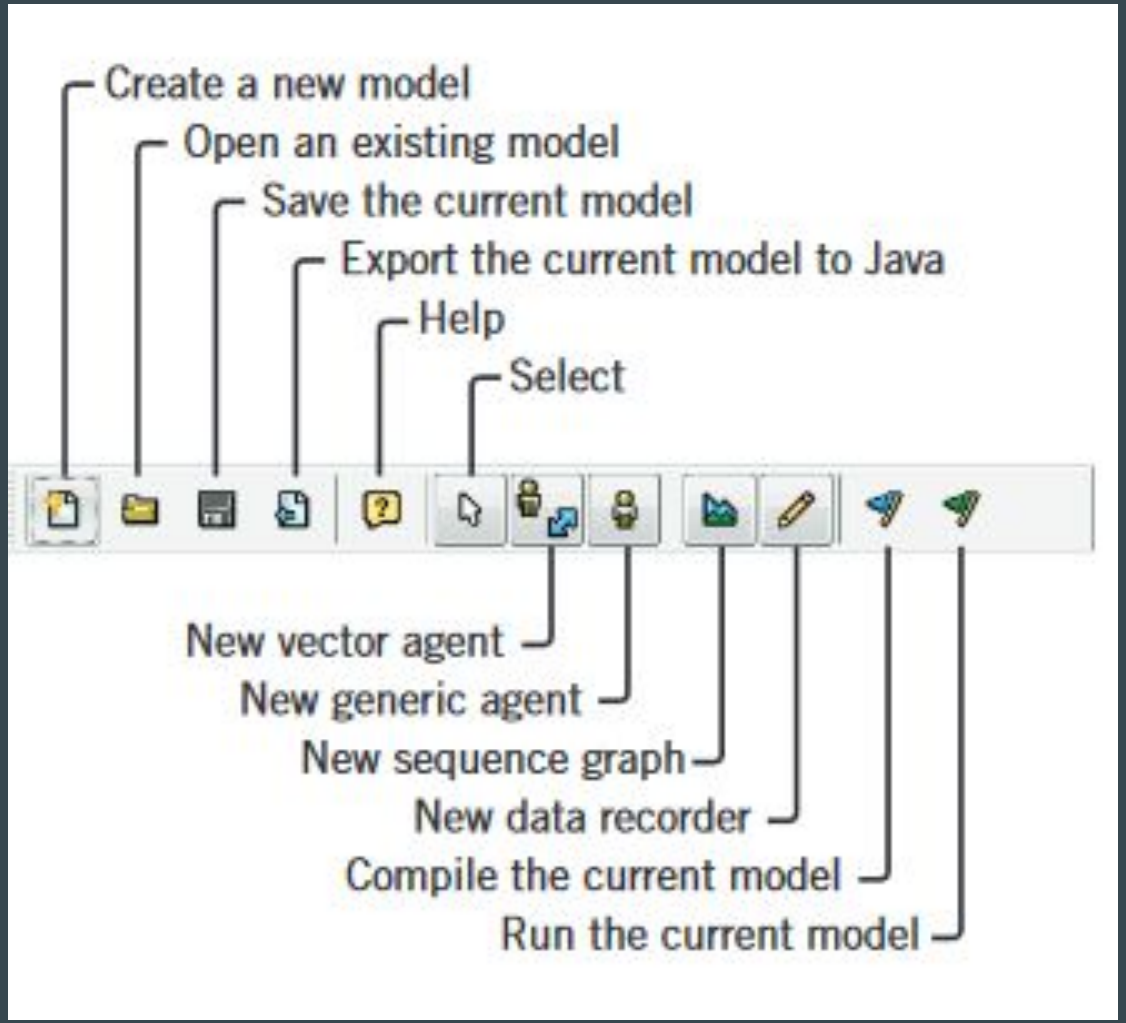
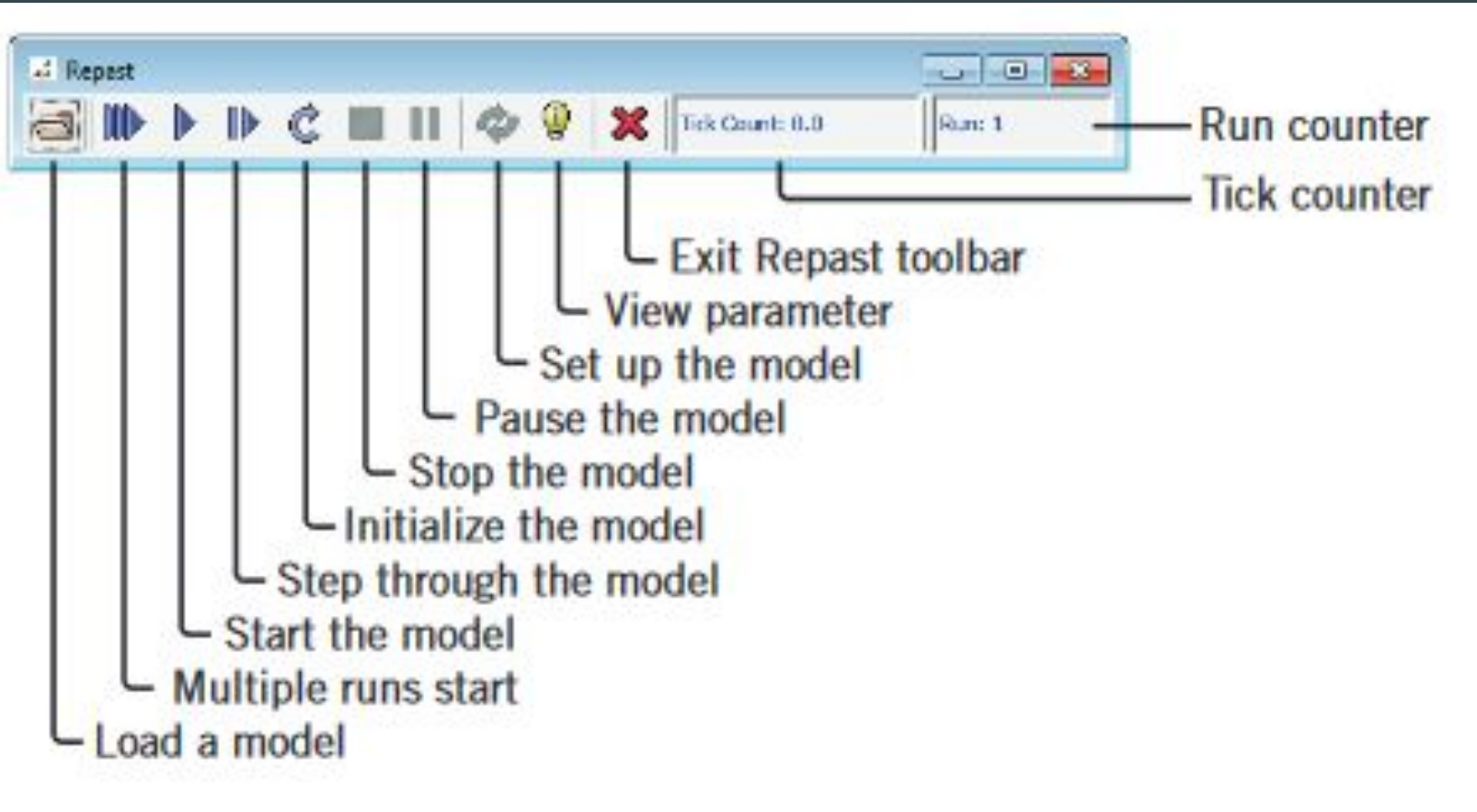


(Johnston, 2013)



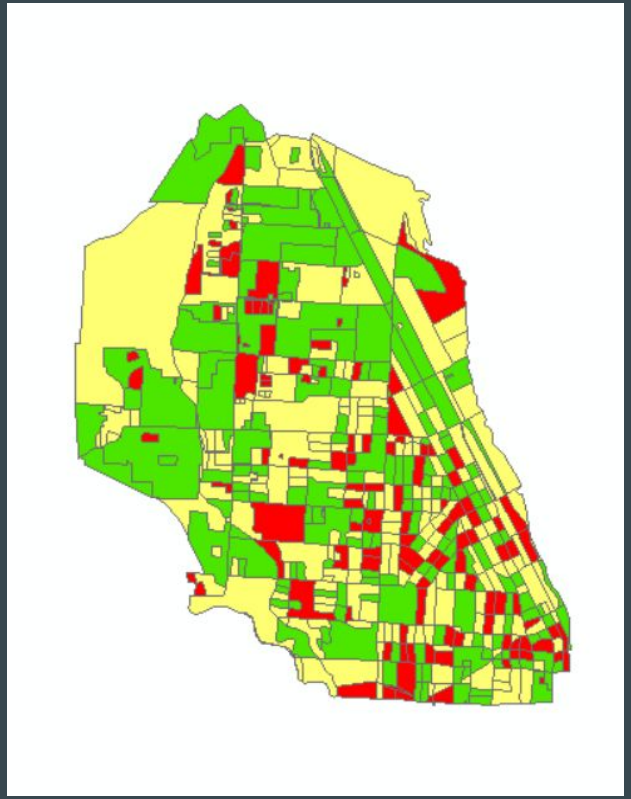
(Johnston, 2013)

Possible Application

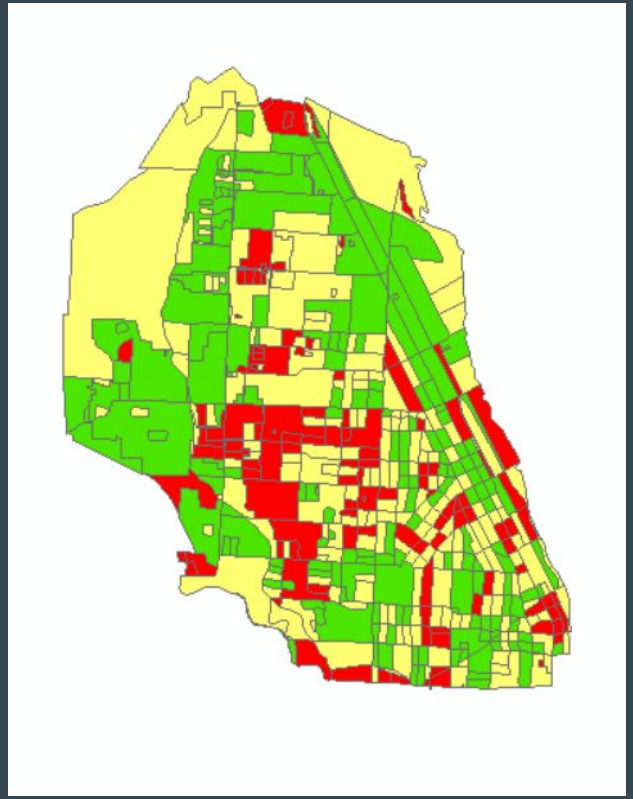
- Urban Planning or Legislation
  - Population demographics, gentrification, and segregation/congregation

- Look at the Extension in ArcMap Desktop

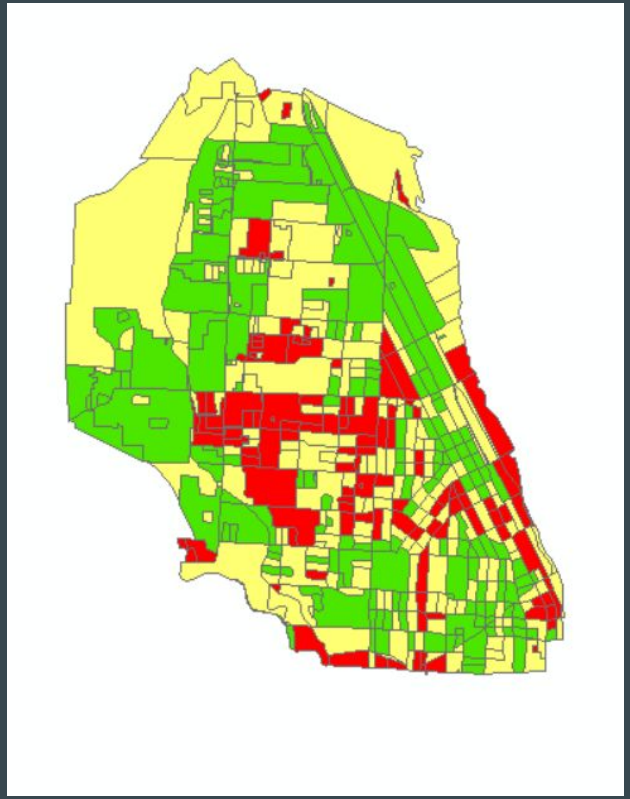
Residents set to tolerate 30% of their neighboring blocks as different
Which was found to be the neutral threshold value in a segregation study (Benenson & Torrens, 2004)



Start of Model

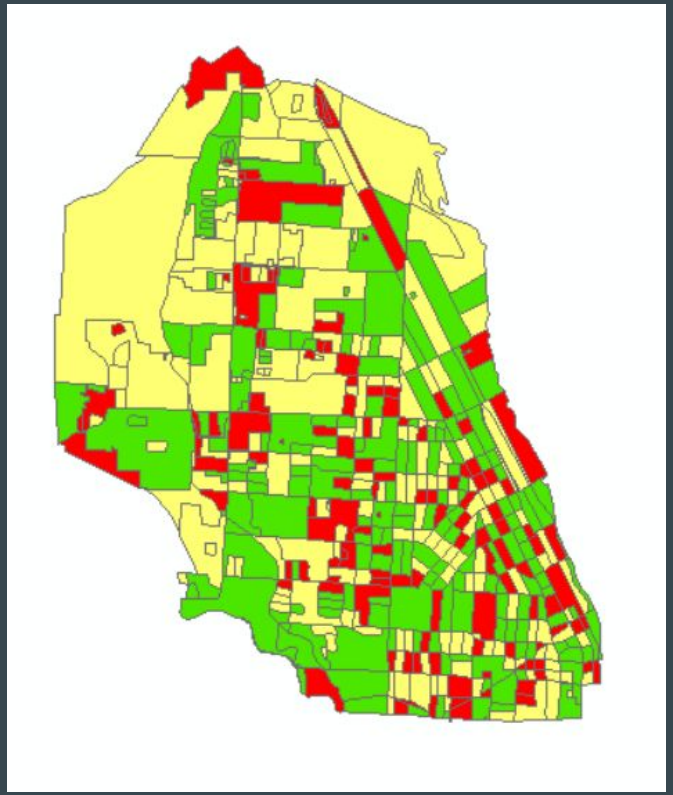


After 5 intervals

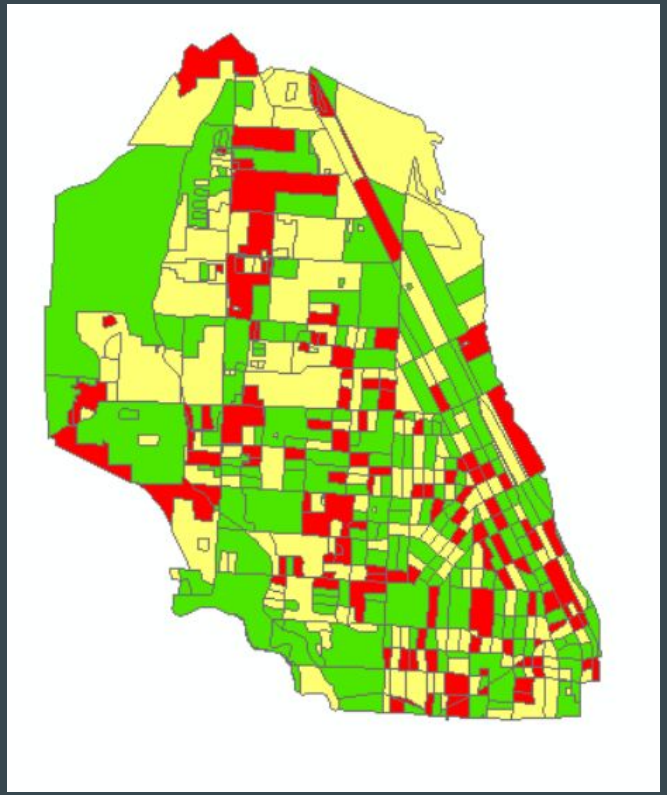


After 25 intervals
No more moves

Residents set to tolerate 80% of their neighboring blocks as different

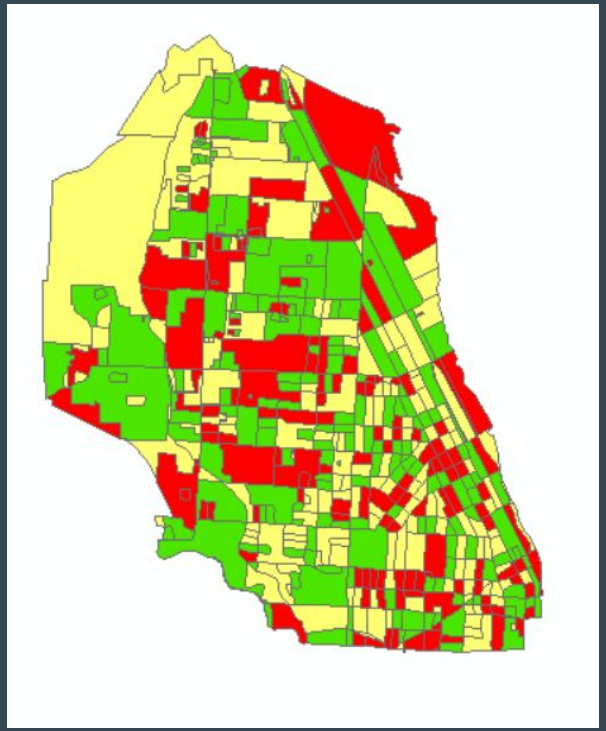


Start of Model

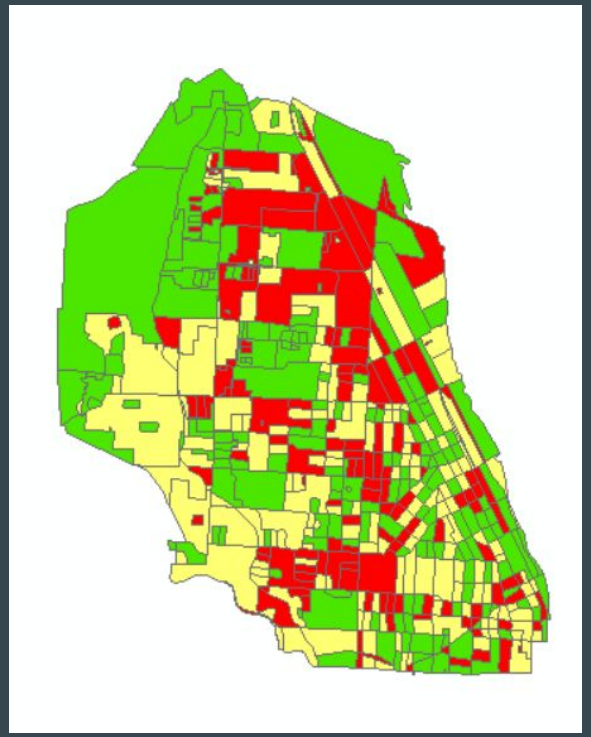


After 5 intervals
No more moves

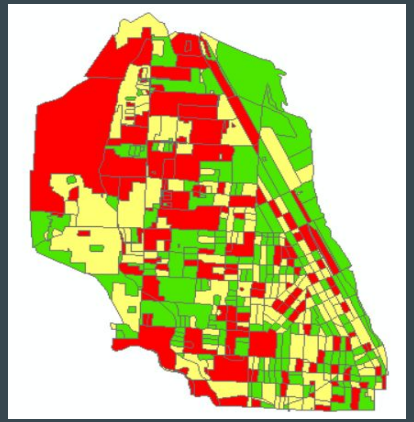
Residents set to tolerate 10% of their neighboring blocks as different



Start of Model

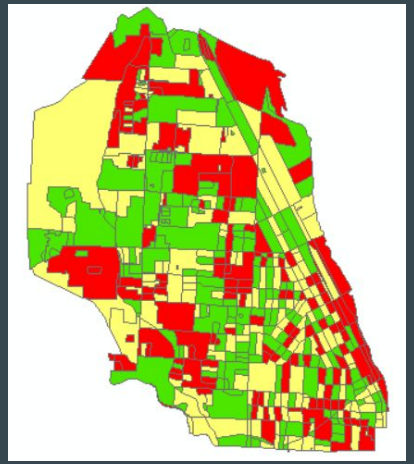


After 5 intervals



After 25 intervals

No pattern



After 35 intervals

No pattern

Never Satisfies

References

- Benenson, I., and P. M. Torrens. (2004). Geosimulation: Automata-based Modeling of Urban Phenomena. Chichester, West Sussex, England: Wiley.

- Johnston, K. M. (2013). Agent Analyst: Agent-based modeling in ArcGIS®. http://resources.arcgis.com/en/help/agent-analyst/pdf/AgentAnalyst.pdf

- Rand, Bill [Complexity Explorer]. (2016 June 26). Agent-Based Modeling: What is Agent-Based Modeling? [Video file]. Retrieved from https://www.youtube.com/watch?v=FVmQbfsOkGc

Thank You

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Any Questions?