

The Future of Urban Network Research

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<http://www.urbannetworks.org>

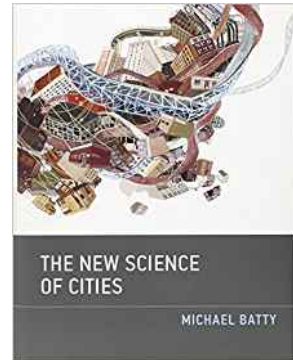
40 scholars, 14 Countries, social & natural sciences

Rapid growth in the size, scope, & scale of urban network research has left the area invigorated, but **without a clear agenda** for future work.

What should the research agenda include at the intersection of **urban studies & network science**?

Where are we now?

“...to understand **place**, we must understand **flows**, and to understand flows, we must understand **networks**.”



Batty (2013, p. 2-3)

IC-Relevant Topics

Economy – Identifying global & regional economic patterns

Transportation – Ensuring accessibility, robustness under failure/attack

Online social – Tracking spatial diffusion via geotagged posts

Offline social – Community cohesion, segregation, & polarization

Disciplines & Strengths

Physics – Big data, methodological sophistication

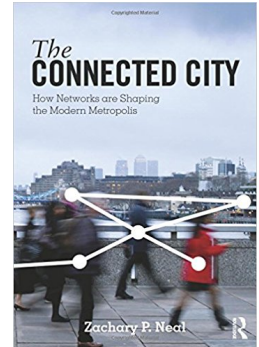
Geography – Spatial data & methods

Sociology – Theory re: human & group interaction

Urban Planning – Practicalities of infrastructure, policy

What is an urban network?

Why: Clarify when networks are a useful tool vs. methodological handwaving with pictures.



Neal (2013)

Issue 1: When can a matrix be treated as a network?

- Paths must matter
- Correlation matrices are not networks
- Original-Destination matrices are not networks

Issue 2: Not all urban networks are the same.

- Content matters
- Transitivity occurs in social networks of people
- Transitivity does not occur in infrastructure

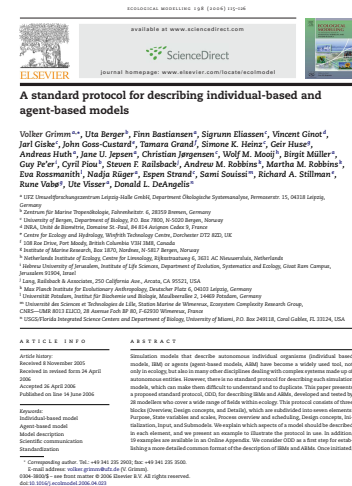
What should be reported?

Why: Facilitate data re-use & collaboration

Issue: The “network” is often presented as if it was a naturally occurring object. But, networks are simplifications, constructions.

Some solutions –

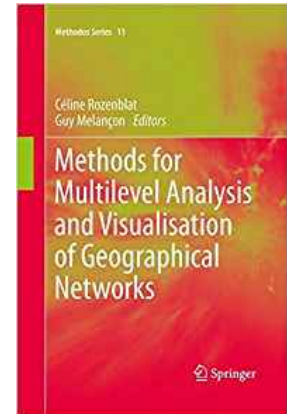
- Adopt minimum reporting standards for publication
- Node definition, measurement, validity
- Edge definition, measurement, validity
- Theoretical justification that paths matter *for these nodes and edges*



Grimm et al. (2006)

What does “multi-____” mean?

Why: Multiple forms of “multi-____” are relevant in complex urban systems, but there is no common language or methods for integration.



**Rozenblat &
Melançon (2013)**

Multi-_____ in urban networks:

Dimensional – Nodes are people, intersections, cities

Mode – People & intersections in the same network

Plex – Financial, Human, & Material flows between cities

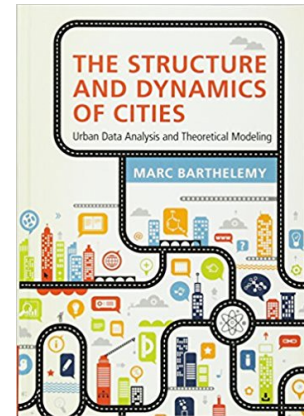
Scale – Intra-city, City-as-system, Inter-city

Level – Over-reliance on node-level analysis to date

LAYER – From GIS: Social network lays over street network

Is spatial special?

Why: Many network methods were developed from non-spatial graph theory. Do they still work when the networks are embedded in space?



Barthelemy (2017)

Some Issues –

- Conventional community detection does not work in spatial networks. They almost always find proximate clusters.
- Conventional statistical null models do not account for spatial embedding.
- Conventional summary statistics (e.g. clustering, path length) do not fully describe spatially embedded networks.

Next Steps from Ghent

Publication

Handbook of Cities & Networks (under contract with Edward Elgar)

Special Issue of *Journal of Urban Affairs* on “Cities, Networks, & Urban Policy” (accepting submissions now)

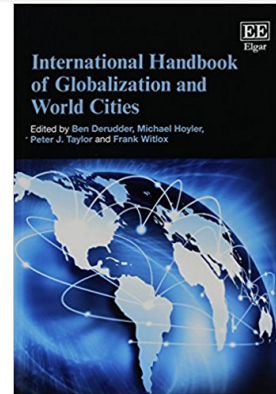
Special Issue of *Networks and Spatial Economics* on “Intersections of Urban Studies & Network Science” (accepting submissions now)

Special Issue of *Urban Studies* on “The Future of Urban Networks”

Funding

Seeking funding to support a recurring urban network symposium

Seeking funding to support collaborations started at Ghent symposium



Derudder et al. (2015)

Summary

The current situation –

- Ghent symposium on The Future of Urban Networks
- Addressing IC-relevant topics, but without a clear agenda

Major Questions –

What is an urban network?
What does “Multi-X” mean?

What should be reported?
Is spatial special?

For the Intelligence Community –

How do we move the IC/Network Science conversation beyond Dark Networks/terrorism and Big Data/Twitter?

How can urban network research better inform intelligence on the **economy**, **transportation**, and online/offline **social** structure?