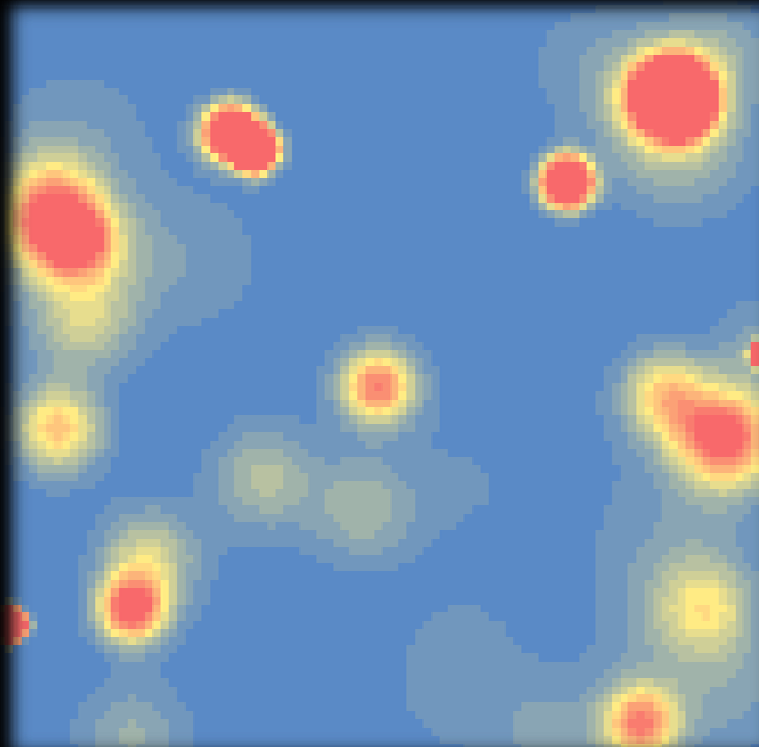


August 9, 2007

Kenn Tevin's



# MODIFIED BURGLARY CODE

# Objective

- Making burglar's movement more realistic
- Reasons:
  - Restricted movement is more realistic
- Changes:
  - Created a neighborhood around each burglar
  - Changed the way burglars are relocated
  - Gave experience values to each burglar

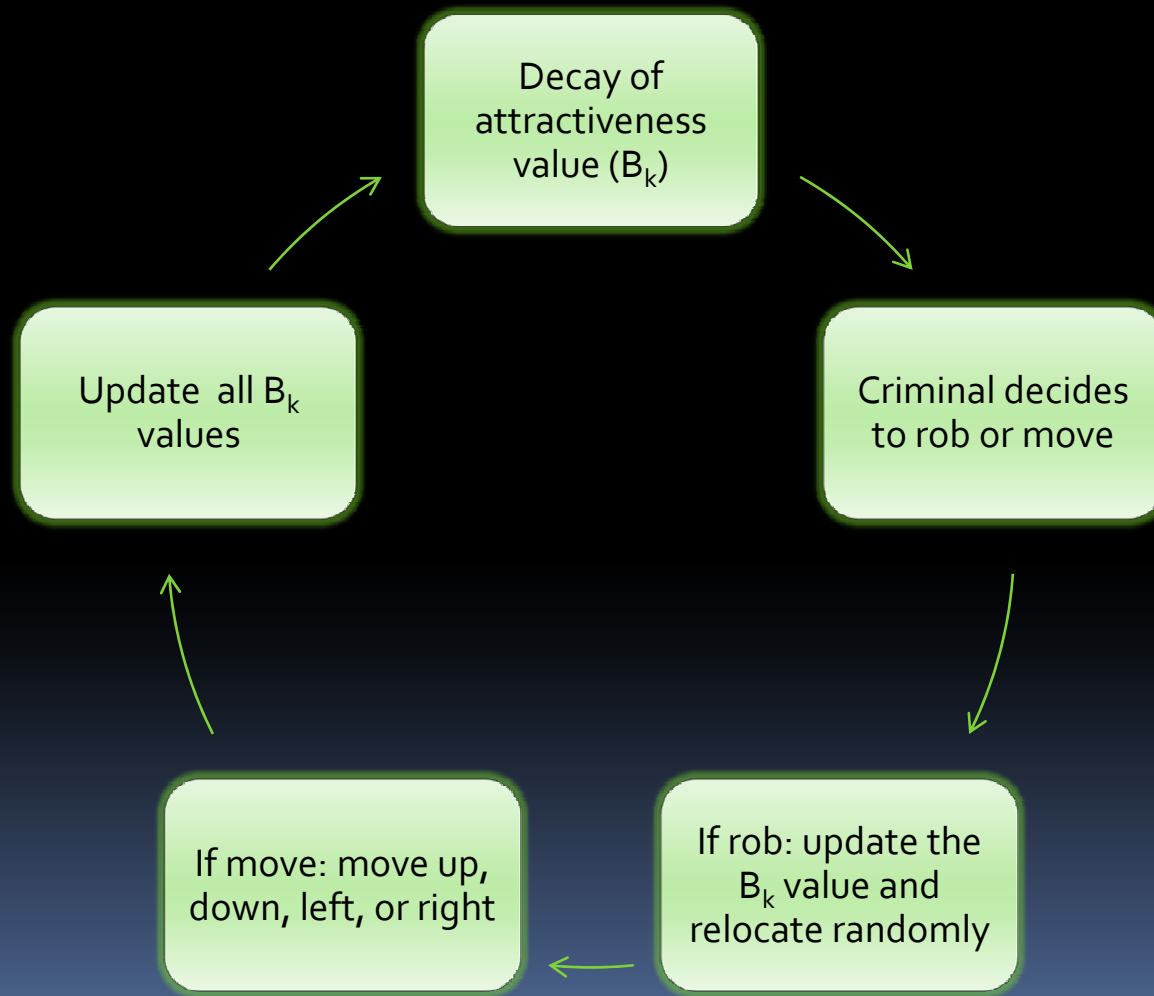
# Other Improvements

- Used 2-dimensional arrays
- Added output-to-file capability
- Created a new color scheme
- Exported to Excel and plotted some graphs

# Some Functions

- Decay Function:
  - $B_k = (1-LAMBDA) * B_k$
- Burglary Function:
  - $B_k = B_k + DELTA$
- Neighborhood Function:
  - $B_k = ETA * B_k + (1-ETA) * (\text{Sum of } B_{neighbor})$

# Old Code



# New Code: Neighborhood

- Radius Component
  - Initial Radius
  - Maximum Radius
  - Movement is restricted within current radius
- Experience Level
  - Increase in radius of sight after a successful burglary

# New Code: New Relocation

- After a successful burglary...
  - Does not relocate
  - Relocate back to home
  - Relocate to a random location within home radius

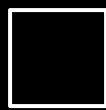
# New Code: Cleaning Up

- Color Scheme:



Low Attractiveness

High Attractiveness



Burglarized Location



Burglar's Home Location



Burglar's Home Location

- 2-Dim Array:

- Rows

- Columns

# New Code: Final Product

## Initialization

### Table Information

- Number of criminals
- Grid size

### Criminal Characteristics

- Initial location (Home)
- Current location
- Radius of sight

### House Characteristics

- Initial attractiveness values

## Running

### Step 1: Decay

- Decay of attractiveness values ( $B_k$ )

### Step 2: Criminal

- Burglarize
  - Increase  $B_k$  value
  - Relocate criminal randomly within the radius
  - Update radius of sight
- Move
  - Compute  $A_k$  values to determine direction of movement
  - Move up, down, left, or right

### Step 3: Attractiveness

- Compute new  $B_k$  values

## Display

### House Locations

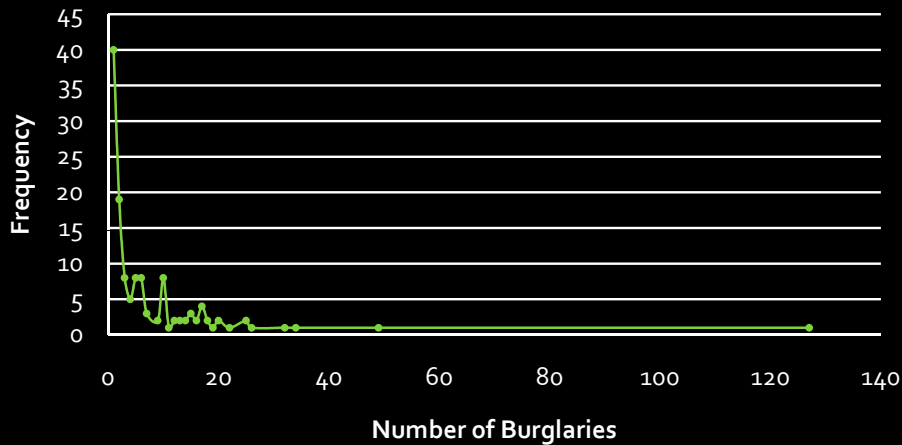
- Attractiveness values ( $A_k$ )

### Key Locations

- Burglarized locations
- Criminals' current locations
- Criminals' home locations

# Excel: Old Code (1)

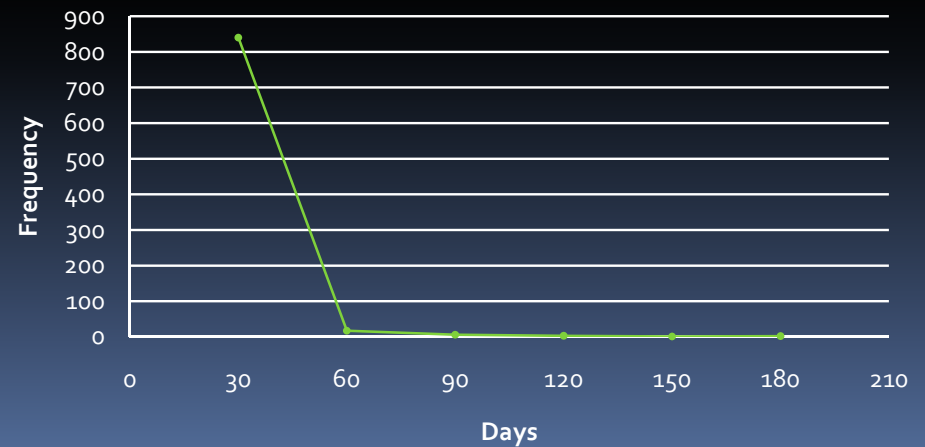
## Number of Repeated Burglary



Initial A	0.1
Initial B	0
Epsilon	0.01
Delta	100
Eta	0.5
Lambda	0.1
Relocation	None

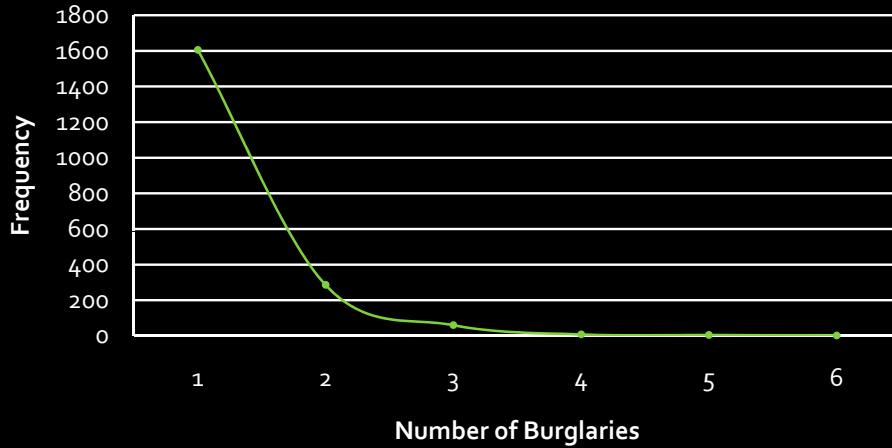
Grid Size	100 x 100
Number of Criminals	50
Initial Radius	50
Radius Change	0
Maximum Radius	50

## Duration of Repeated Burglary



# Excel: Old Code (2)

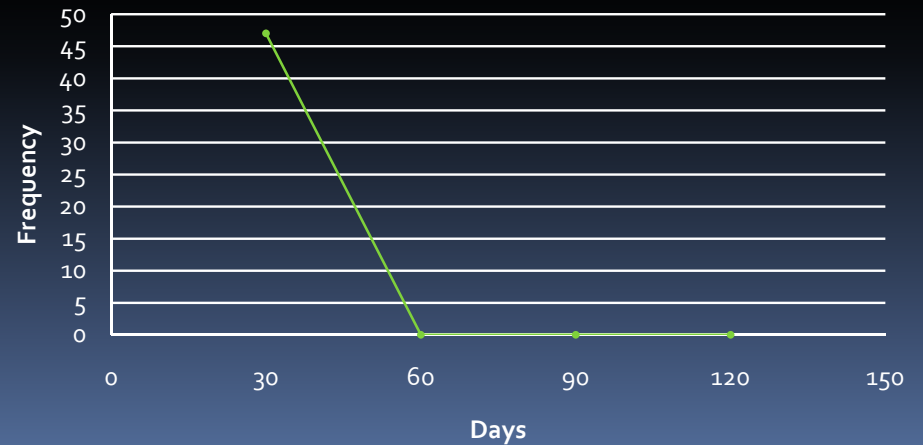
## Number of Repeated Burglary



Initial A	0.001
Initial B	0.0
Epsilon	1.0
Delta	1.0
Eta	0.5
Lambda	0.01
Relocation	Random

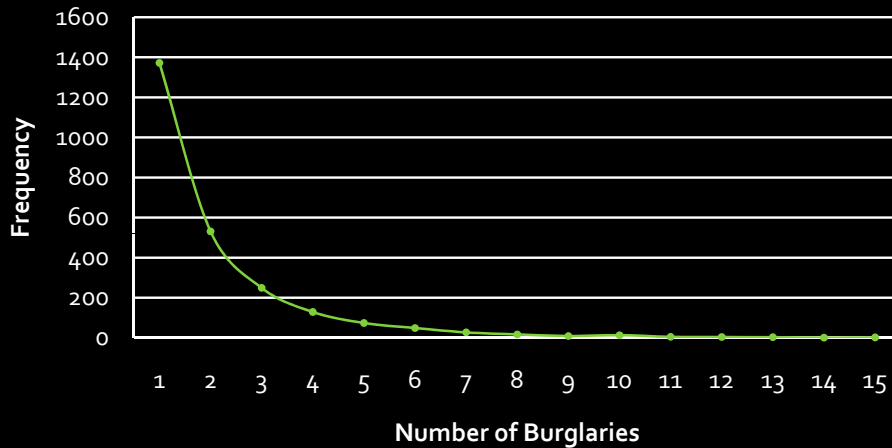
Grid Size	100 x 100
Number of Criminals	50
Initial Radius	100
Radius Change	0
Maximum Radius	100

## Duration of Repeated Burglary



# Excel: New Code ( $R_{\max}=10$ )

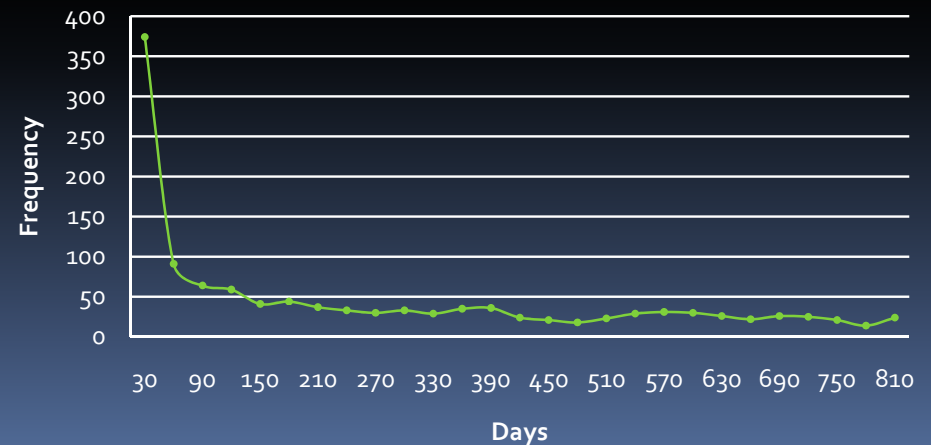
## Number of Repeated Burglary



Initial A	0.001
Initial B	0.0
Epsilon	1.0
Delta	1.0
Eta	0.5
Lambda	0.01
Relocation	Random

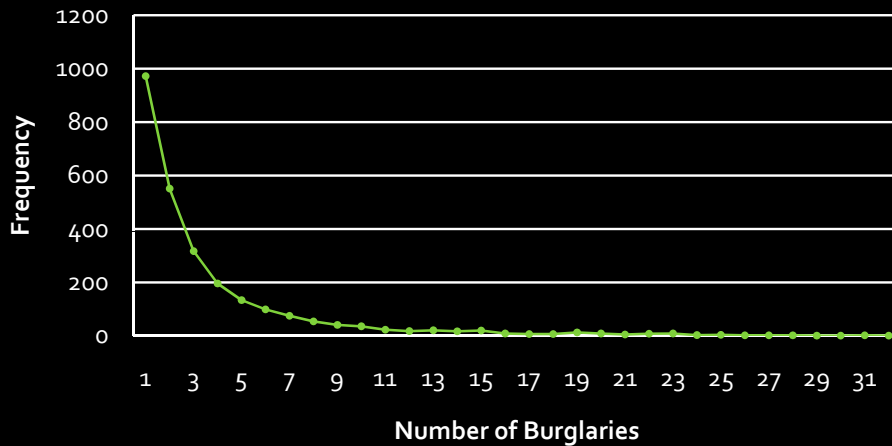
Grid Size	100 x 100
Number of Criminals	50
Initial Radius	3
Radius Change	1
Maximum Radius	10

## Duration of Repeated Burglary



# Excel: New Code ( $R_{max}=7$ )

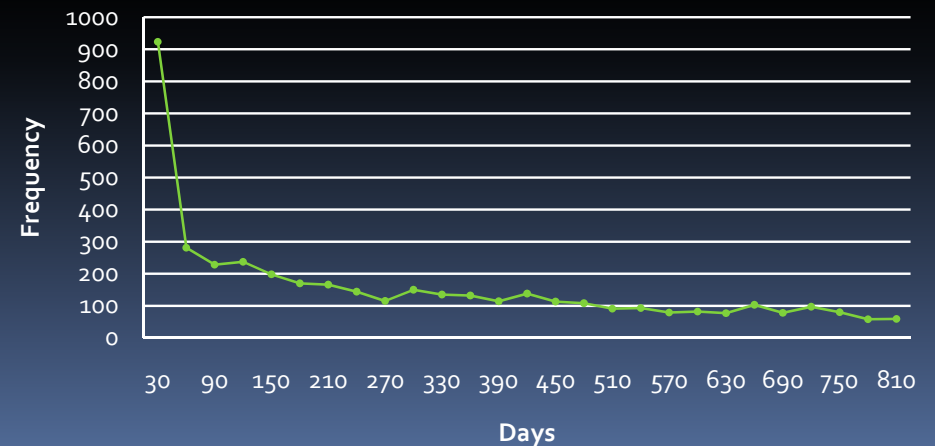
## Number of Repeated Burglary



Initial A	0.001
Initial B	0.0
Epsilon	1.0
Delta	1.0
Eta	0.5
Lambda	0.01
Relocation	Random

Grid Size	100 x 100
Number of Criminals	50
Initial Radius	3
Radius Change	1
Maximum Radius	7

## Duration of Repeated Burglary



# Conclusion

- Still need to be more rigorous in comparing different conditions
- Random relocation is more realistic than no relocation
  - Random relocation: A few sustaining hotspots, if any, but with a reasonable number of burglaries
  - No relocation: Sustaining hotspots, but an enormous number of burglaries
- Home relocation is similar to random relocation

# Conclusion

- Radius of Sight:
  - Introducing a radius component produces more repeated burglaries
  - Putting more radius restriction results in more burglaries

# Further Research

- Test criminals each starting with different characteristics:
  - Different radius functions
- Test houses with different characteristics:
  - Different initial attractiveness values
- Test different parameters of the attractiveness function with new model:
  - Especially  $\eta$  (ETA)

# Demonstrations



KennModFinal0809.exe



Any Questions?