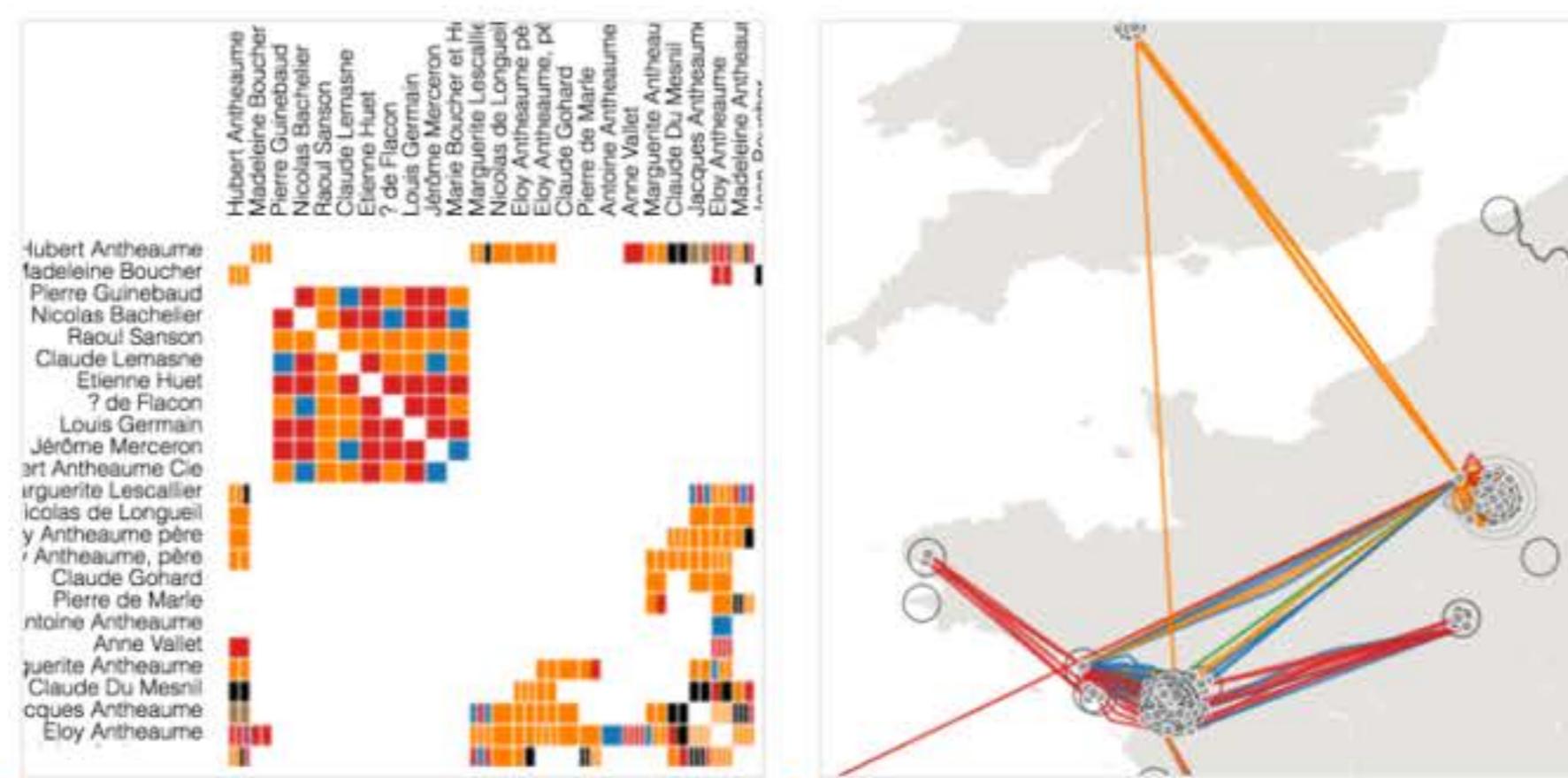
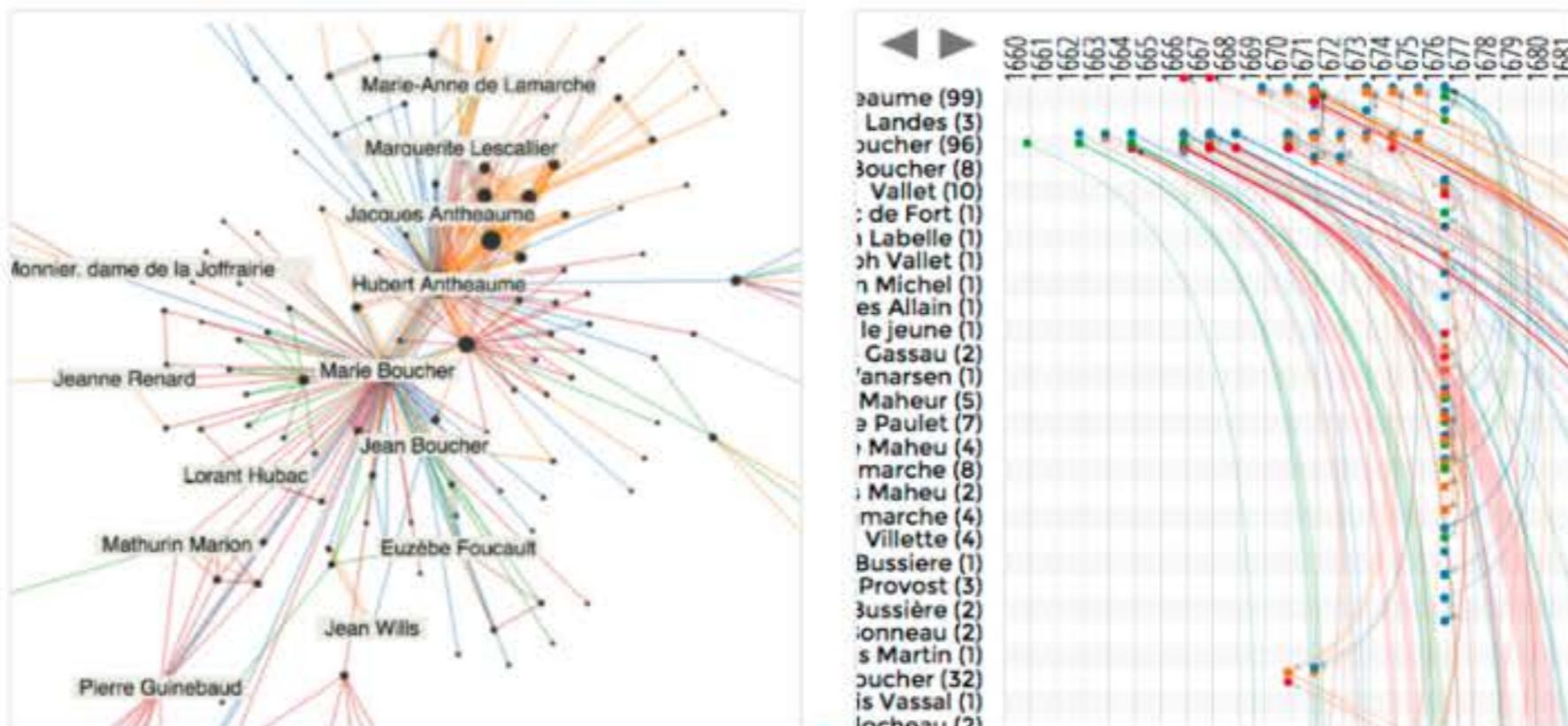


# Visualizing Spatio-Temporal Data

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# Occupancy

EXECUTIVE

FACILITY

IT

OPERATIONS

## Building 1000



Building 1000

CRAC 20

Start Command

Command On

Communication Loss



false

Local OFF

true

Space Temperature

67.0 °F

Space Humidity

56.0 %

Stages

0.0

Percent Load

0.0 %

Water Temperature



Oil Pressure



Generator

Water Temperature

Water  
90.54

Oil Pressure

Oil  
0 psi

Full Tank

false

Half Tank

false

Empty Tank

false

## Haise 8



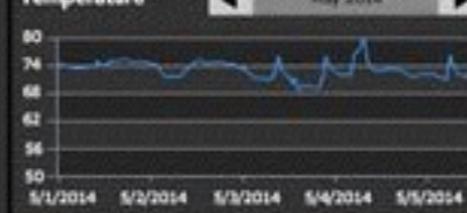
kW

May 2014



Temperature

May 2014



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 4P1 Rm 139 DRCC

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 CPLA BL 1000 CF2A

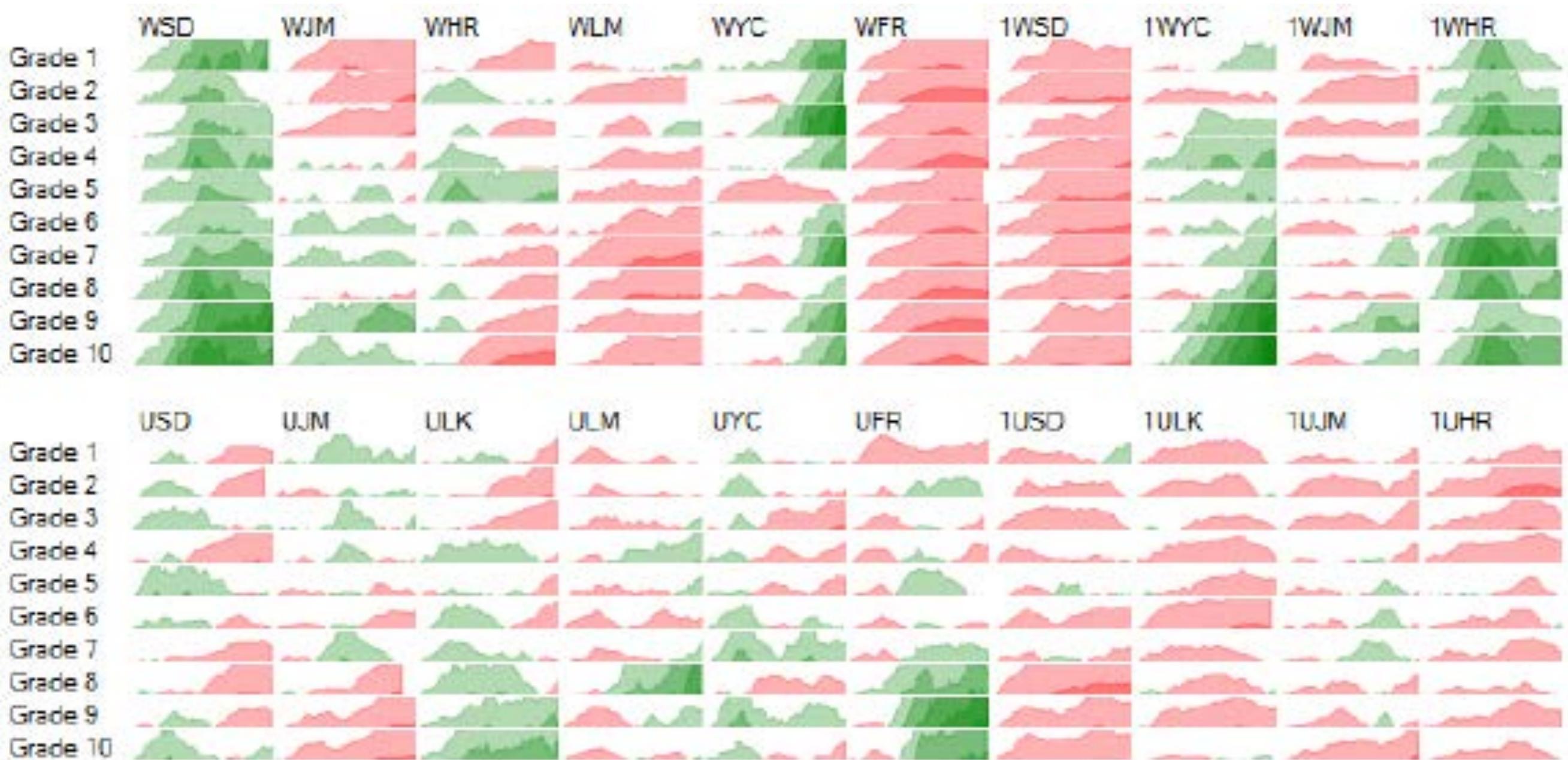
BL 1000 HPA BL 1000 HSBCNP

Rm 100 HGB HGB Rm 100 HPB

Input Voltage L1-L2	Output Voltage L1-L2
472.76 V	
Input Voltage L2-L3	Output Voltage L2-L3
476.40 V	208.40 V
Input Voltage L3-L1	Output Voltage L3-L1
476.15 V	207.99 V
Average Input Voltage L-L	Average Output Voltage L-L
475.08 V	207.34 V
Input kW	Output kW
98.88 kW	98.03 kW

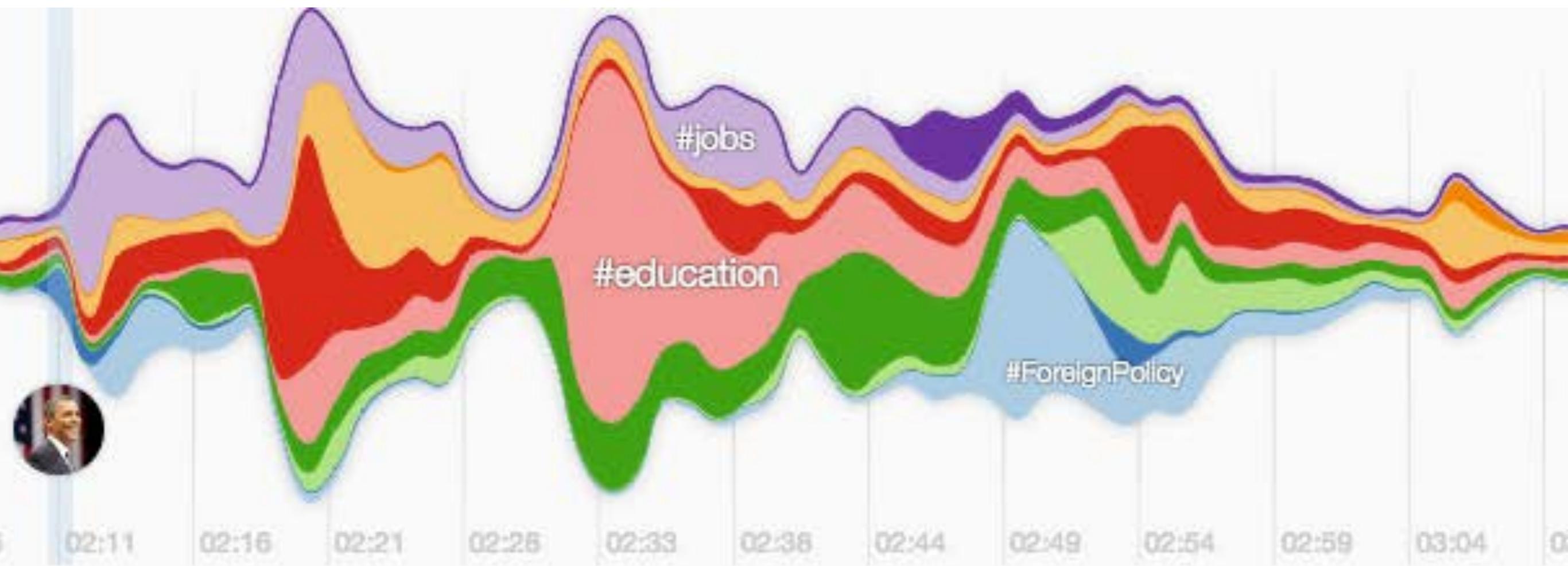
Time



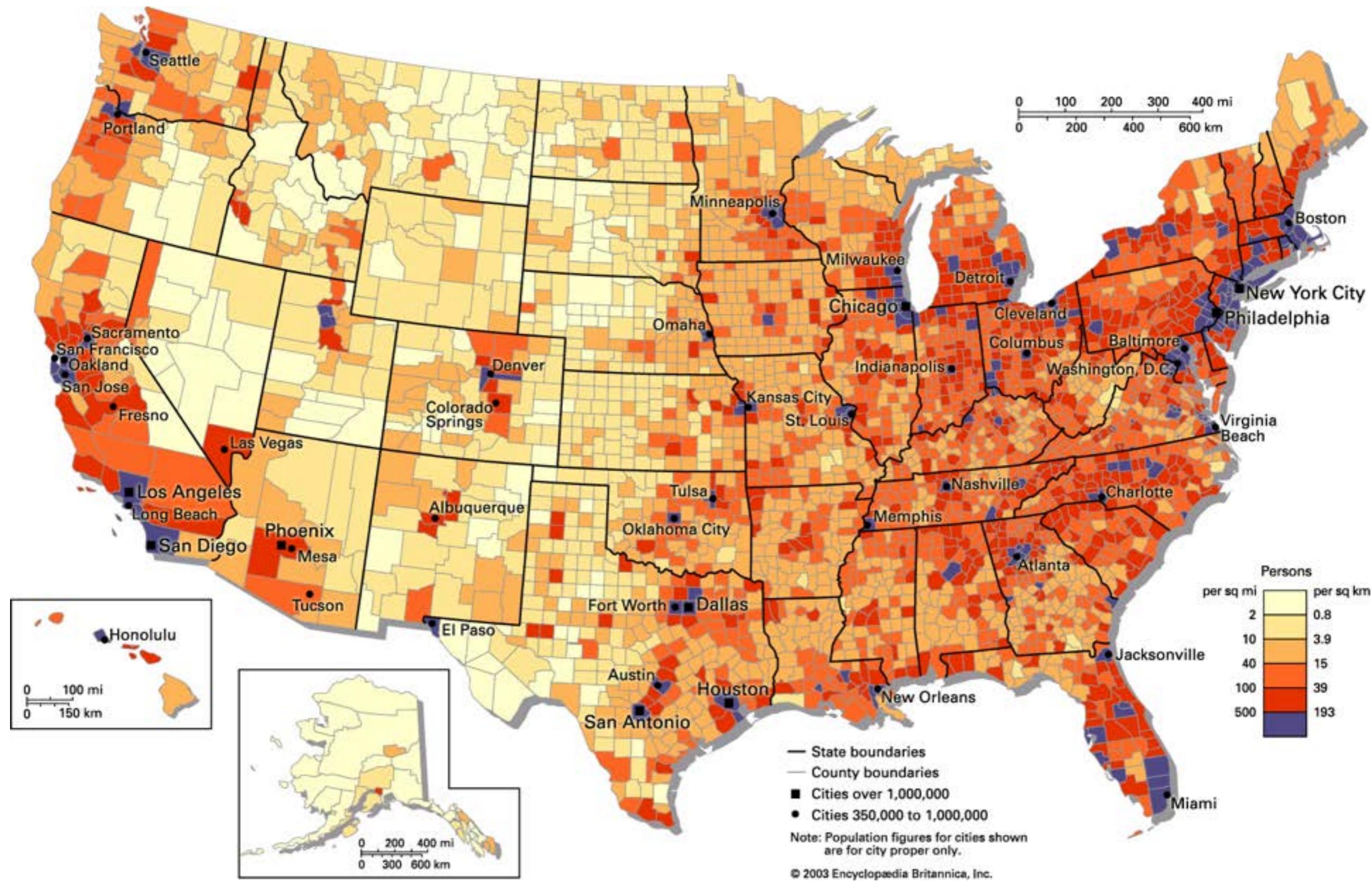


Sizing the horizon: the effects of chart size and layering on the graphical perception of time series visualizations  
J Heer, N Kong, M Agrawala

# Streamgraphs



Space

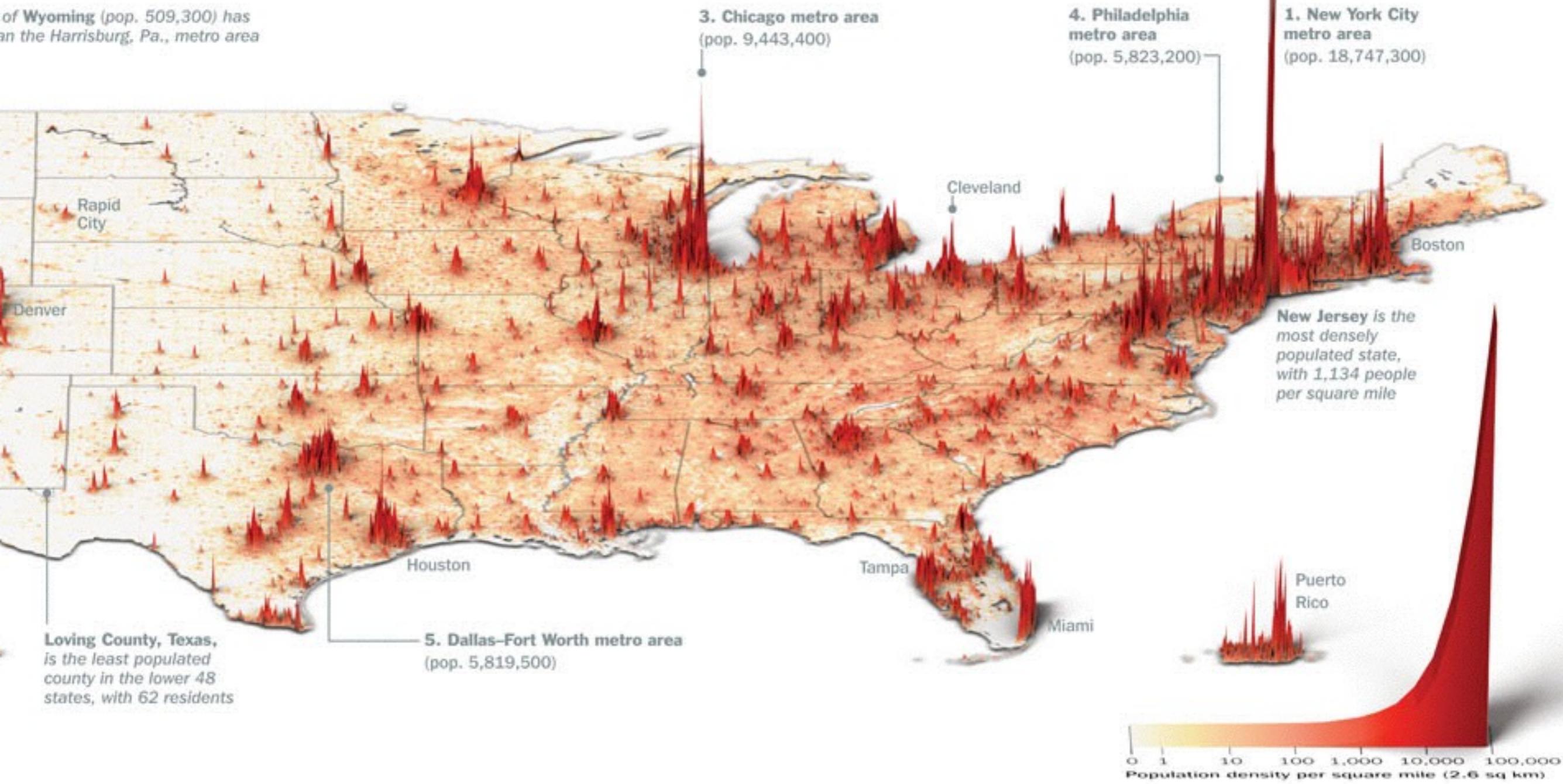


g. We are also moving  
nation is a vast prairie

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  
in the Harrisburg, Pa., metro area



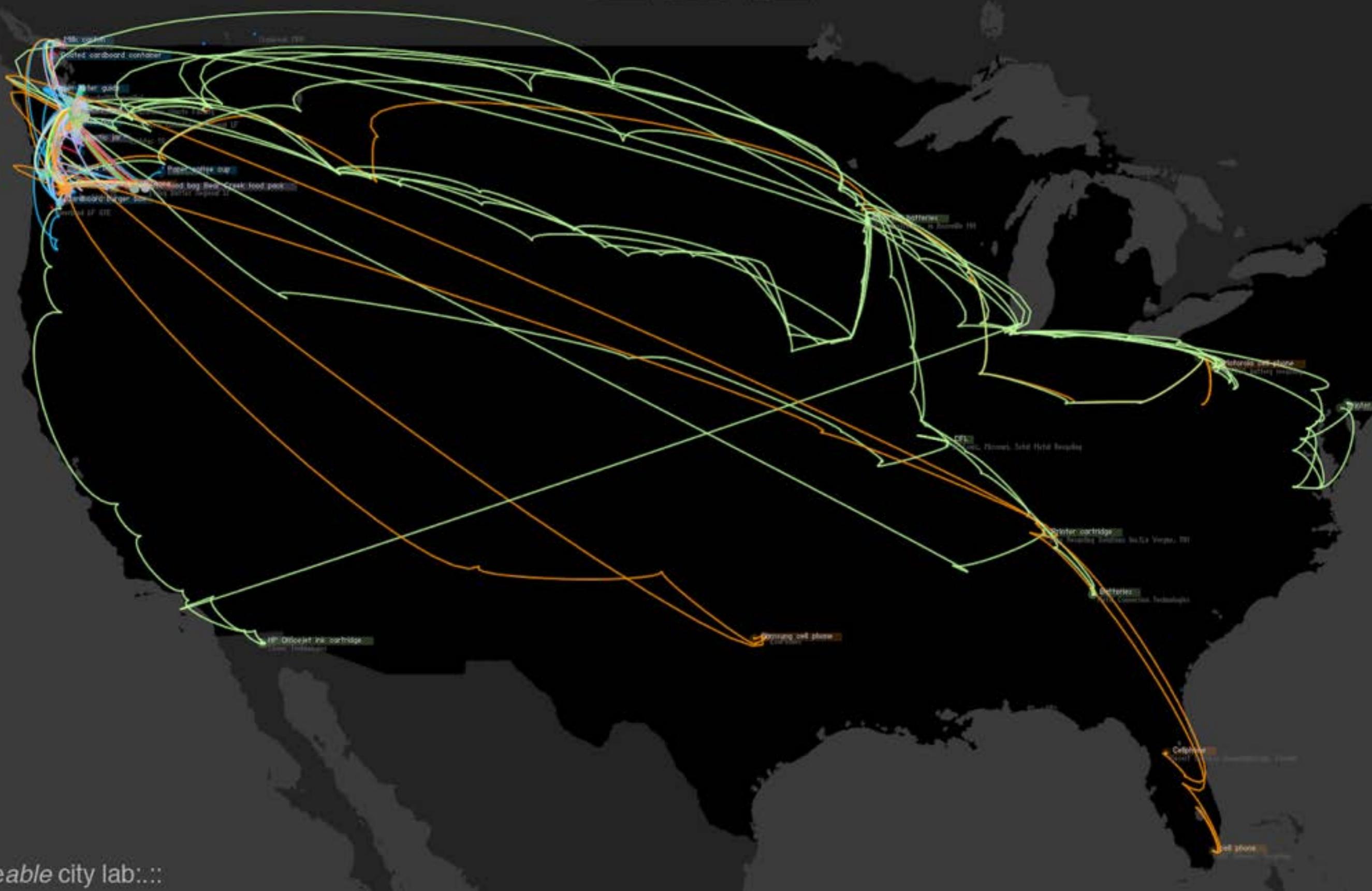
Space + time

1940 traces

100

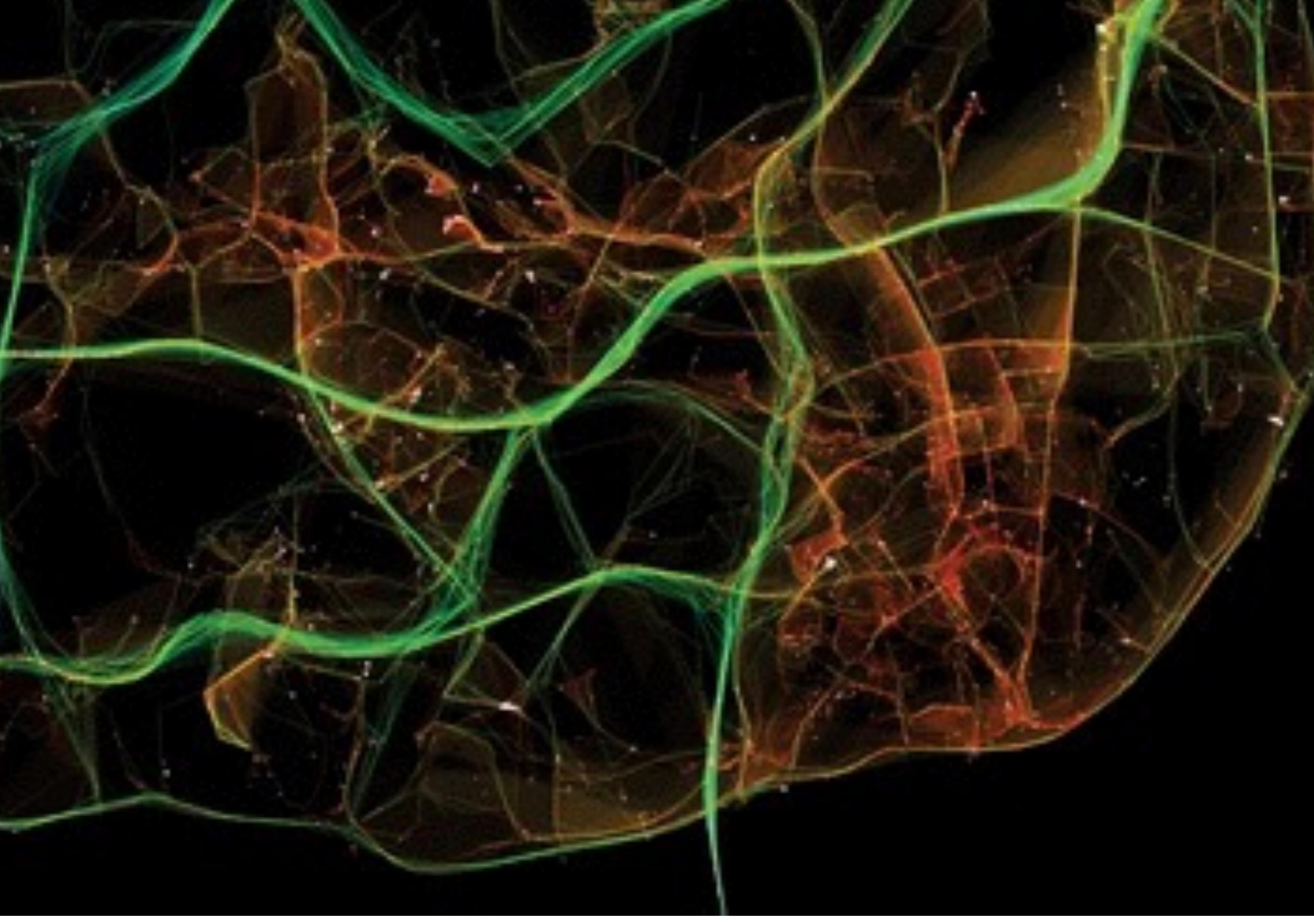
100

100



*enseable city lab:::*

<http://senseable.mit.edu/trashtrack>



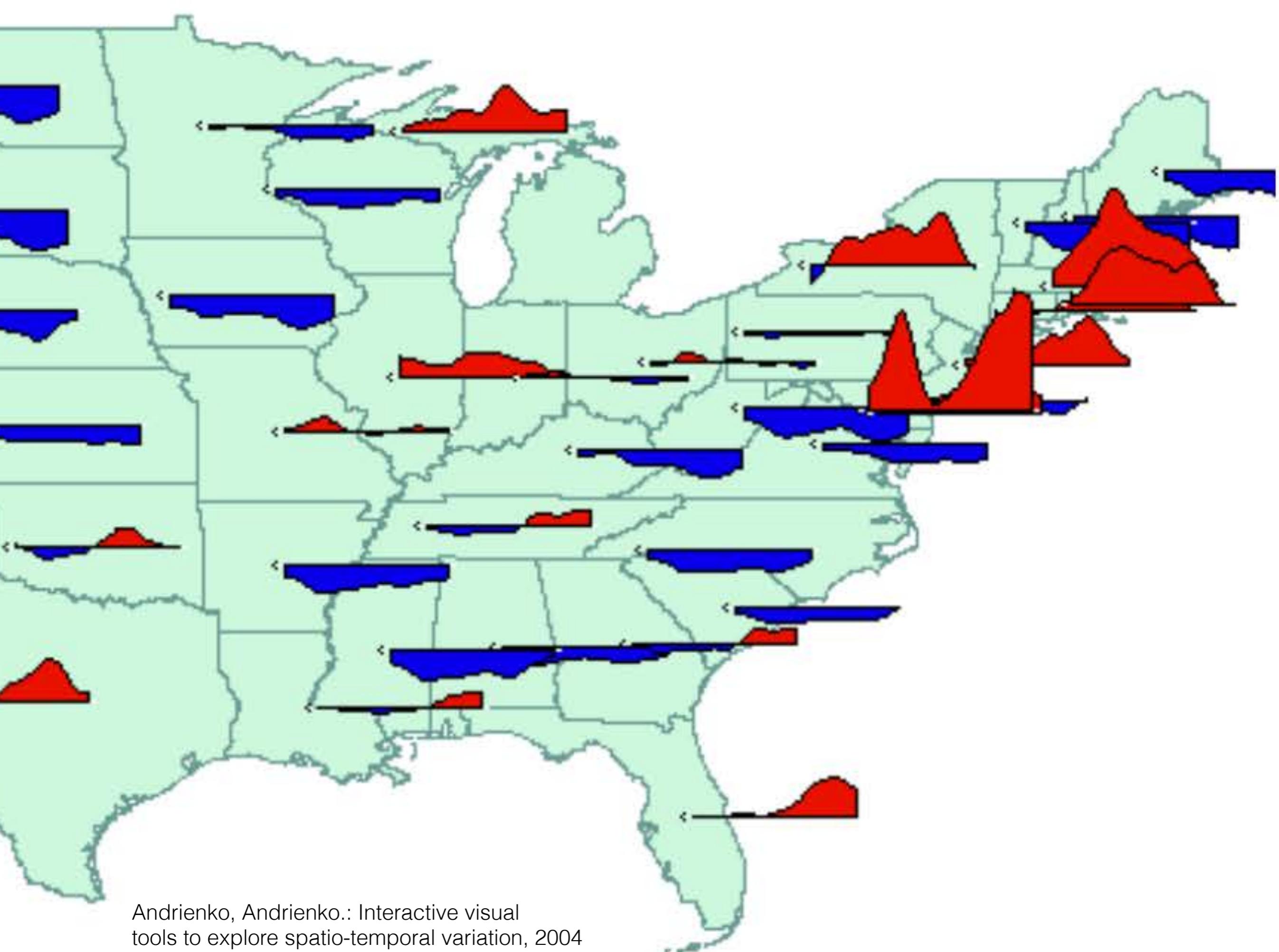
A map of a city's road network, showing a dense web of streets. Morning peak traffic flow is represented by thick, glowing yellow lines that form a complex web across the network, indicating the variety of routes used during peak hours.

Looking ahead to 2032 ...

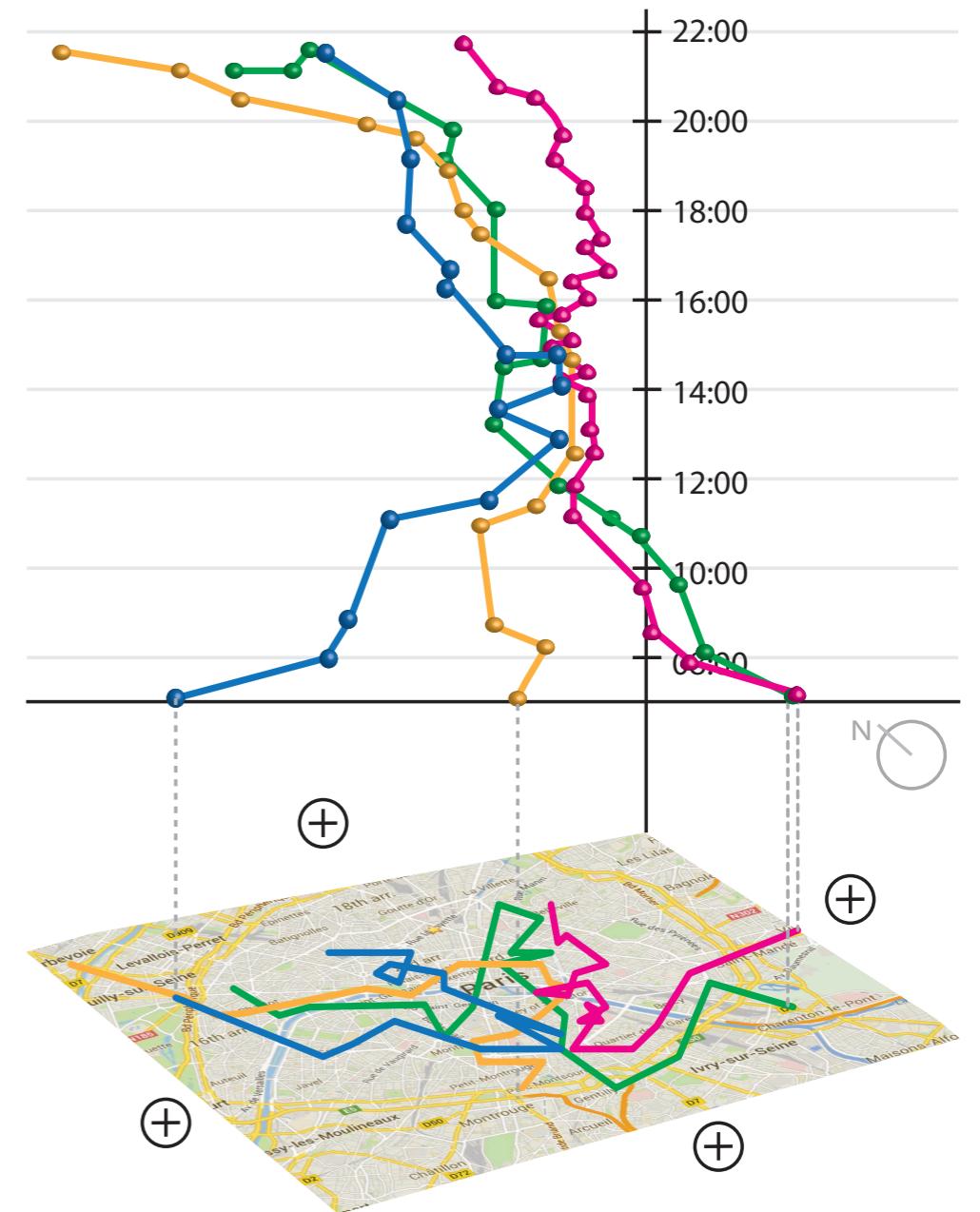
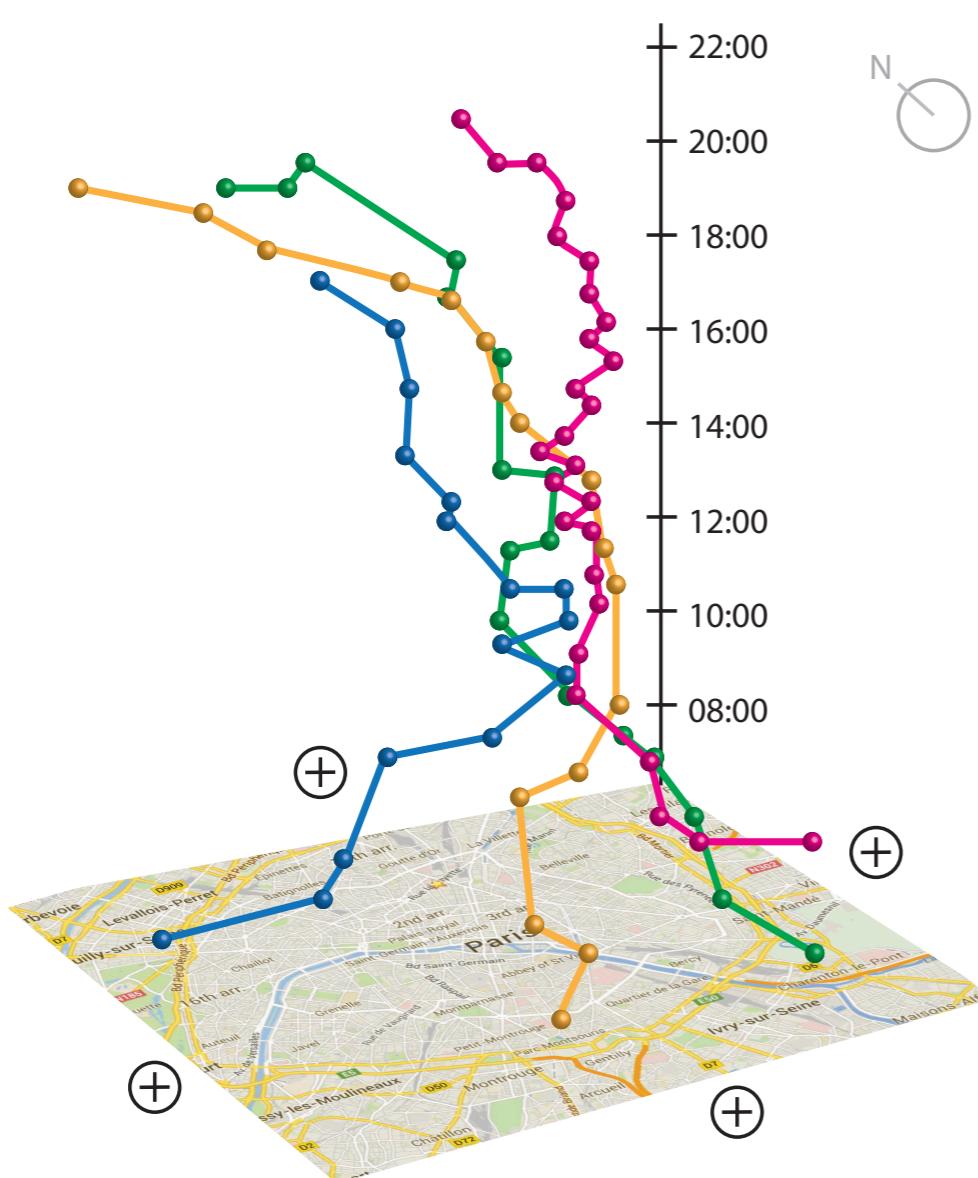
Without the NDR we see  
morning peak traffic using a  
variety of routes.

Morning peak  
traffic flow



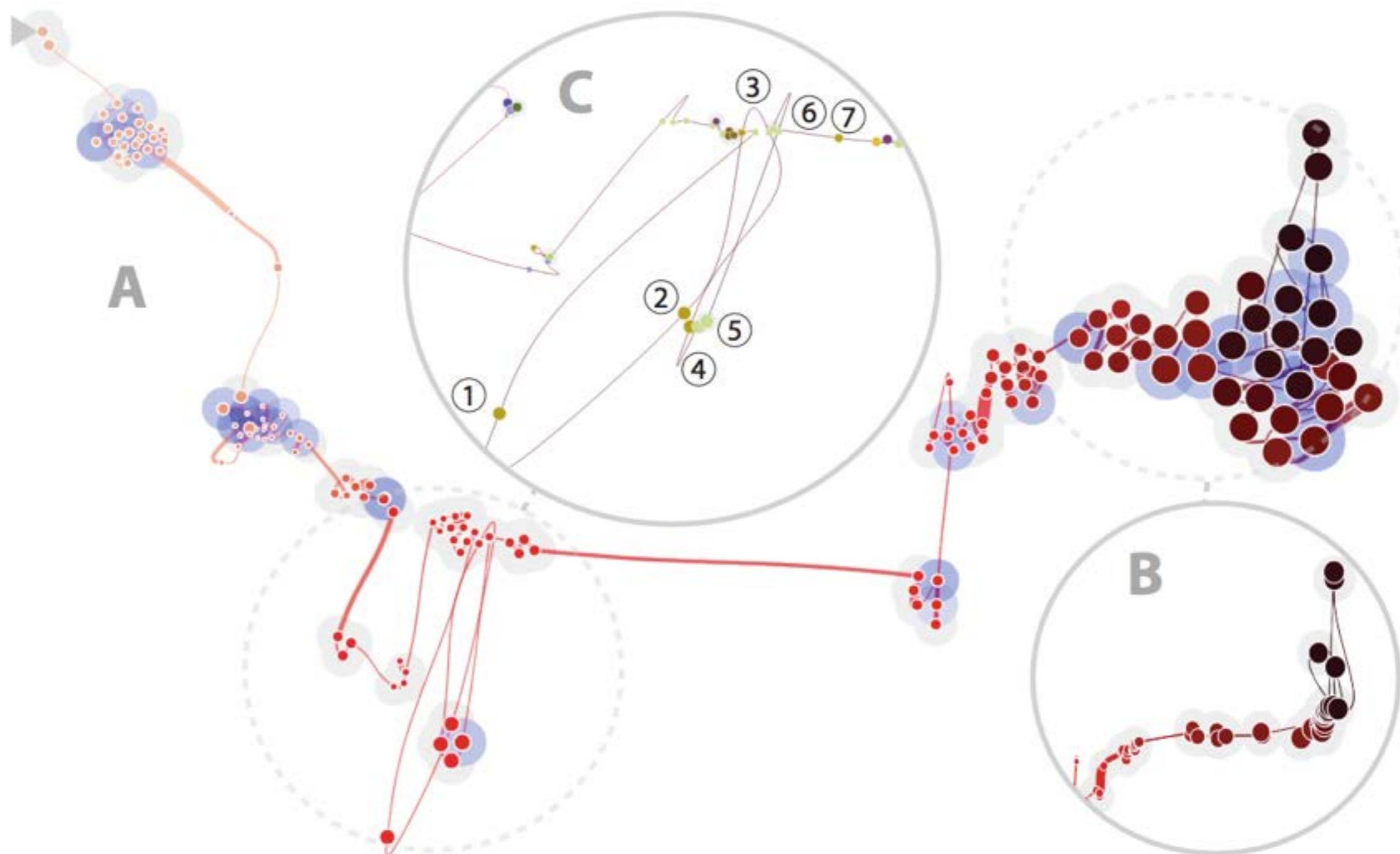


Andrienko, Andrienko.: Interactive visual  
tools to explore spatio-temporal variation, 2004



Change

# Time curves

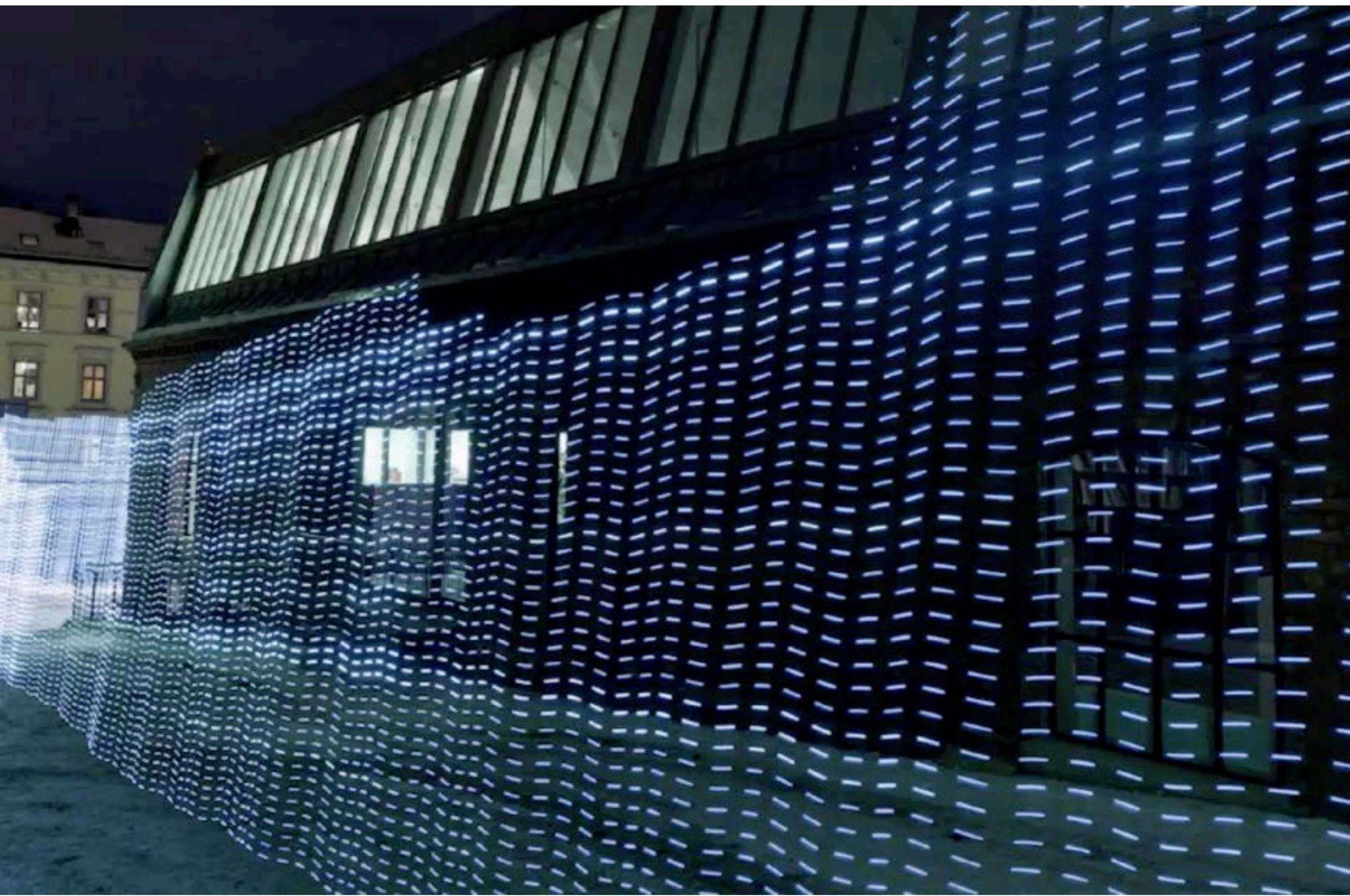


<http://timecurves.benjbach.me>

# In-Situ Data Visualization



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



Data Comics





## How much do you know about global health?

Let's do a self-test:

Which country in each pair has highest life expectancy?

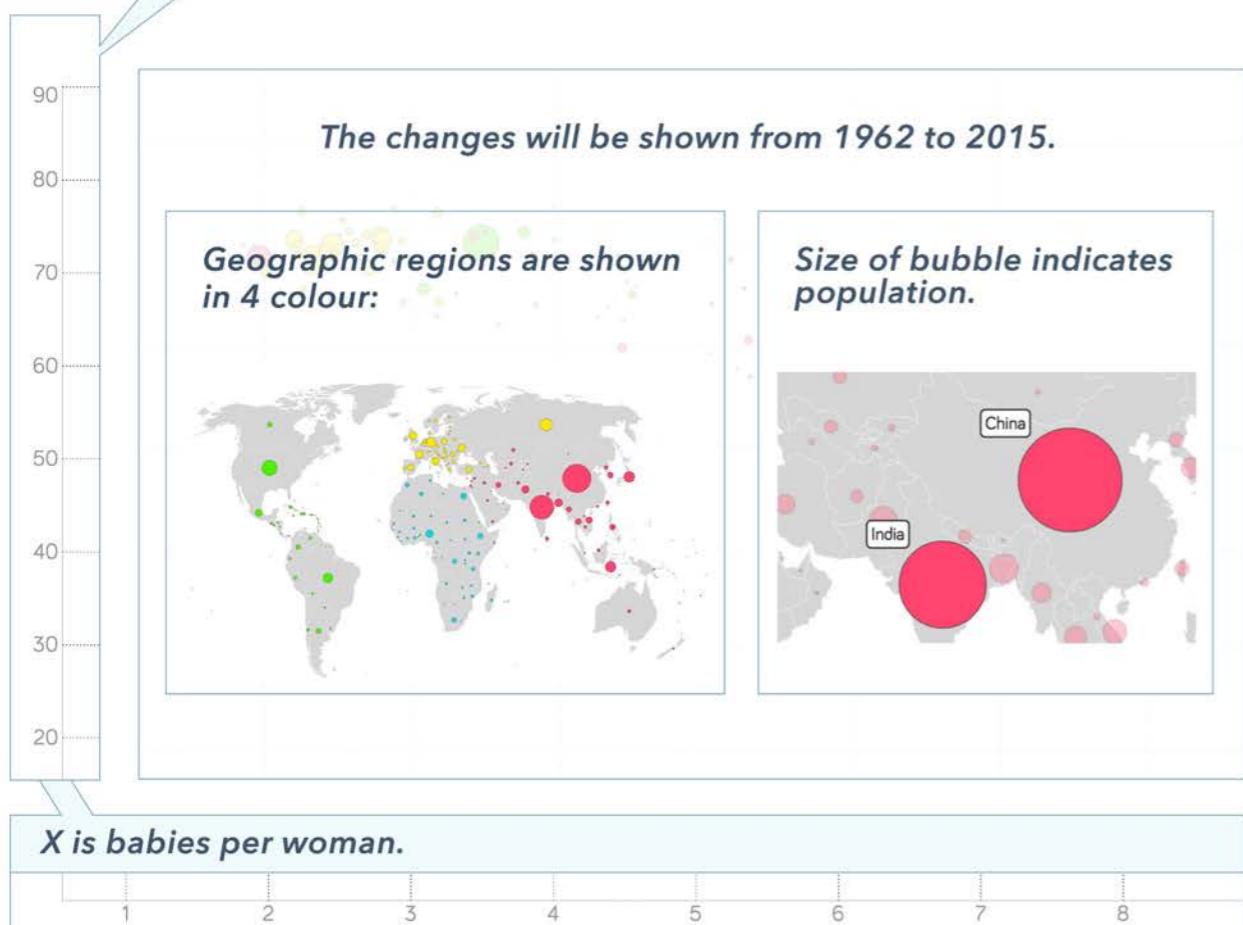
- |             |    |                 |
|-------------|----|-----------------|
| A. Poland   | or | B. South Korea  |
| A. Malaysia | or | B. Russia       |
| A. Pakistan | or | B. Vietnam      |
| A Thailand  | or | B. South Africa |

Answer: B A B A

**Get it wrong? don't worry!**

The following dataset will change your mindset:

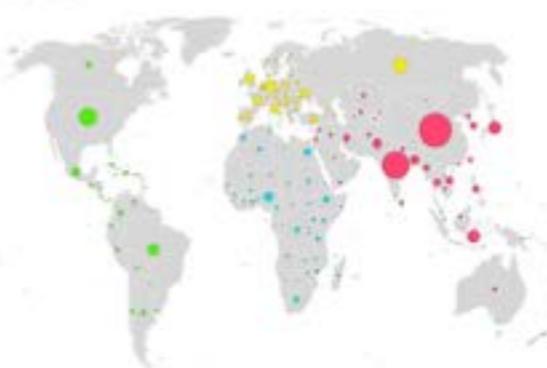
Y axis presents years of life expectancy.



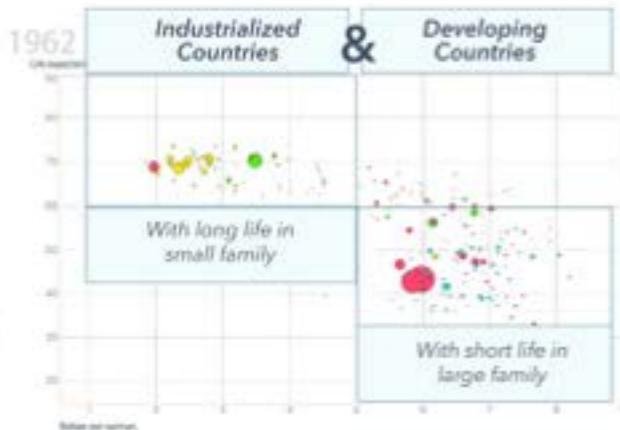
1

What do you really think about the word in 1962?

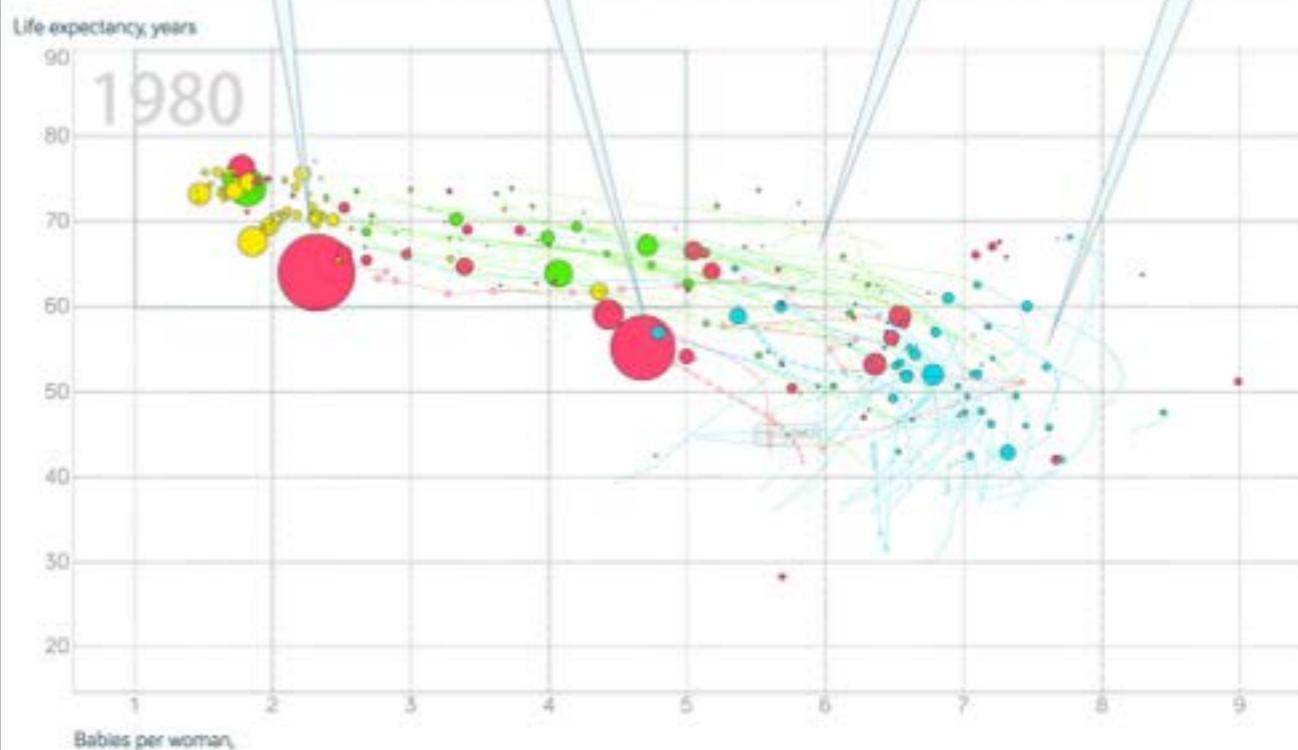
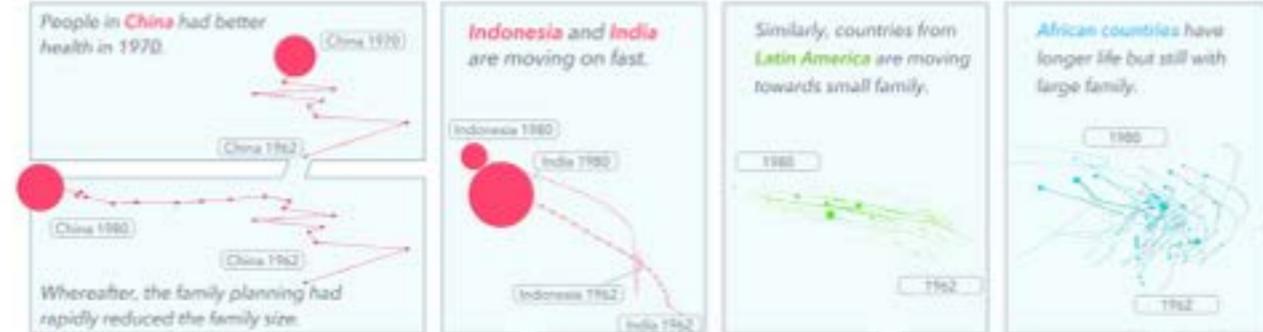
1962



We can divide these countries into two part: they are

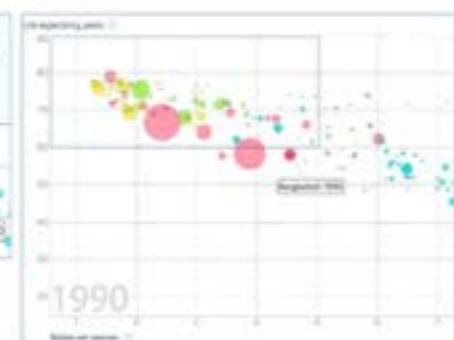
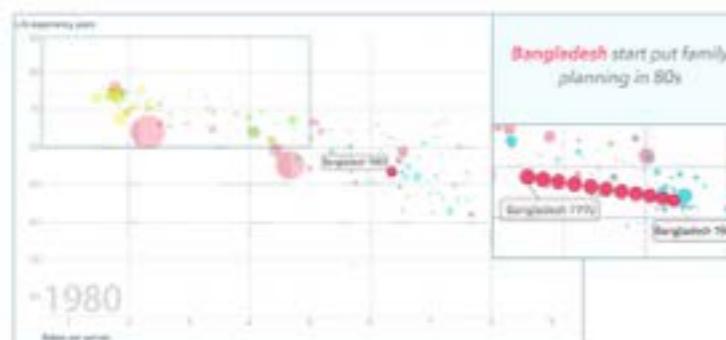


Then what has happened since 1962? Let's start from 1962 - 1980:

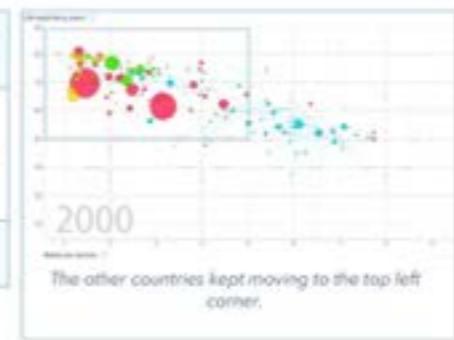
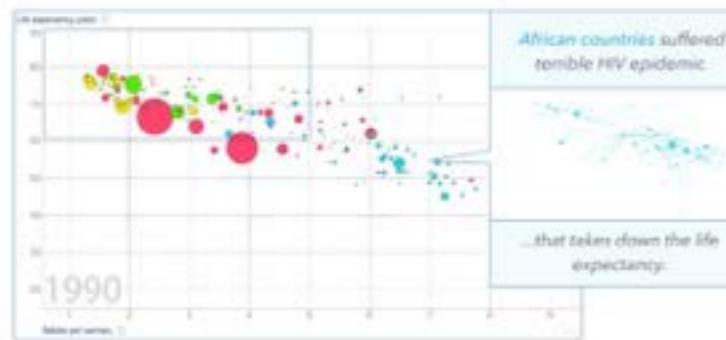


2

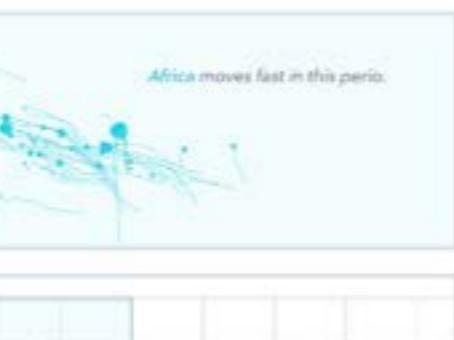
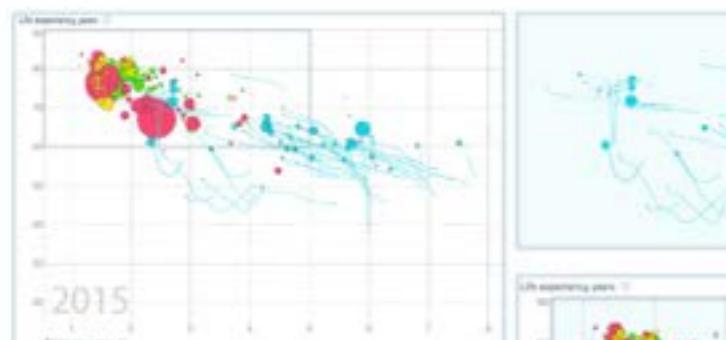
Now let's look at the next decade from 1980 - 1990



The next ten years from 1990 - 2000

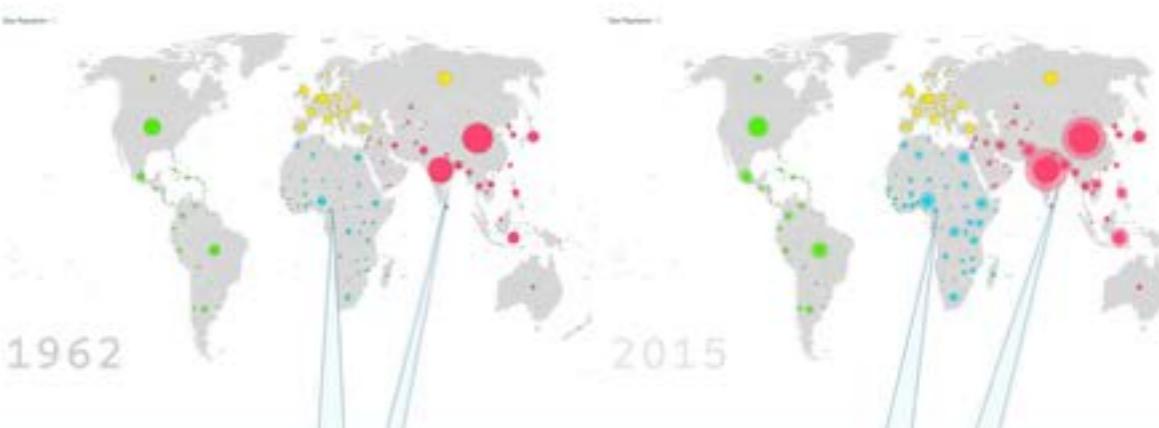


Final fifteen years of rapid growth from 2000 - 2015



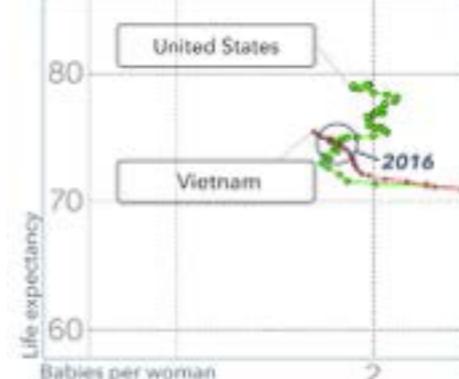
2015

Let's review what has happened so far

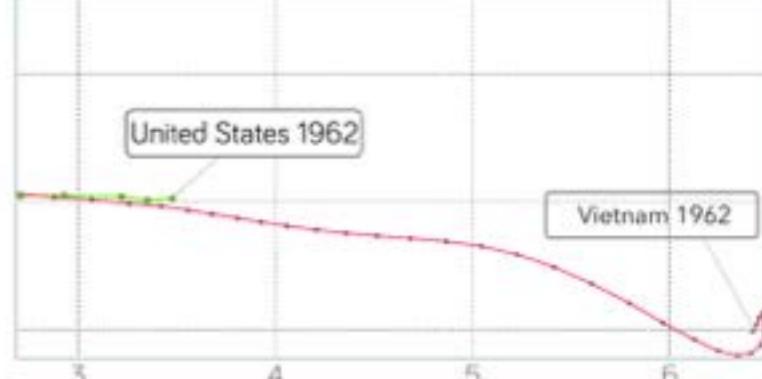


There is a notable increase in population, especially in Africa and Asia.

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



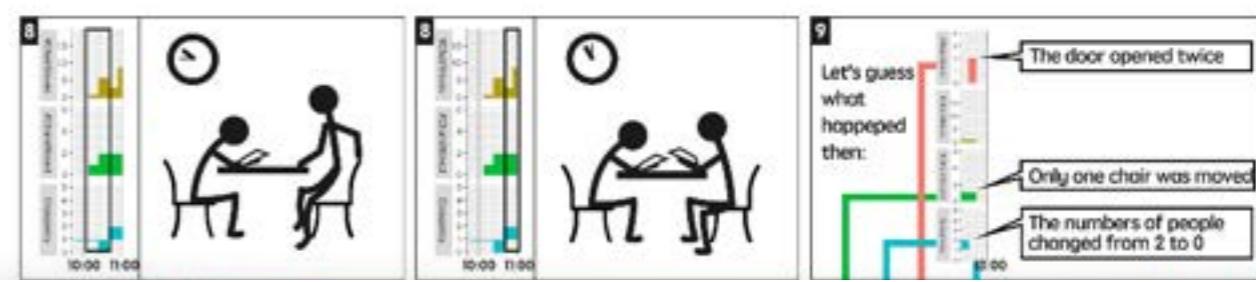
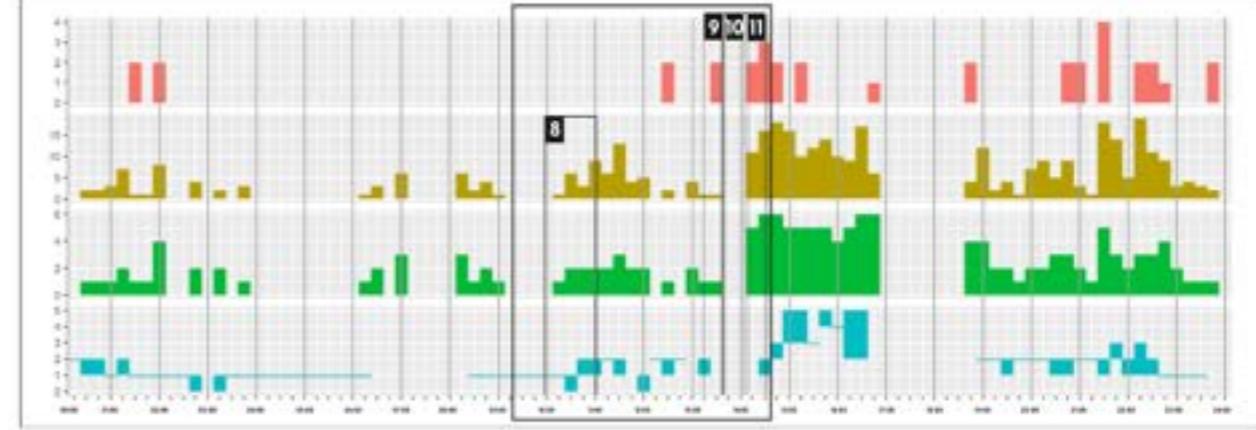
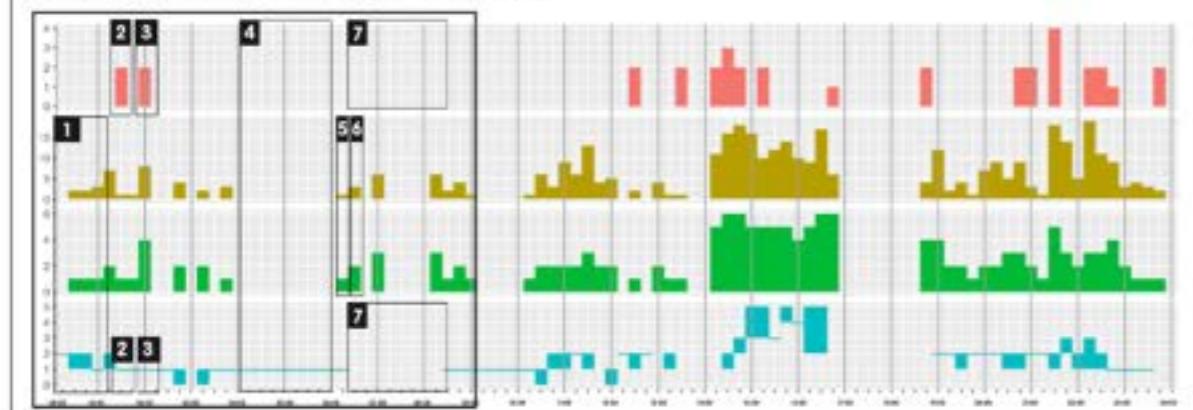
However, if we do not look into the data, we underestimate tremendous change in Asia which was in social change before we saw the economical change.



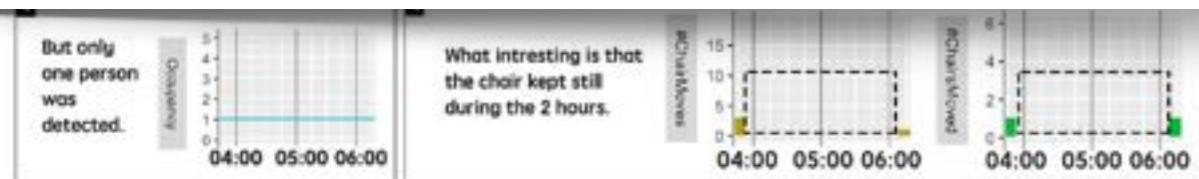
Today, we have a completely new word with smaller family size and higher health level.



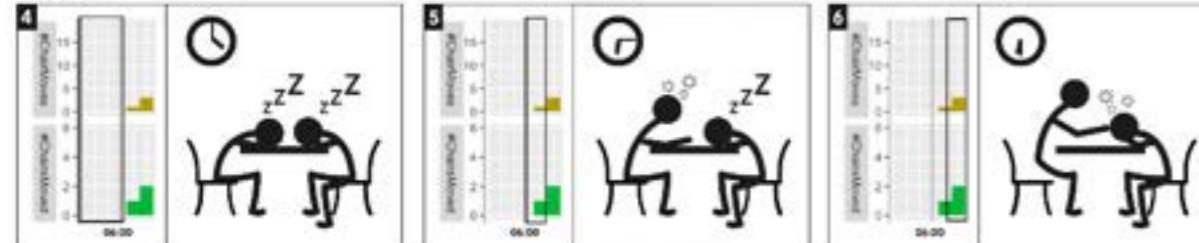
Let's look at some of the data in detail:



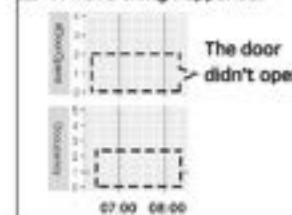
<http://datacomics.net>



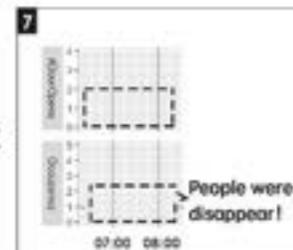
Maybe:



7 A weird thing happened:

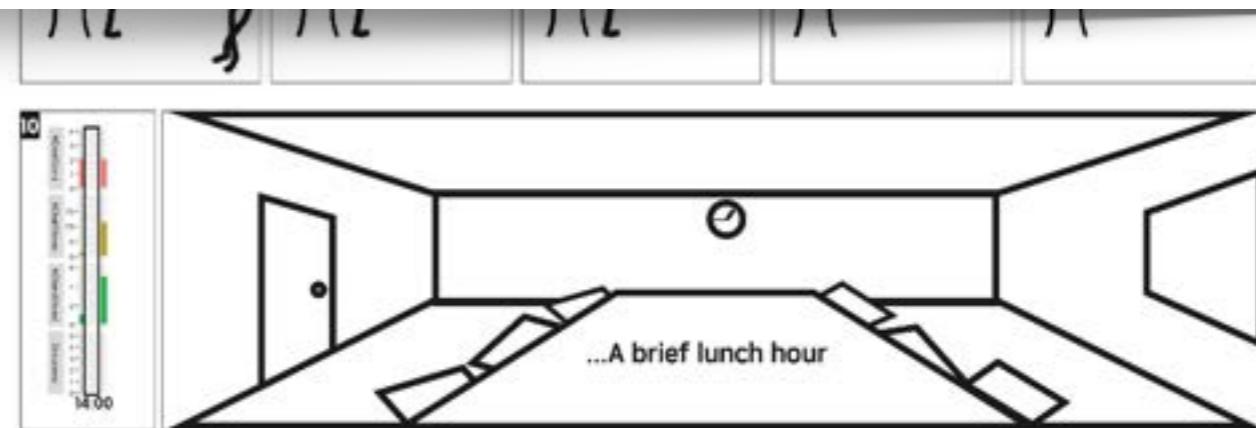


But

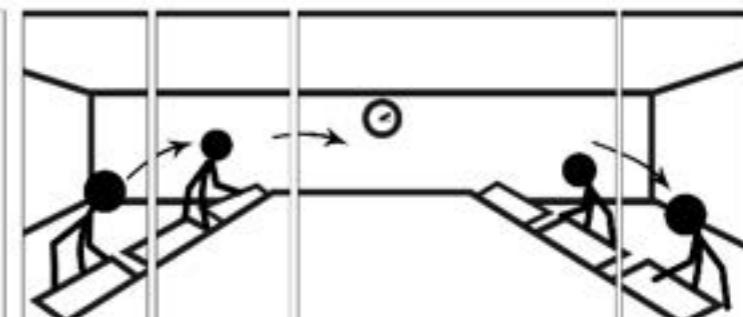


There were  
3 Possibilities:

1. Missing data
2. The door kept opening, and they went out.
- 3.



10 From 14:00 to 14:15, one people came in, moved 6 chairs. Then went out... Who was that?



YES !  
Maybe a cleaner

# 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>