Urban Encounters of the 3rd Type

Vassilis Kostakos

Lab:USE, University of Madeira
HCII, Carnegie Mellon University

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3rd ICA Workshop on Geospatial Analysis and Modeling

Multidisciplinary research

I say Who's on first, What's on second, I Don't Know's on third.
Well then who's on first?
Yes.
I mean the fellow's name.
Who.
The guy on first.
Who.
The first baseman.
Who.
The guy playing...
Who is on first!
I'm asking YOU who's on first.
That's the man's name.
That's who's name?
Yes.
Well go ahead and tell me.
That's it.
That's who?
Yes.

-"Who is on first"

My community's approach

- Human computer interaction
- Pervasive / Ubiquitous computing

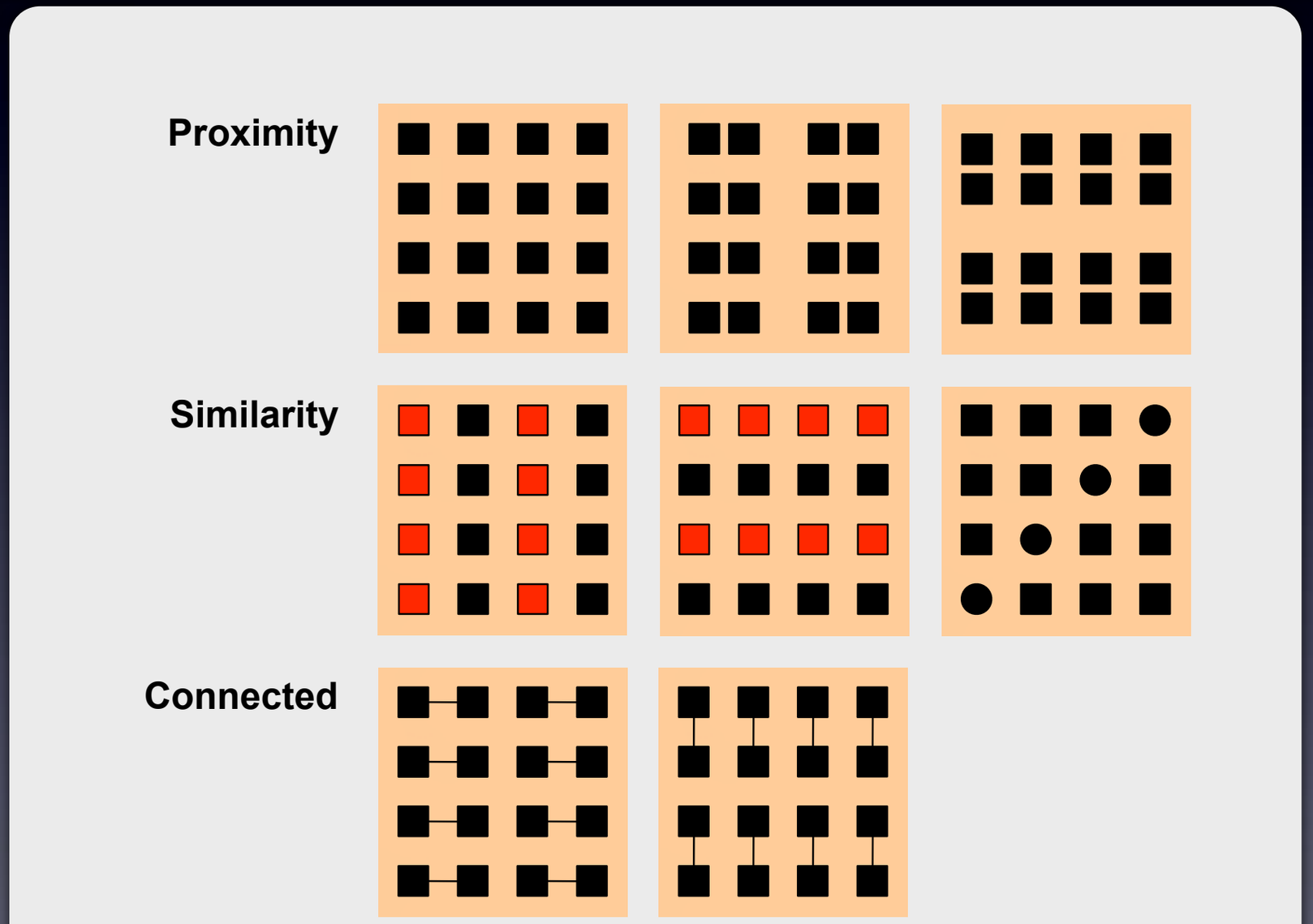
Human Computer Interaction 101

$

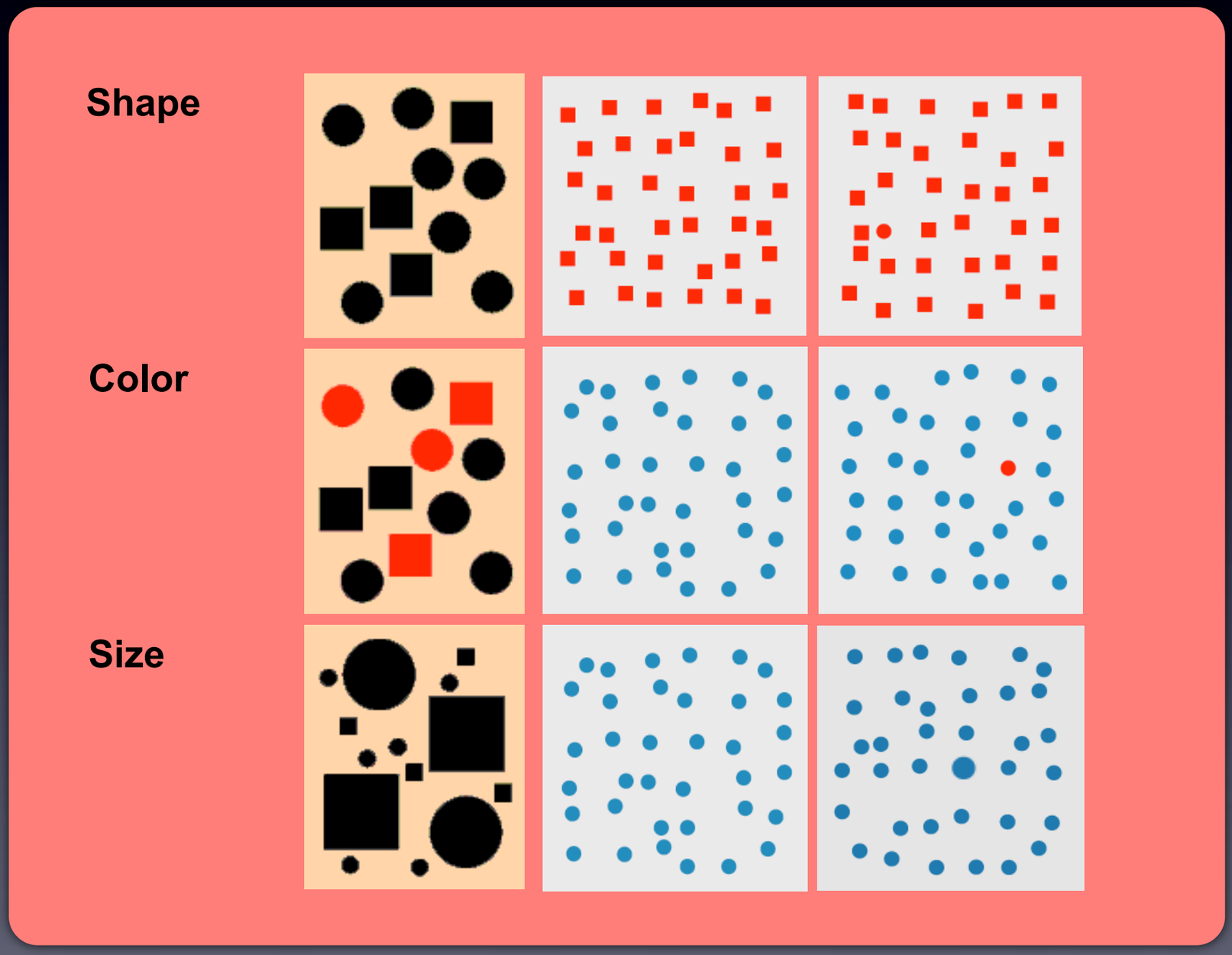
C:\>

1 user 1 computer

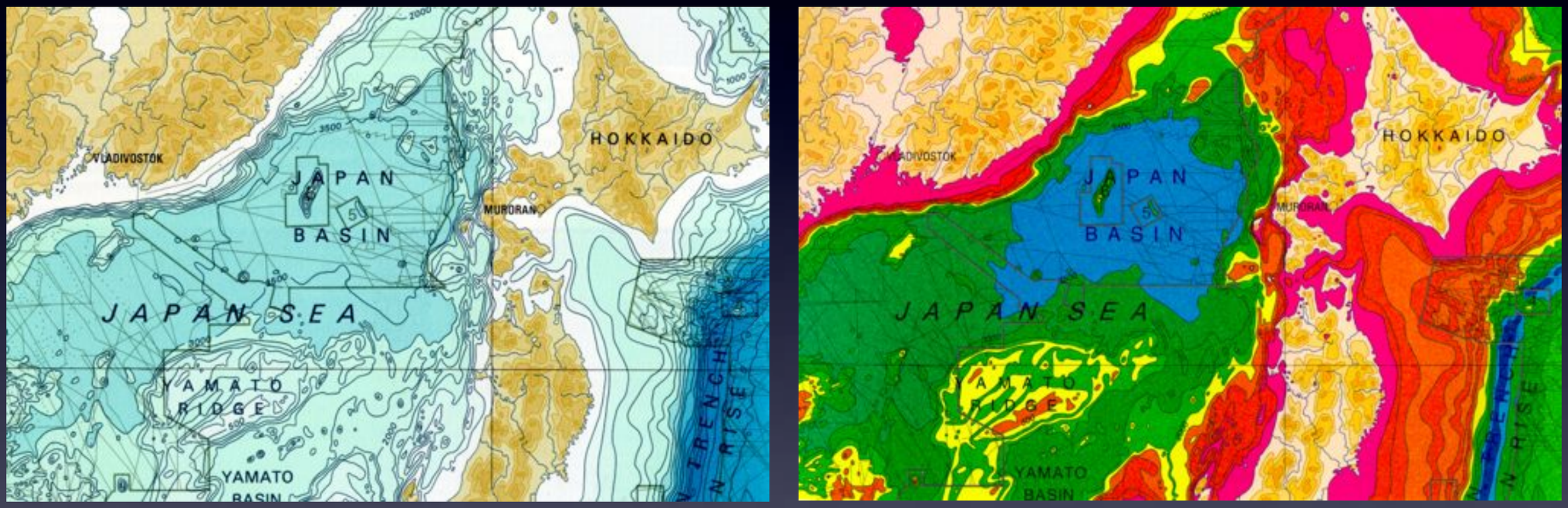
Grouping things



Making things separate



Intensity vs. Hue



The human eye has 10 times more rods than cones. This means that humans are better at interpreting changes in **intensity** rather than changes in **color**.

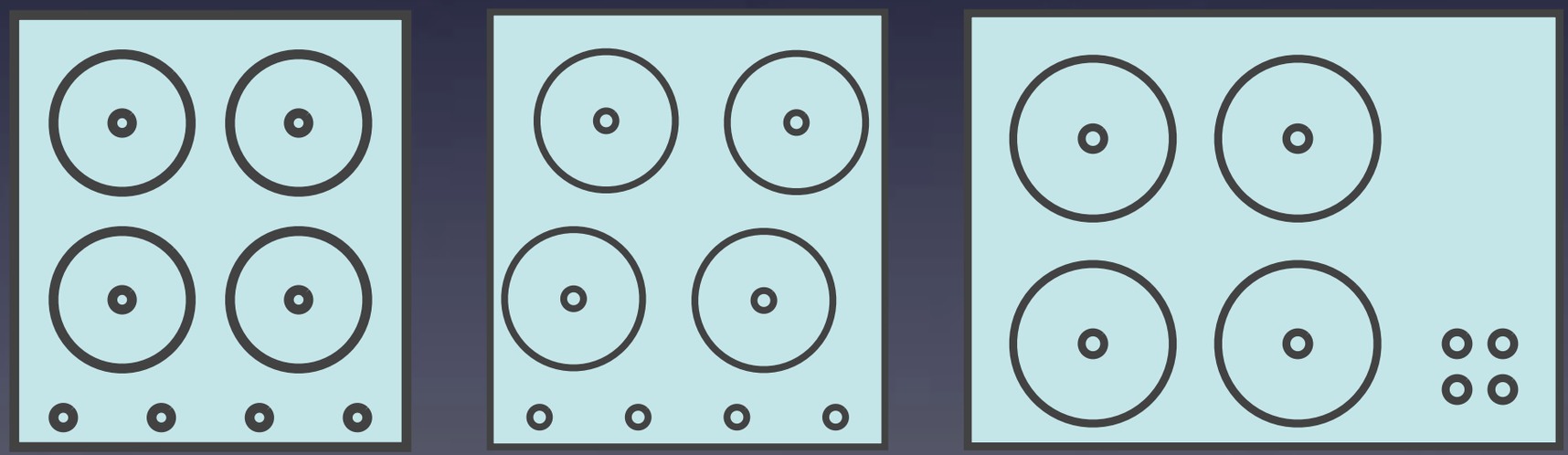
Focus

BAD

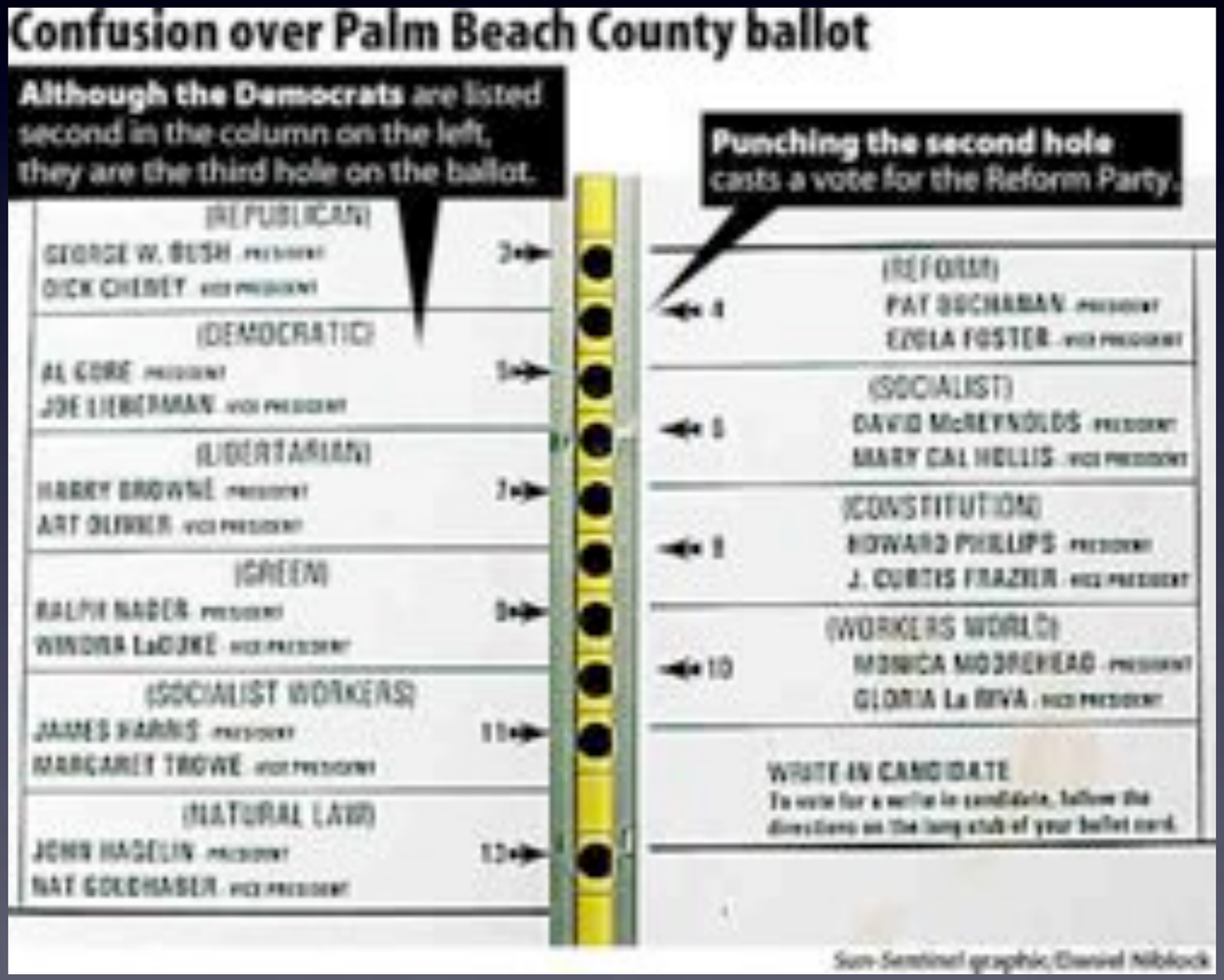
GOOD

Humans find it difficult to perceive simultaneously highly saturated, spectrally extreme colors.

Mappings



Mappings


Confusion over Palm Beach County ballot
Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.
Punching the second hole casts a vote for the Reform Party.
(REPUBLICAN)
GEORGE W. BUSH
DICK CHENEY
3
(DEMOCRATIC)
AL GORE
JOE LIEBERMAN
5
(LIBERTARIAN)
HARRY BROWNE
ART OLIVIER
7
(GREEN)
RALPH NADER
WINONA LaDUKE
9
(SOCIALIST WORKERS)
JAMES HARRIS
MARGARET TROWE
11
(NATURAL LAW)
JOHN HAGELIN
NAT GOLDHABER
12
4
(REFORM)
PAT BUCHANAN
EZOLA FOSTER
8
(SOCIALIST)
DAVID McREYNOLDS
MARY CAL HOLLIS
(CONSTITUTION)
HOWARD PHILLIPS
J. CURTIS FRAZIER
10
(WORKERS WORLD)
MONICA MOOREHEAD
GLORIA La RIVA
WRITE-IN CANDIDATE
To vote for a write-in candidate, follow the directions on the long stub of your ballot card.
Sun-Sentinel graphic/Daniel Nibbeck

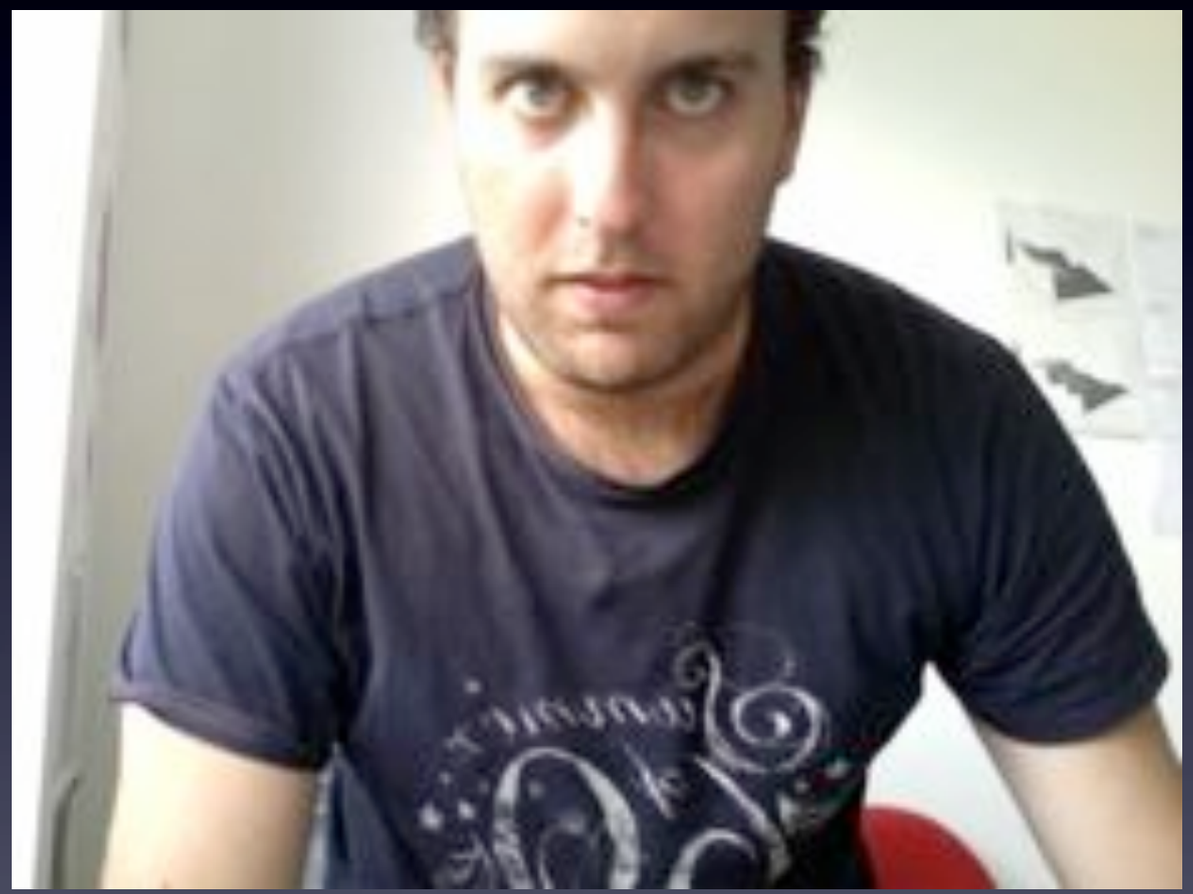
Feed-back &
Feed-forward

Emergence of networking

- Many users - many computers
- Online collaborative systems

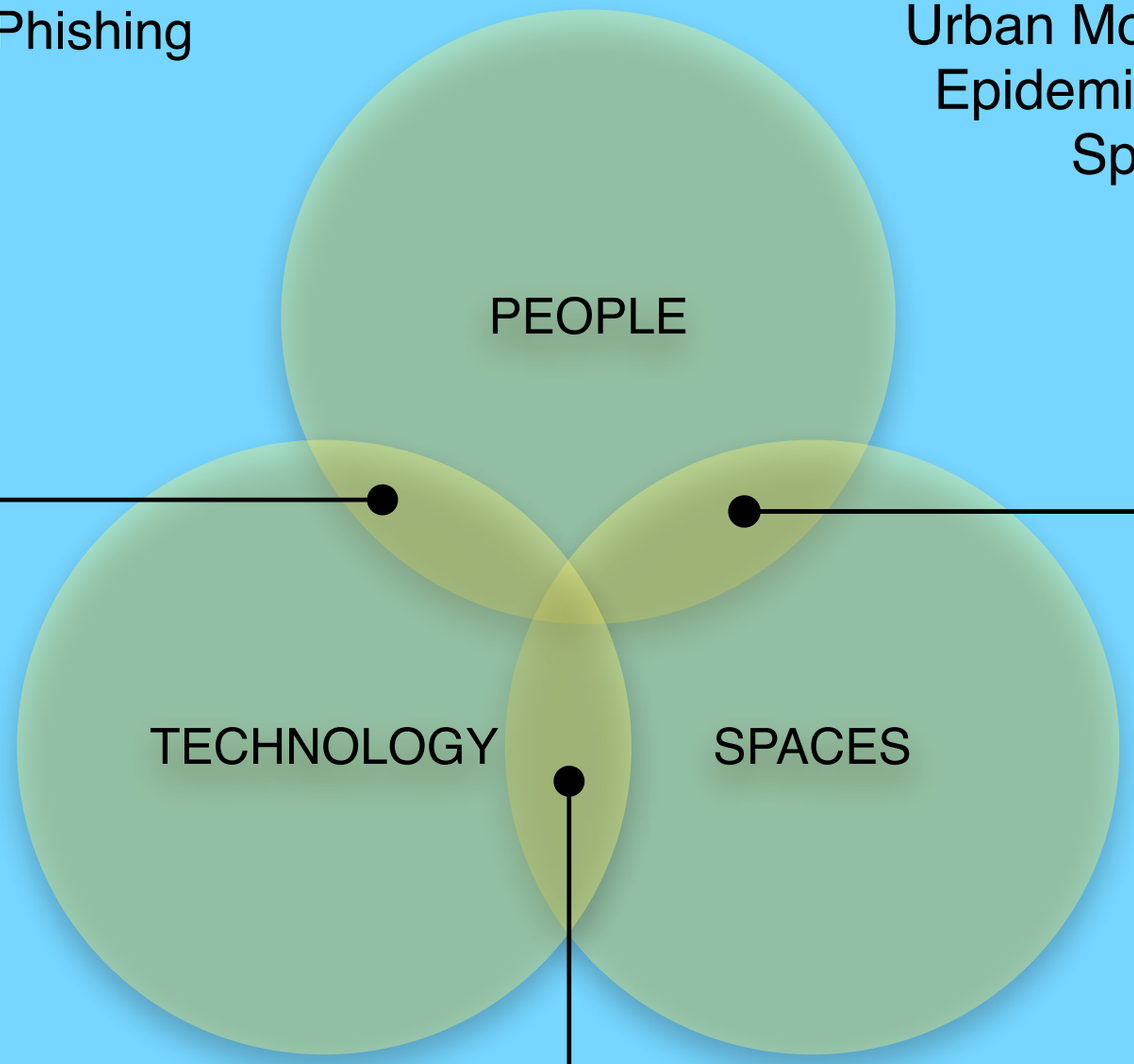
Making eye contact

Perception of authority



Human Computer Interaction,
Trust, Privacy, Phishing

Spatial & Transpatial Social Networks
Urban Mobility & Encounter
Epidemiology & Diffusion
Space Syntax



Augmented Spaces
Situated Services
Delay Tolerant Networks

Let me show you my lab

Welcome to my Lab

the city is the system

Plan of attack

- Step 1: Collect data. What is out there?
- Step 2: Create models to explain what is out there. Identify metrics.
- Step 3: Use the models to create **better** systems.

Pervasive Computing 1.0

Controversy is a measure of progress

BBC NEWS | Technology | Bluetooth helps Facebook friends

http://news.bbc.co.uk/2/hi/technology/6949473.stm

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Your news when you want it

Last Updated: Thursday, 16 August 2007, 14:37 GMT 15:37 UK

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Bluetooth helps Facebook friends

A team of UK researchers is combining the power of social network Facebook with communications tool Bluetooth to learn more about human interactions.

Cityware nodes have been set up in Bath and London

Bath University scientists have created a tool which can use the unique ID of Bluetooth devices, like a mobile phone, to build new friendship networks.

Users register with the Facebook tool, called Cityware, that tracks encounters in the real world via Bluetooth.

It is part of a wider project backed by Nokia, HP Labs and Vodafone.

Dr Vassilis Kostakos, research associate at the University of Bath, said: "Networks are everywhere - social and digital.

"The really nice thing about Bluetooth is that when you are walking down the street, although you are not talking to anyone, your Bluetooth device can be talking to other devices.

"People with Bluetooth devices are actually creating an ad hoc communications infrastructure where information can

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- Art project tracks Bluetooth users
  22 May 07 | Technology
- Legal fight over Bluetooth chips
  04 Jan 07 | Technology

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- About Cityware on Facebook (requires registration)

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News feeds

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2. Photo the Bangladesh army cannot stand
3. Wilson plea over 'suicide' claims
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5. Wildfires rage on across Greece

- Most popular now, in detail

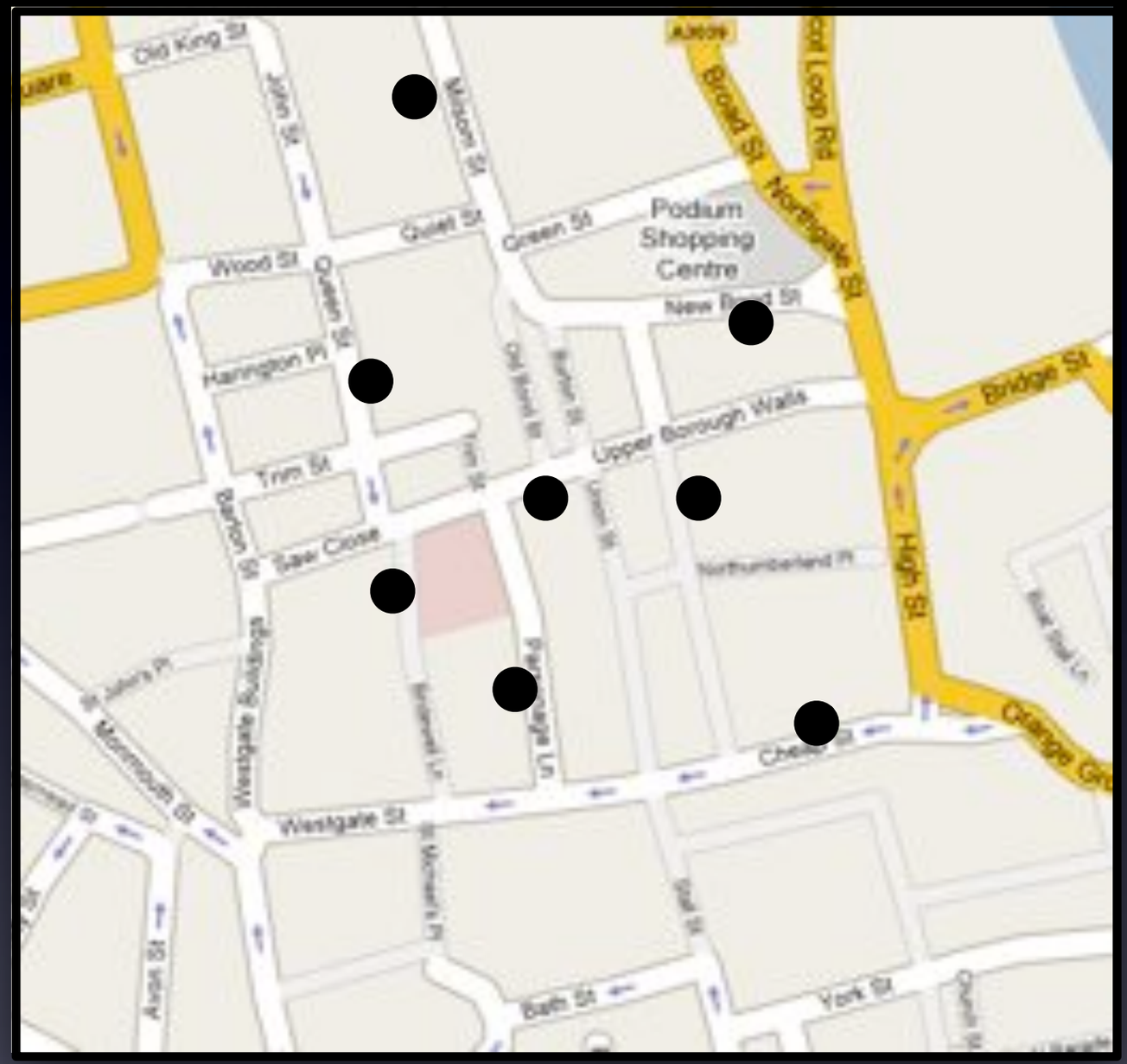

Gypsy Bandito


Computer Software News
Bluetooth + facebook = creepy, but kind of cool

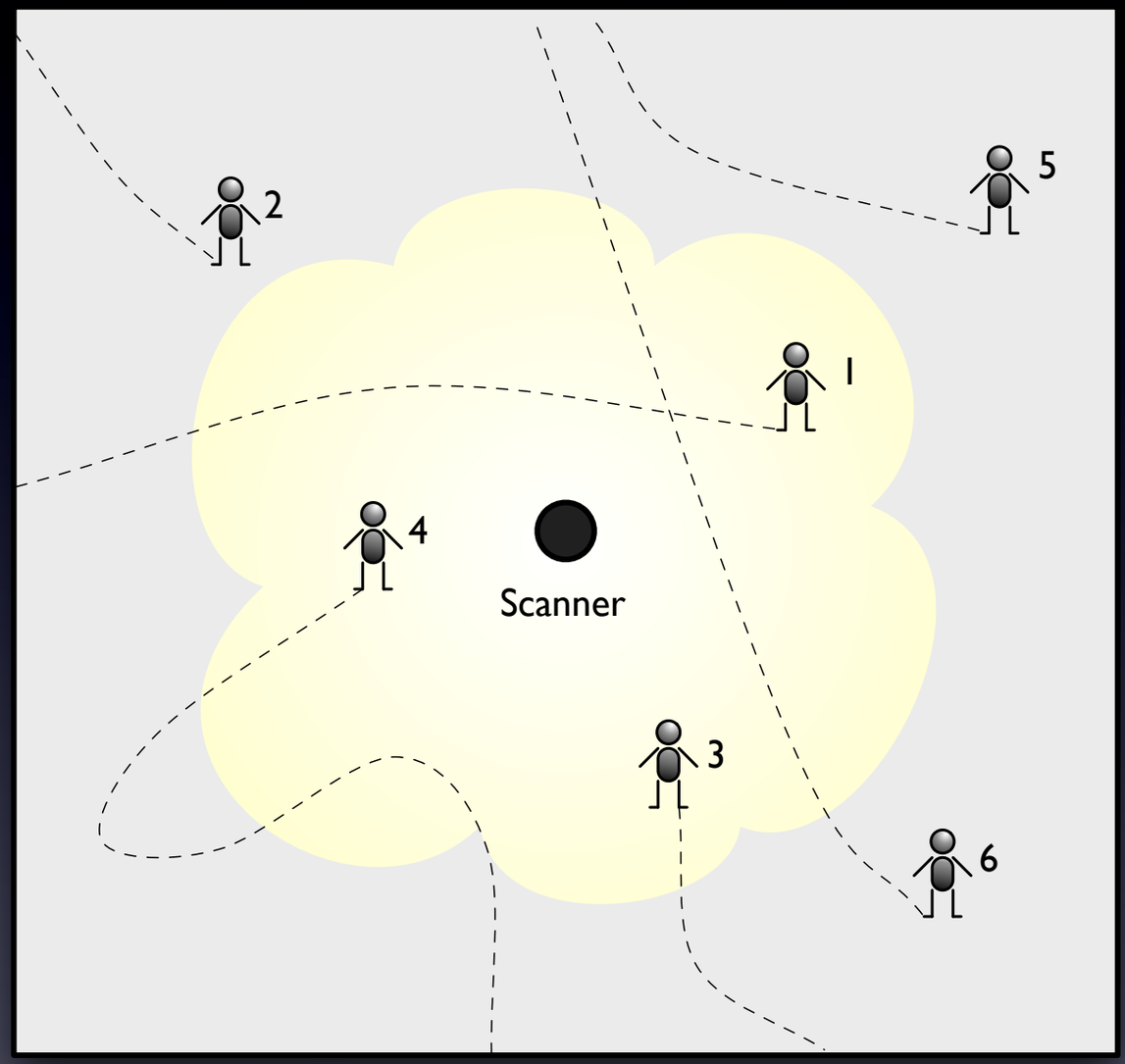

DigiMemo.com

Mixed reactions

- People are unsure how to react
- It is definitely 2.0



O'Neill, E., Kostakos, V., Kindberg, T., Fatah gen. Schiek, A., Penn, A., Stanton Fraser, D. and Jones, T. (2006). Instrumenting the city: developing methods for observing and understanding the digital cityscape. In proceedings of UbiComp 2006, Lecture notes in Computer Science 4206, Springer, pp. 315-332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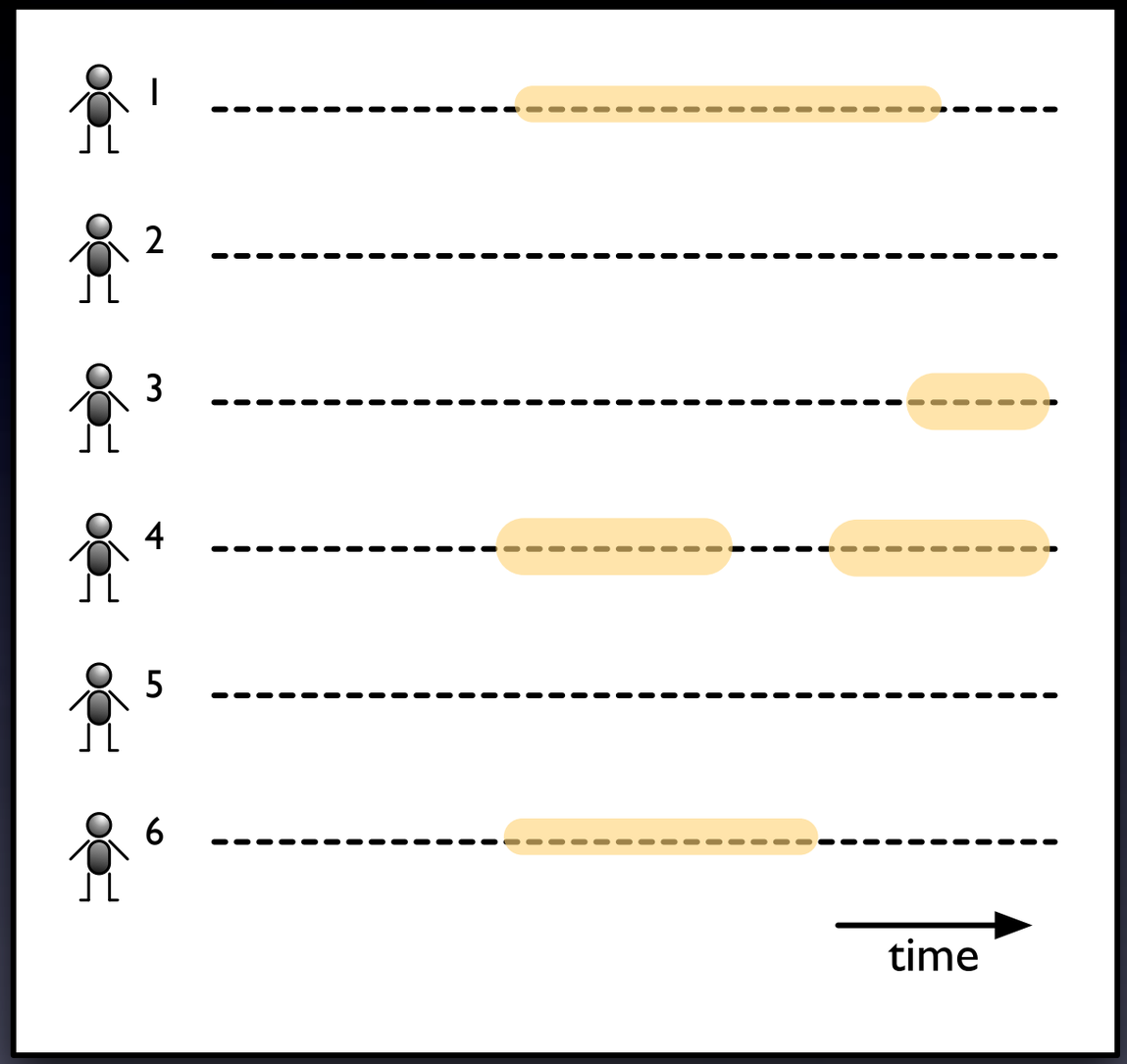
Scanner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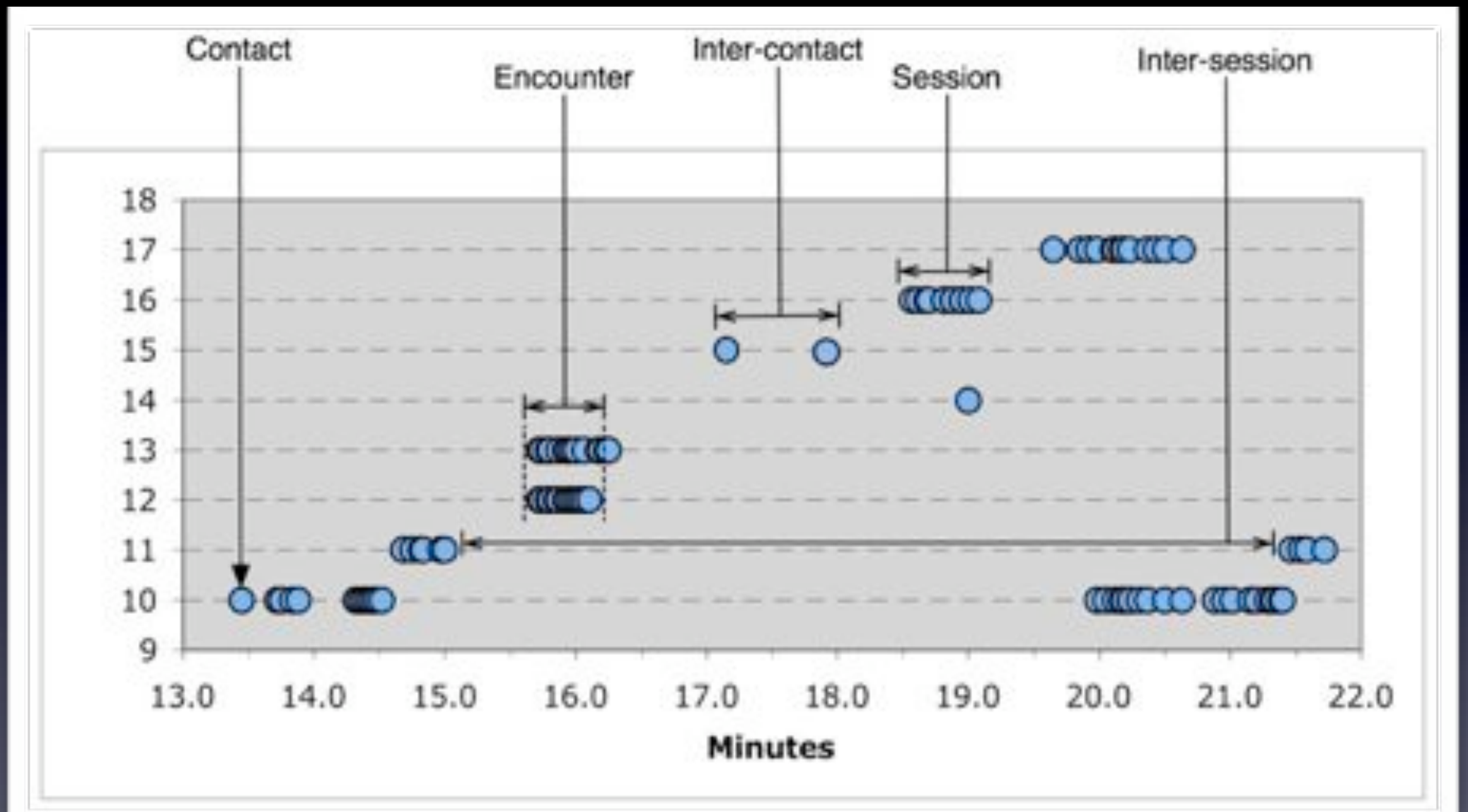
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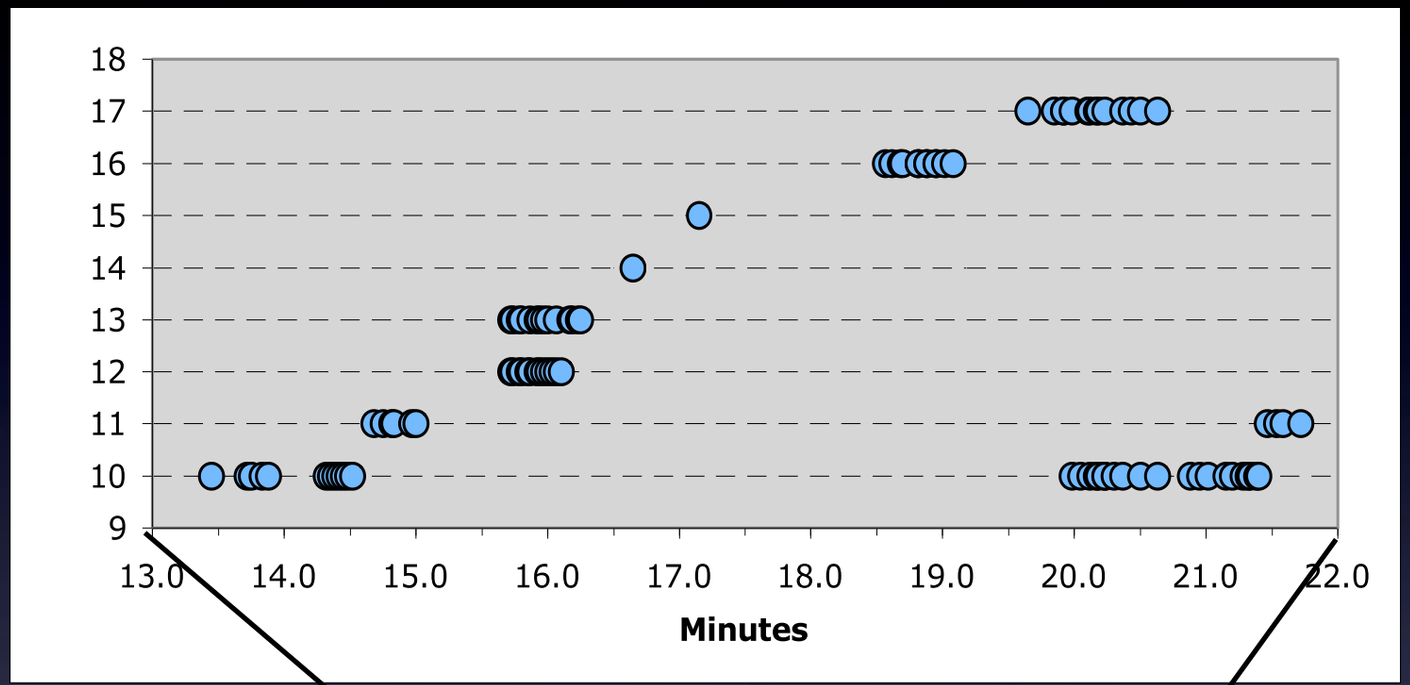
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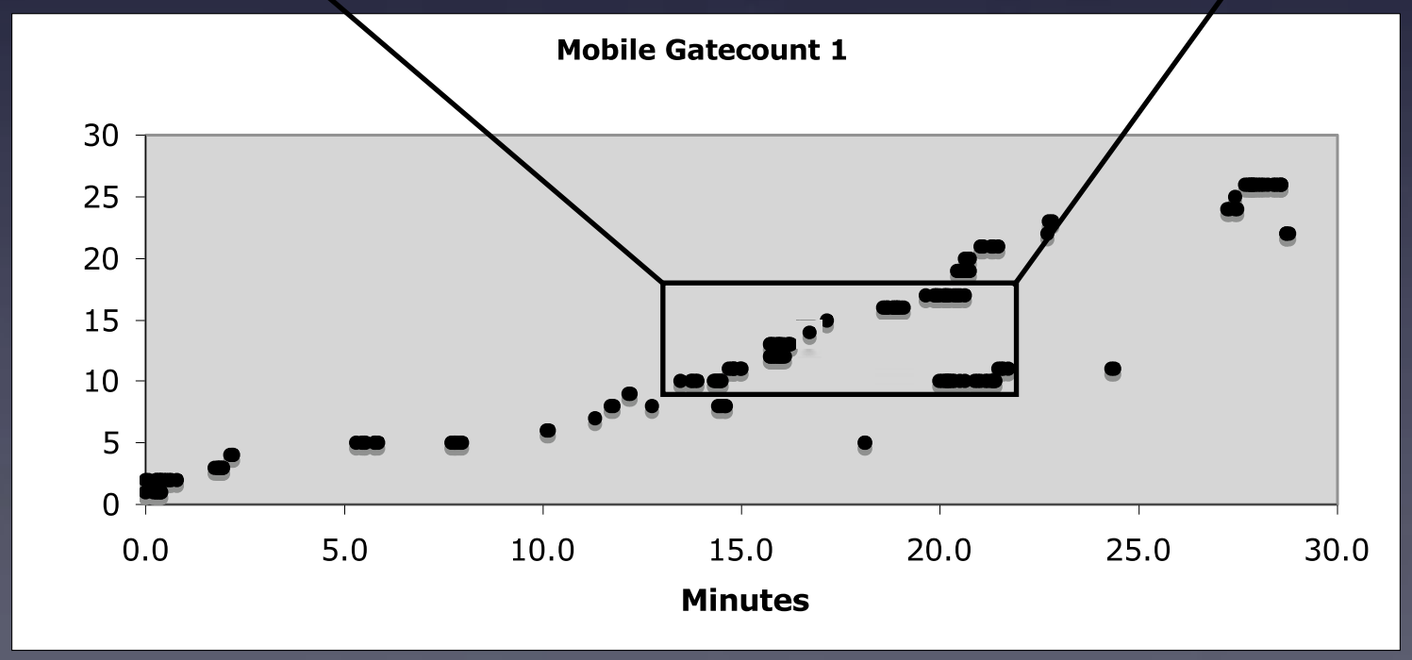
Mobile Gatecount 1
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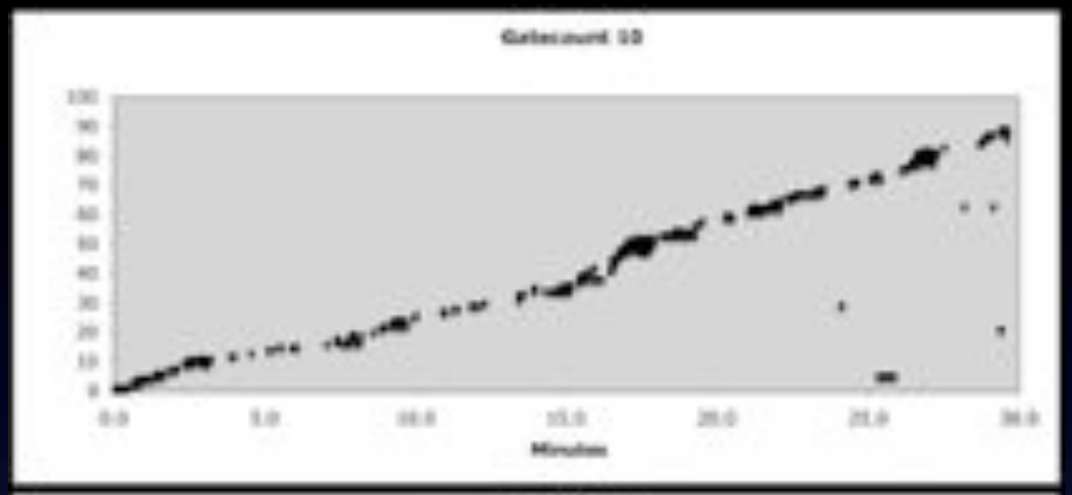
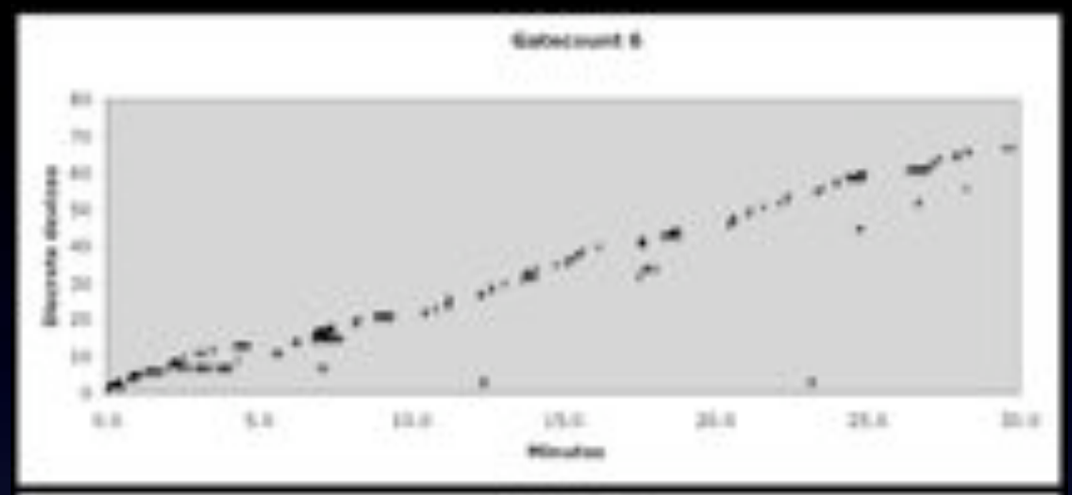
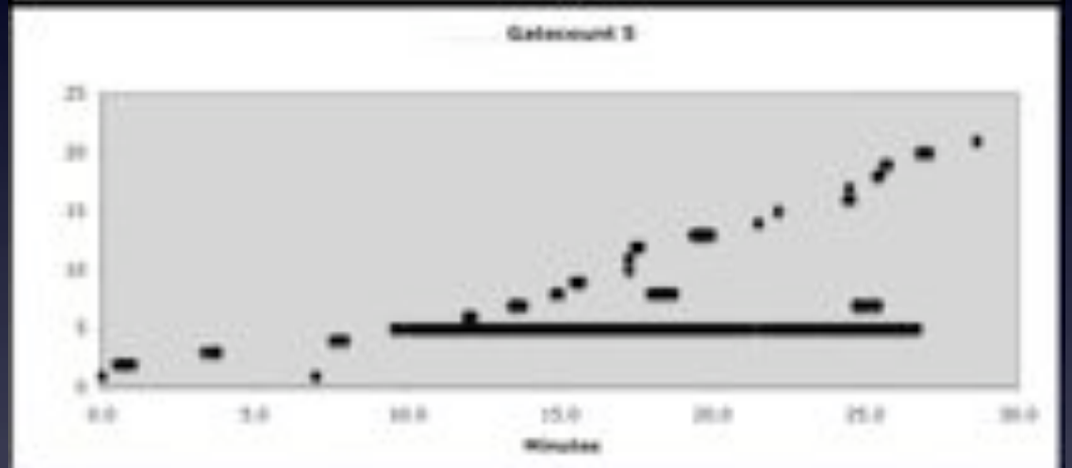
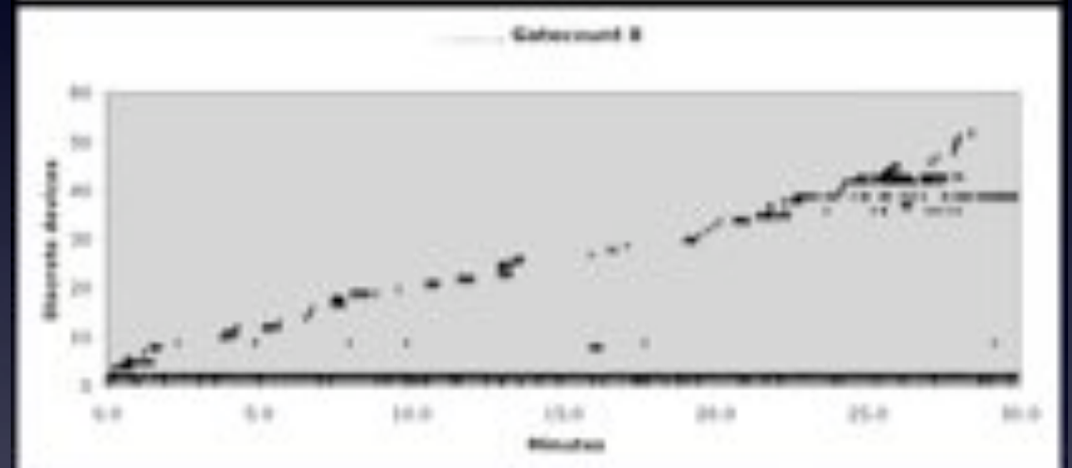
Minutes

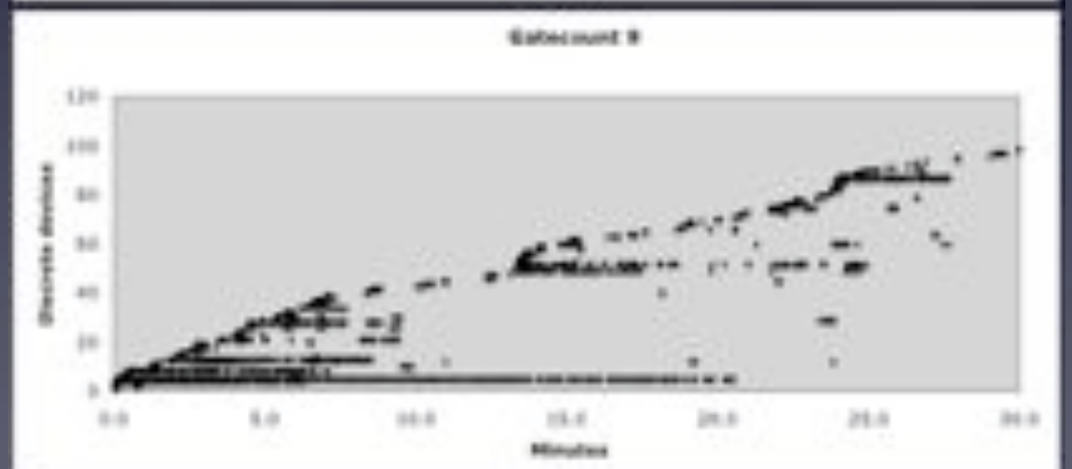
Gatecount timelines

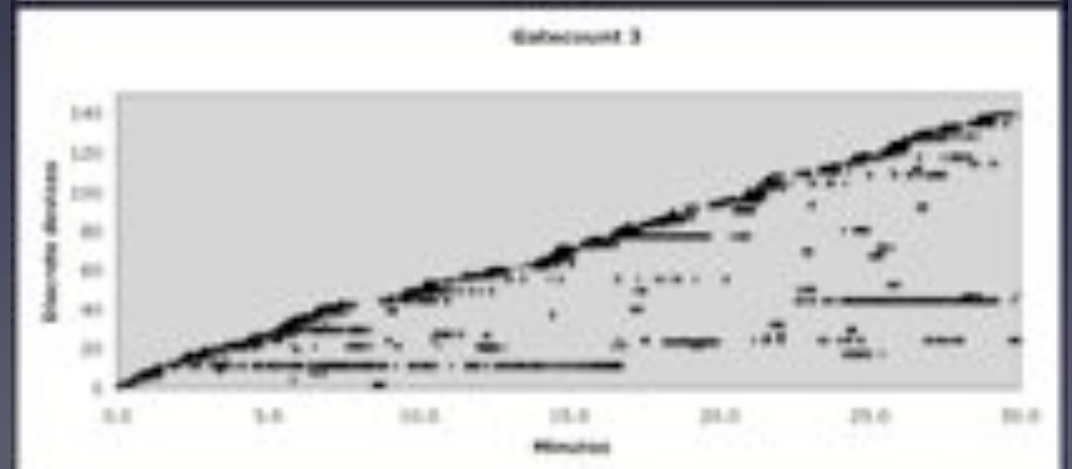


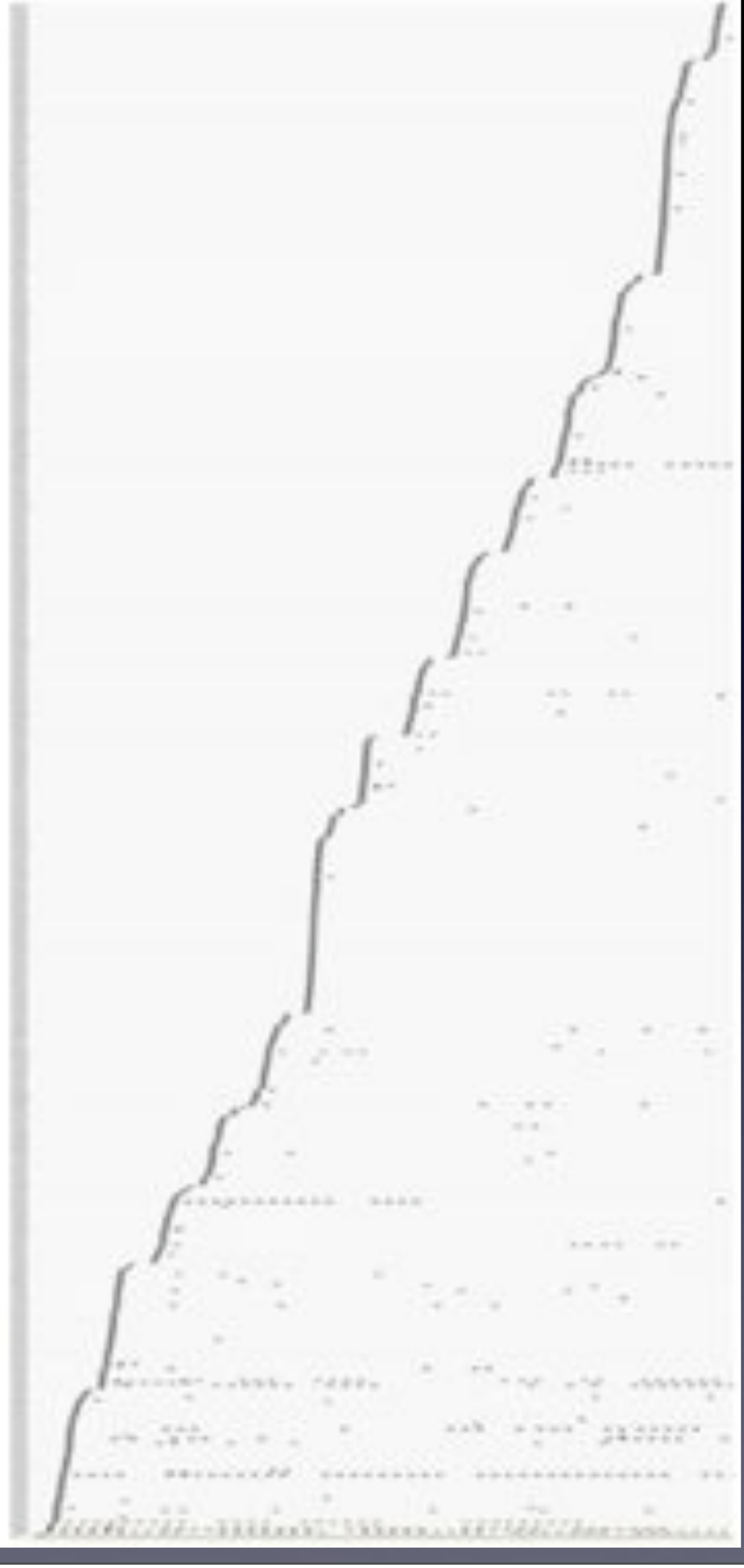


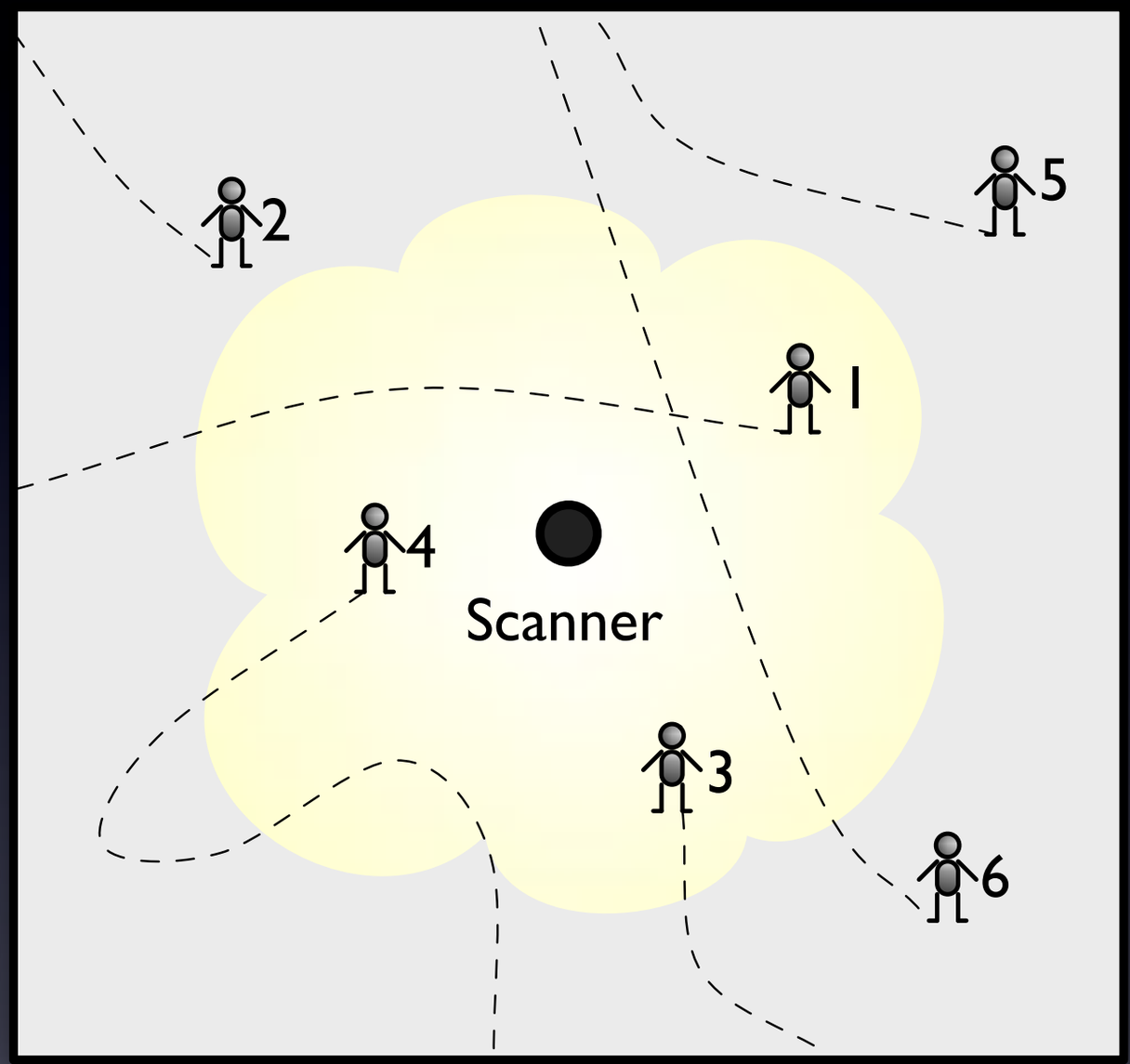








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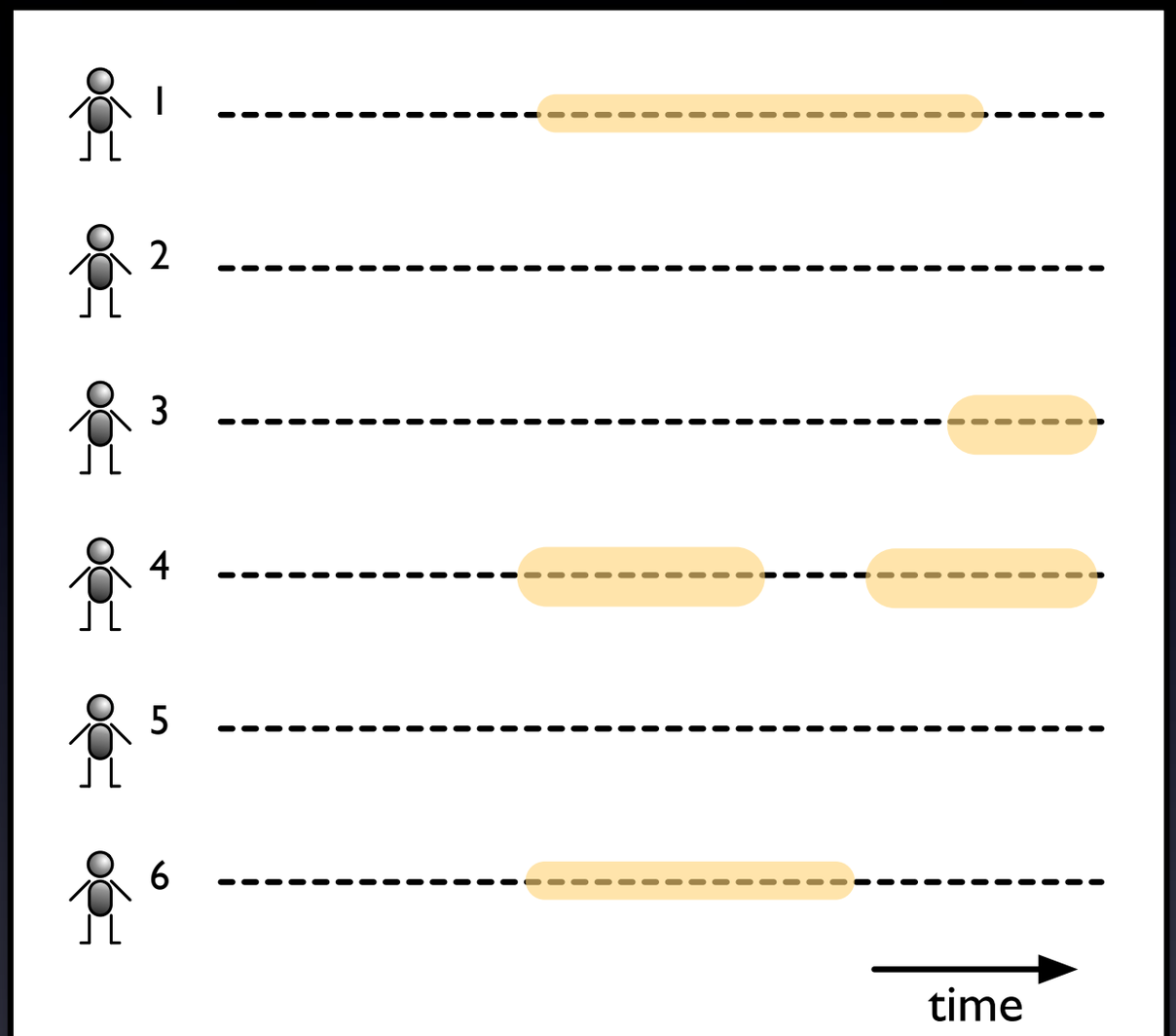
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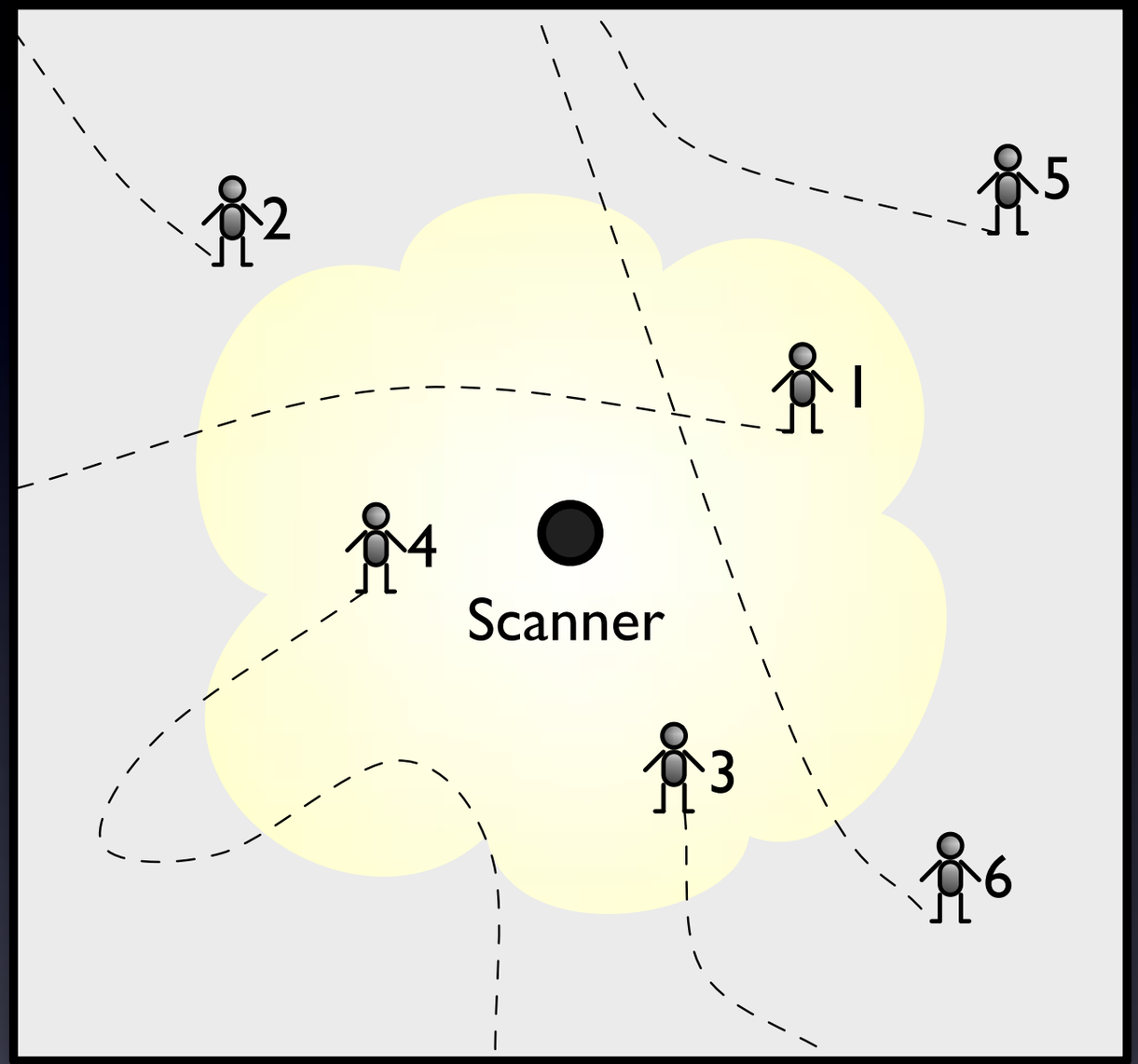
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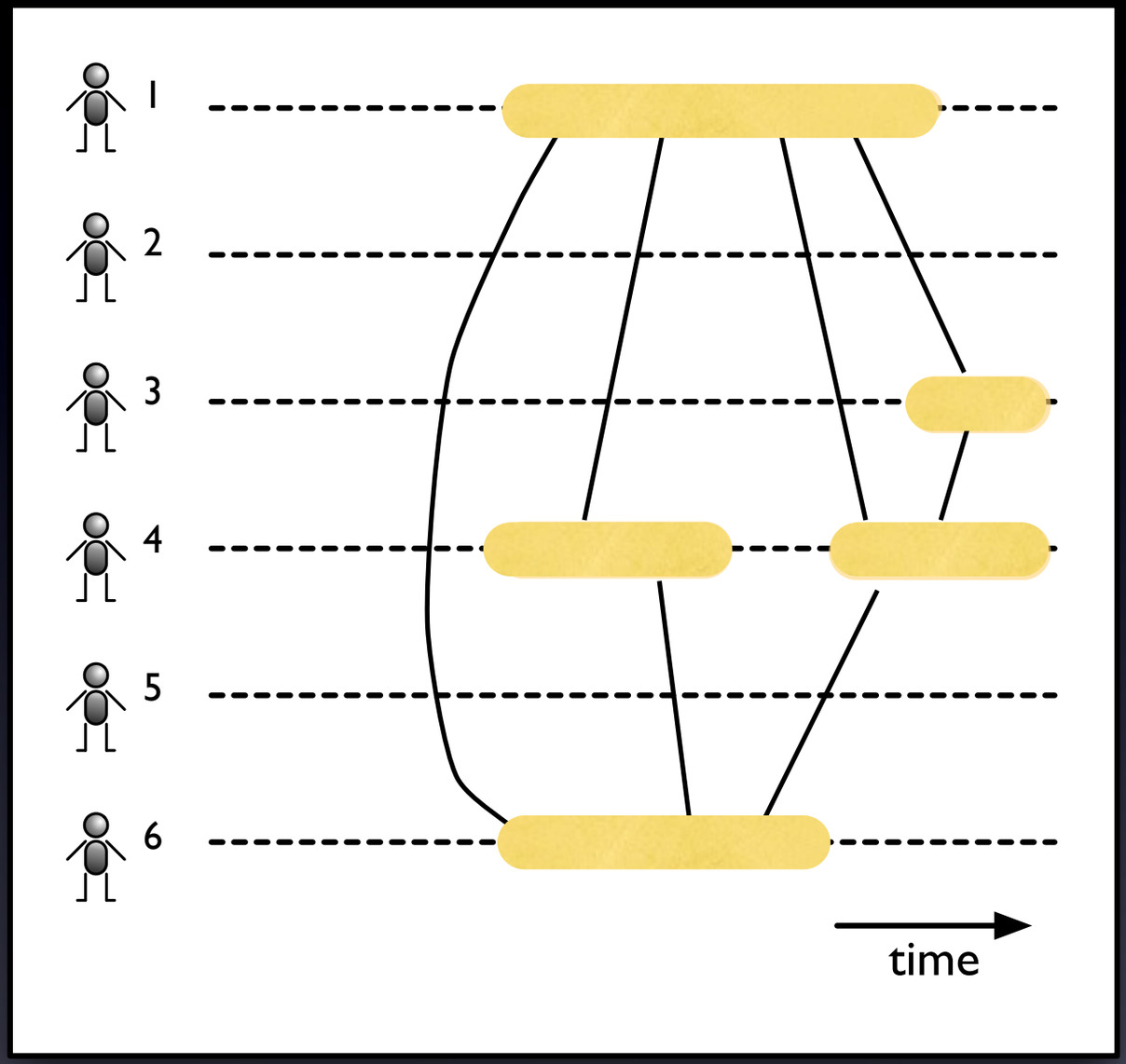
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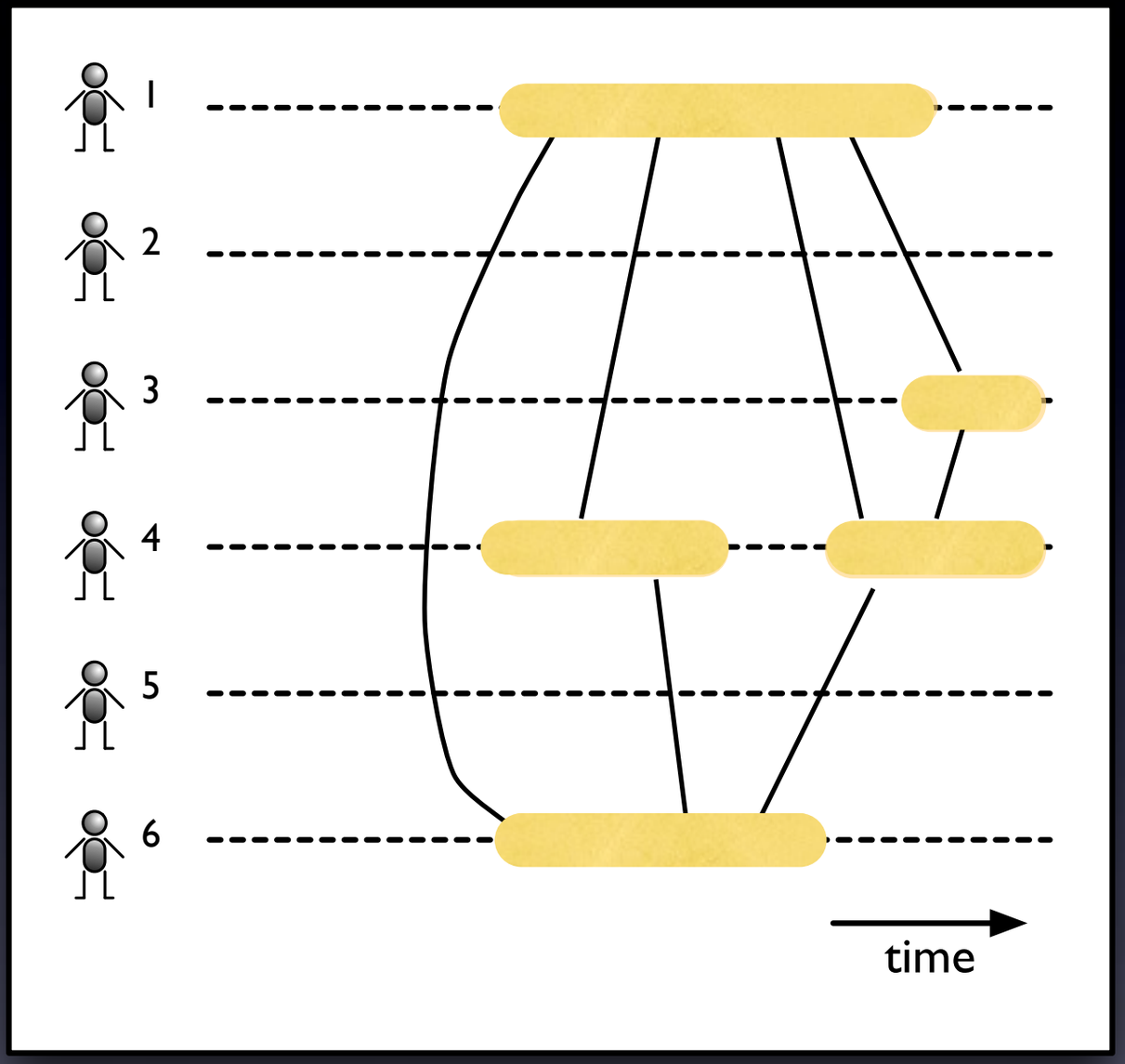
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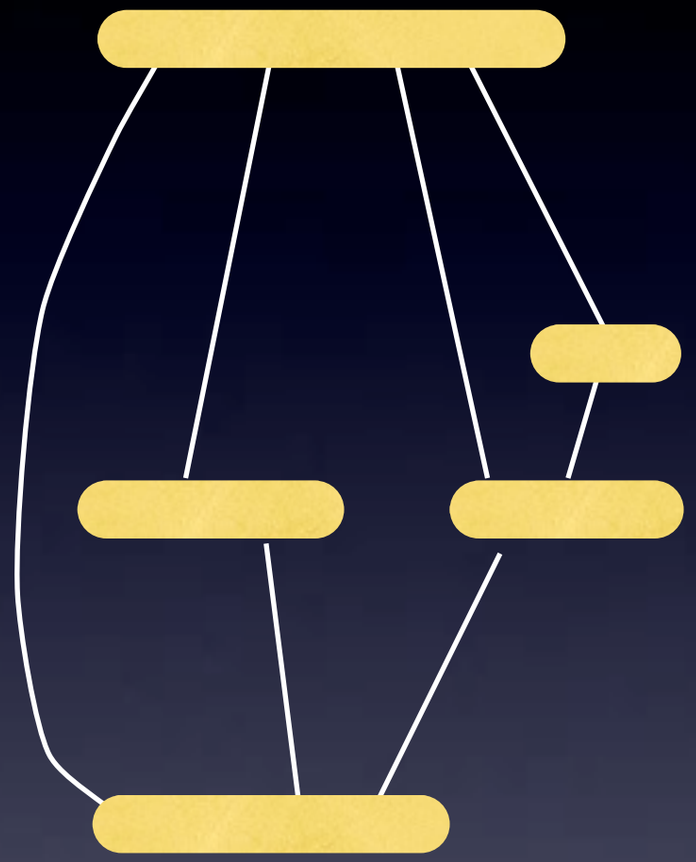
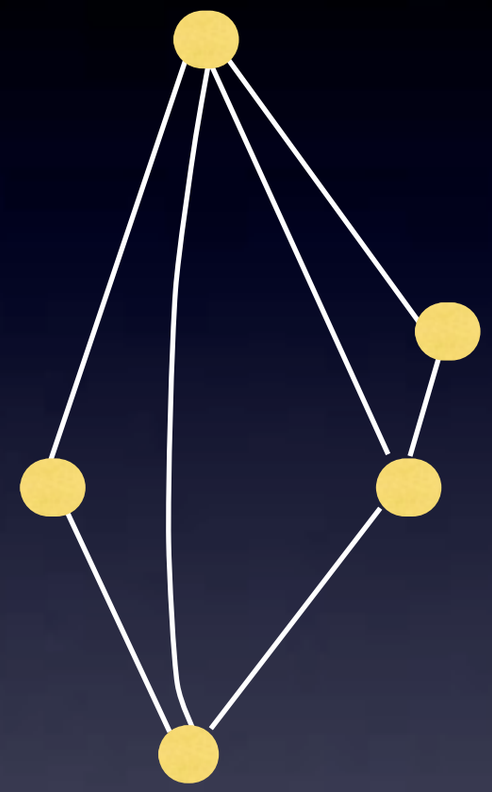
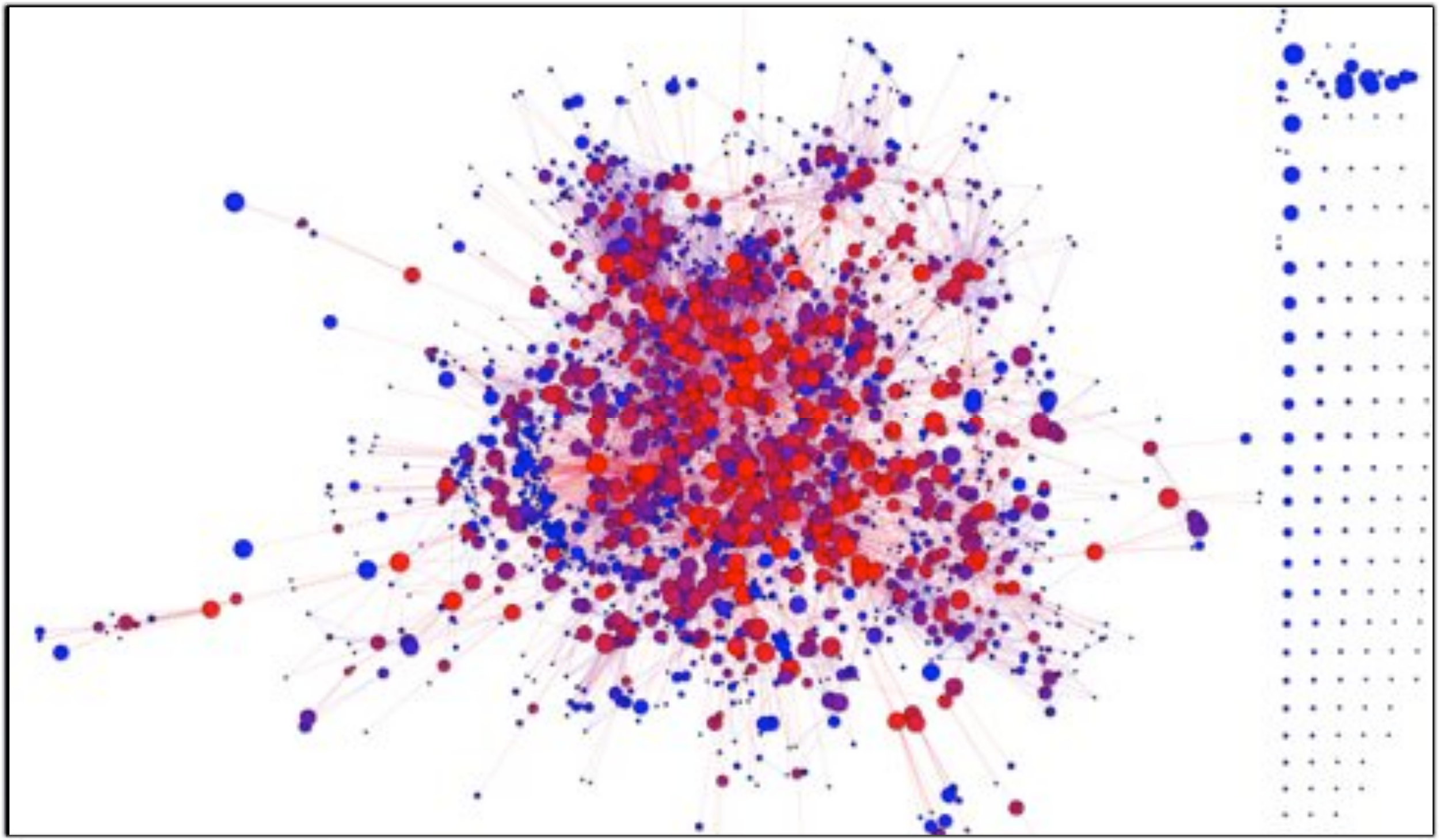
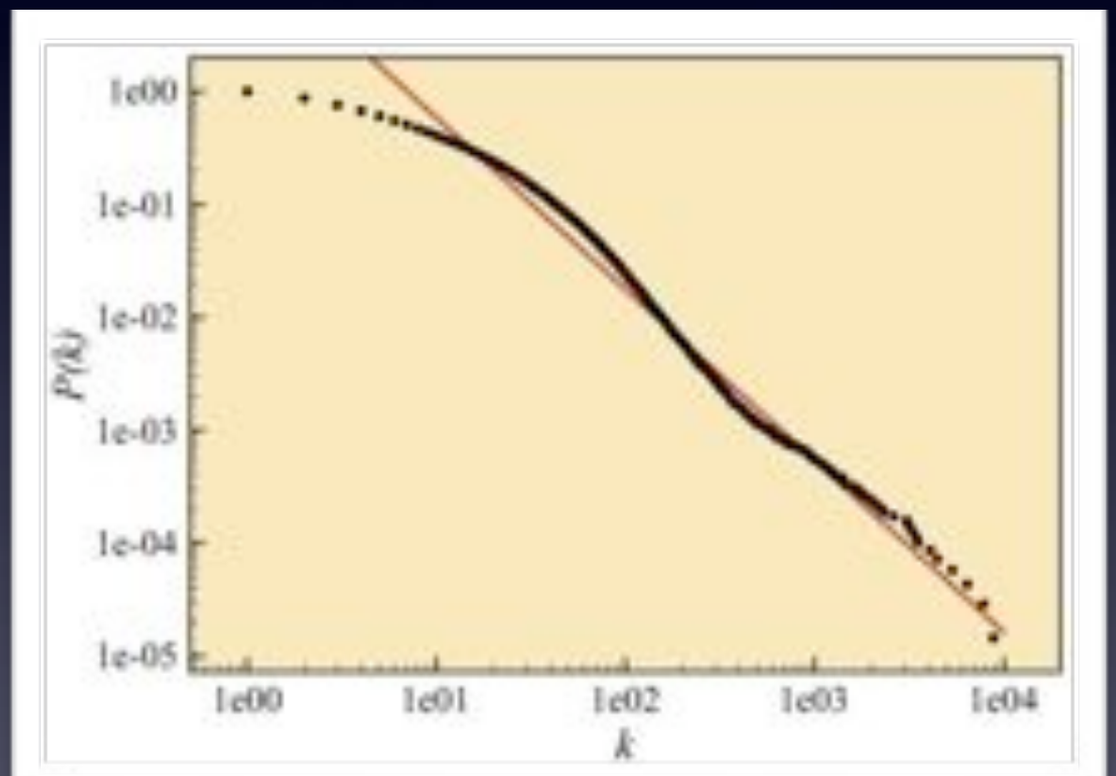


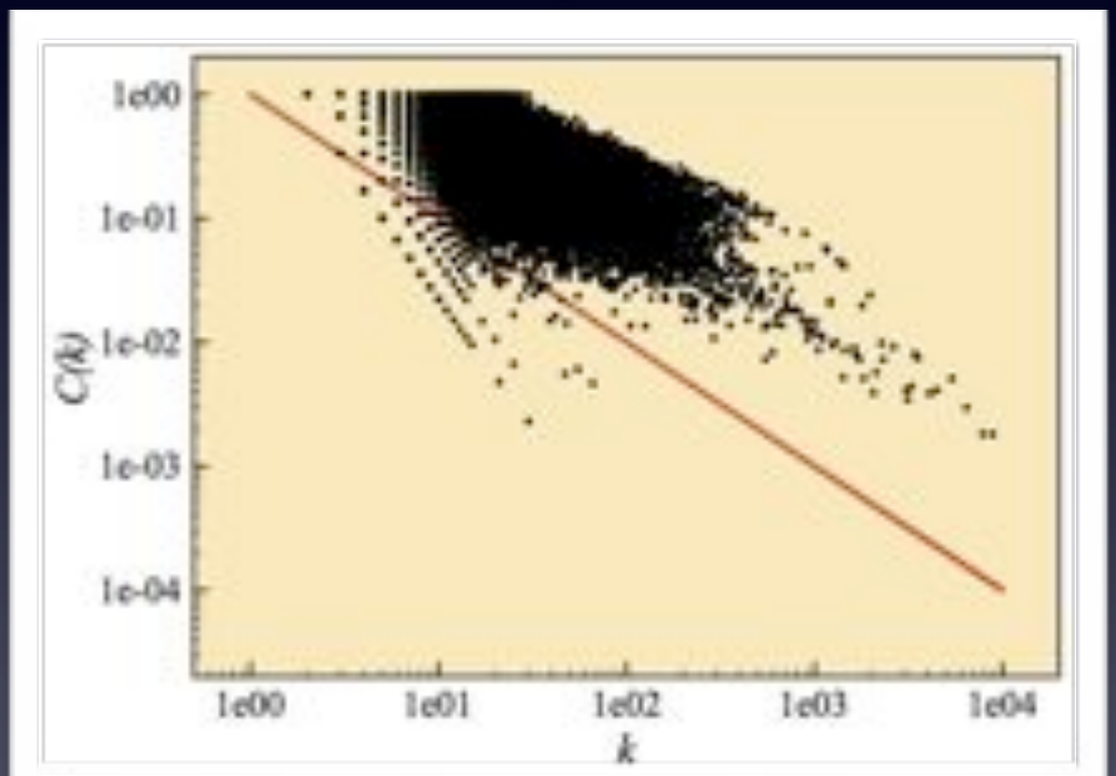


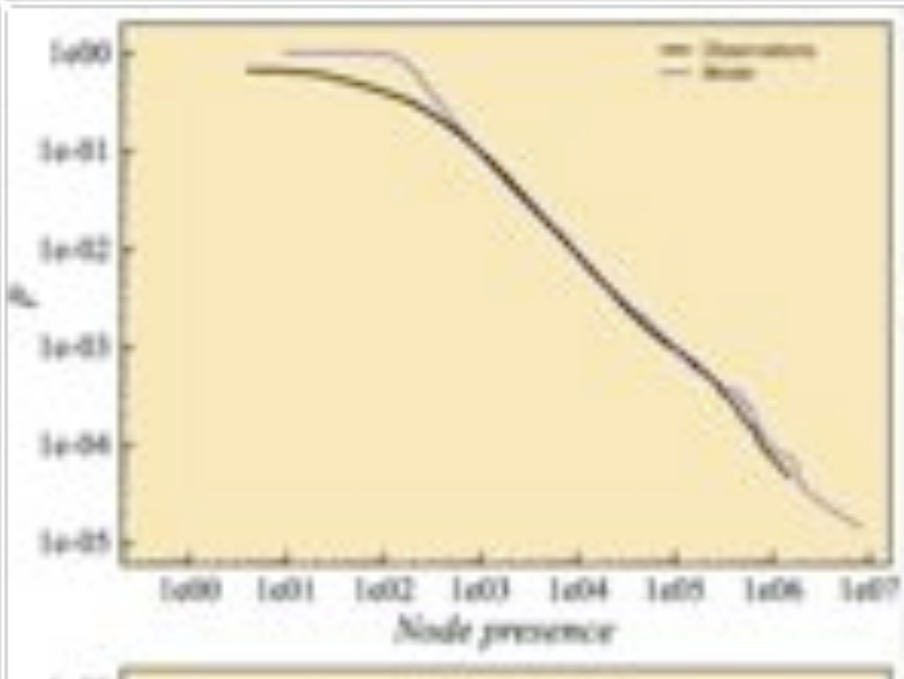


Kostakos, V., O'Neill, E., Penn, A. (2007). Brief encounter networks. arXiv:0709.0223

Power laws and exponential decays



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1e-01
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1e-03
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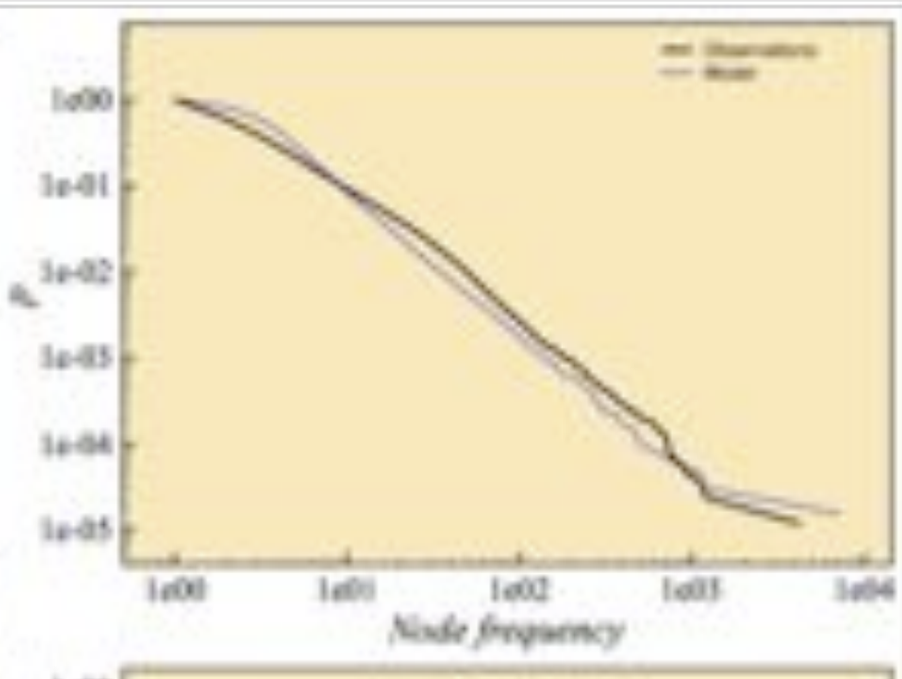
p_k
1e+00 1e+01 1e+02 1e+03 1e+04 1e+05 1e+06 1e+07
Node presence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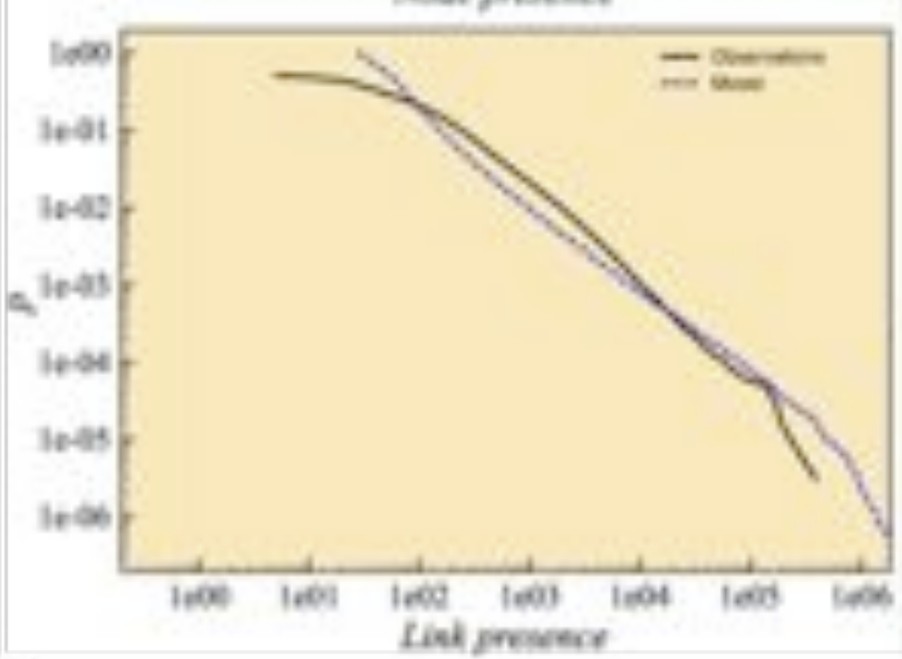
Node frequency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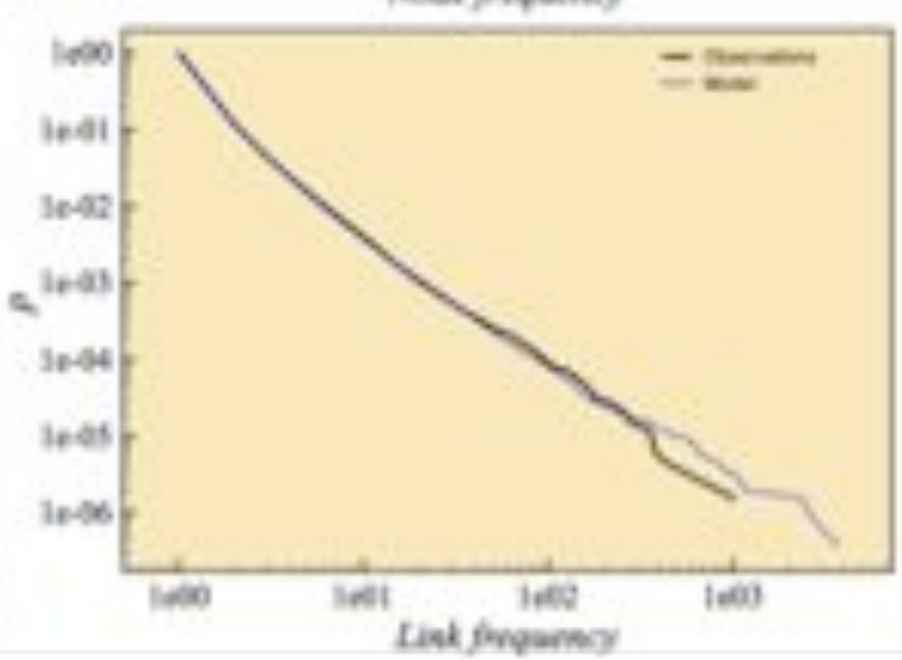
Link presence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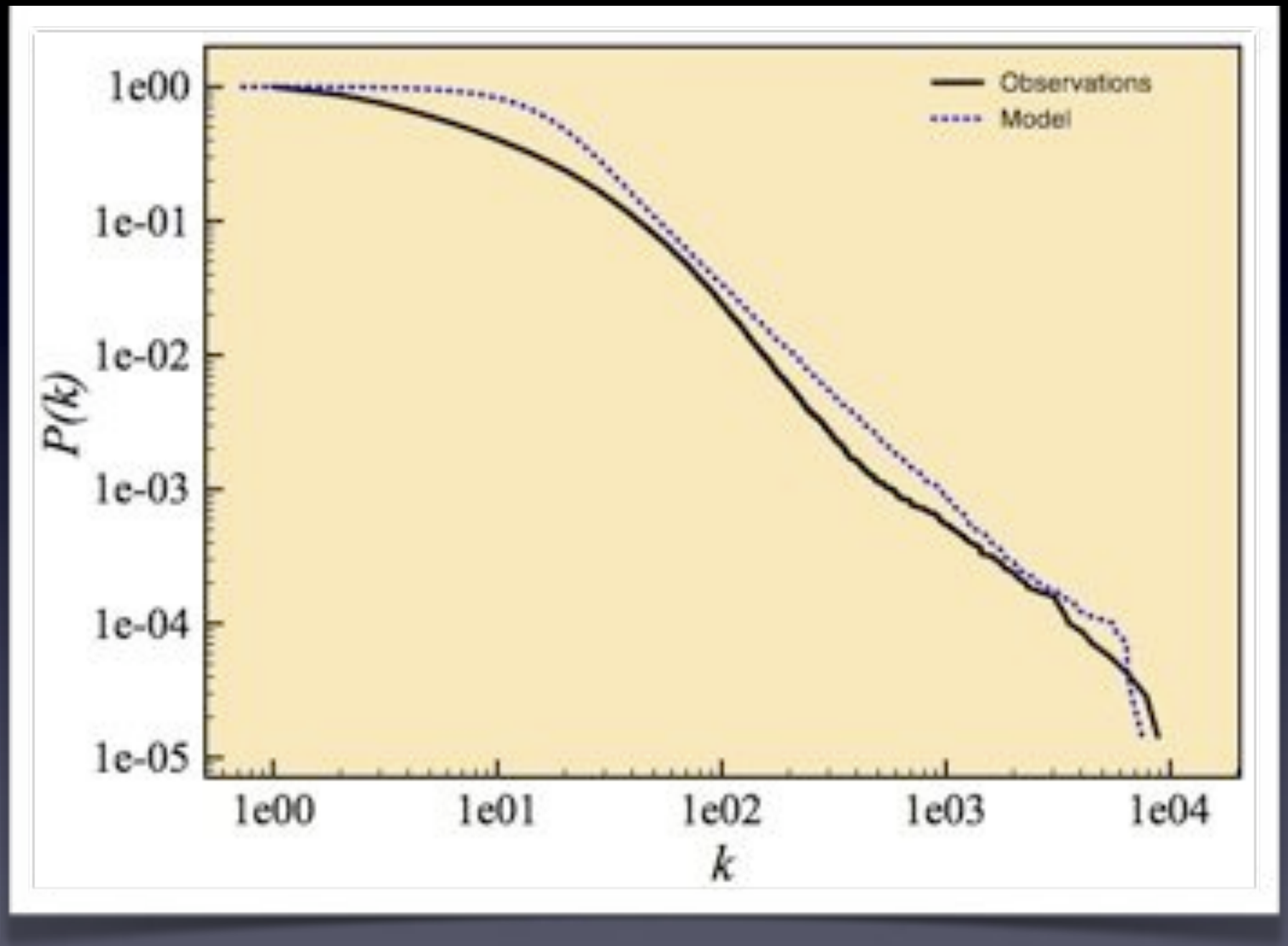

Kostakos, V. and O'Neill, E. (2007). Quantifying the effects of space on encounter. In proceedings of Space Syntax Symposium 2007, Istanbul, pp. 9701-9709.


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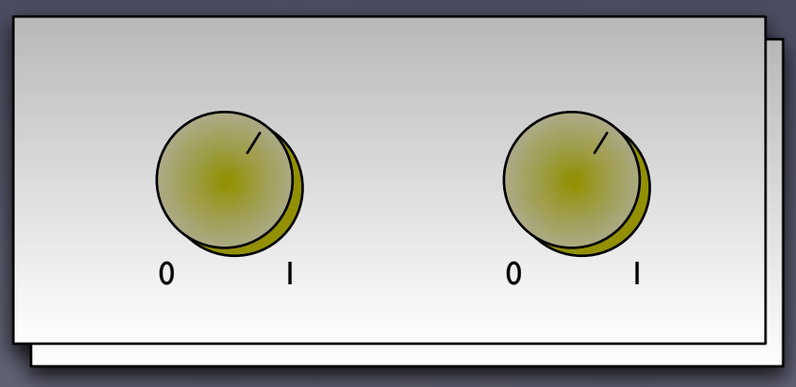
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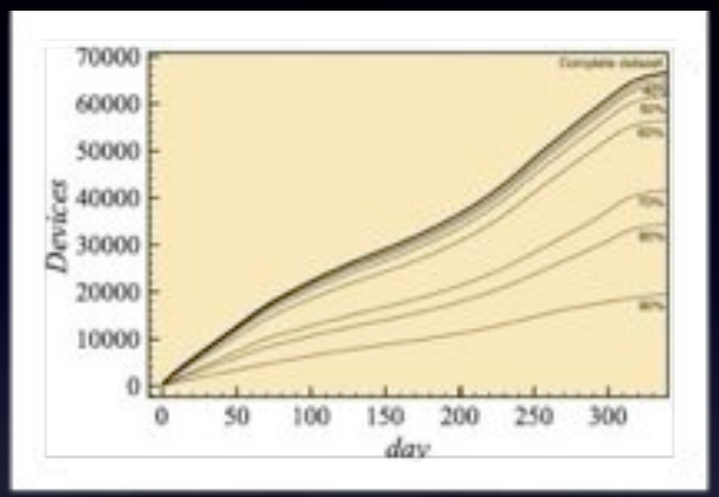
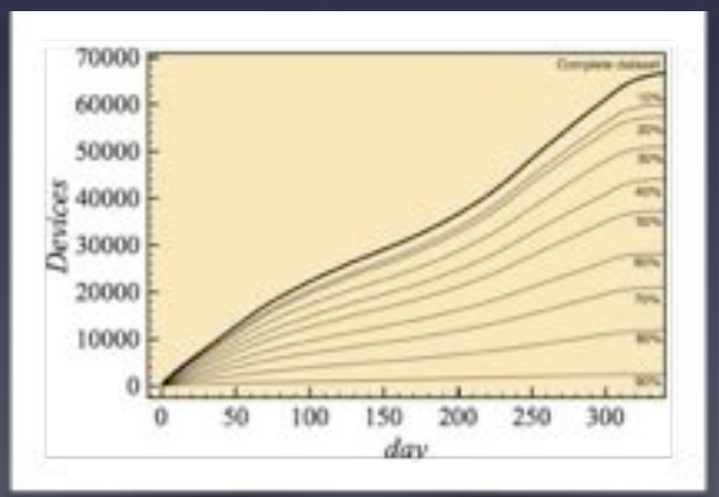
No Friends

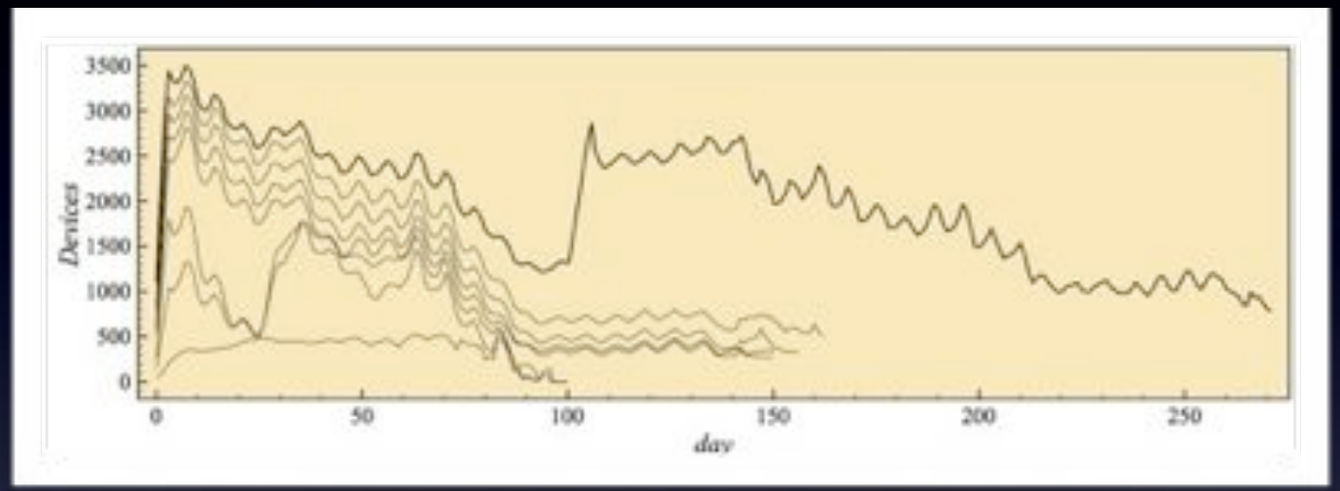
No Strangers

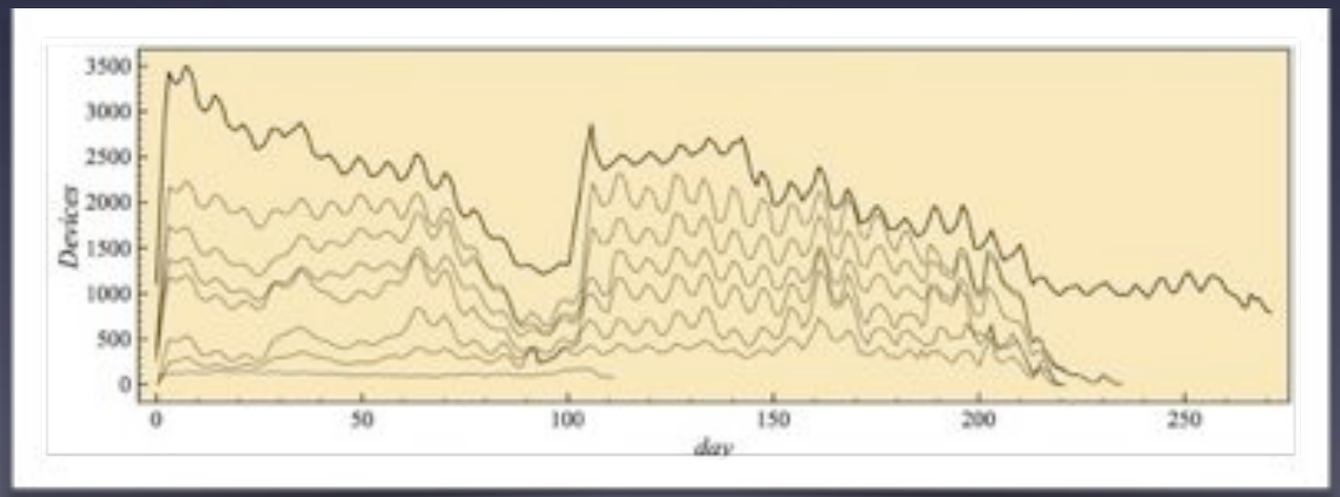
Information



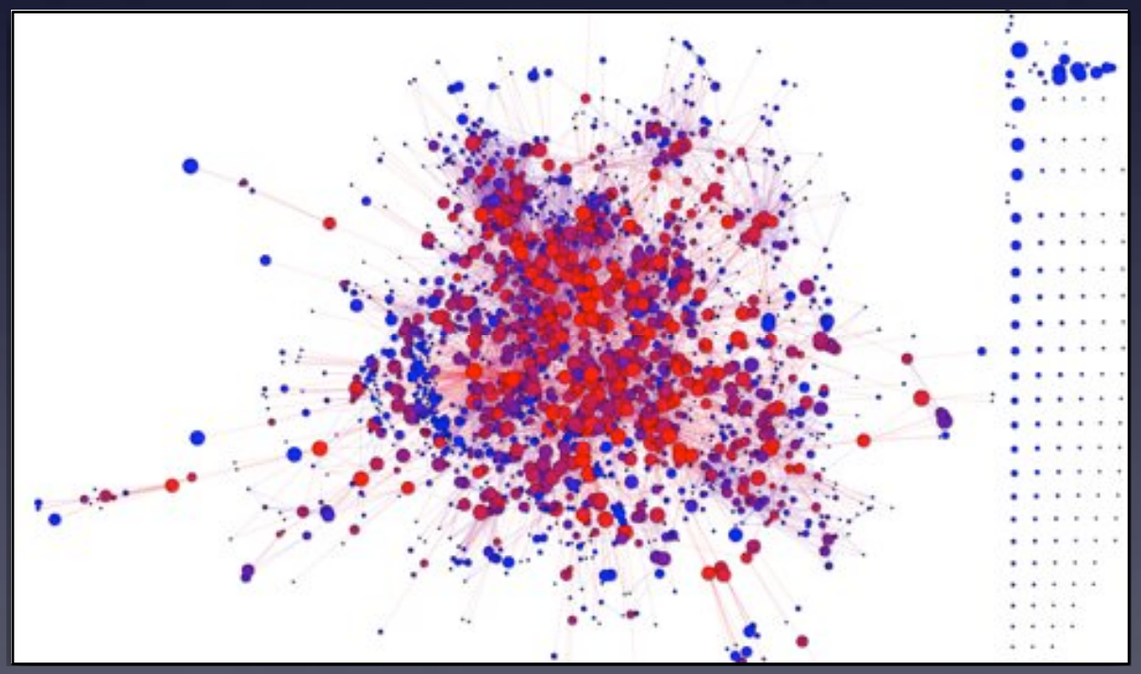


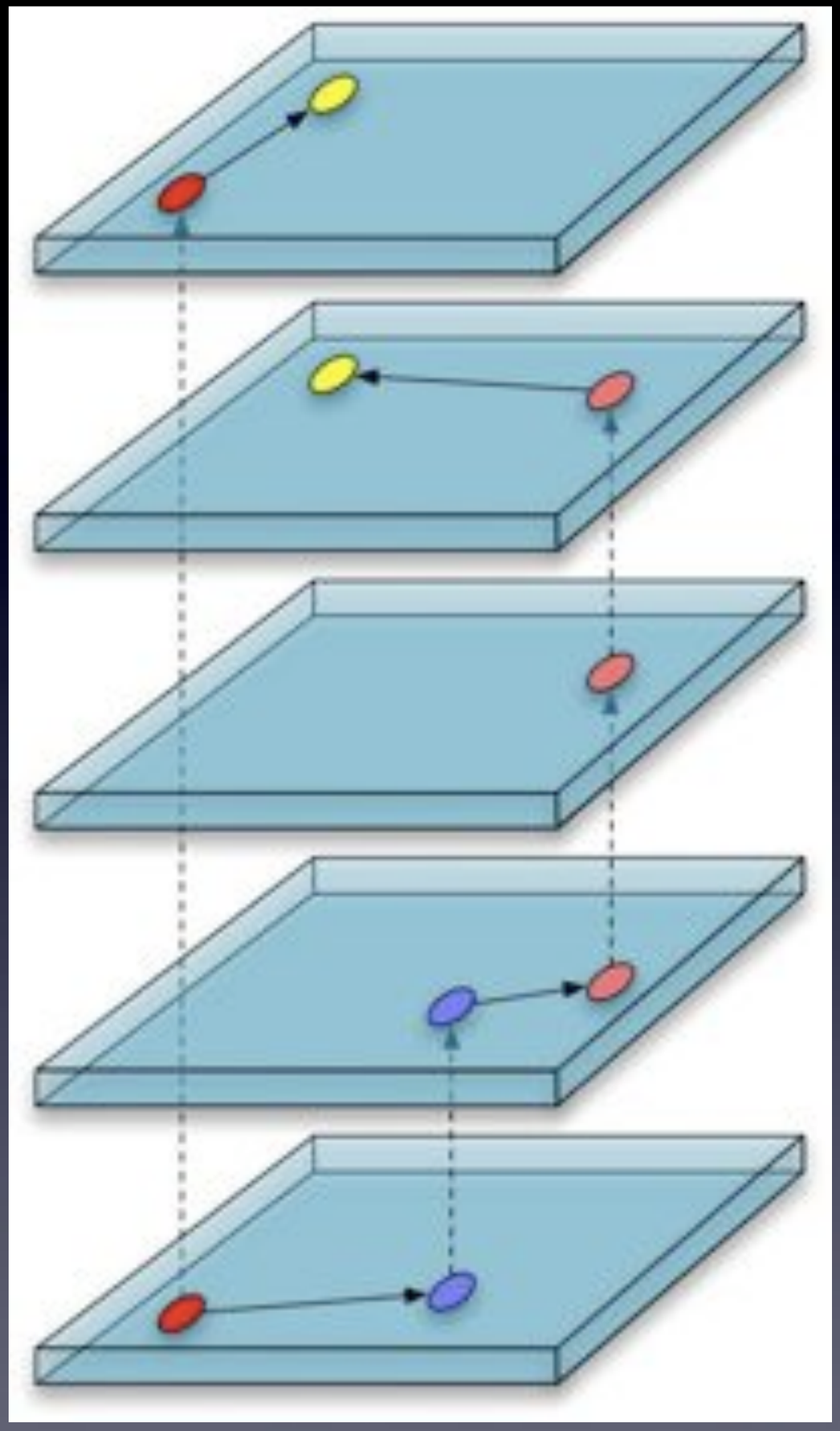
Viruses

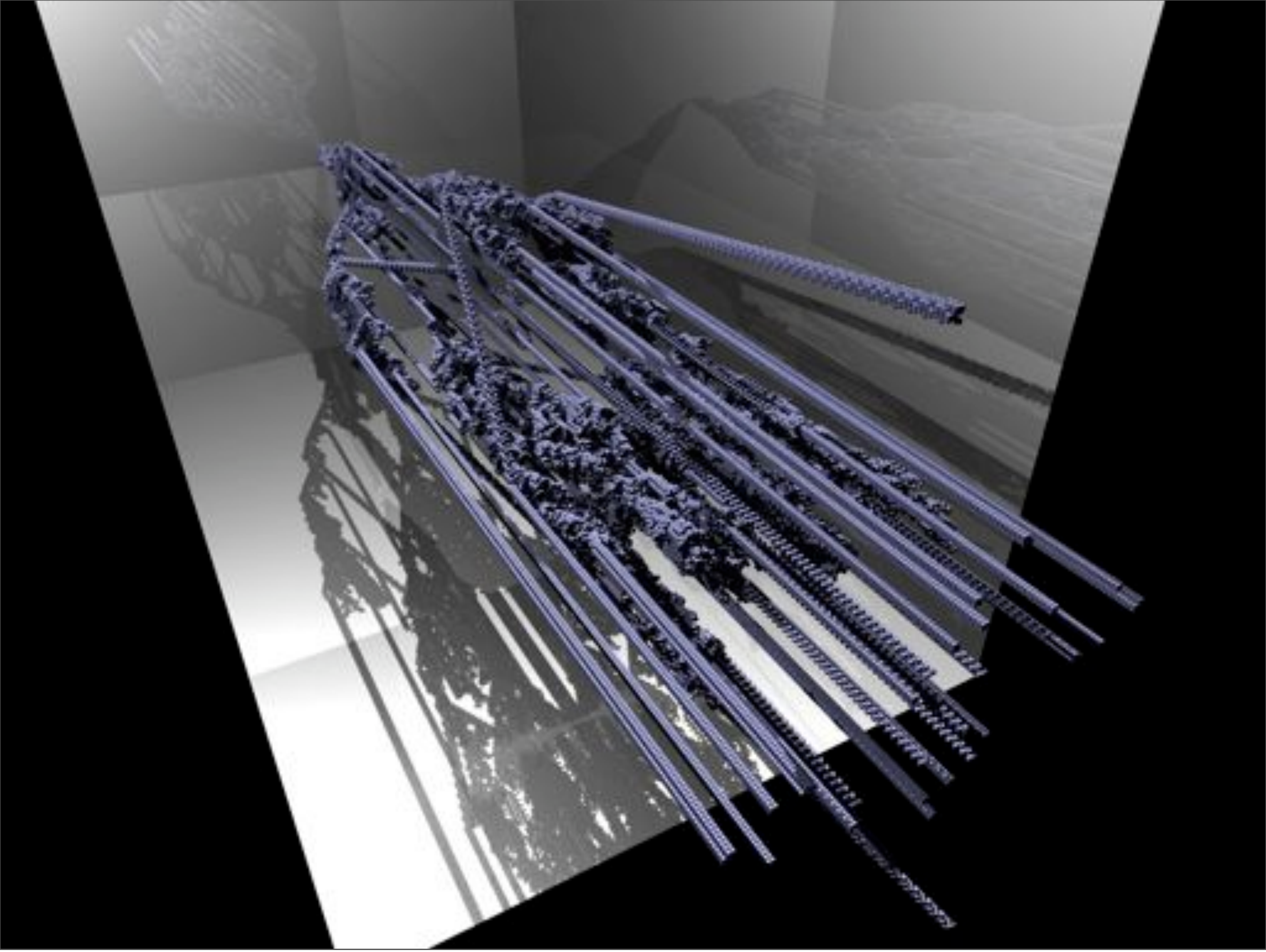




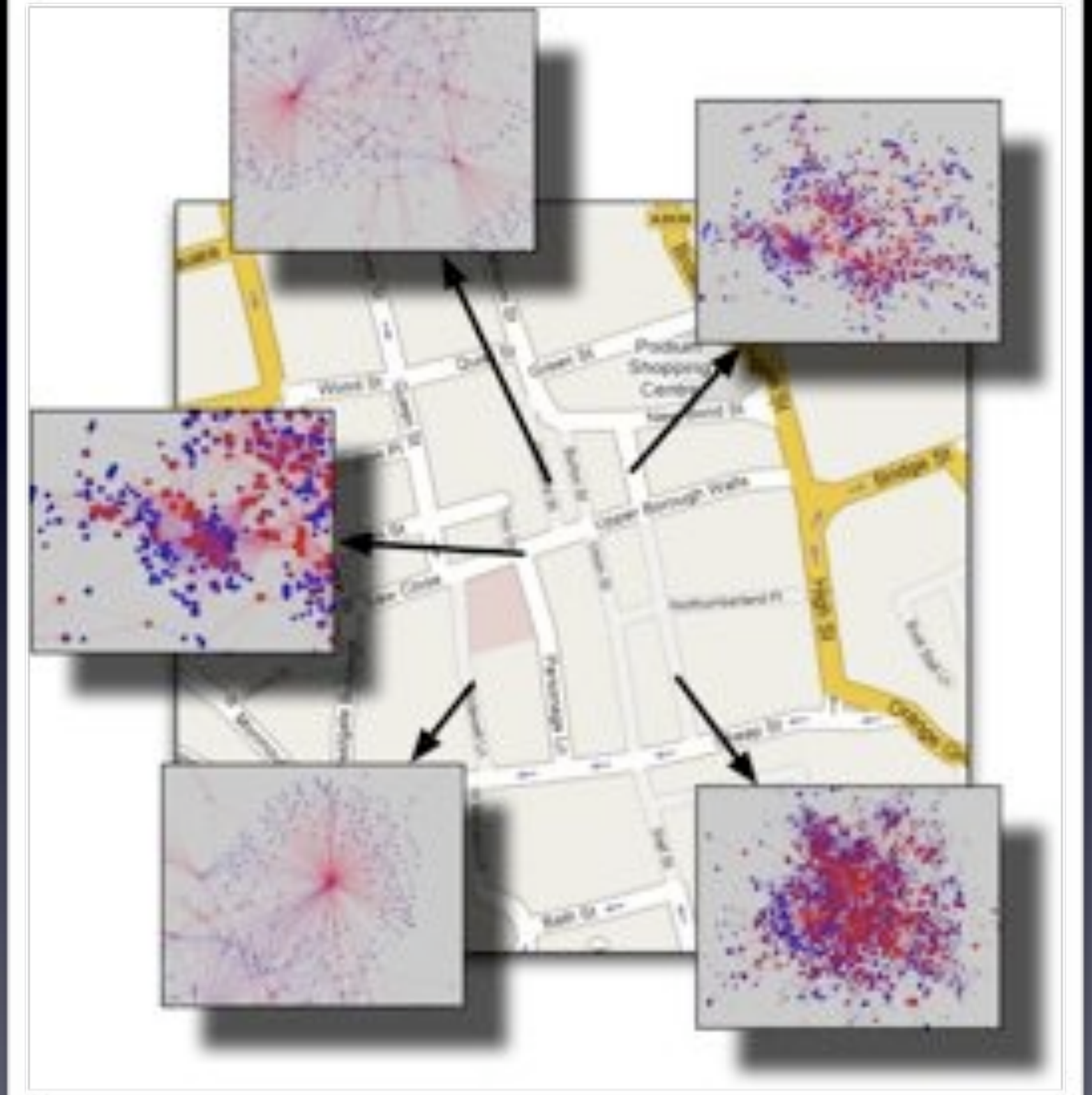
Considering time





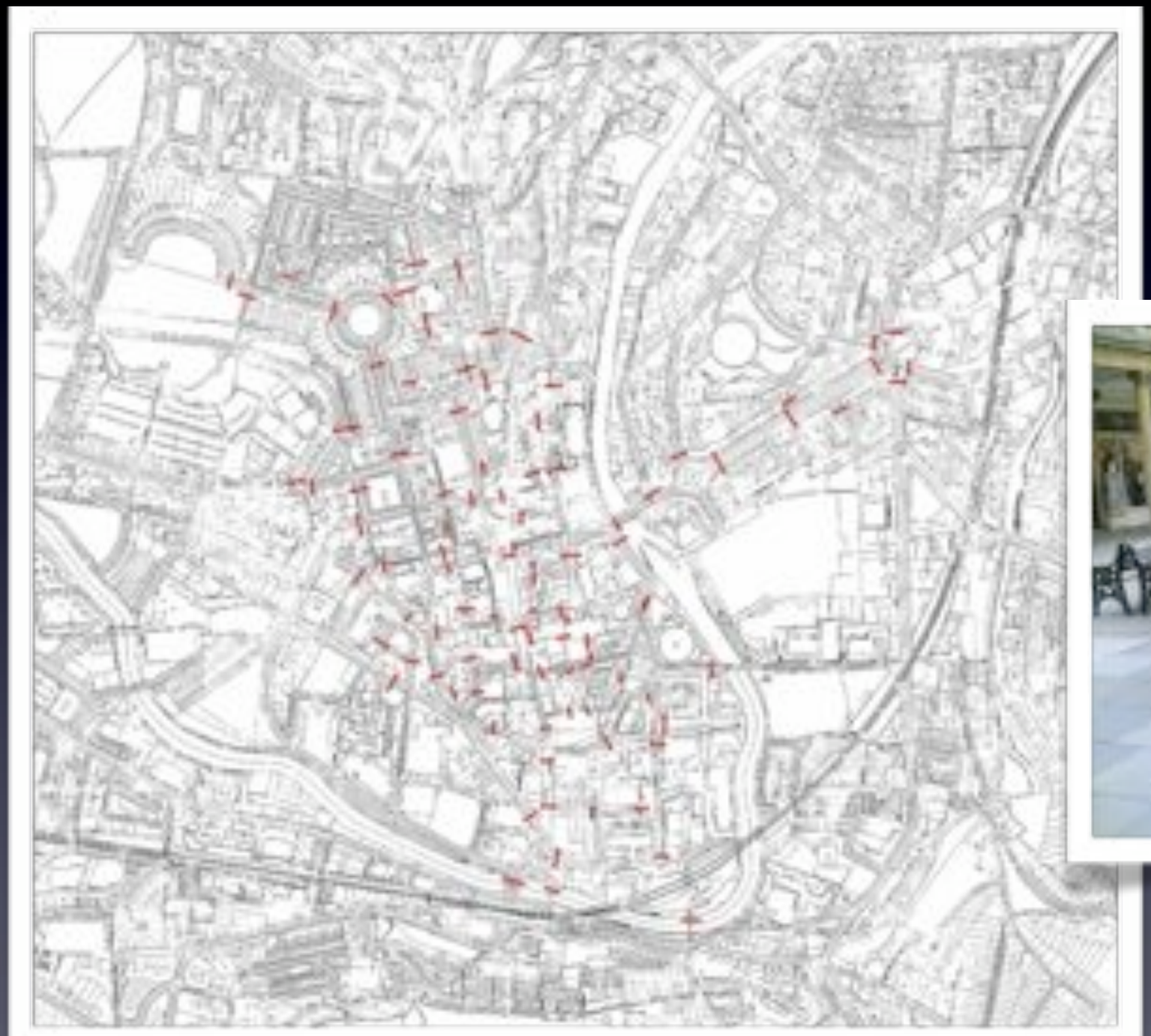


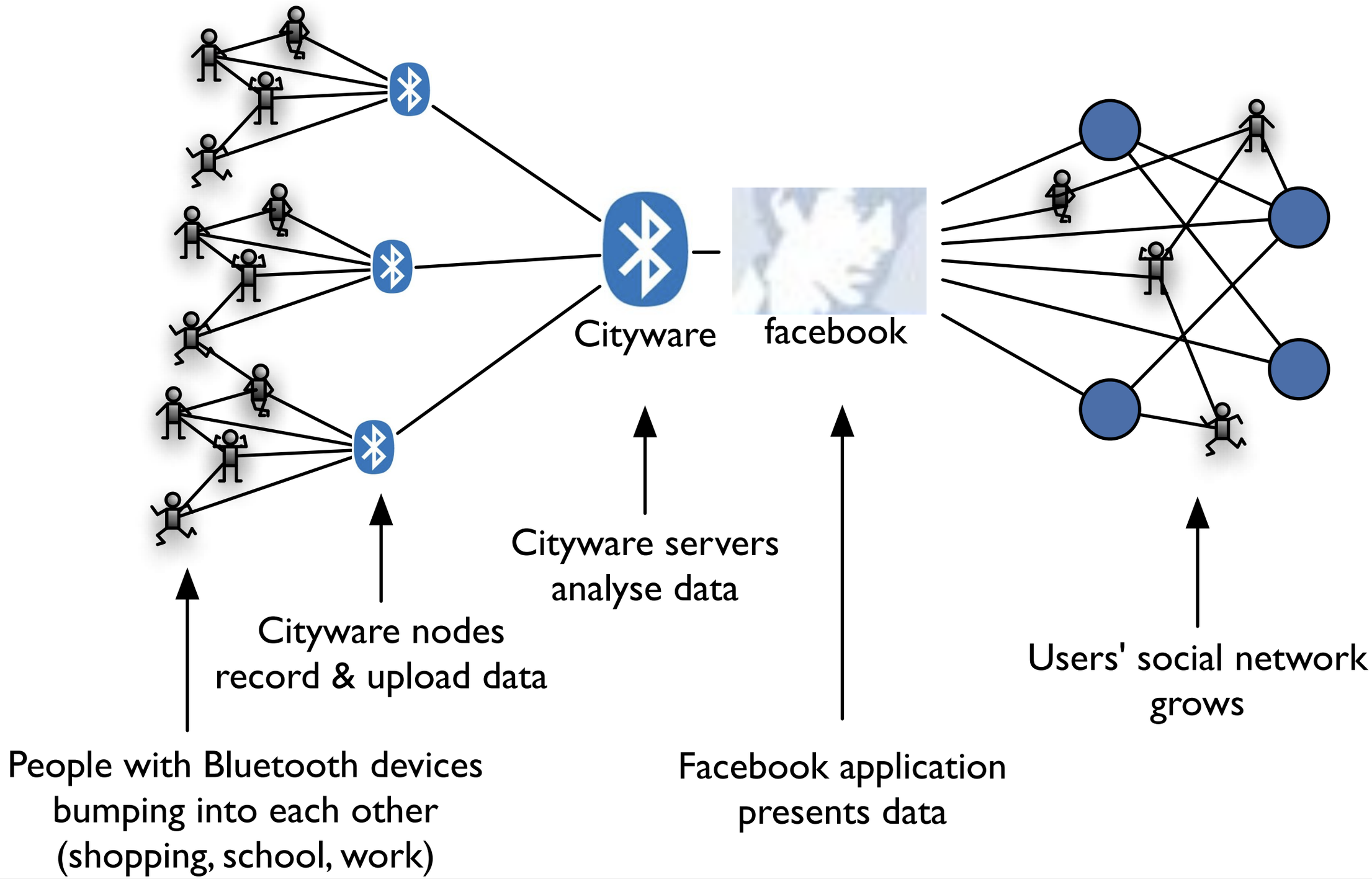
Thursday, 6 August 2009



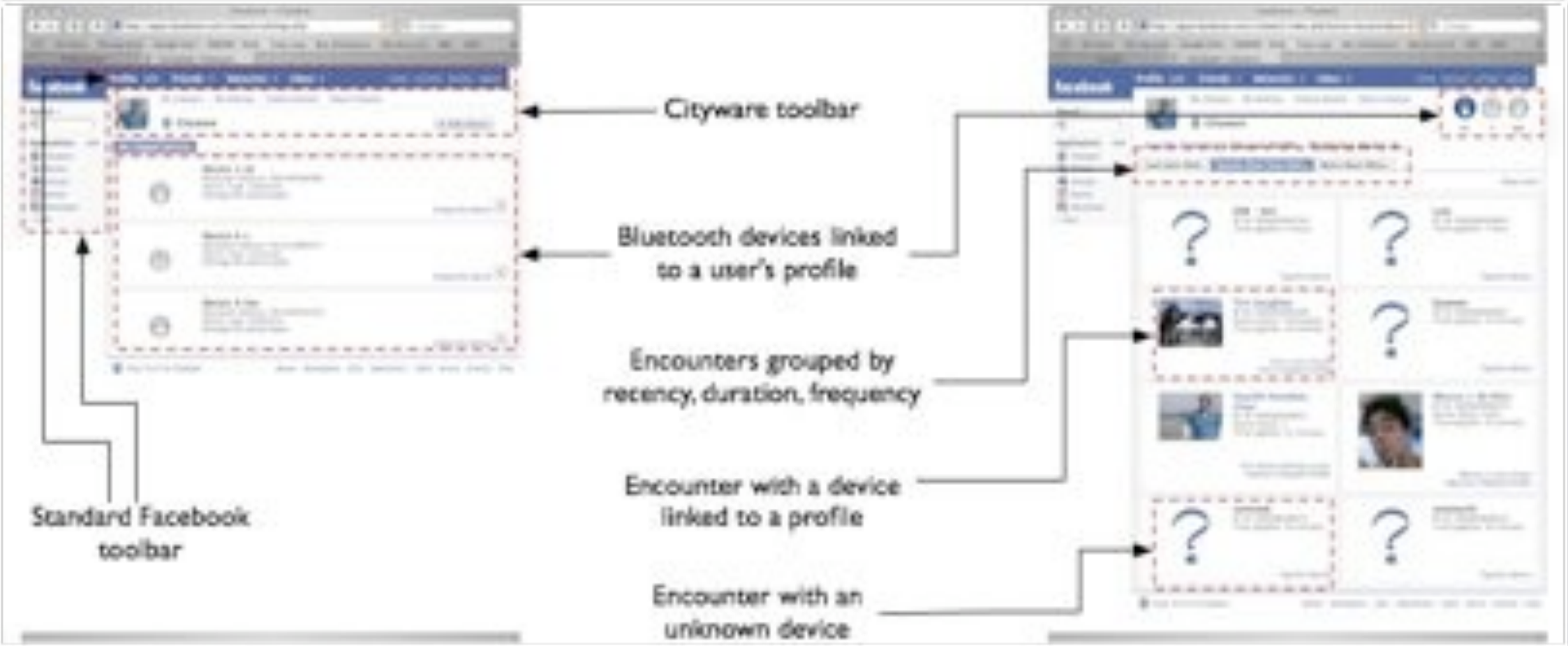
Kostakos, V. (to appear). Space Syntax and pervasive systems. In B. Jiang and X. A. Yao (Eds.), Geospatial Analysis and Modeling of Urban Structure and Dynamics, Springer, New York.

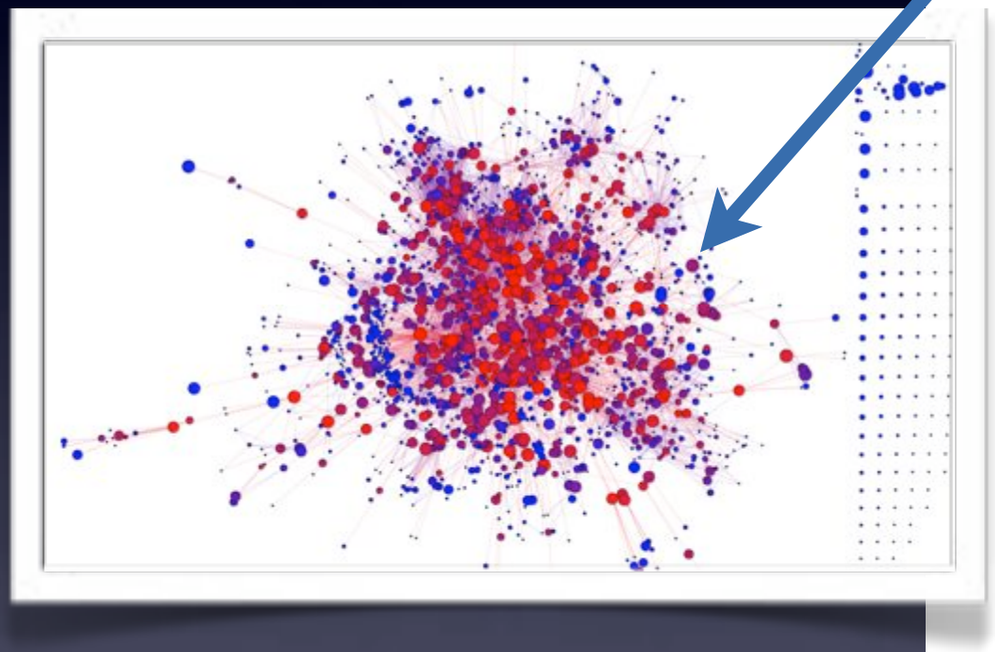
Data annotation

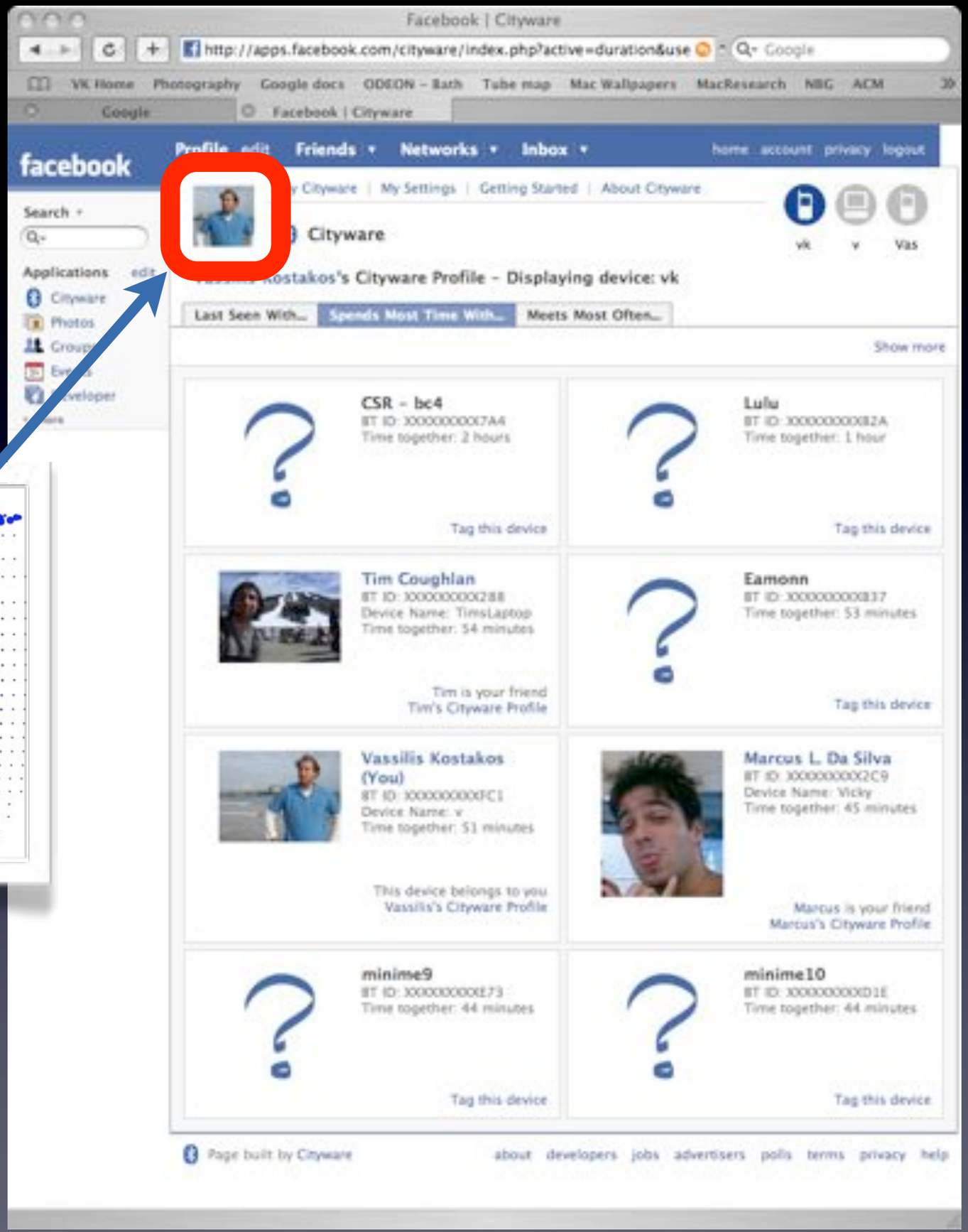




Kostakos, V. and O'Neill E. (2008). Cityware: Urban Computing to Bridge Online and Real-world Social Networks. In M. Foth (Ed.), Handbook of Research on Urban Informatics: The Practice and Promise of the Real-Time City. Hershey, PA: Information Science Reference, IGI Global, pp. 195-204

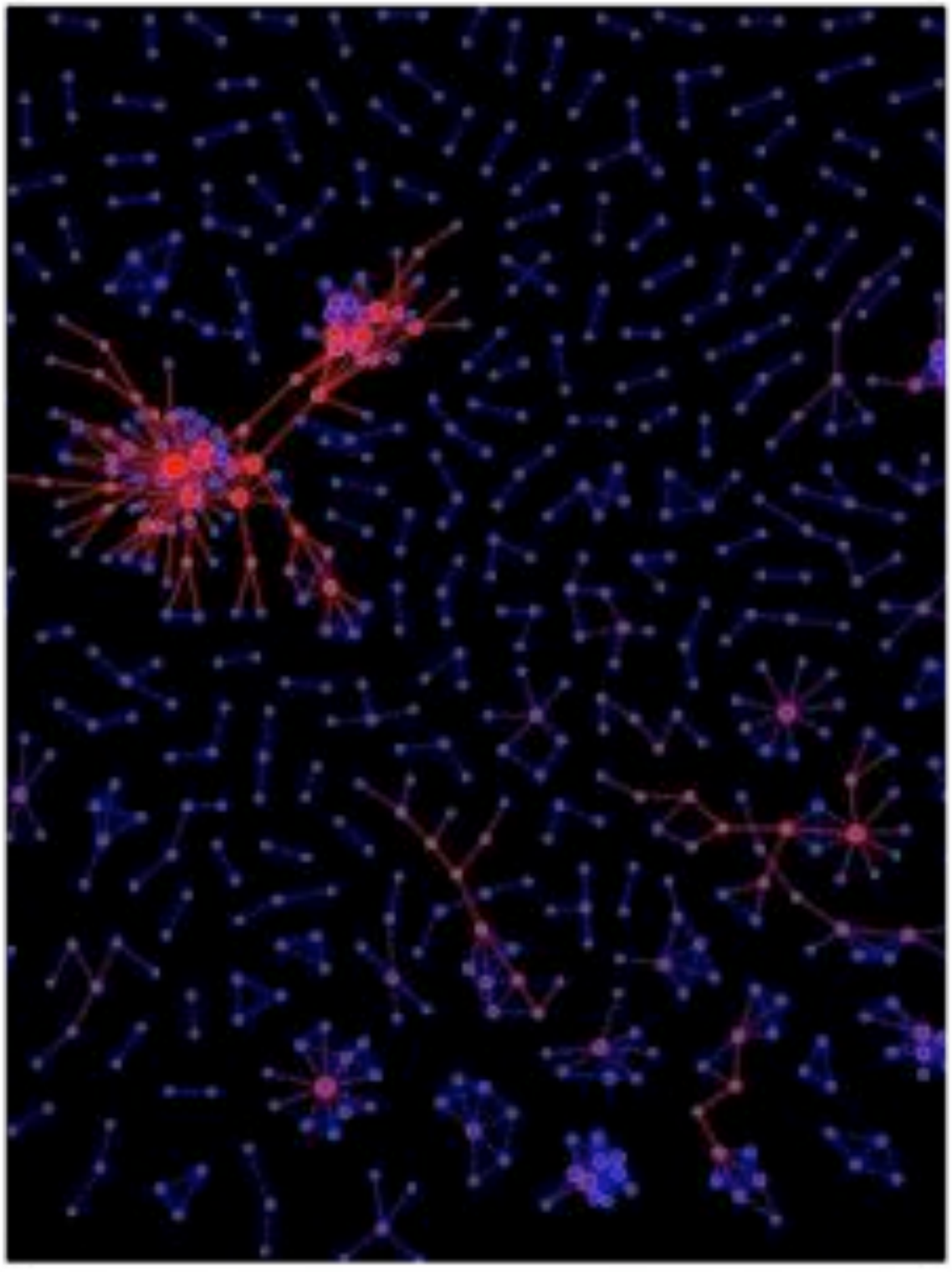

Cityware toolbar
Bluetooth devices linked to a user's profile
Encounters grouped by recency, duration, frequency
Encounter with a device linked to a profile
Encounter with an unknown device
Standard Facebook toolbar



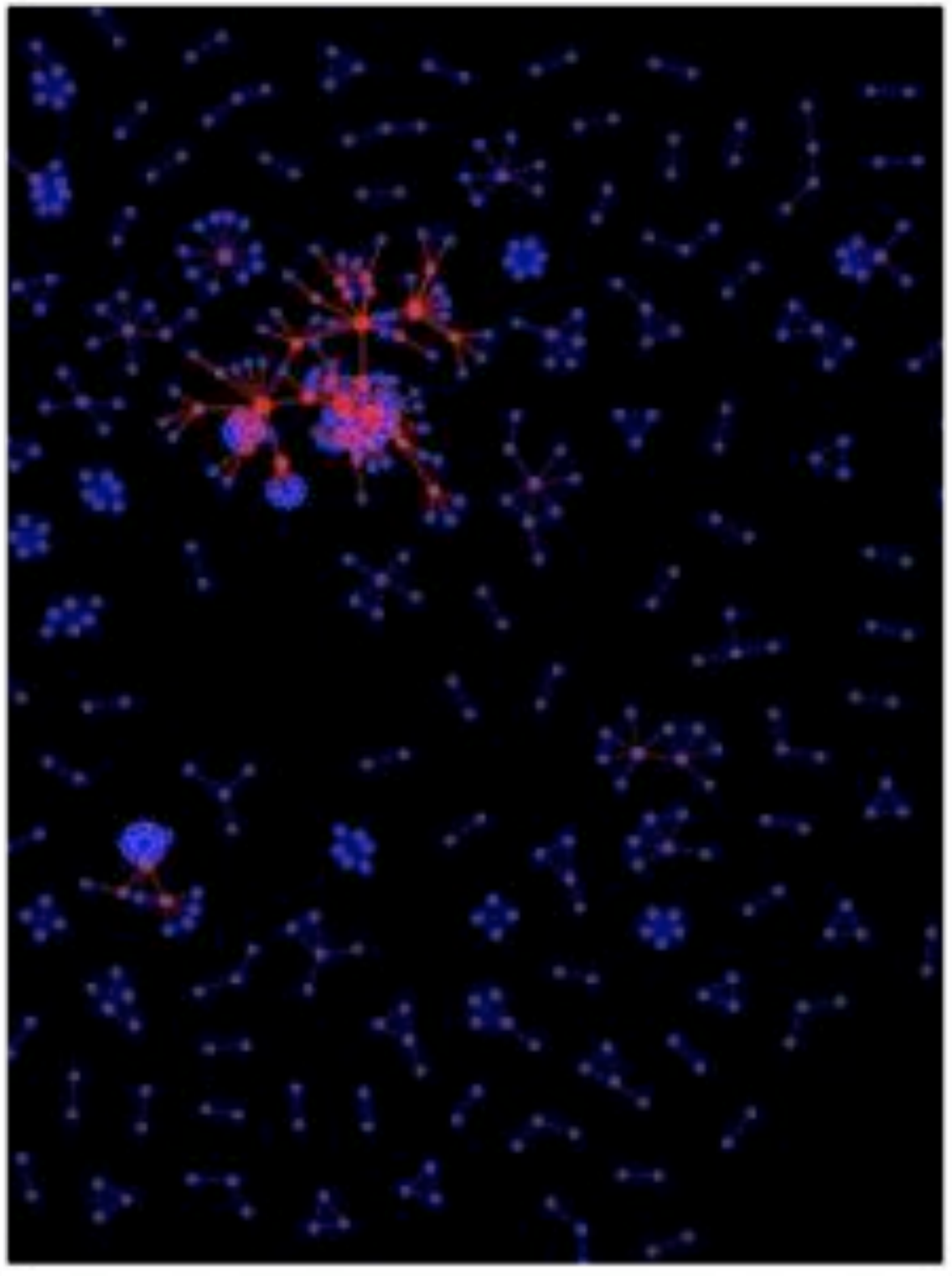

Facebook | Cityware
http://apps.facebook.com/cityware/index.php?active=duration&use
facebook
Profile edit
Friends
Networks
Inbox
home account privacy logout
My Settings
Getting Started
About Cityware
Search
Cityware
vk
v
Vas
Applications edit
Cityware
Photos
Last Seen With...
Spends Most Time With...
Meets Most Often...
Show more
CSR - bc4
BT ID: 300000000074
Time together: 2 hours
Tag this device
Lulu
BT ID: 300000000082A
Time together: 1 hour
Tag this device
Tim Coughlan
BT ID: 300000000288
Device Name: TimsLaptop
Time together: 54 minutes
Tim is your friend
Tim's Cityware Profile
Eamonn
BT ID: 300000000837
Time together: 53 minutes
Tag this device
Vassilis Kostakos (You)
BT ID: 300000000FC1
Device Name: v
Time together: 51 minutes
This device belongs to you
Vassilis's Cityware Profile
Marcus L. Da Silva
BT ID: 300000000X2C9
Device Name: Vicky
Time together: 45 minutes
Marcus is your friend
Marcus's Cityware Profile
minime9
BT ID: 300000000E73
Time together: 44 minutes
Tag this device
minime10
BT ID: 300000000D1E
Time together: 44 minutes
Tag this device
Page built by Cityware
about developers jobs advertisers polls terms privacy help

Cityware for Facebook

- US
  - MIT
  - Stanford
  - Boston
  - Urbana-Champaign
  - Michigan
  - Portland
  - Oklahoma
  - New York
  - Ohio
- UK
  - Cambridge
  - Oxford
  - Nottingham
  - Lancaster
  - Warwick
  - Bristol
  - Manchester
- Melbourne
- Bremen
- Cairo
- Iceland

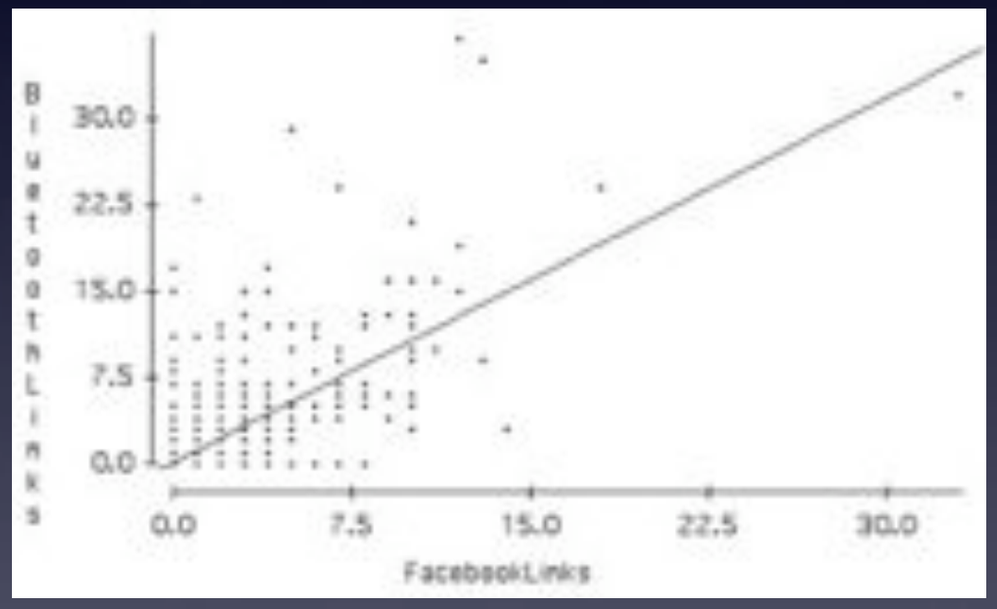


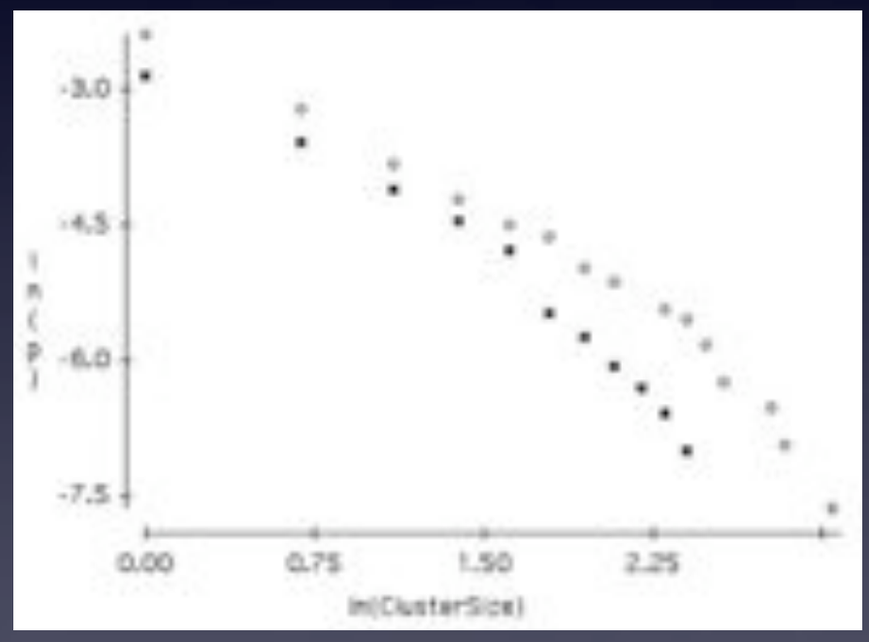
Facebook



Bluetooth

Bluetooth vs. Facebook



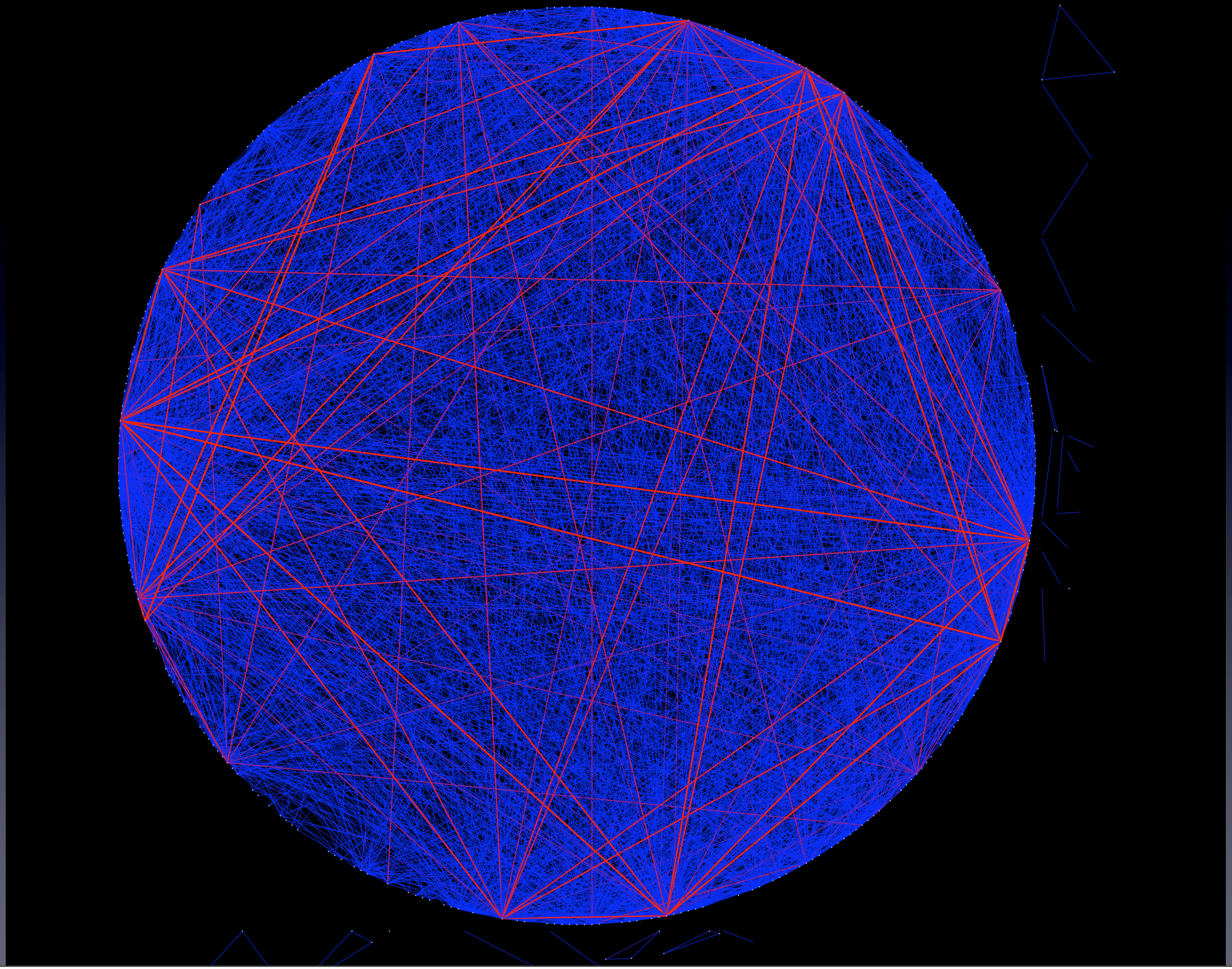


o - Facebook

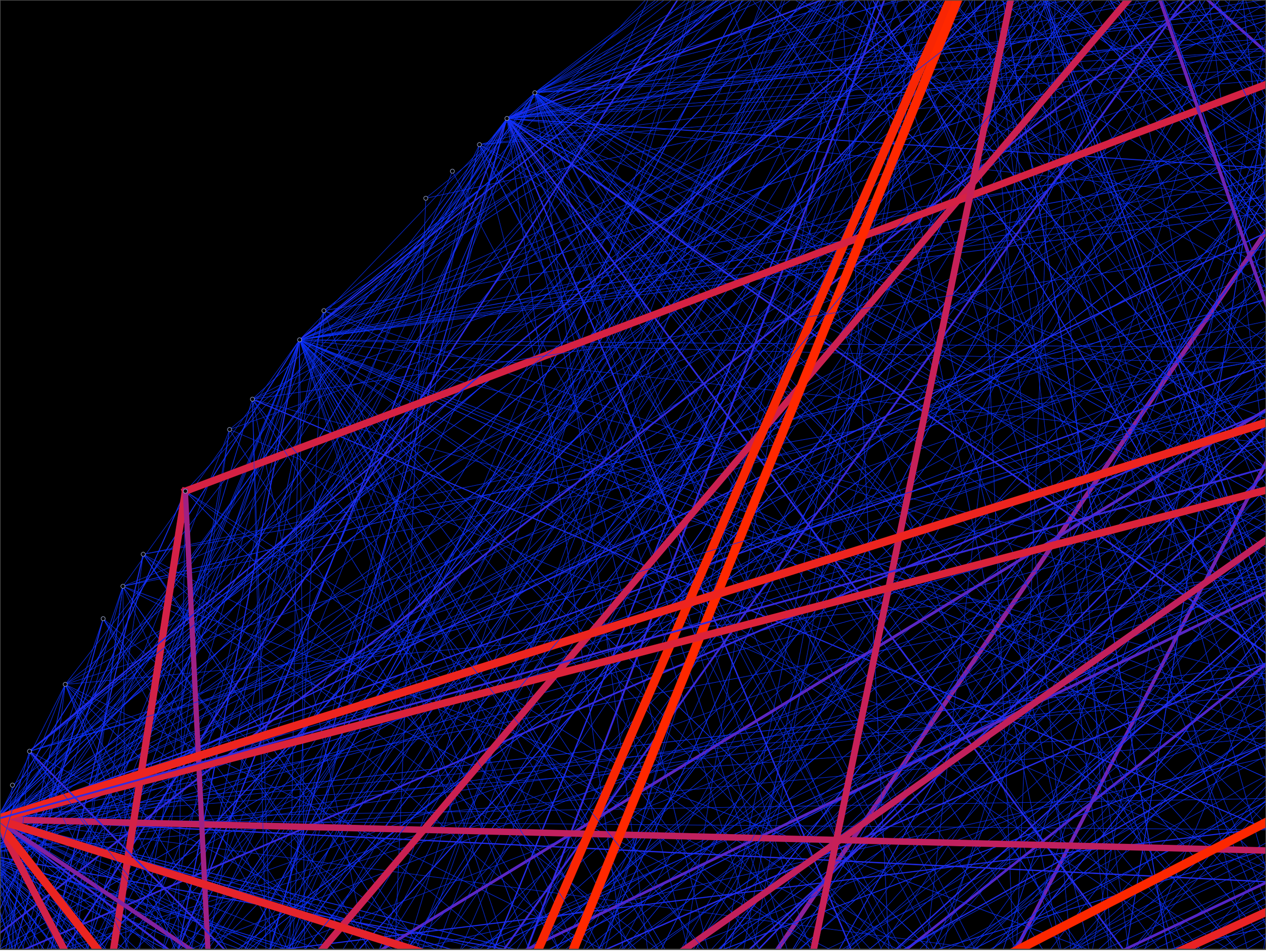
x - Bluetooth

Relationships between scanning sites

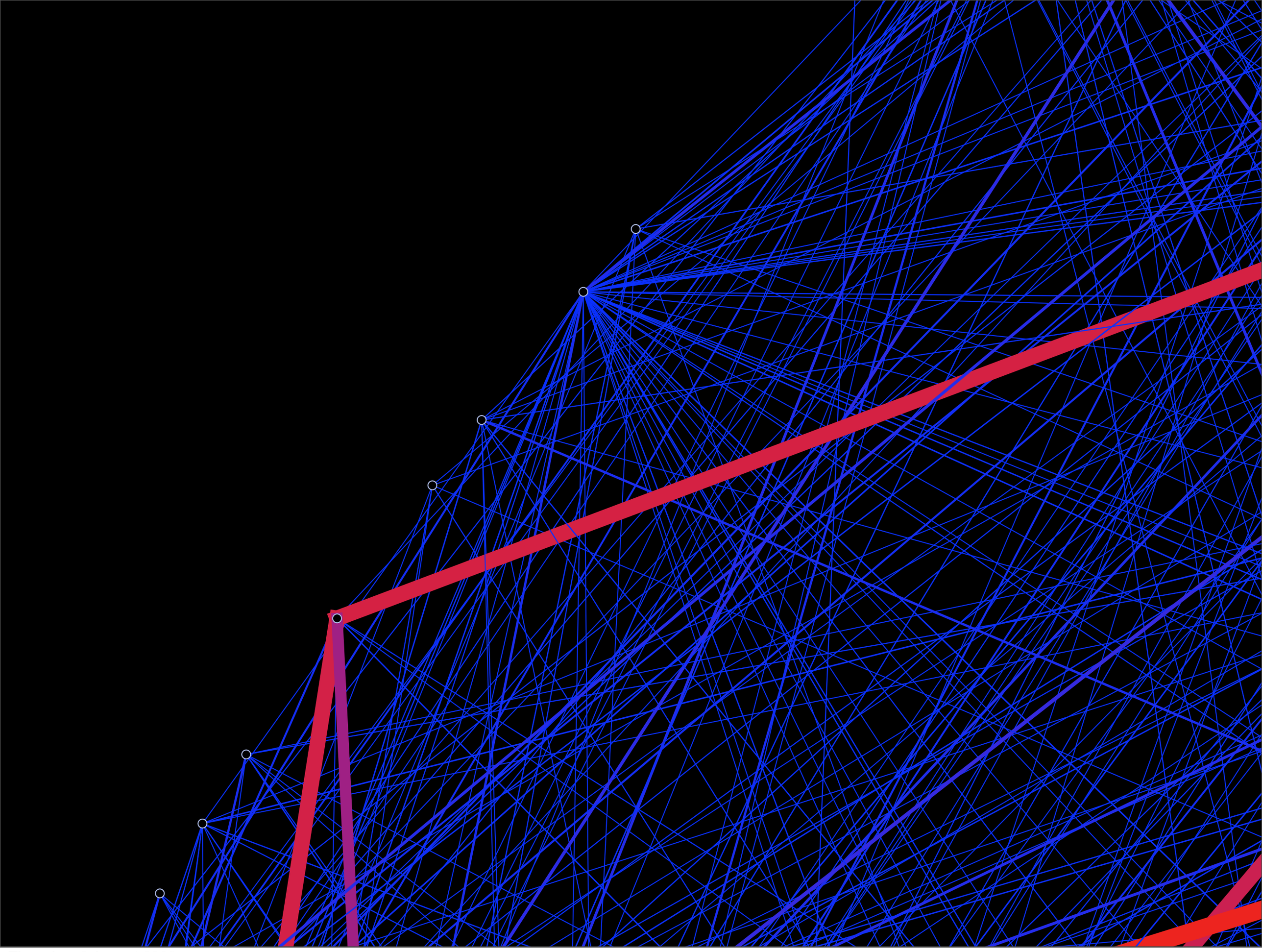
- Node: a physical location on the earth
- Link nodes that have been visited by same individual (bluetooth)
- “Heavy links” have many people travelling on them



Thursday, 6 August 2009

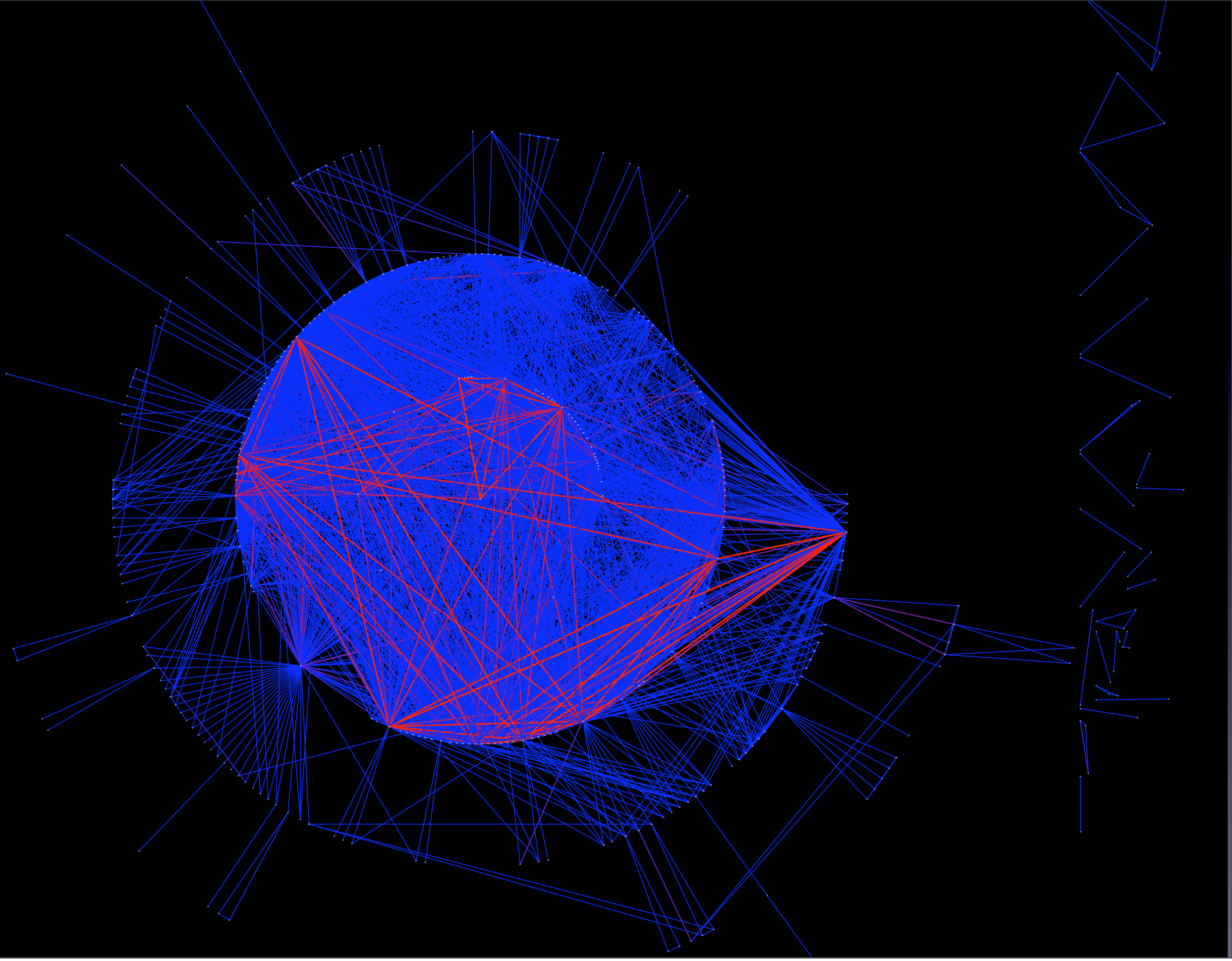


Thursday, 6 August 2009



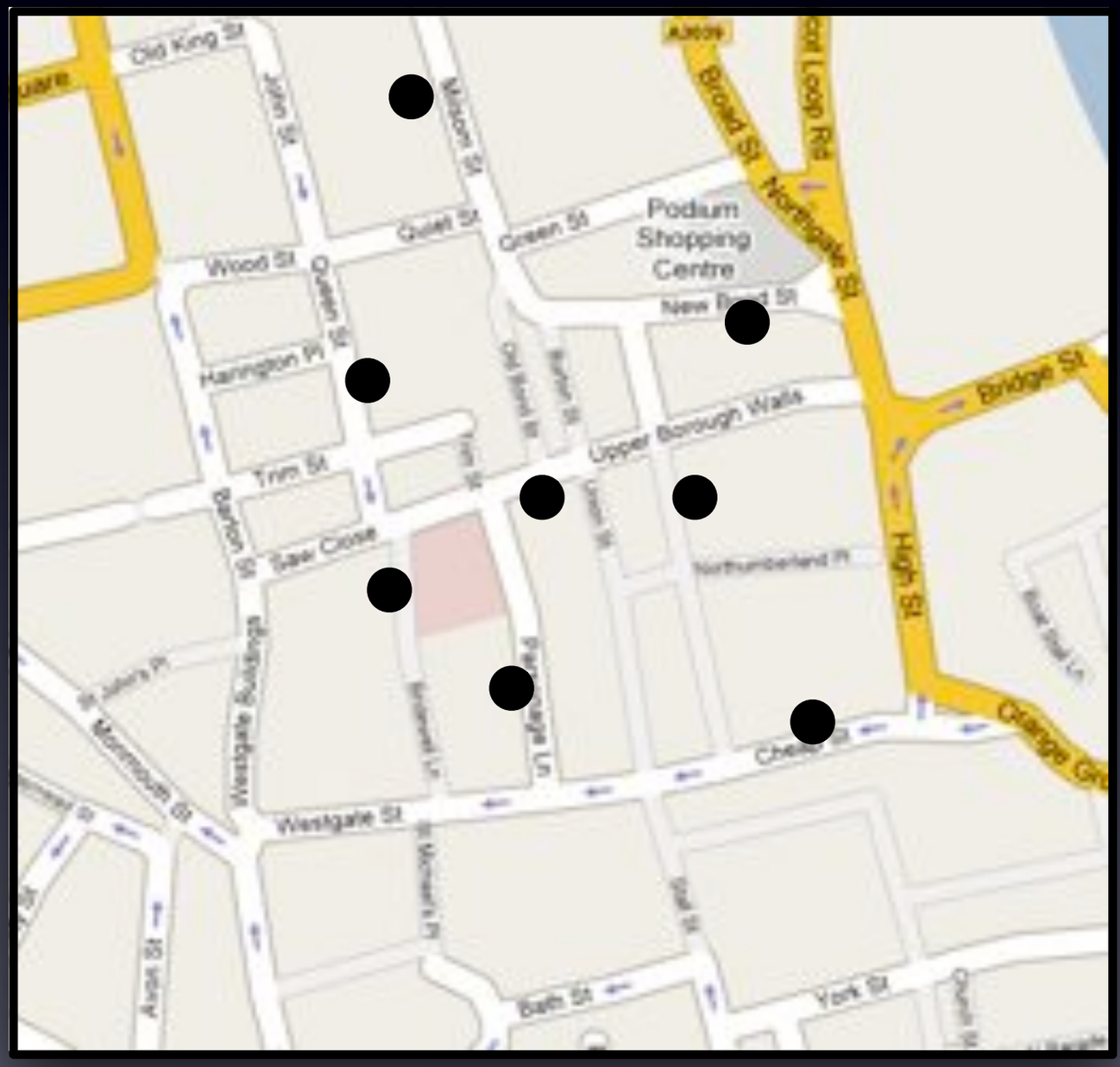
Thursday, 6 August 2009

It's a small world!



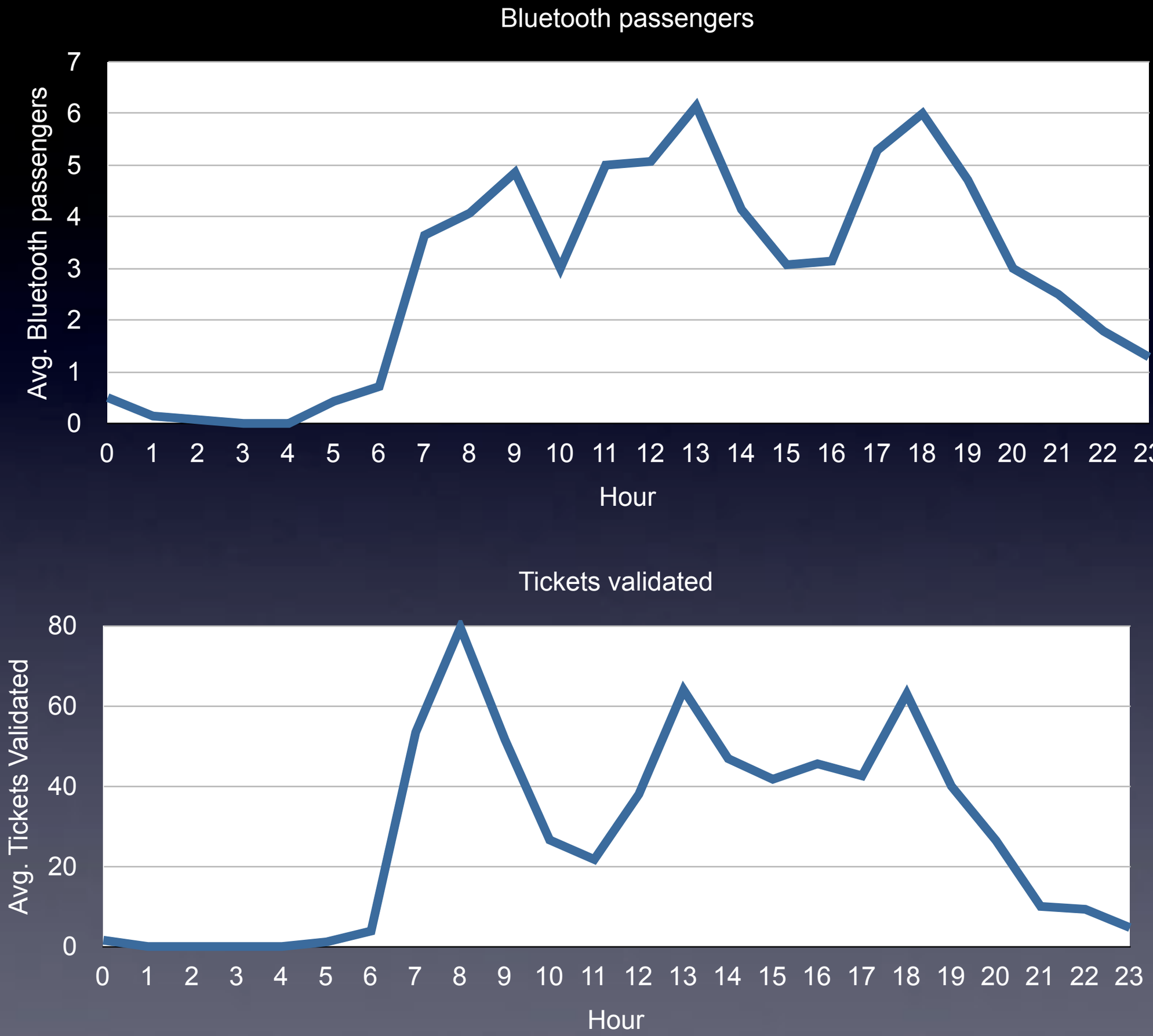
Thursday, 6 August 2009

Real-time traffic measurement

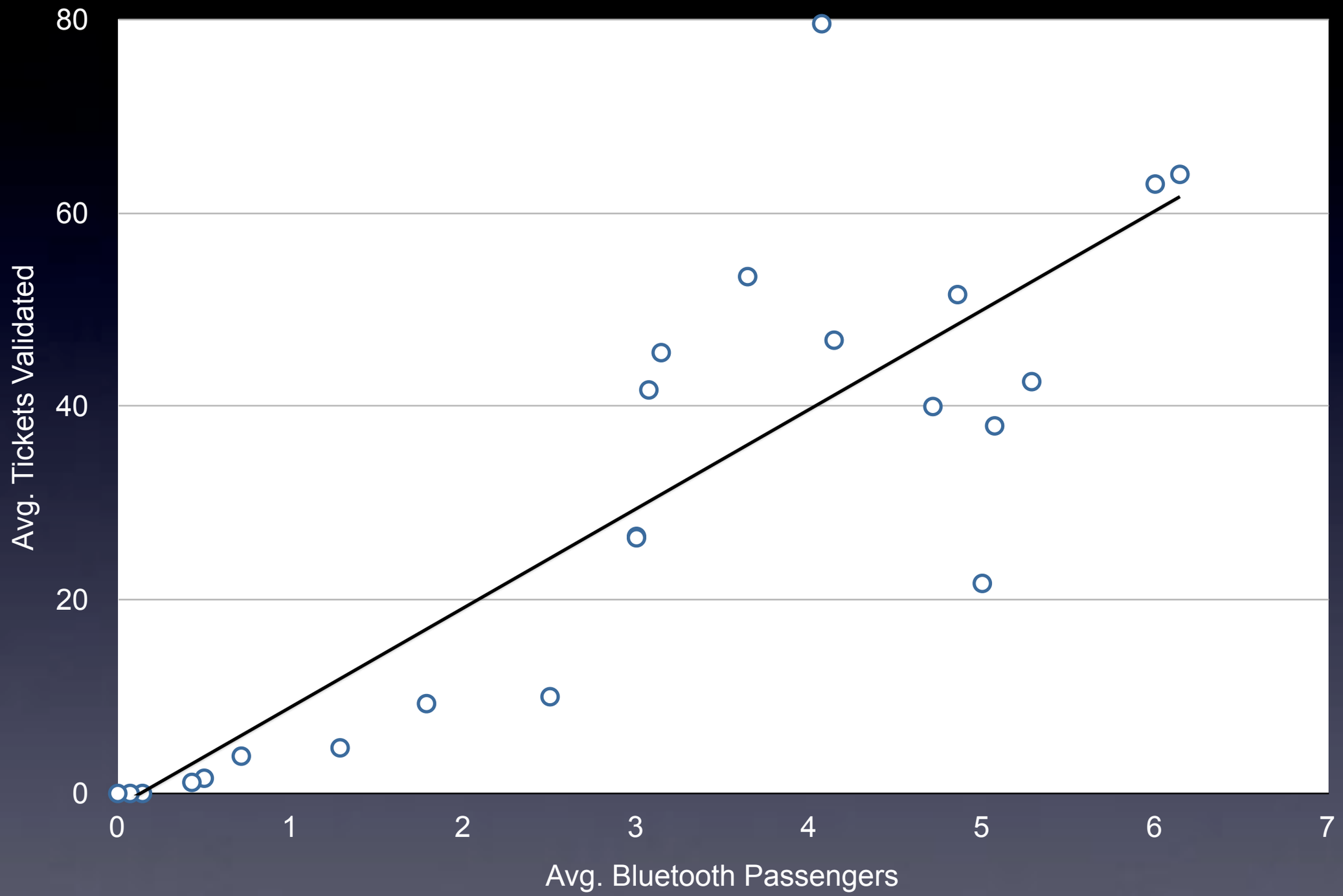


Intelligent sensing for public transport

Kostakos, V. (2008). Towards sustainable transport: wireless detection of passenger trips on public transport buses. arXiv:0806.0874.


Bluetooth passengers
Avg. Bluetooth passengers
0
1
2
3
4
5
6
7
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour

Tickets validated
Avg. Tickets Validated
0
20
40
60
80
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Hour


80
60
40
20
0
Avg. Tickets Validated
0
1
2
3
4
5
6
7
Avg. Bluetooth Passengers

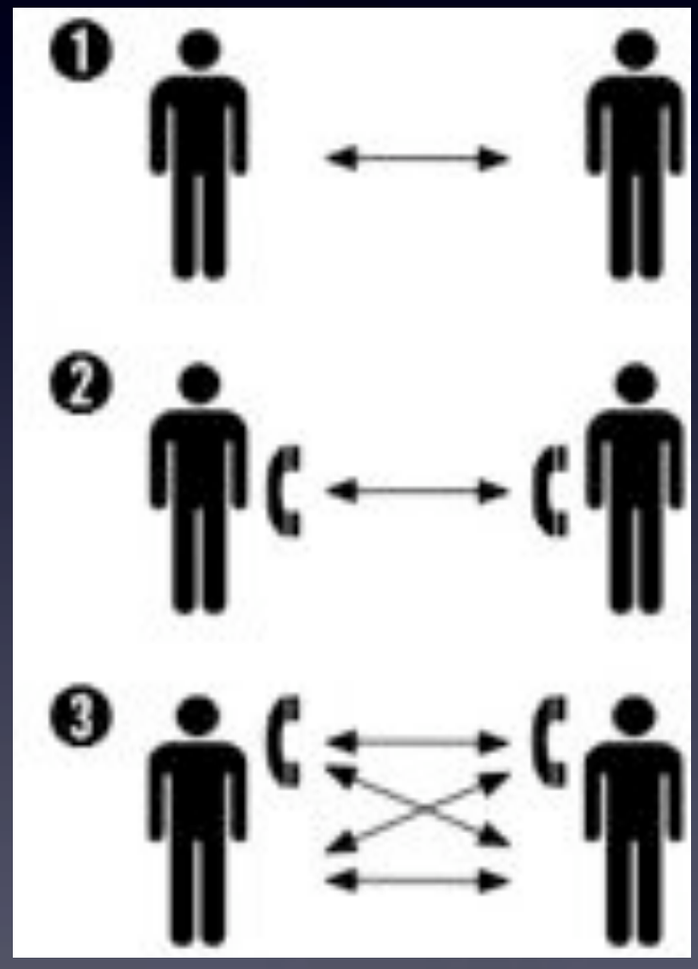
Towards useful metrics

UPI characteristics	Metrics	Methods
Mobility	Distance traveled Speed Flow Visit duration	Gatecounts Mobile Scanners Emulation Simulation
Temporal structure	Laws and rules Time-based distributions	Inter-connection analysis Longitudinal gatecounts Emulation Simulation
Social structure	Network analysis metrics (e.g. degree, betweenness, closeness)	Longitudinal static snapshots Mobile scanners Emulation Simulation
Spatial structure	Space syntax metrics (e.g. integration, choice)	Space syntax Simulation
Facts and figures	Statistical characteristics	Wardriving Gatecounts Static snapshots Mobile Scanners

Kostakos, V., Nicolai, T., Yoneki, E., O'Neill, E., Kenn, H. and Crowcroft, J. (2009). Understanding and measuring the urban pervasive infrastructure. Personal and Ubiquitous Computing, Springer, 13(5):355-364.

Urban encounters of the 1st, 2nd & 3rd type

1. Direct human communication
2. Communication replaced by technology
3. Communication augmented by technology



Fatah gen. Schieck, A., Kostakos, V., Penn, A. (to appear). Exploring the Digital Encounters in the Public Arena. In K. Willis, G. Roussos, K. Chorianopoulos, M. Struppek (Eds.), Shared Encounters, Springer, Germany

The end!

- Questions?

- vassilis @ cmu . edu
- http:// www . labuse . org

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