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Social Network Analysis & Agent-Based Modeling

Overview & Applications for Community-Based Work

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Overview

- Introduction to social network analysis (SNA)
  - Examples & Applications
- Introduction to agent-based modeling (ABM)
  - Examples & Applications
- Integrated example of SNA & ABM

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Social Network Analysis

An approach to understanding social phenomena by examining the structure of relationships among entities

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Social network analysis: Building Blocks

Nodes:

Entities in the network

Examples:

People, non-profits, businesses, schools, airports, households

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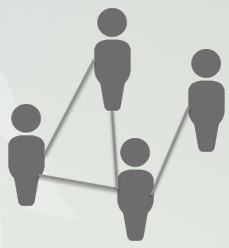
Social network analysis: Building Blocks

Ties (Edges):

The relationships among nodes



Examples:

- Friendships
- Non-profit referrals
- Business partnerships

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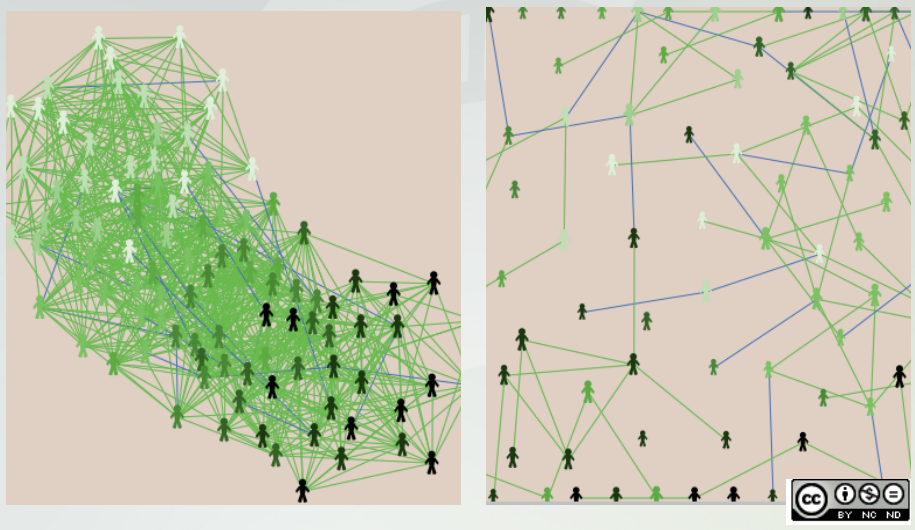
Network Structure: Density



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Network Structure: Centrality

- **Degree centrality:** number of ties a given node has
- **Betweenness centrality:** network bridging
- **Closeness centrality:** distance to other nodes

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A Brief Example

Nodes (dots):
community members

Ties (lines):
Friendships

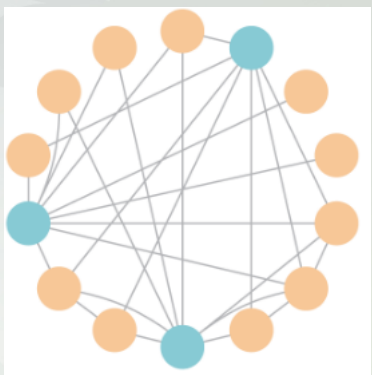

Image from the Washington Post

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A Brief Example

Colors represent opinions

Orange = pro-hats
Blue = anti-hats

Community members care about their friends' opinions!

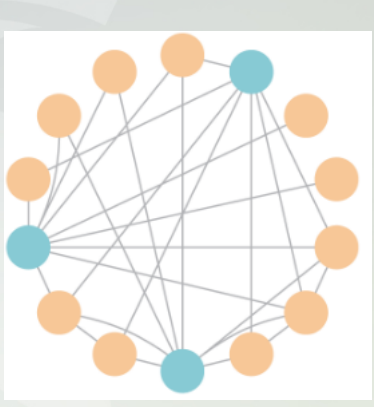

Image from the Washington Post

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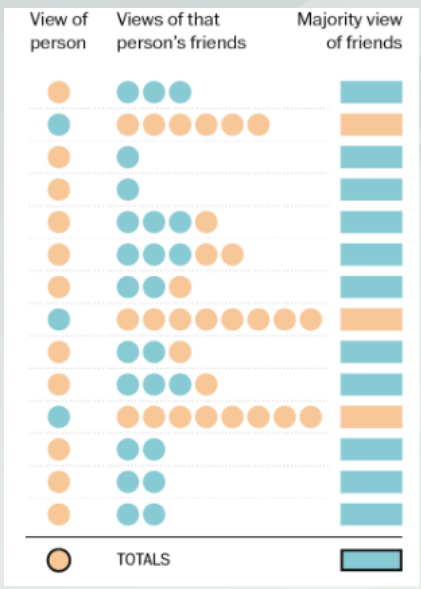
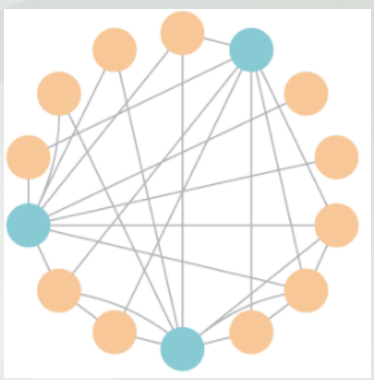
What the Network looks like to each person





Images from the Washington Post

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Applications for Community-Based Work

Reconnaissance:

Understanding community phenomena

Intervention:

What/where to target

Evaluation:

Collaboration/coordination

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Network Data & Analysis

- Challenges:
  - Difficult to collect sufficient data
  - Ethical issues
- Resource: PARTNER Tool

PARTNER

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A note on Modeling

- All of us are modelers
- The rise of an epidemic, traffic patterns, social problems
- Logic models, theories of change

“All models are wrong, but some are useful” – George Box

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What is Agent-Based Modeling?

Epstein (1999):

1. Heterogeneous agents interacting with each other and their environment
2. Agents follow simple rules
3. Generate large-scale phenomena

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Let's walk through an example…

Image: http://vignette2.wikia.nocookie.net/gaming-galaxies/images/c/ca/PVZ_Zombie_Suit.png/revision/latest?cb=20131101224657

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Heterogeneous agents interacting with each other and their environment

Heterogeneous:

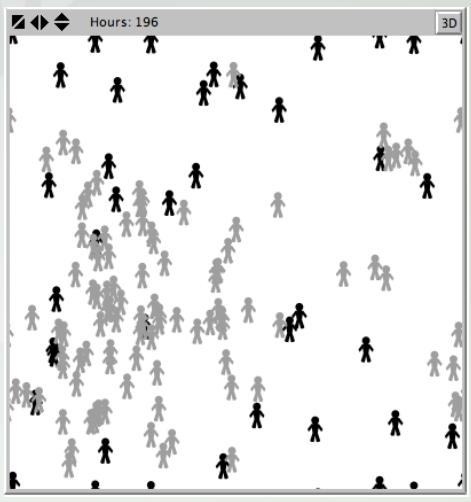
Each agent is unique

Autonomous:

No central committee

Environment:

Bounded space



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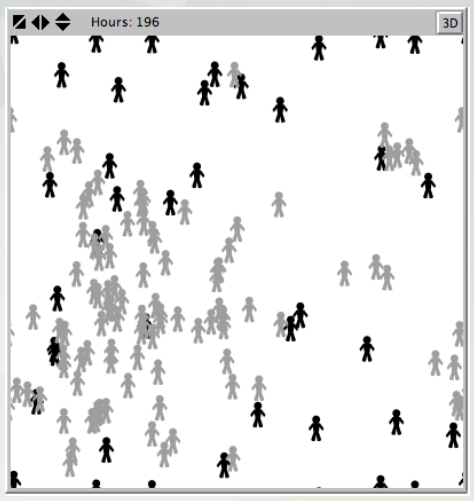
Agents follow simple rules

1. People always keep moving (and move faster than zombies)
2. If they encounter a zombie, they either kill it or turn into a zombie



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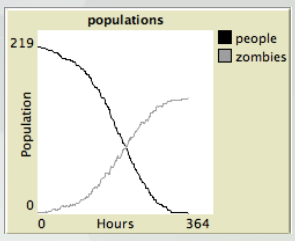
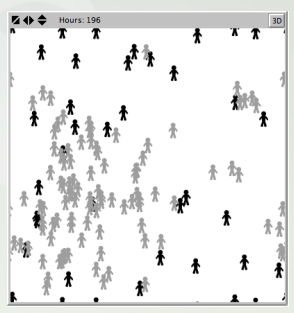
Generate large-scale phenomena

The spread of zombie-ism!





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Why use ABM?

- Represent multiple stakeholders' understandings of a problem
- Uncover assumptions
- Guide data collection
- Test potential effects of an intervention

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Generating ABMs

Modeling cycle (Railsback & Grimm, 2012)

Programmed using simulation software (Netlogo is great!)

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ABM & SNA are great on their own…

But even better together!

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Networked community change:

Modeling Information Sharing Networks in Community Change Efforts

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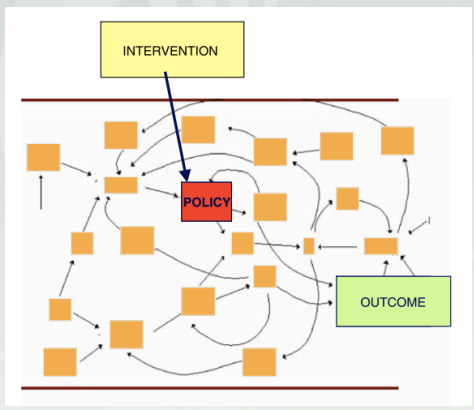
Community Change Efforts

Complex problems: e.g., homelessness, job access, educational attainment



Foster-Fishman, Nowell, & Yang (2007)

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Approaches to NCC

ABLechange
Simple rules. Small wins. Big changes.

Foster-Fishman & Watson, 2011

COLLECTIVE IMPACT FORUM

Kania & Kramer, 2011

Burns, 2007

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Commonalities

- Development of a common issue
- Choosing an organizing stakeholder
- Organizer behavior
- Stakeholder tie formation
- Learning

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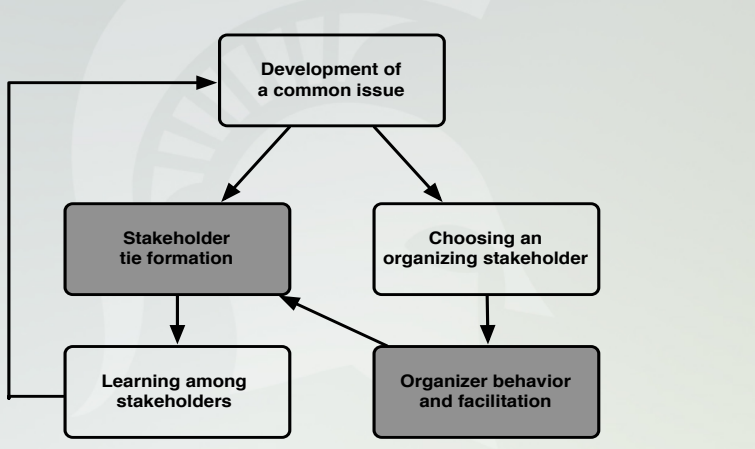
Social Networks & NCC



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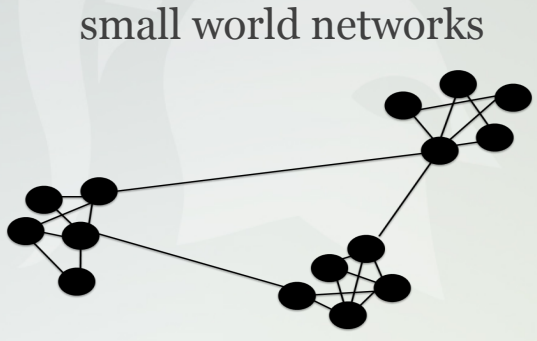
Social Networks & NCC

High clustering + Short paths =

small world networks



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Research Questions

To what extent does networked community change yield small world networks:

- Under ideal conditions?
- Under *less ideal* conditions?

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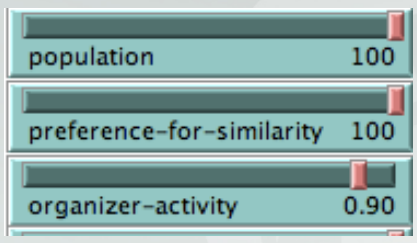
Agent-Based Model Parameters



100 Stakeholders

Manipulated:

- Homophily in tie building
- organizer activity

Measured:

- Small world quotient (Uzzi & Spiro, 2005)

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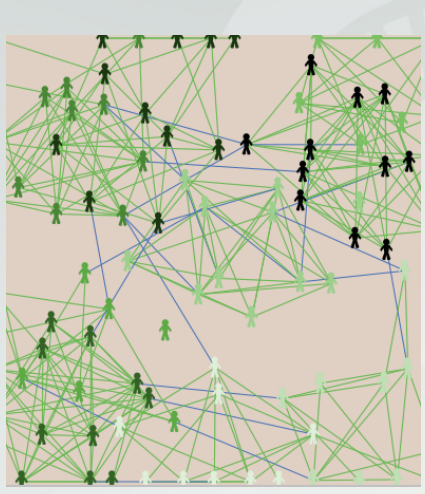
Model Process



Setup:

Stakeholders with interest values

On each iteration:

1. Participating stakeholders meet
2. Form ties or break ties?
3. Organizer forms a tie?

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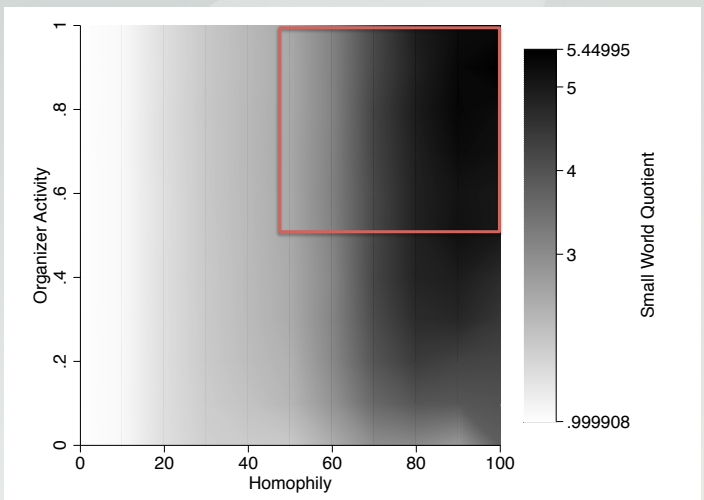
Findings: Ideal



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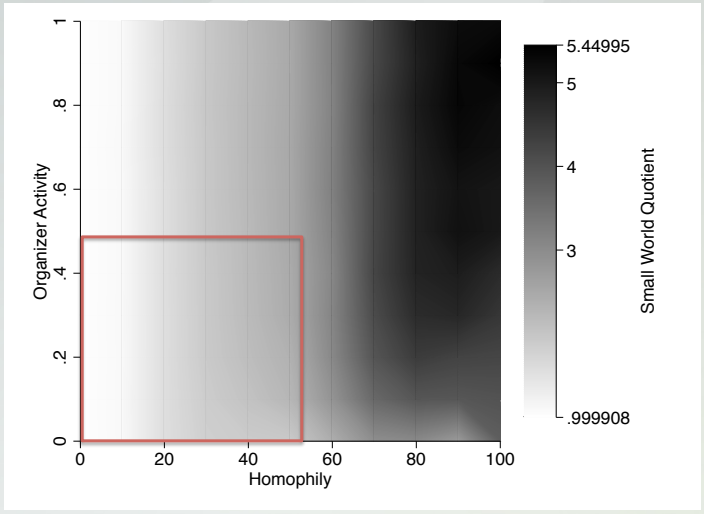
Findings: Less Ideal



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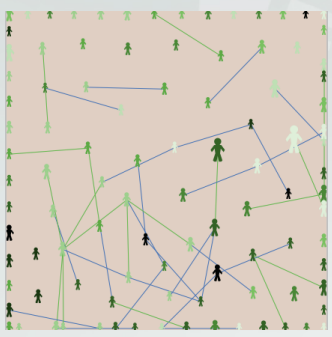
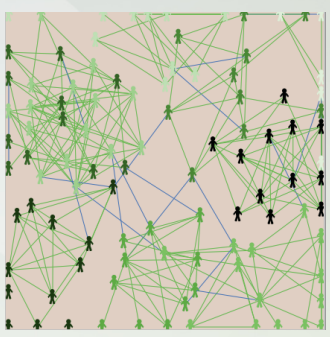
Findings: Challenges

Power Dynamics



Stakeholder Turnover



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Implications & Directions

- When the organizer and participants follow simple rules, small worlds are maximized
- Stakeholder capacity-building can provide support for the simple rules associated with NCC approaches
- Real-world circumstances often interfere with ideal processes

Future direction: a model that accounts for implementation challenges

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Questions & Comments?