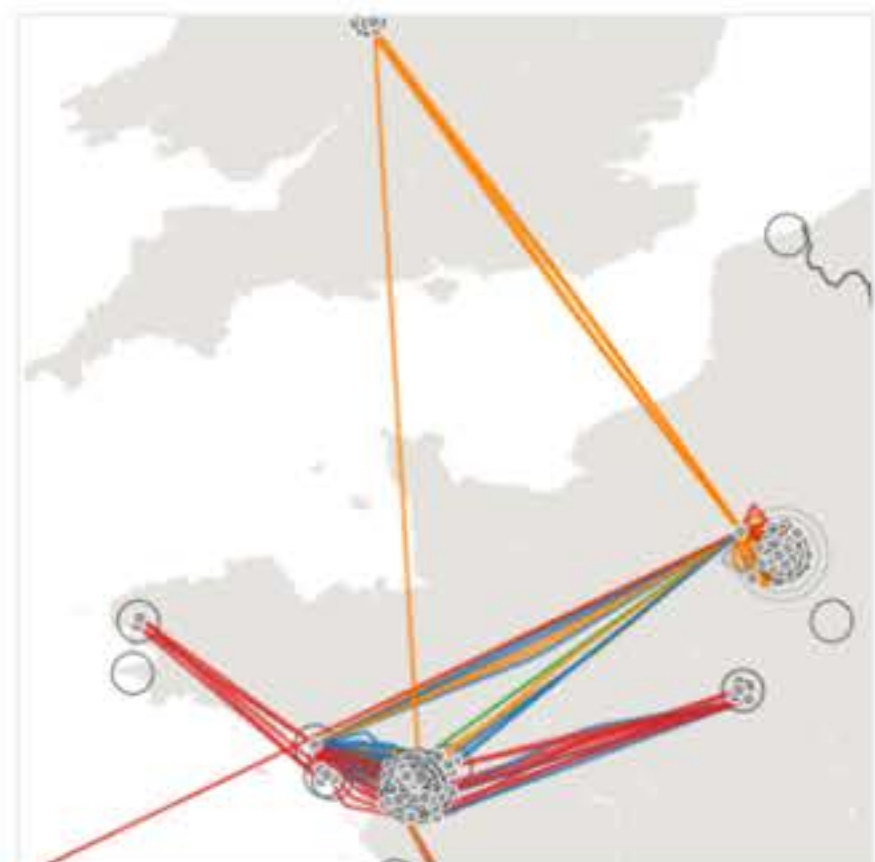
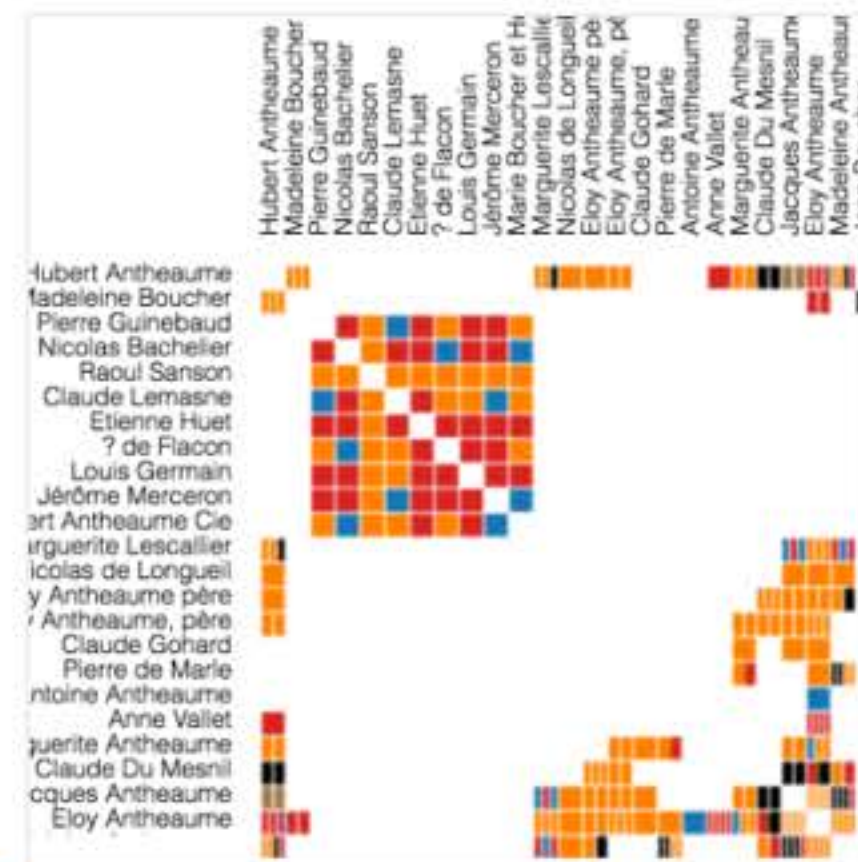
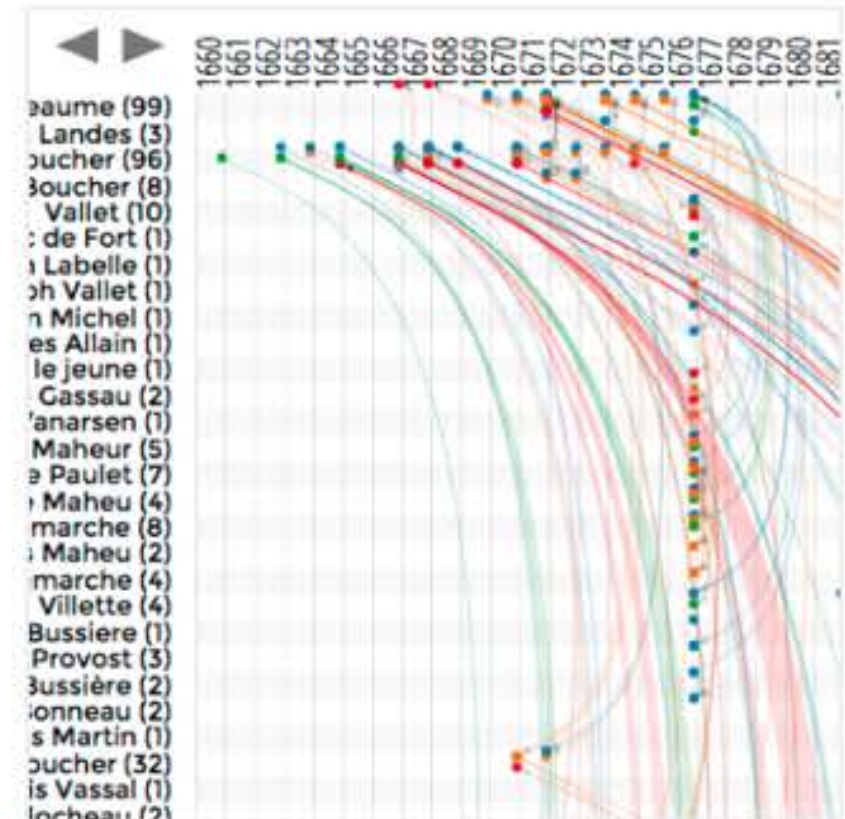
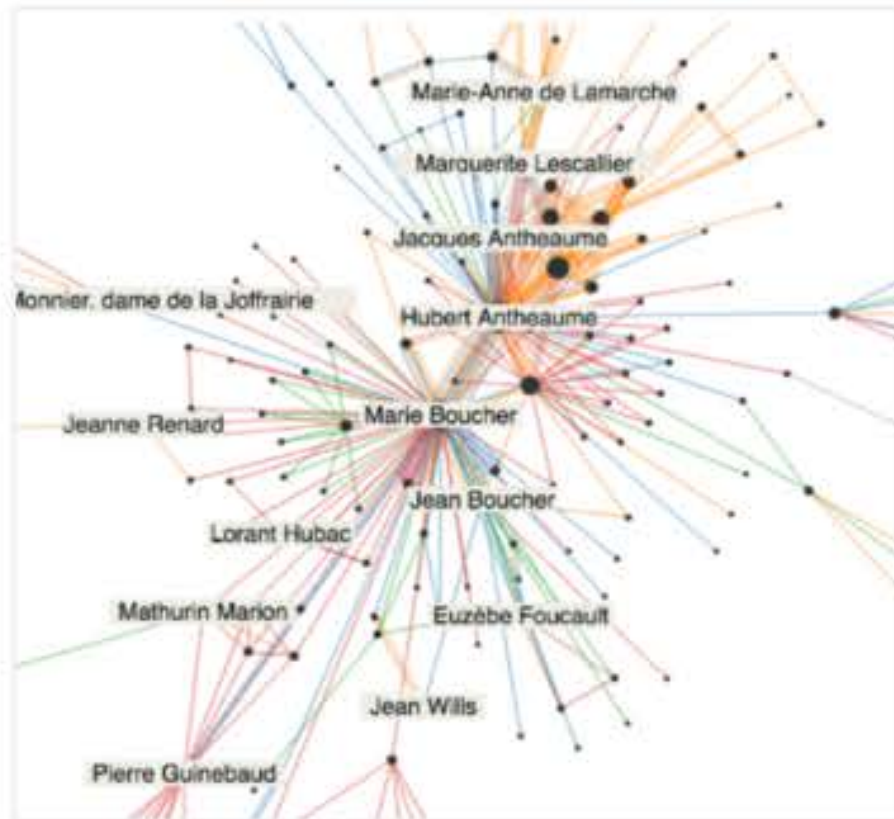


Visualizing Spatio-Temporal Data

Benjamin Bach

Lecturer for Design Informatics and Visualization
University of Edinburgh



Occupancy



Building 1000

Building 1000

Scheduler

Chiller Pad

Chiller 1

Chiller 2

Chiller 3

Chiller 4

Bunker 9605

Bunker 9607

Bunker 9609

Bunker 9611

Bunker 9613

Bunker 9615

Bunker 9617

CRAC 20

Start Command
OnCommand On
Command Off

Communication Loss

false

Local Off

true

Space Temperature

67.0 °F

Space Humidity

56.0 %

Stages

0.0

Percent Load

0.0 %

Remote Off

false

Air Flow Loss

false

Leak

false

Change Filters

false

Hi Temp

false

Lo Temp

false

Smoke Detected

false

Generator

Water Temperature

Water
90.54

Oil Pressure

Oil
0 psi

Full Tank

false

Half Tank

false

Empty Tank

false

Haise 8



kW



Temperature



Floorplan

History Builder

Computer Room Cooling Units

10

11

15

16

18

19

20

21

22

PDUs

H1

H2

H3

K1

K2

K3

Breaker Panels

Rm 139 4PI

Rm 139 DPCC

Rm 145 145A

Rm 145 145B

Rm 145 S85

Rm 147 S82

Rm 147 S83

Rm 147 S84

Haise C-D

Kilrain A-B

BL 1000 C1A

BL 1000 CF2A

BL 1000 HPA

BL 1000 H8CHP

Rm 100 H8B H8C

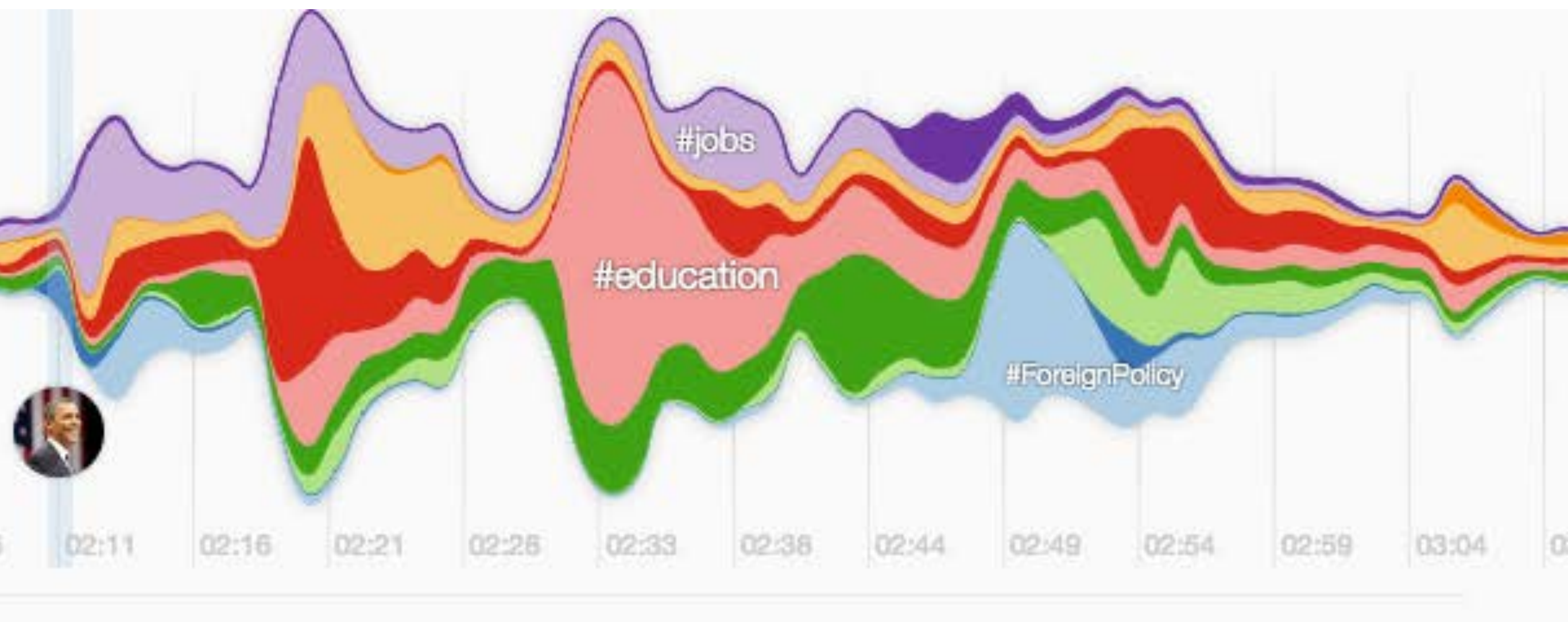
Rm 100 H8B

Time

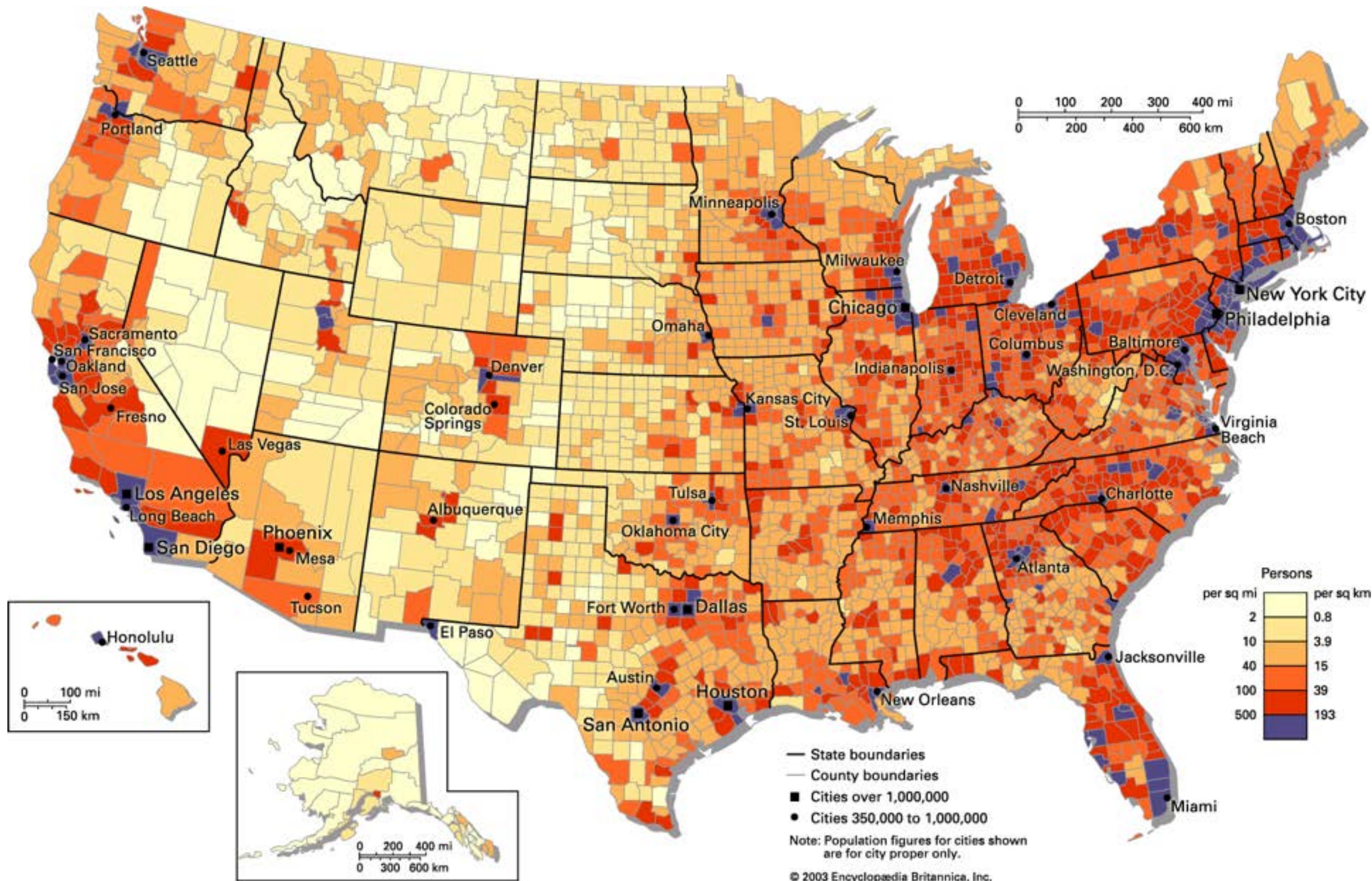




Streamgraphs



Space



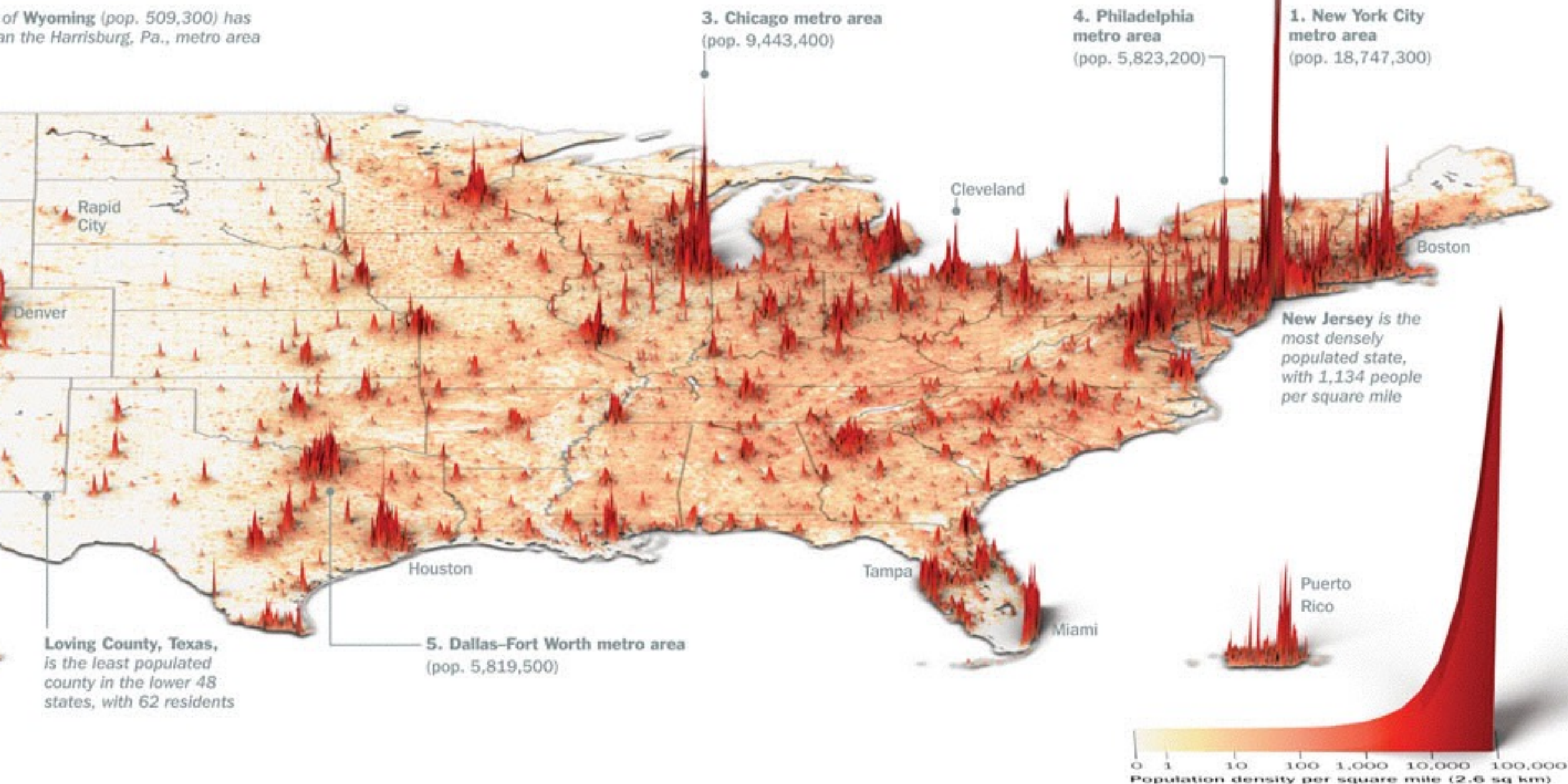
• • •

g. We are also moving
nation is a vast prairie

Our families are getting smaller—with one vital exception. Compared with those of Europe and Japan, the U.S. population is younger and more colorful because of the continued arrival of immigrants and their higher-than-average birthrates. Of the 100 million Americans who will join us in the next 37 years, half will be immigrants or their children. In the next few decades, 97% of the world's population growth will occur in the developing world; the U.S. is the largest developed country in the world that is still growing at a healthy clip. That matters, strategically, economical-

Ala.; Possum Trot, Ky.; or Lonelyville, N.Y. But they are all probably close to someone's idea of paradise. —By Nancy Gibbs

of Wyoming (pop. 509,300) has
an the Harrisburg, Pa., metro area



Sources: U.S. Census Bureau; LandScan 2003/UT-Battelle, LLC

Space + time



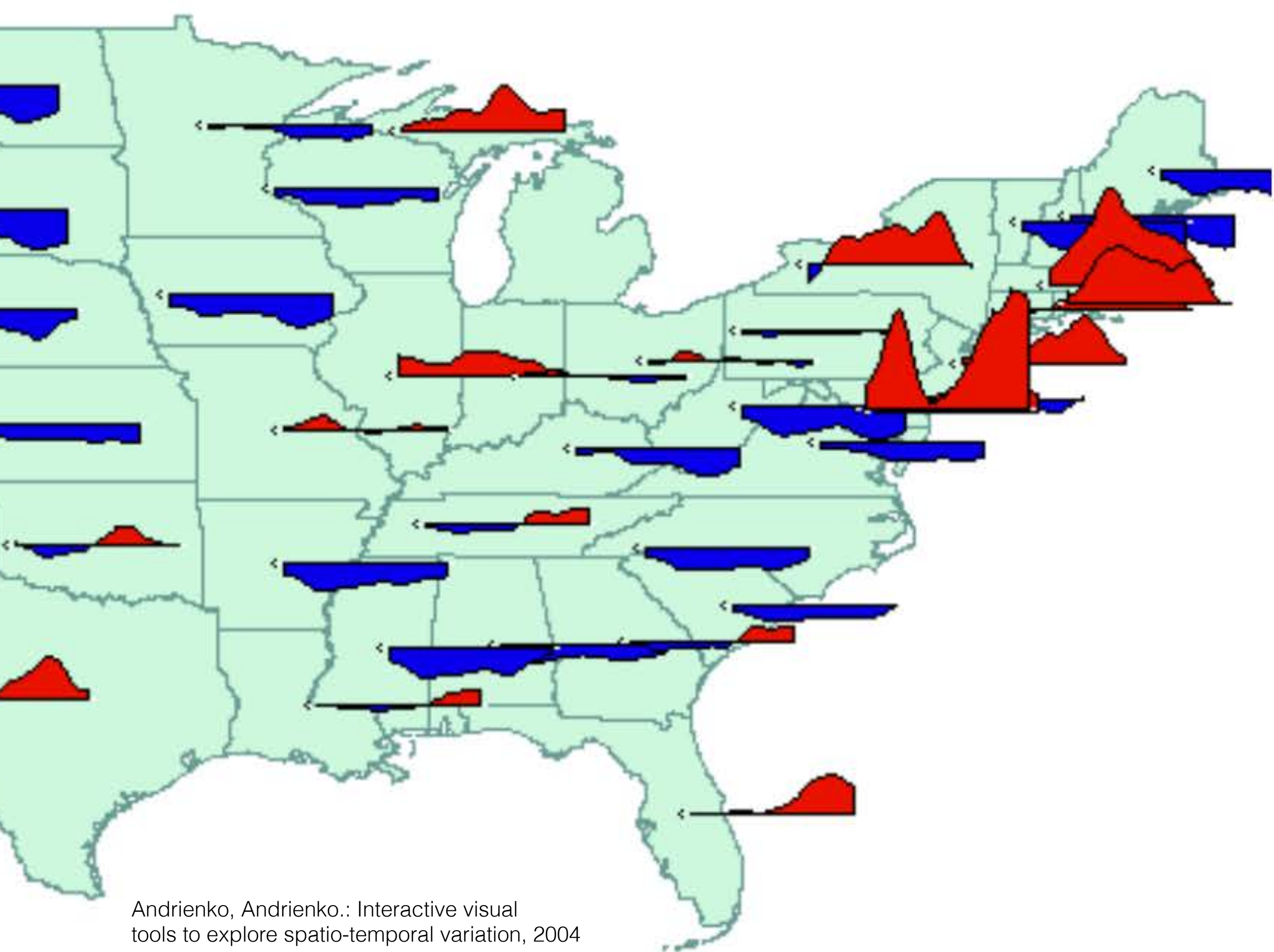
Looking ahead to 2032 ...

Without the NDR we see
morning peak traffic using a
variety of routes.

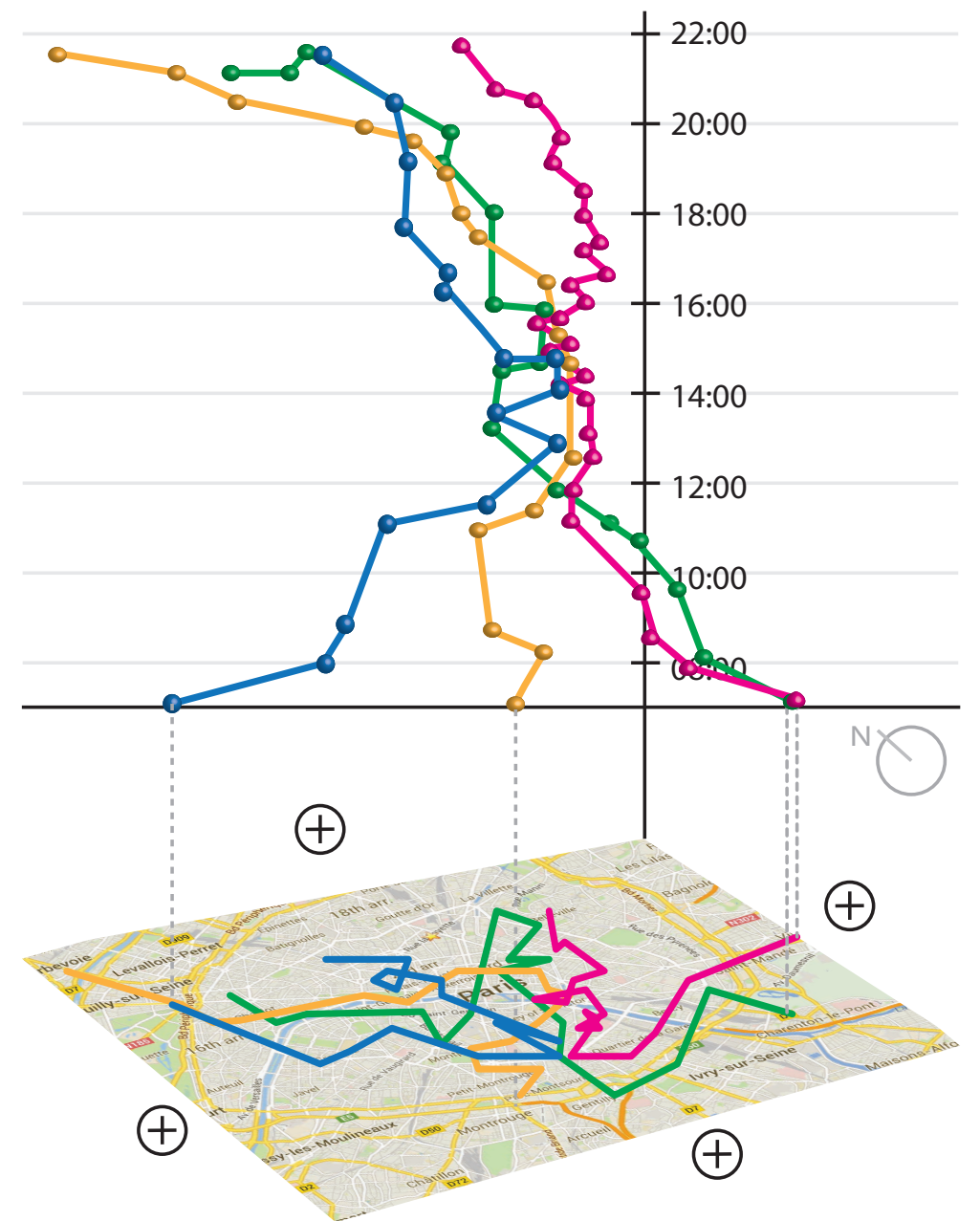
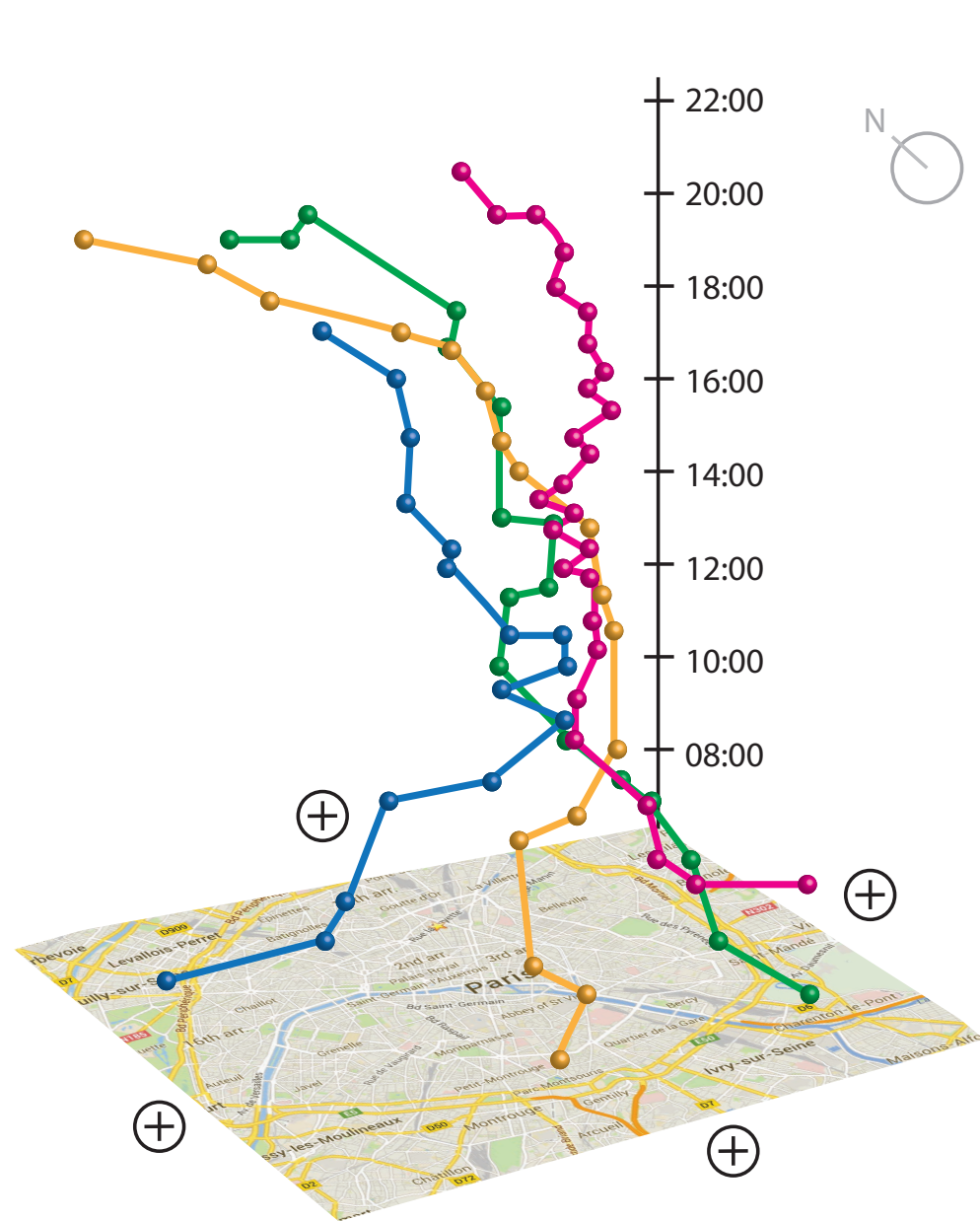
Morning peak
traffic flow





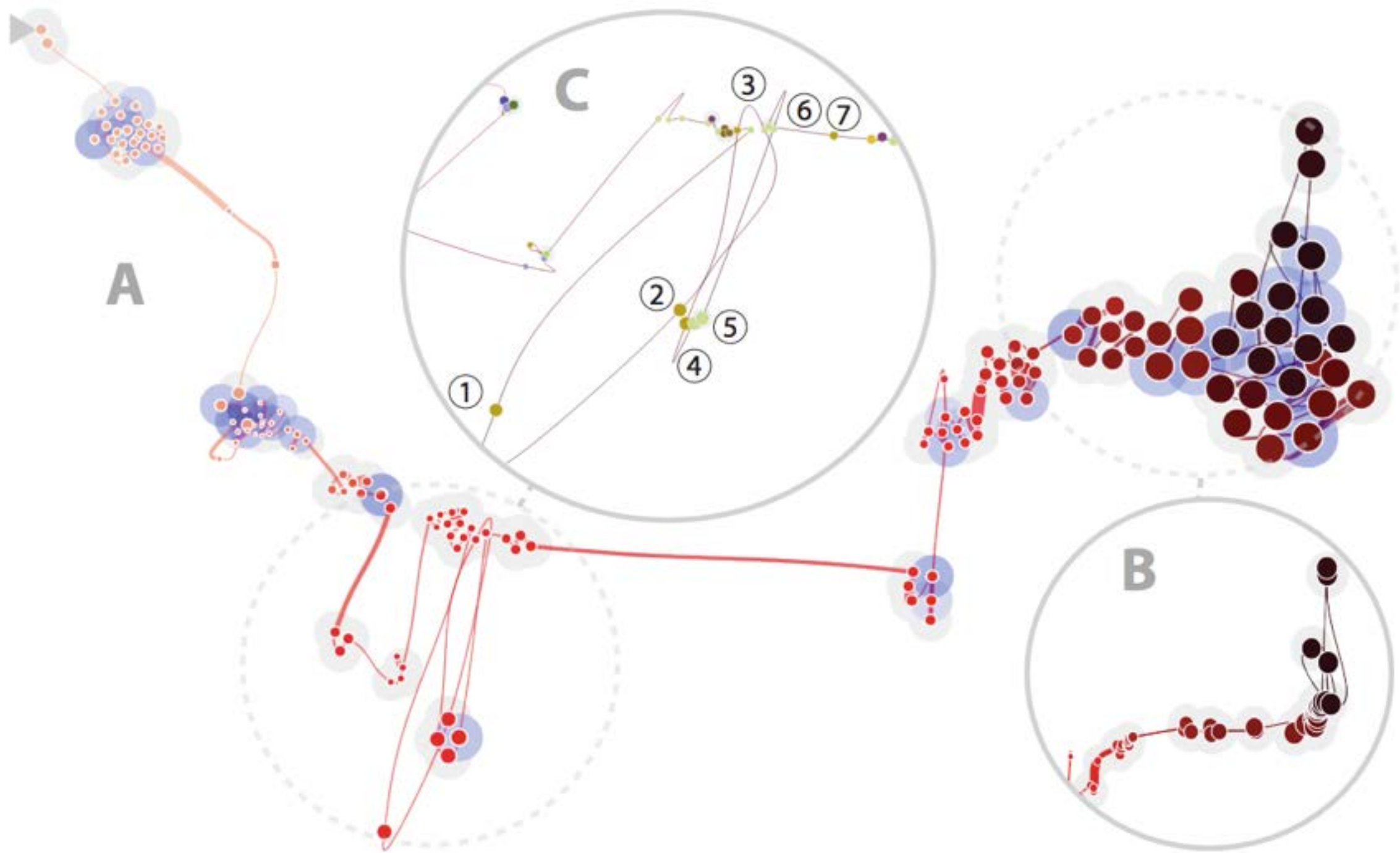


Andrienko, Andrienko.: Interactive visual
tools to explore spatio-temporal variation, 2004



Change

Time curves



<http://timecurves.benjbach.me>

In-Situ Data Visualization



S. Ritterbusch, S. Ronnas, I. Waltschl^oger, P. Gerstner, and V. Heuveline. Augmented reality visualization of numerical simulations in urban environments.



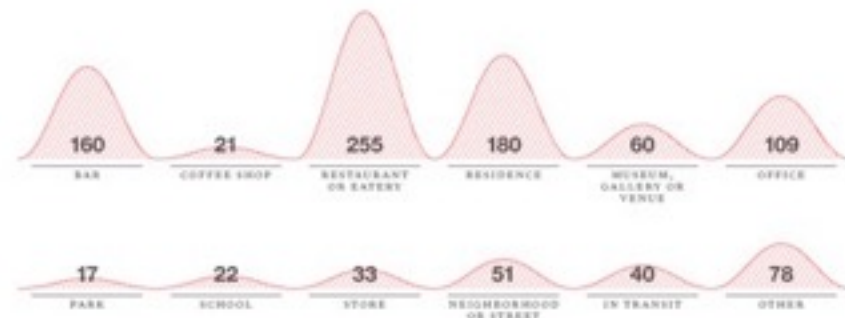
Data Comics

Feltron Reports

Where

Location and methods of transportation.

FIGURE 7. LOCATIONS RECORDED



TOTAL LOCATIONS RECORDED

258

MOST REPORTED LOCATION

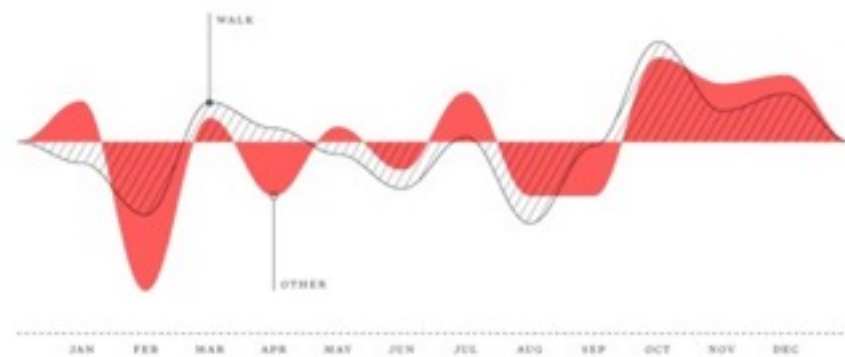
Office

73 TIMES BY 25 PEOPLE

AVERAGE LOCATIONS PER ENCOUNTER

1.83

FIGURE 8. WALKING VS. OTHER FORMS OF TRANSPORTATION



METHODS OF TRANSPORTATION

23

AIRPLANE, BIKE, BUS, CAR, ELEVATOR, ESCALATOR, FERRY, GONDOLA, DRAGINATION, ICE EAST RAIL, LIMO, NJ PATH, PUBLIC TRANSPORTATION, ROLLER-COASTER, HOOPER, SMALL PLASTIC HORSE, SUBWAY, TAXI, TELEPORTATION, TIME TRAVEL, TRAIN, TRAM AND WALKING

CARS USED

Fifteen

1998 CHEVY VENTURE, 2005 VOLVO S40, 99 TOYOTA COROLLA, BMW, CHRISTOPHER MURPHY'S CAR, HONDA CIVIC, IAN FLEMING'S CAR, LORRAINE (1999 MERCEDES WAGON), MARINA'S CAR, RENTAL CAR, ROB'S CAR, TOYOTA CAMRY, VAN, VW BEETLE AND A VW JETTA

REPORTS WITH TRANSPORTATION

56%

BEST FORM OF TRANSPORTATION

Limo

JUN 12, 2009, 4 FAVORITE MOMENTS

QUESTION 5. WHERE WERE YOU AND NICHOLAS?

Shebeen (surprise).
MARTIN P, JANUARY 28

Footcamp at MSFT offices (NERD) in Cambridge, Ma.
MATT P, MARCH 28

AP and SK's roof.
RICHARD, JULY 4

Red Hook pool.
JESSICA B, JULY 25

Ace Bar for Gigi's birthday.
REBECCA, NOVEMBER 20

QUESTION 6. DID YOU GO ANYWHERE ELSE TOGETHER?

Into the conference room.
MARIE-CLAIRE, APRIL 1

To Momofuku-Ko.
DANIELLE, JUNE 8

Walked out to pick up lunch.
MATTHEW G, APRIL 28

The beach.
MICHAEL N, JULY 11

Olga's for champagne to celebrate, someone's house for the dance party.
RYAN, DECEMBER 25

QUESTION 7. WAS ANY FORM OF TRANSPORTATION USED?

I believe Nick drove.
LEWIS, MAR 17

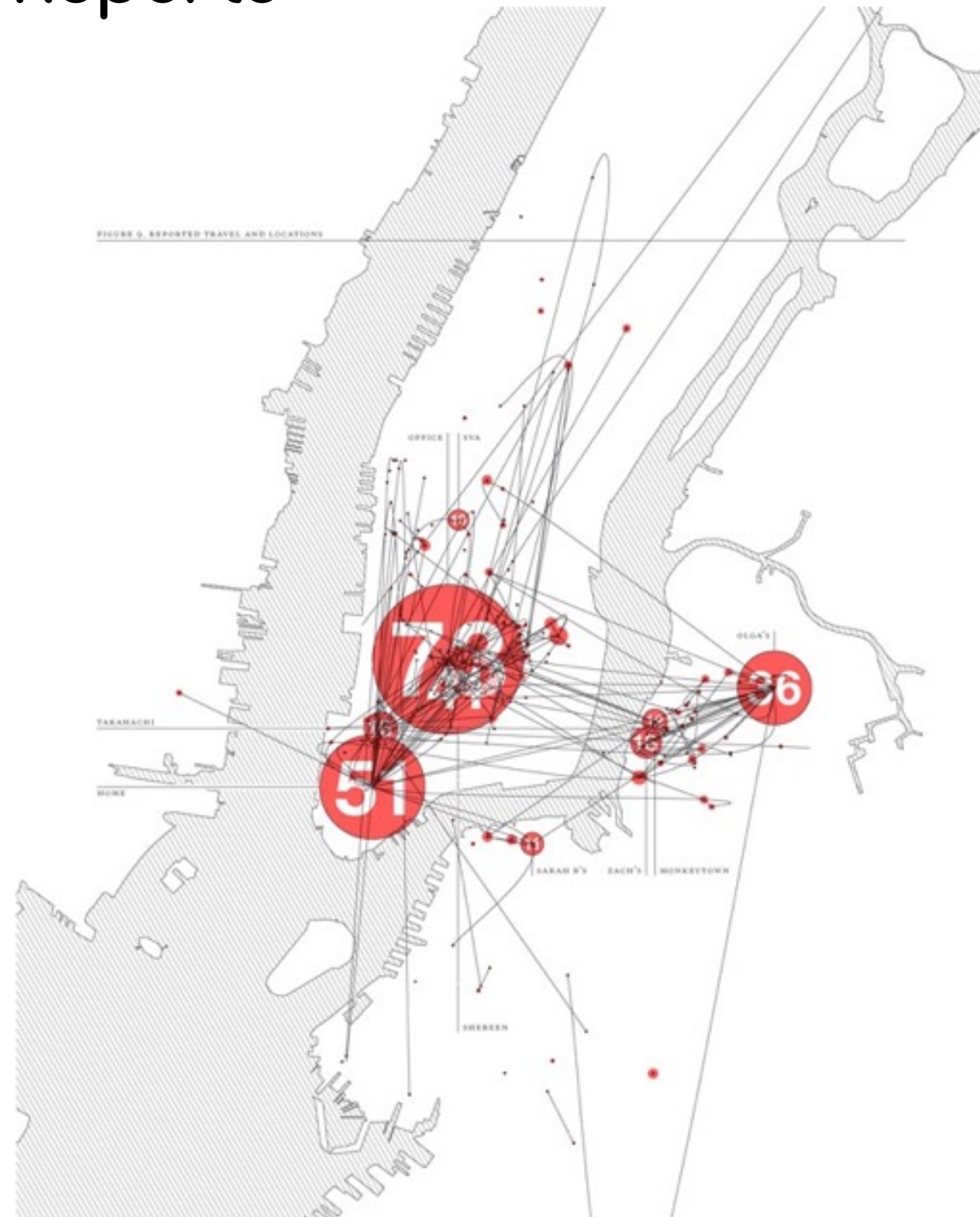
Limo. Best limo ride ever.
MARIANA, JUN 12

Yes, type unknown.
ZACH, AUG 19

Peds, JMZ, 4/5/6 trains.
OLGA, OCT 17

Airplane.
KACIE, OCT 23

FIGURE 9. REPORTED TRAVEL AND LOCATIONS





How much do you know about global health?

Let's do a self-test:

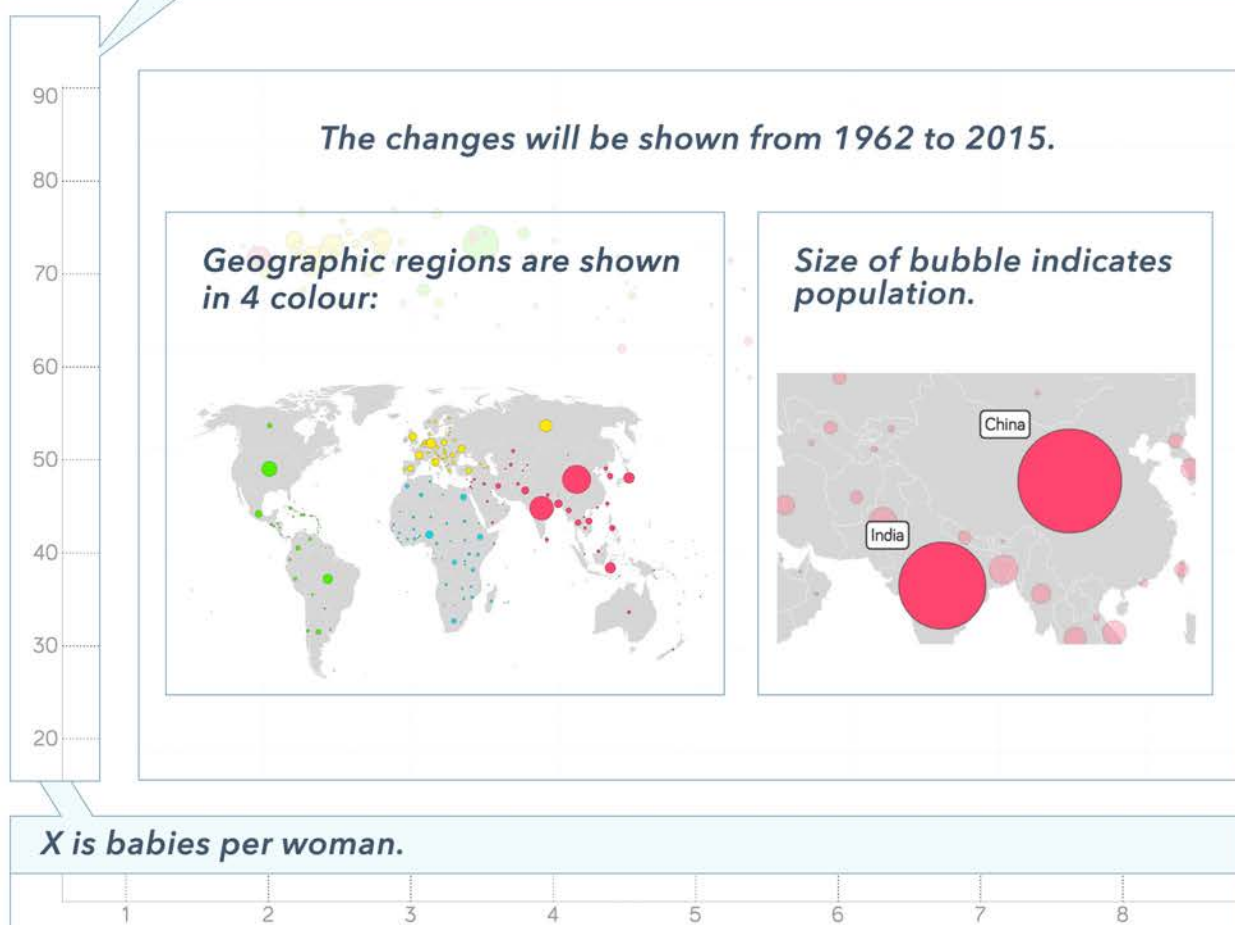
Which country in each pair has highest life expectancy?

- | | | |
|-------------|----|-----------------|
| A. Poland | or | B. South Korea |
| A. Malaysia | or | B. Russia |
| A. Pakistan | or | B. Vietnam |
| A Thailand | or | B. South Africa |

Answer: B A B A

Get it wrong? don't worry!
The following dataset will change your mindset:

Y axis presents years of life expectancy.



What do you really think about the word in 1962?

We can divide these countries into two part: they are

1962



1962

Industrialized Countries

&

Developing Countries

With long life in small family

With short life in large family

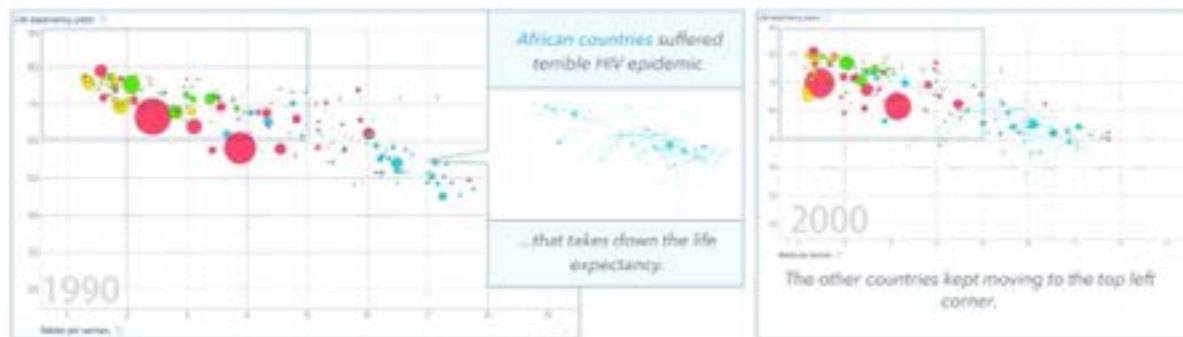
Then what has happened since 1962? Let's start from 1962 - 1980:



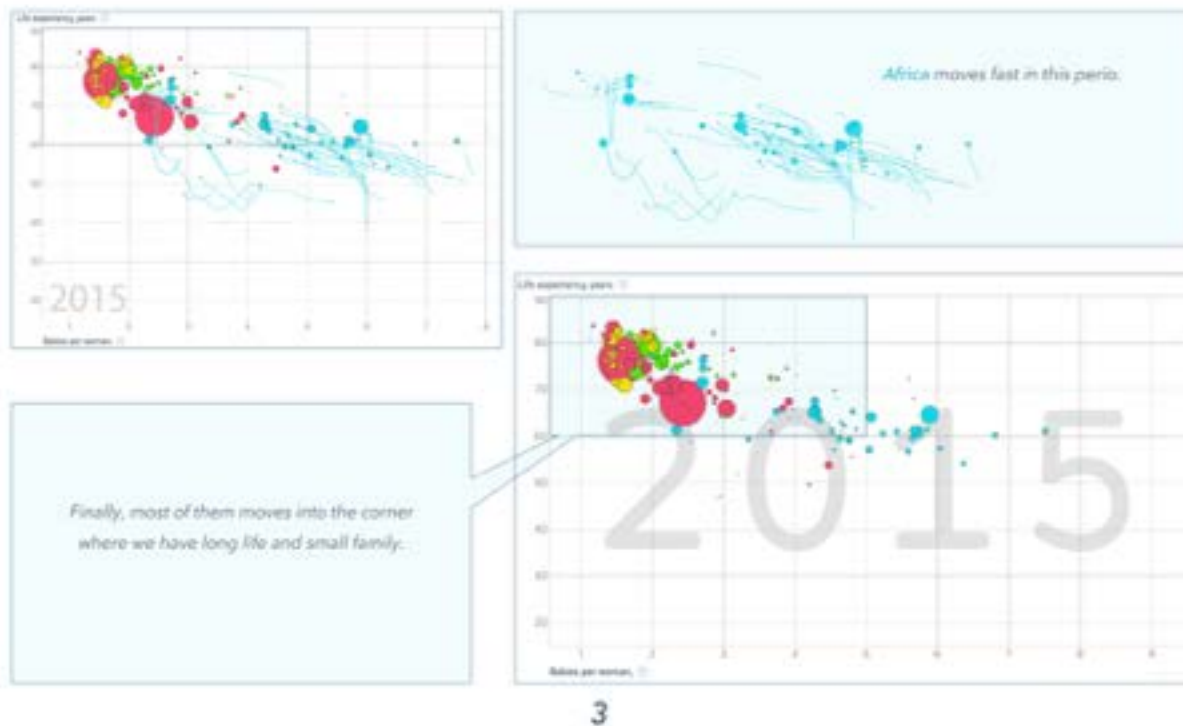
Now let's look at the next decadea from 1980 - 1990



The next ten years from 1990 - 2000



Final fifteen years of rapid growth from 2000 - 2015



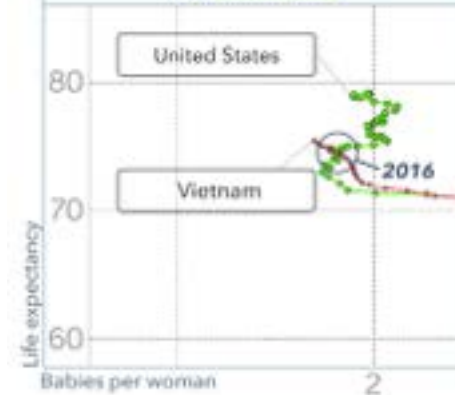
3

Let's review what has happened so far

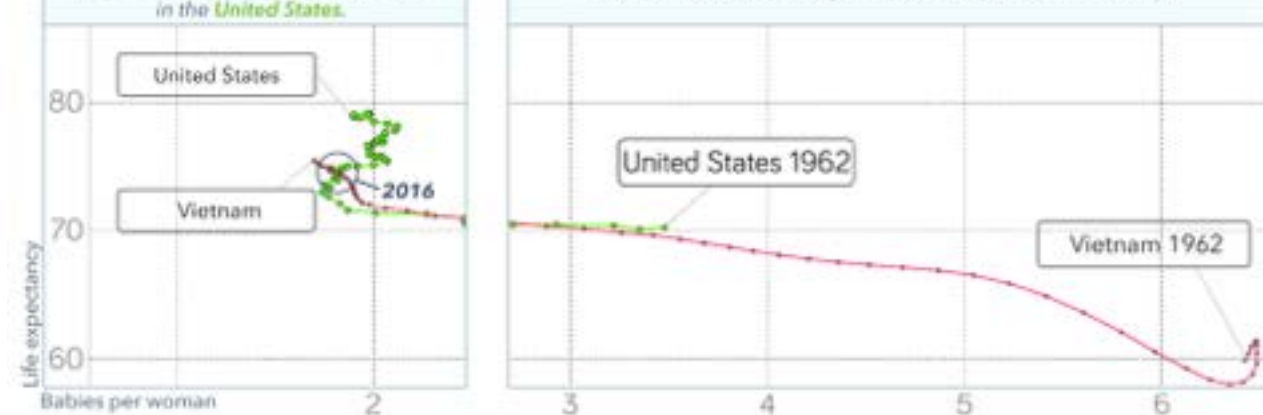


There is a notable increase in population, especially in Africa and Asia.

In 2006, we have in Vietnam the same life expectancy and same family size as in the United States.



However, if we do not look into the data, we underestimate tremendous change in Asia which was in social change before we saw the economical change.

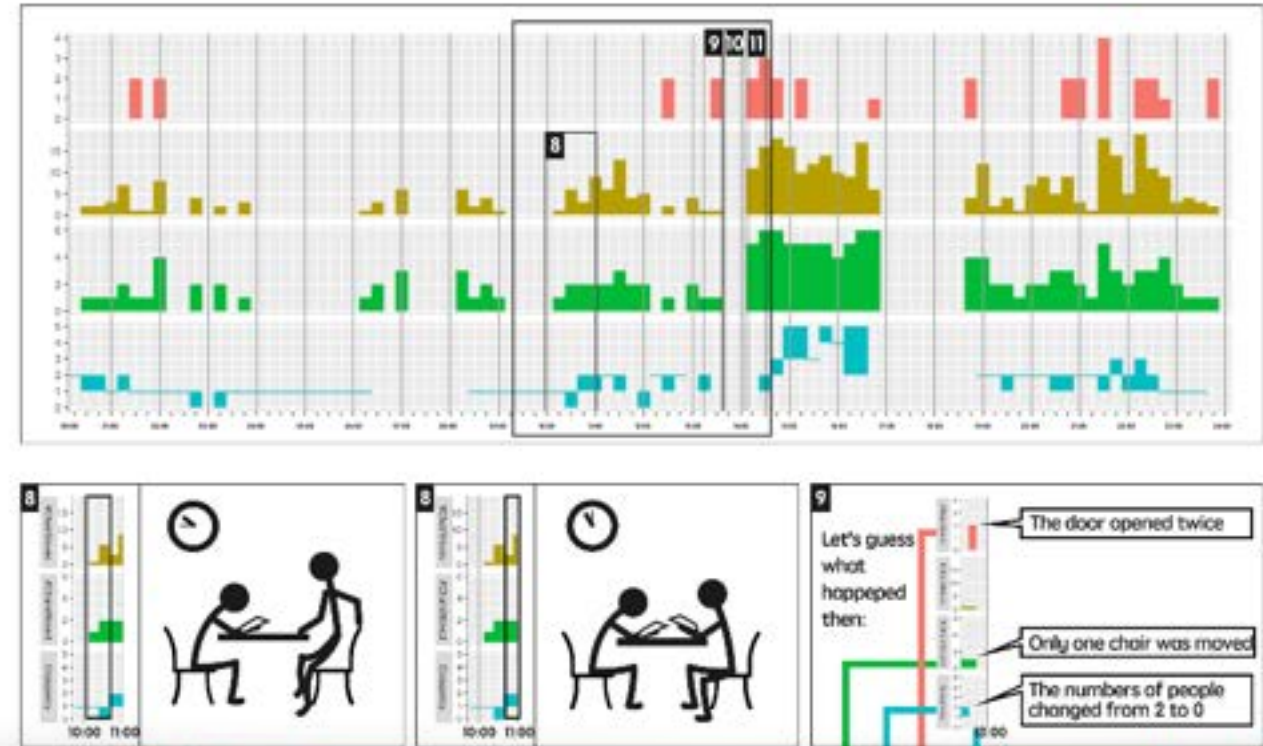
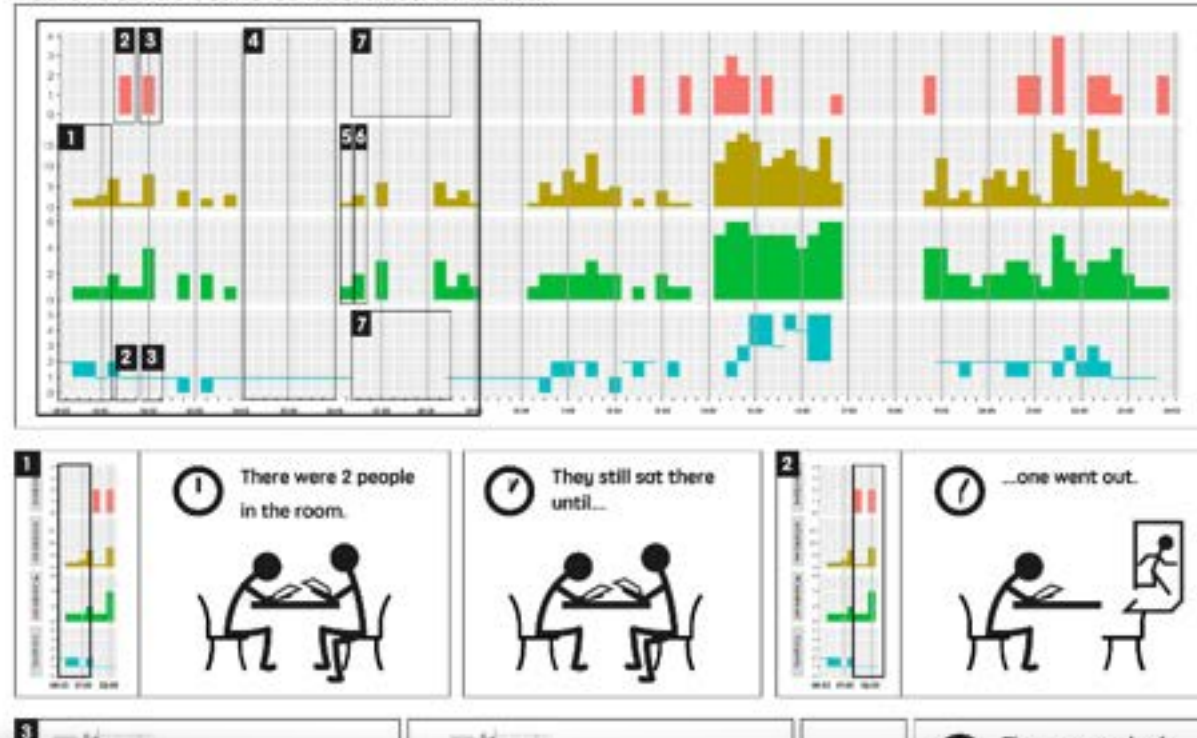


Today, we have a completely new world with smaller family size and higher health level.

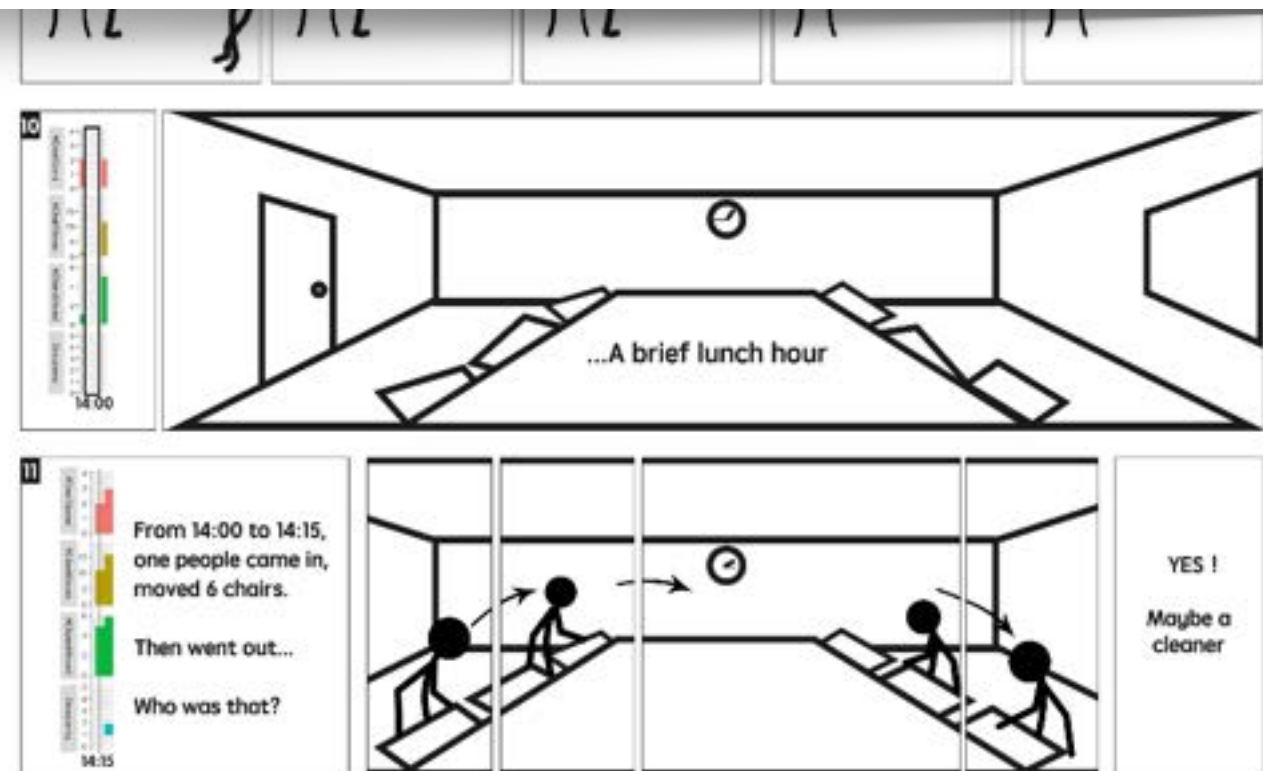
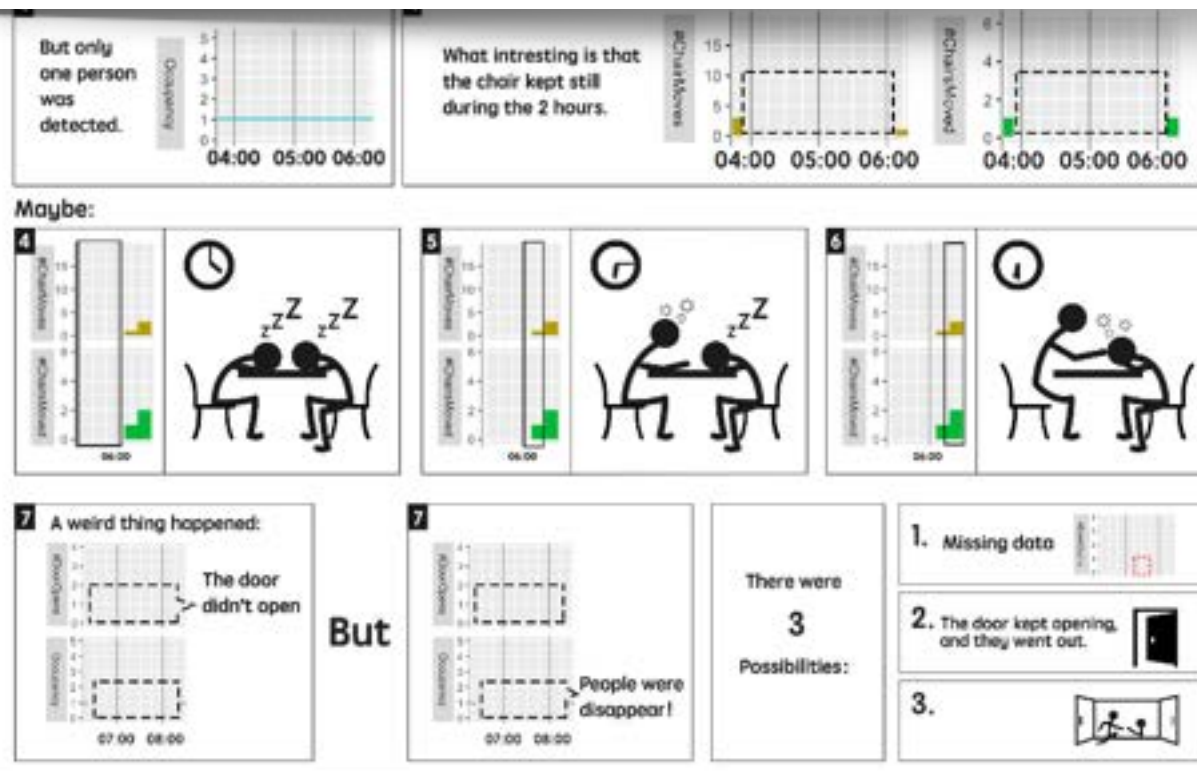


4

Let's look at some of the data in detail:



<http://datacomics.net>



Scenarios

- Inside rooms & houses
- Learning?
- Automatic creation?

and challenges

- Questions? Information?
- Audience? Messages?
- Exploration vs. Communication?
- Embedded visualizations?

Thank you.

Benjamin Bach

@benjbach

<http://benjbach.me>