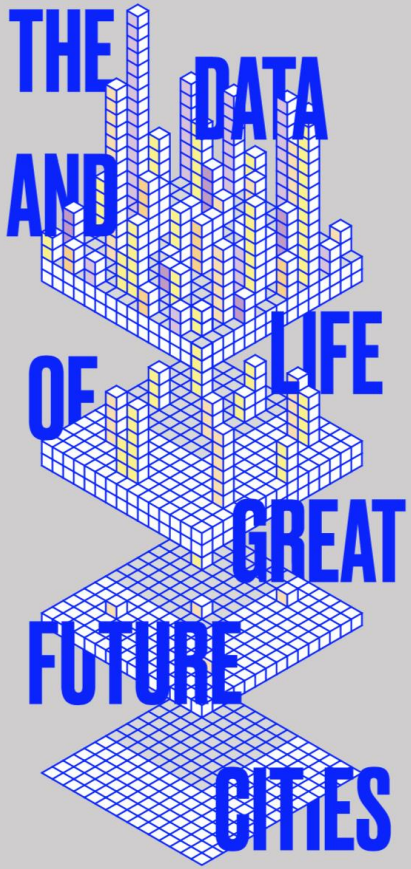
@danielequercia



Why am I here?

What’s in it for you?

What's in it for **you**?

_ a tour on goodcitylife.org
_ can repeat in your cities (replicable & scalable methodology)
_ unsolved problems/collaborations

NOKIA Bell Labs

Inventing the Future X Network

1925

Creation of Bell Labs
The engineering departments of the American Telephone and Telegraph Company (AT&T) and Western Electric were consolidated into Bell Telephone Laboratories. Their mission was to research and design communication technologies for the rapidly expanding telephone network and to explore fundamental areas of science that could shape the future of the industry. Over the years, many cornerstone technologies of modern society have been invented at Bell Labs and 8 Nobel Prizes have been awarded to its researchers

1930's

1937
Electron Diffraction
Demonstrating wave nature of matter

1940's

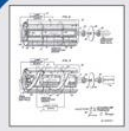
1948
"A Mathematical Theory of Communications"
By showing that all communications channels – of any type – have a fundamental capacity limit, Claude E Shannon founded the field of information theory

1950's

1954
Solar cells

1956
Transistor
To replace the vacuum tube, Bardeen, Brattain and Shockley created a working point-contact transistor. This basic building block for all digital products is the foundation for our information society

1958
LASER
In their 1958 paper, Schawlow and his brother-in-law Townes described in detail a proof of concept for the LASER. The laser enables a wide variety of applications: fiber-optic communications, digital storage, barcode scanners, precision surgery and industrial cutting tools



1960's

1962
Telstar
Transatlantic live TV broadcast via satellite

1970's

1973
UNIX and C Language
Thompson and Ritchie's elegant design made it an immediate hit with the programming community when it was released in 1974. UNIX would later on become the Internet's foundation

1976
Fiber Optic Network
First demonstration of 45 Mbit/s transmission

1977
Electronic Structure of Magnets and Glasses

1978
Cosmic Microwave Background Radiation
Pioneering work on radio communications using the Holmdel Horn Antenna provides support for the Big Bang Theory

1978
Commercial Cellular Network
Invention of the cellular concept and creation of the first commercial network

1980's

1980
Demonstration of DSP
Large-scale integrated circuit for digital signal processing

1995
Commercial DWDM
Pioneering work on wavelength multiplexing in optical fibers

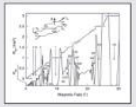
1990's

1995
Integrated ADSL Chip
After co-inventing ADSL technology, follow-up innovations like vectoring continued to generate world records for high speed data transfer over copper telephone lines, fueling the Internet

1997
Laser-Based Cooling and Trapping of Atoms
To understand the fundamental limits of materials and matter

1998
Wireless MIMO Spatial Multiplexing
Invention of wireless transmission based on multiple spatial paths

1998
Fractional Quantum Hall Effect
Discovery of a novel collective quantum fluid state of matter



2000's

2006
Software Defined Routing
Predecessor of Software Defined Networks (SDN)

2009
CCD
Boyle and Smith's picture phone research realized the enormous potential of the Charge Coupled Device as an imaging device, leading to the invention of the digital photo, video cameras, scanners, satellite surveillance and ultra-sensitive astronomical telescopes

2009
Coherent 100G Optics
Invention of the future of high speed optical communications with coherent processing

2009
World's first standard compliant LTE call

2010's

2011
lightRadio Cube
First demonstration of building block of future small cell wireless networks

2014
XG-FAST
First demonstration of 10 Gbps over copper telephone wires

2014
Fluorescence Microscopy
Ground-breaking work on sub-wavelength optical microscopy leads to super-resolution microscopy at cellular level

2015
GreenTouch
International consortium delivers new technologies to improve energy efficiency in wireless networks by more than 10,000X

2015
Optical MIMO-SDM
Pioneering work on utilizing the spatial dimension in fiber, showing greater than 10X increase in optical network capacity

2015
The Future X Network: A Nokia Bell Labs Perspective
First Nokia Bell Labs book written

2016
5G Massive Connectivity
First demonstration of 1M simultaneous, ultra-low latency connections in a single cell for 5G and IoT

The Future

Nokia Bell Labs continues to solve the great industry challenges, producing disruptive innovations for the next phase of human existence

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(S) 5.01
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CUSP
CENTER FOR URBAN SCIENCE+PROGRESS
LONDON

Typical slide format

paper title (can be «googled»)

[*AAAI ICWSM*] Smelly Maps: The Digital Life of Urban Smellscapes

Measuring the intangible
social-dynamics.net
Nokia Bell Labs, Cambridge UK

smart city

goodcitylife.org

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FOOD & HEALTH
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[*ACM cscw'14*] Aesthetic Capital: What Makes London Look Beautiful, Quiet, and Happy?

Design for **urban beauty**

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A

B

goodcitylife.org/happymaps

[*ACM cscw'14*] Aesthetic Capital: What Makes London Look Beautiful, Quiet, and Happy?

UrbanGems | Beautiful Gems | Happy Gems | Quiet Gems | About | email | password | sign in | sign up

UrbanGems: Crowdsourcing Quiet, Beauty and Happiness

Change Question | Which place do you find more beautiful? | Progress: 5/10

Picture Info

Picture Info

Can't Tell

UNIVERSITY OF CAMBRIDGE

[*ACM cscw'14*] Aesthetic Capital: What Makes London Look Beautiful, Quiet, and Happy?

most beautiful

...

least beautiful

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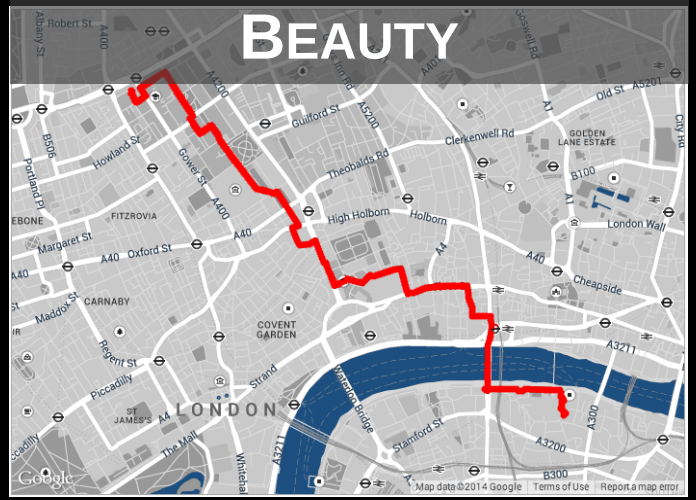
The Shortest Path to Happiness

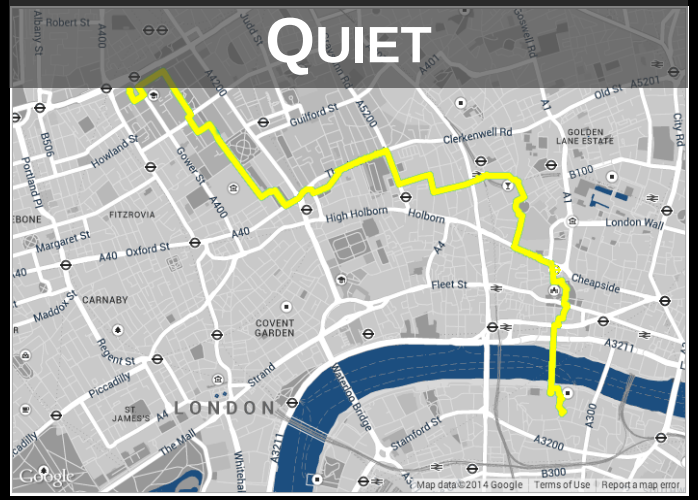
Shortest

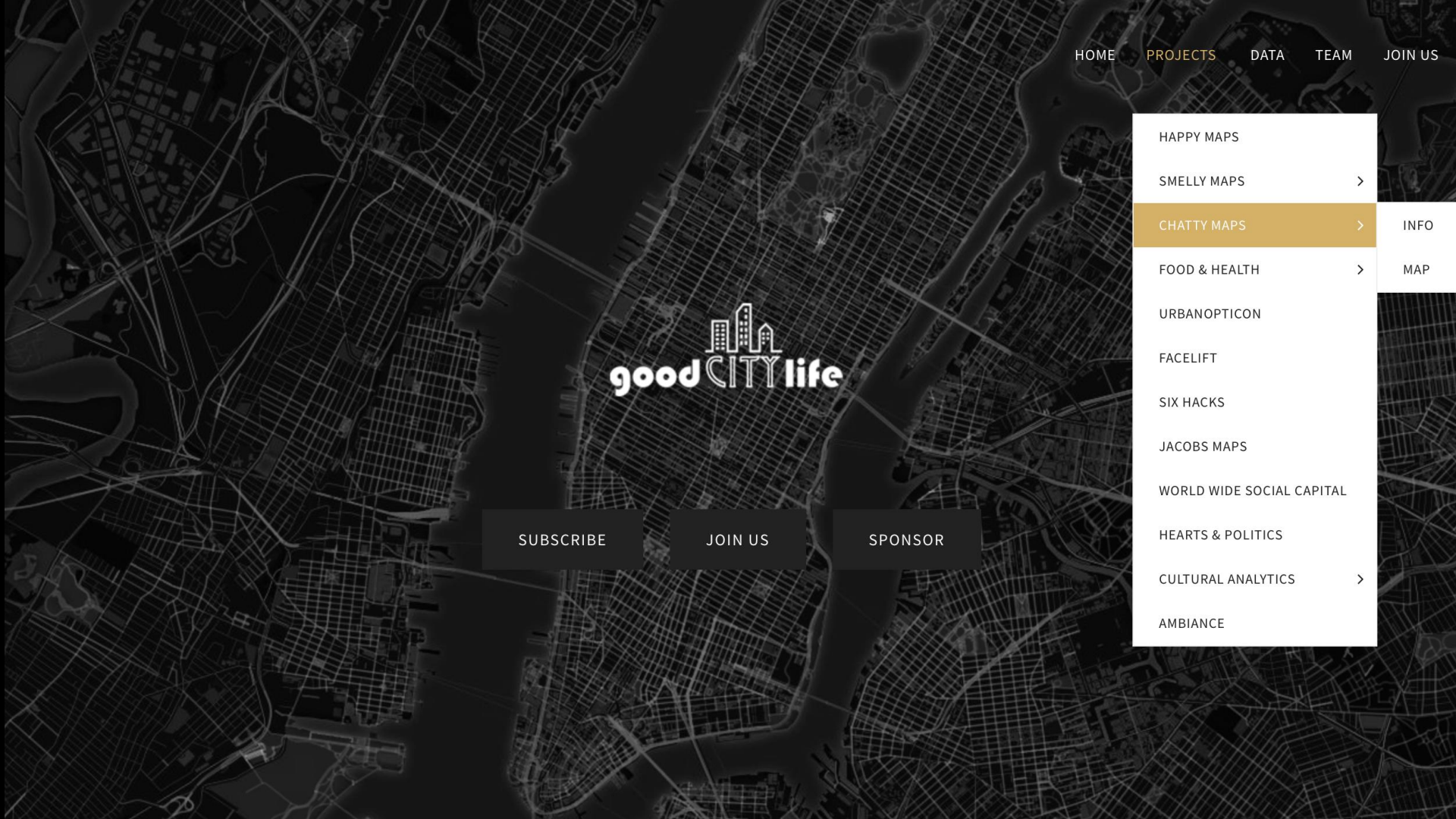
Happy

Beauty



Quiet

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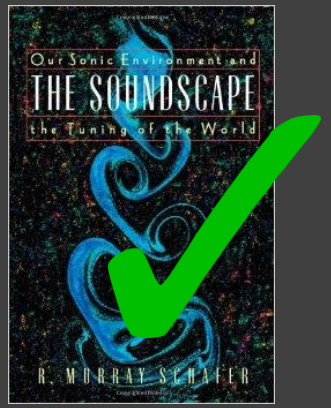
Research

Cite this article: Aiello LM, Schifanella R, Quercia D, Aletta F. 2016 Chatty maps: constructing sound maps of urban areas from social media data. *R. Soc. open sci.* **3**: 150690. http://dx.doi.org/10.1098/rsos.150690

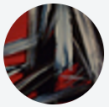
Chatty maps: constructing sound maps of urban areas from social media data

Luca Maria Aiello[1], Rossano Schifanella[2], Daniele Quercia[3] and Francesco Aletta[4]

[1]Yahoo Labs, London, UK
[2]University of Turin, Turin, Italy
[3]Bell Labs, Cambridge, UK
[4]University of Sheffield, Sheffield, UK



FIRST URBAN SOUND DICTIONARY



Scott Johnson + Follow

New Orleans Street Musicians ...

PRO

This violinist literally played with such feeling and beauty that 'grown men' were tearful in the audience.
French Quarter, New Orleans, Louisiana, USA
(Please View Full Screen ...)

musicians guitar violin music

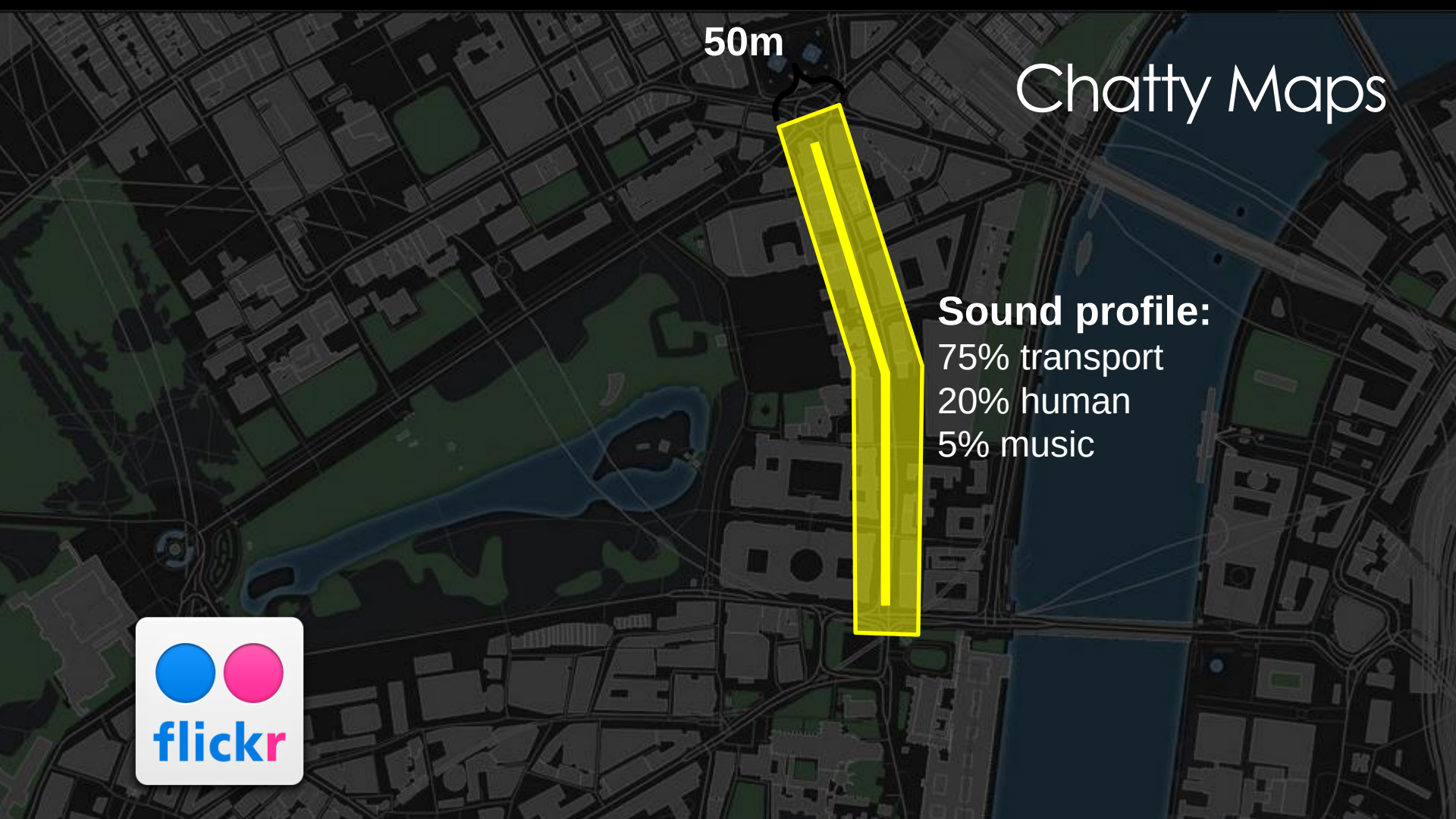
natural light Louisiana Nikon

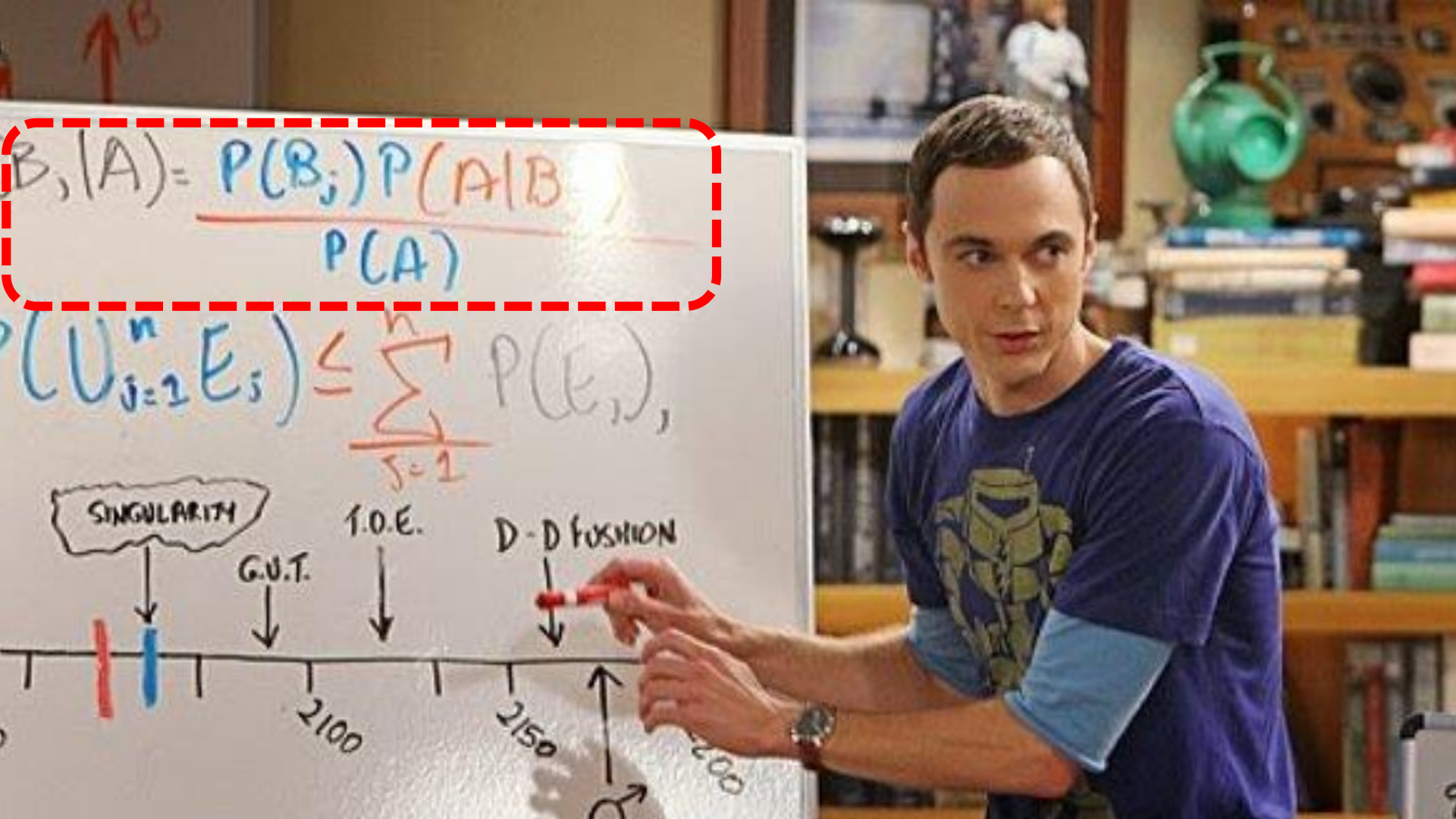
1,579 views 44 faves 13 comments

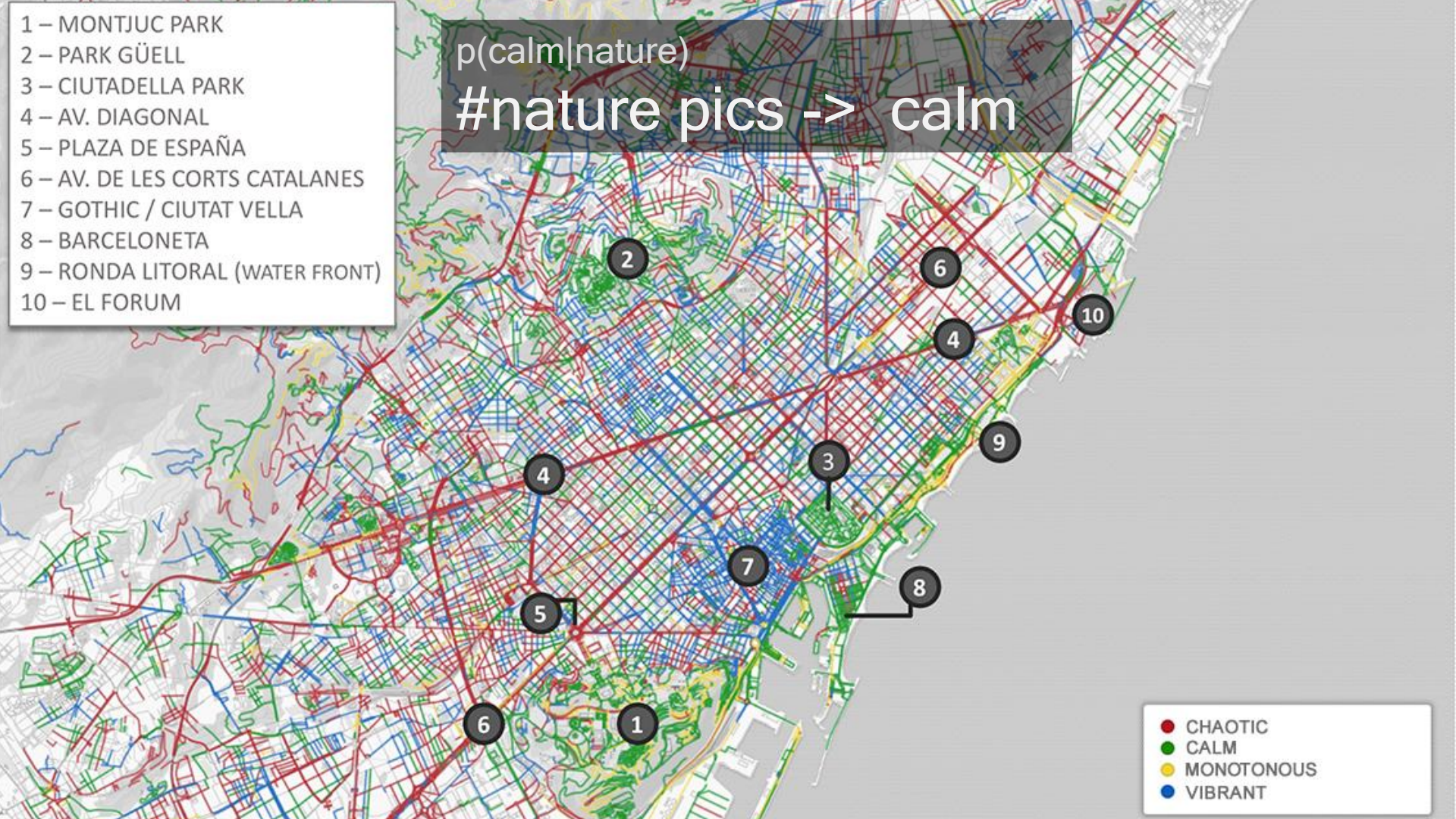
Taken on April 29, 2015

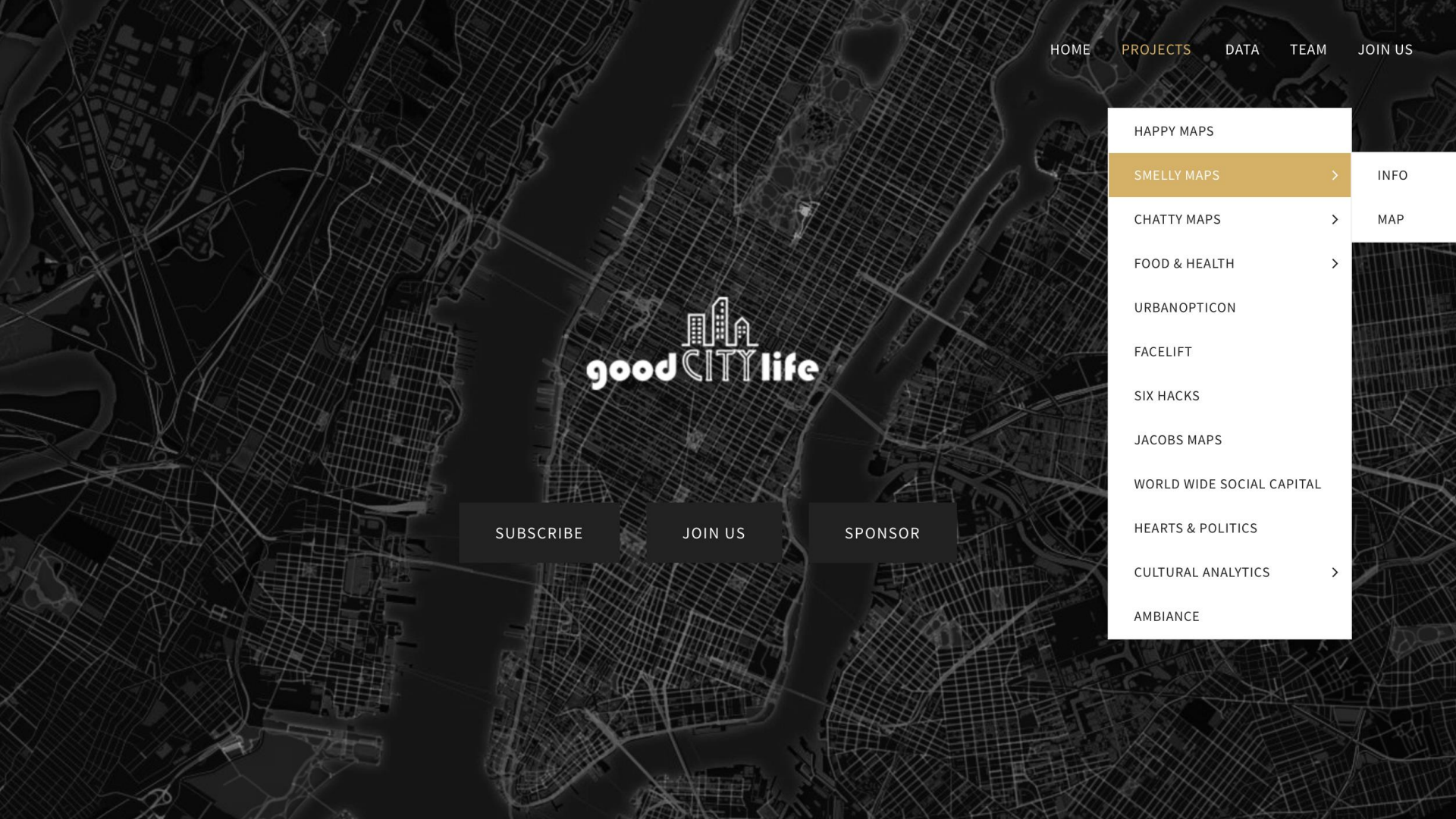
Some rights reserved

French Quarter, New Orleans, Louisiana


50m
Chatty Maps
Sound profile:
75% transport
20% human
5% music
flickr


$P(B_i|A) = \frac{P(B_i)P(A|B_i)}{P(A)}$
$P(\bigcup_{j=1}^{n} E_j) \leq \sum_{j=1}^{n} P(E_j)$
SINGULARITY
G.U.T.
T.O.E.
D-D FUSHION
2100
2150


1 – MONTJUC PARK
2 – PARK GÜELL
3 – CIUTADELLA PARK
4 – AV. DIAGONAL
5 – PLAZA DE ESPAÑA
6 – AV. DE LES CORTS CATALANES
7 – GOTHIC / CIUTAT VELLA
8 – BARCELONETA
9 – RONDA LITORAL (WATER FRONT)
10 – EL FORUM
p(calm|nature)
#nature pics -> calm
CHAOTIC
CALM
MONOTONOUS
VIBRANT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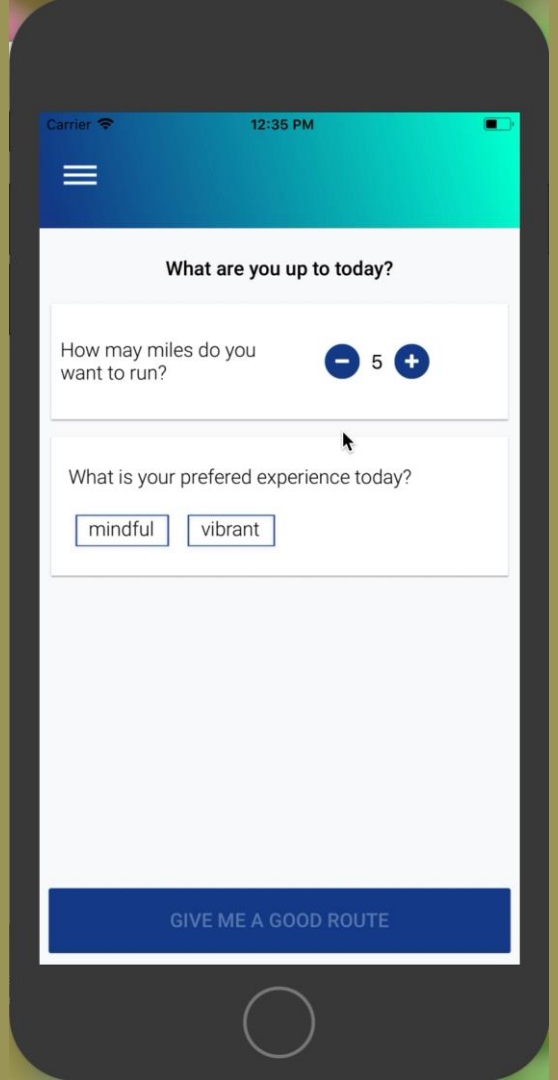
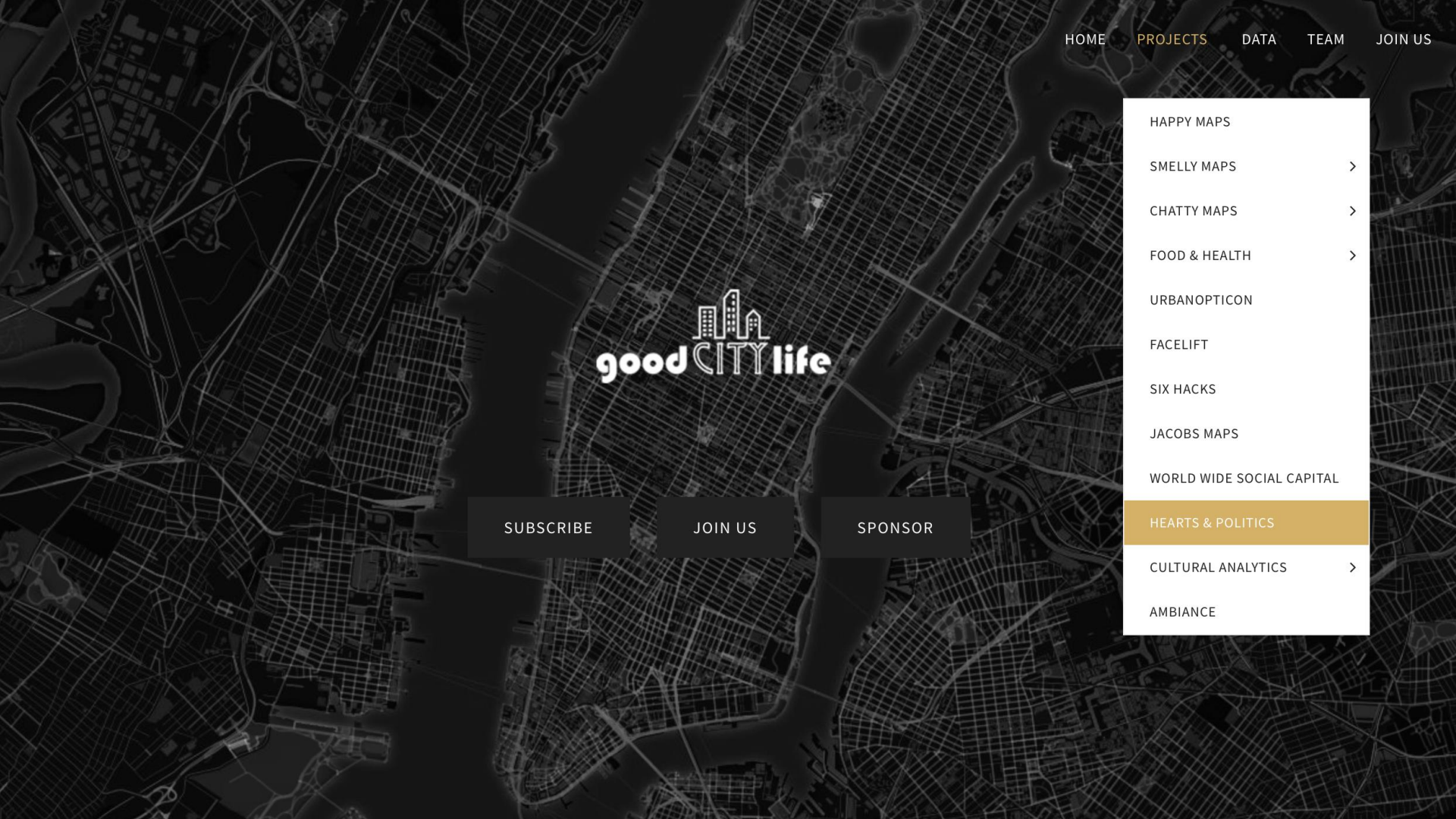
smell walks Amsterdam, Pamplona, Glasgow, Edinburgh, Newport, Paris, New York.

Match collected words to social media


Carrier
12:35 PM
What are you up to today?
How may miles do you want to run?
5
What is your prefered experience today?
mindful
vibrant
GIVE ME A GOOD ROUTE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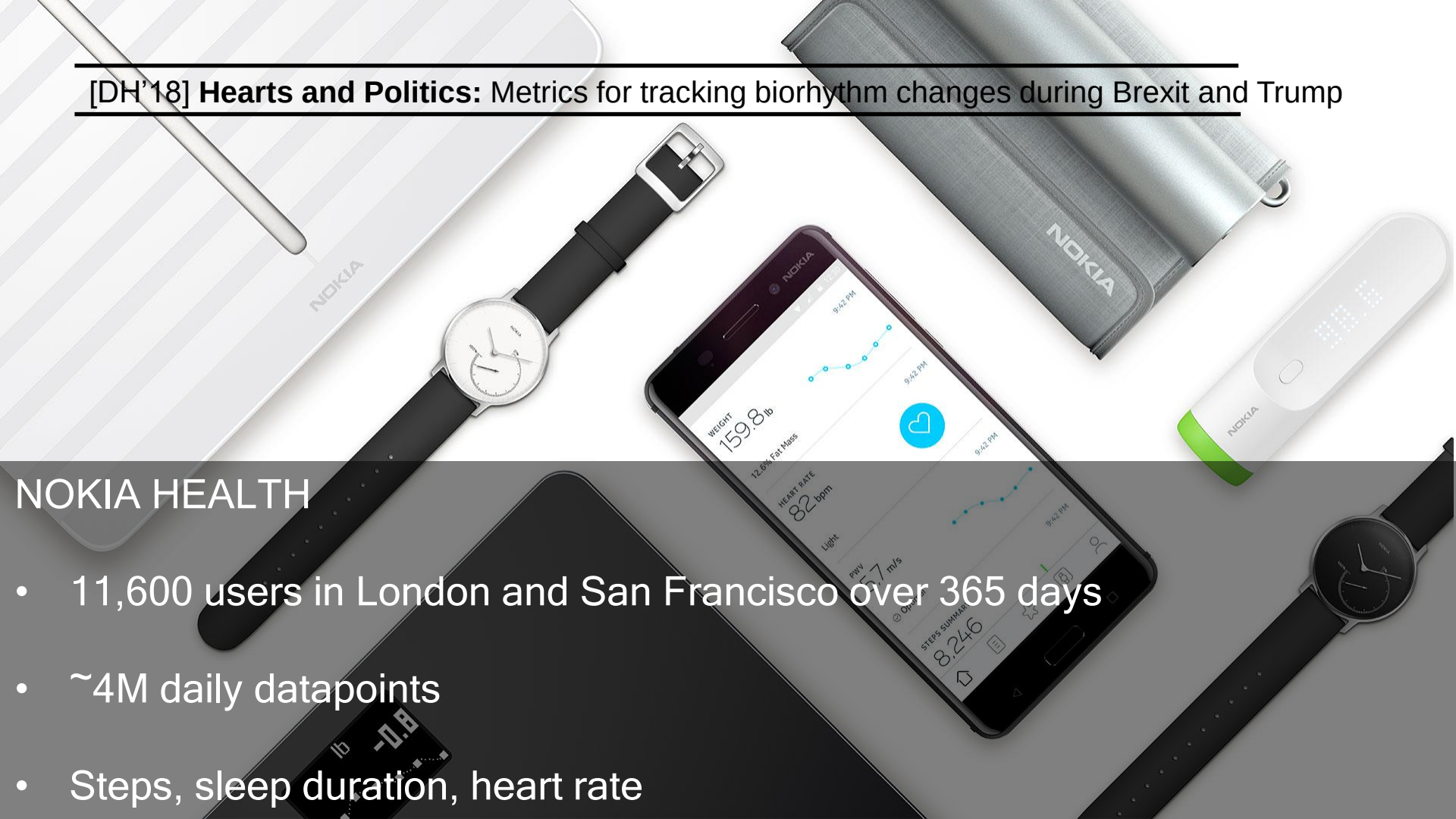
Hearts and Politics

Metrics for Tracking Biorhythm Changes during Brexit and Trump

NOKIA Bell Labs

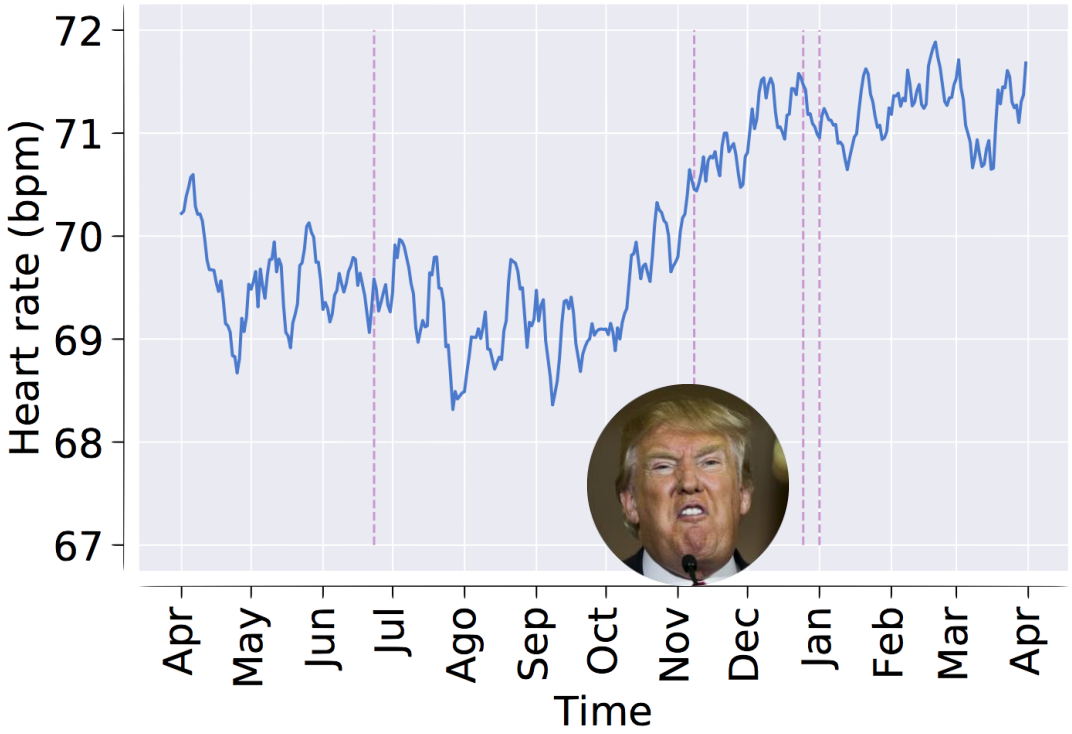
[DH'18] **Hearts and Politics:** Metrics for tracking biorhythm changes during Brexit and Trump



NOKIA HEALTH

- 11,600 users in London and San Francisco over 365 days
- ~4M daily datapoints
- Steps, sleep duration, heart rate

Aggregate avg volume of heart rate

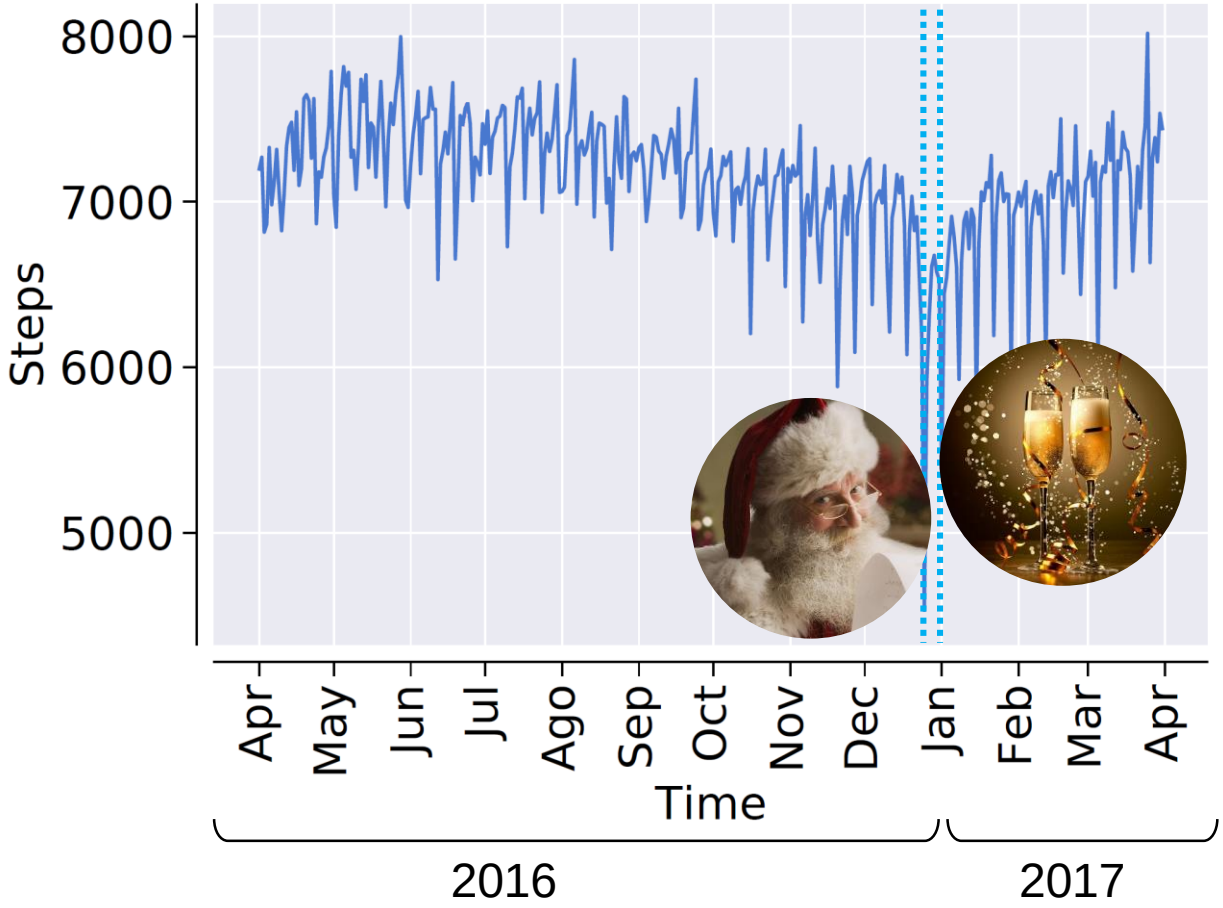


3 Metrics

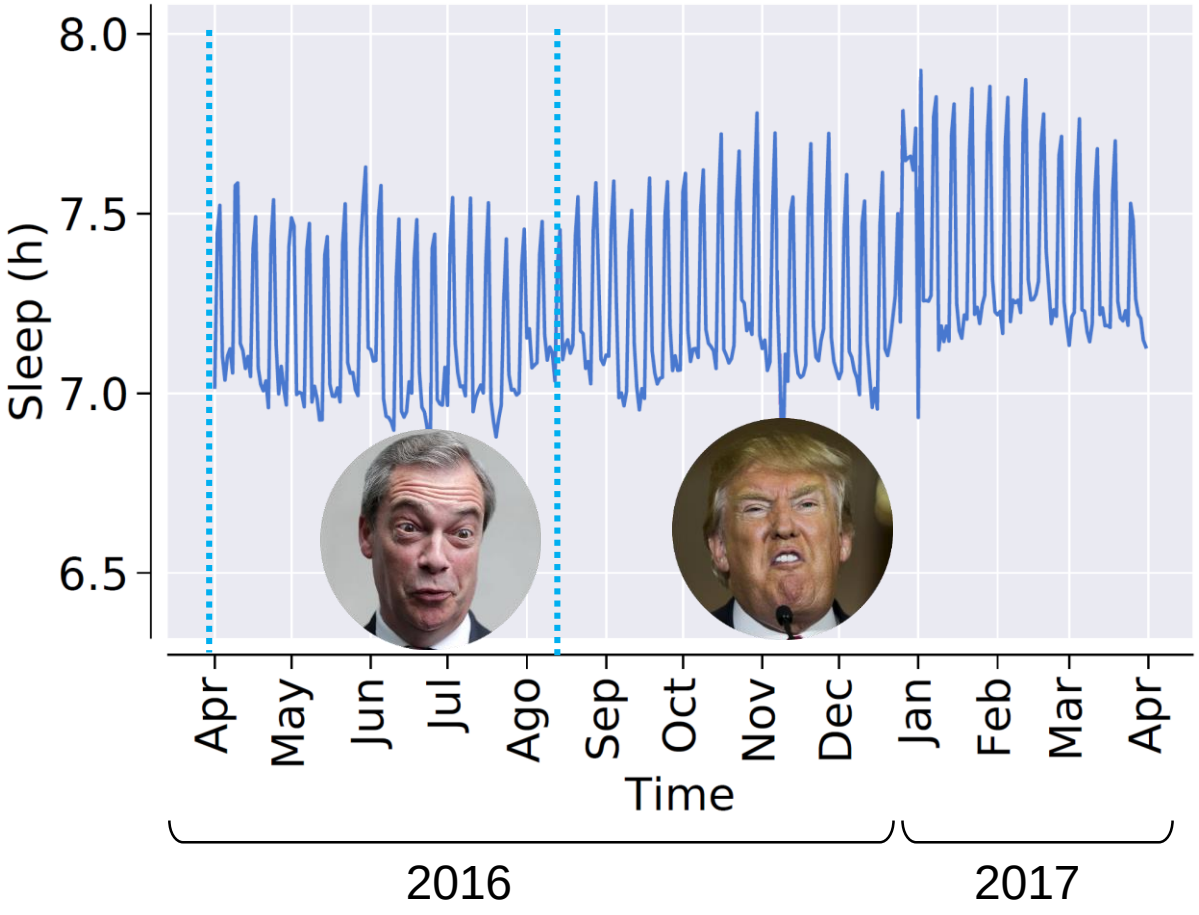
Volume
Rhythms
Synchronicity

[DH'18] **Hearts and Politics:** Metrics for tracking biorhythm changes during Brexit and Trump

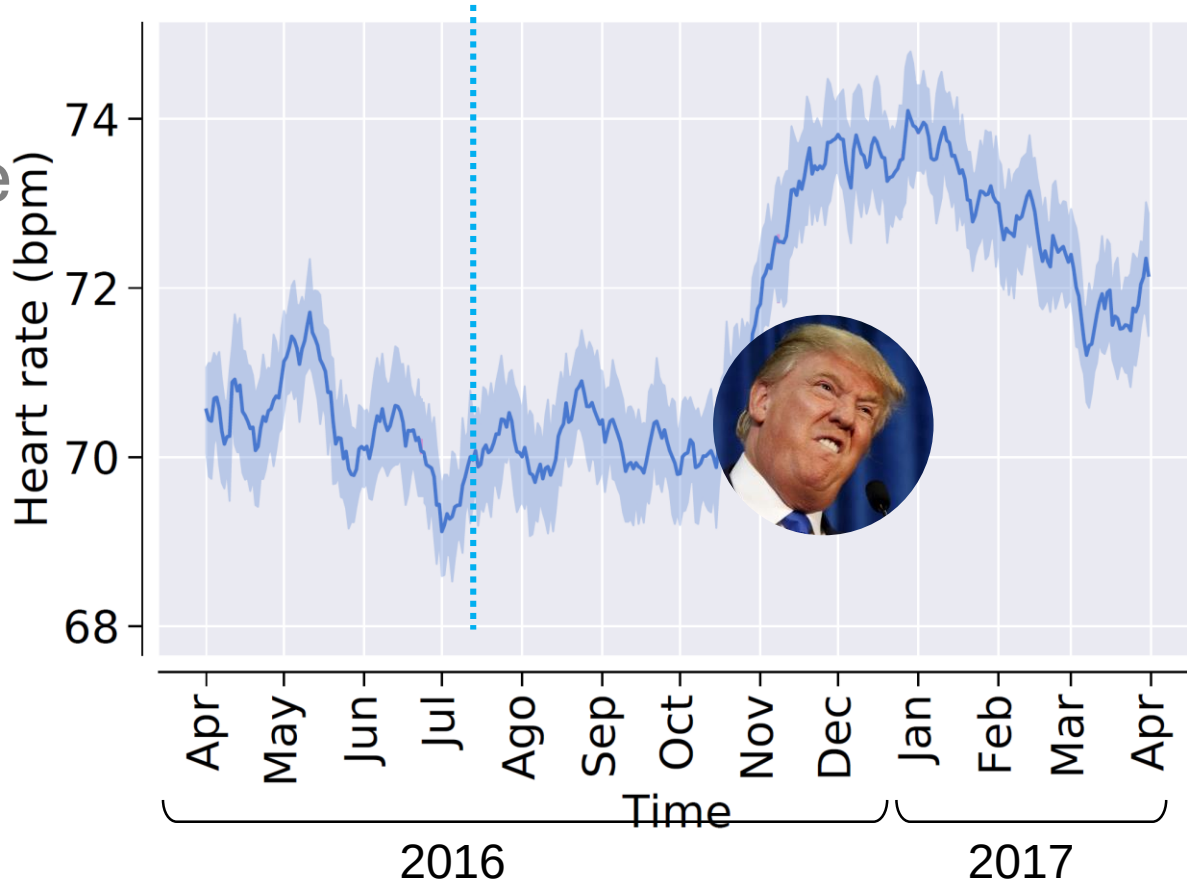
Volume: steps



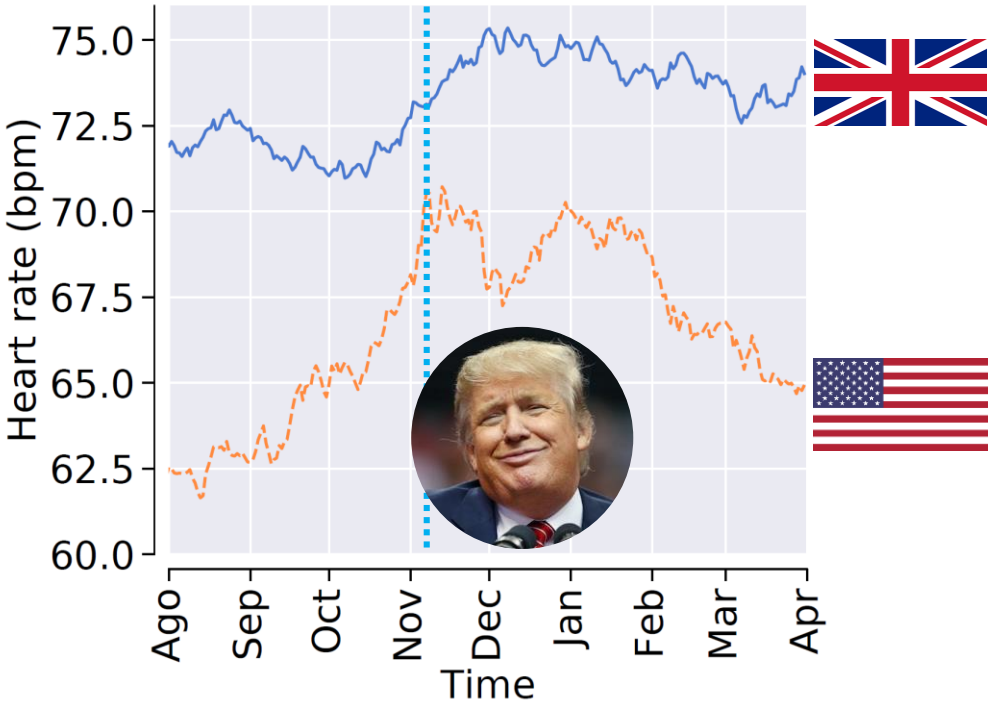
Volume:
sleep



Volume: avg heart rate



Volume: avg heart rate

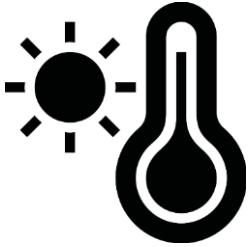


Ruling out confounding factors

New users

Increased activity

Software update



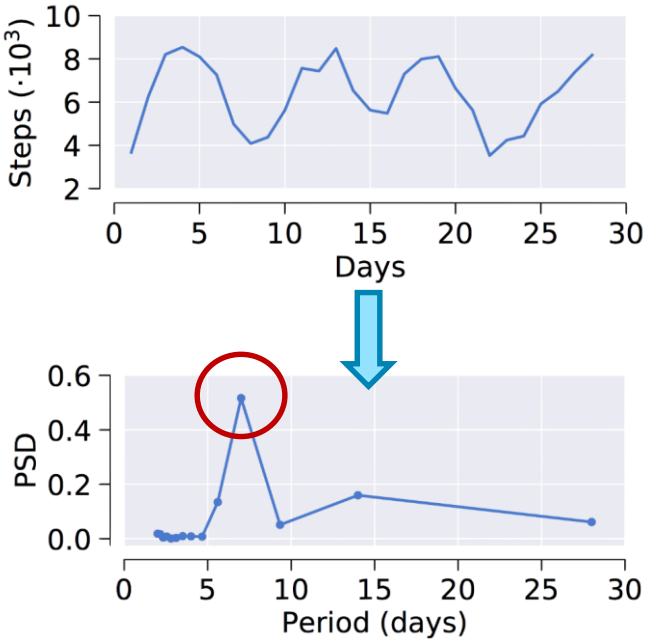
Temperature

Ruling out confounding factors

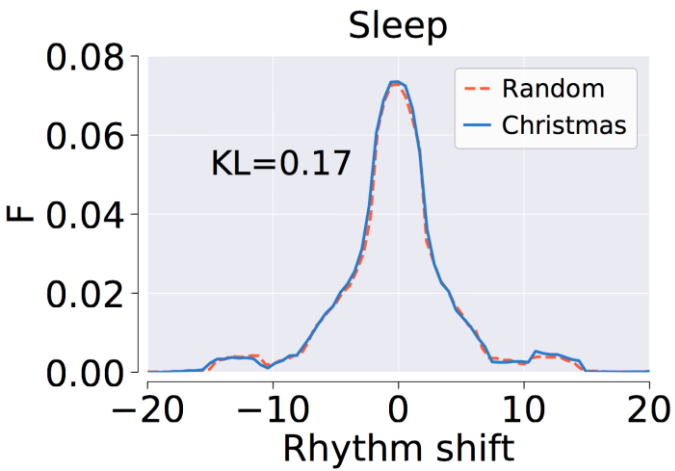
Hearts of Americans started beating faster in the days leading to Trump's election. They took months to go back to normal.

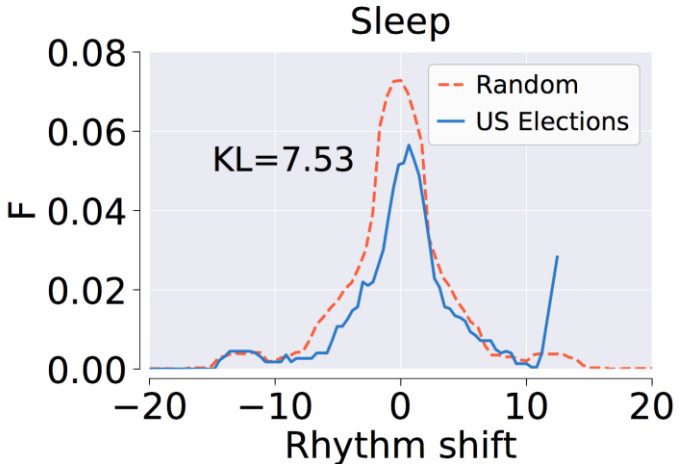
Rhythms

Rhythm disruption

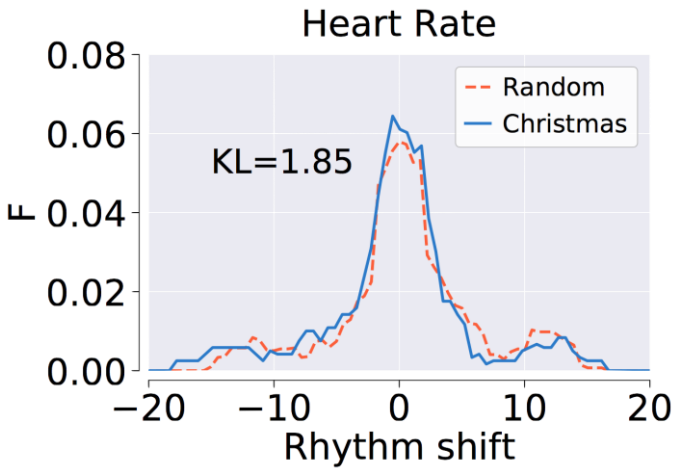


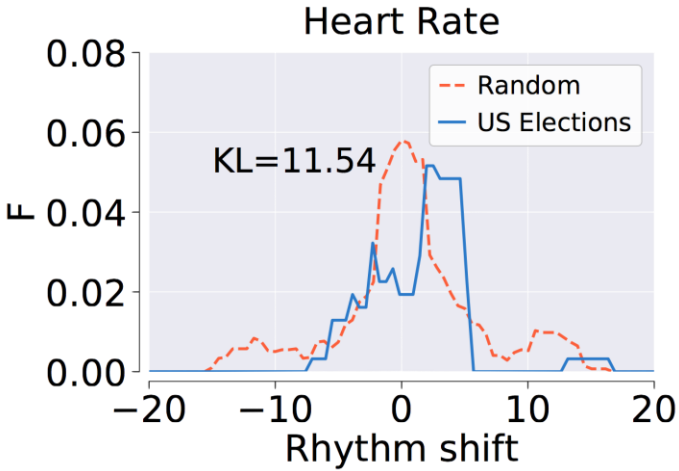
Rhythm disruption - results



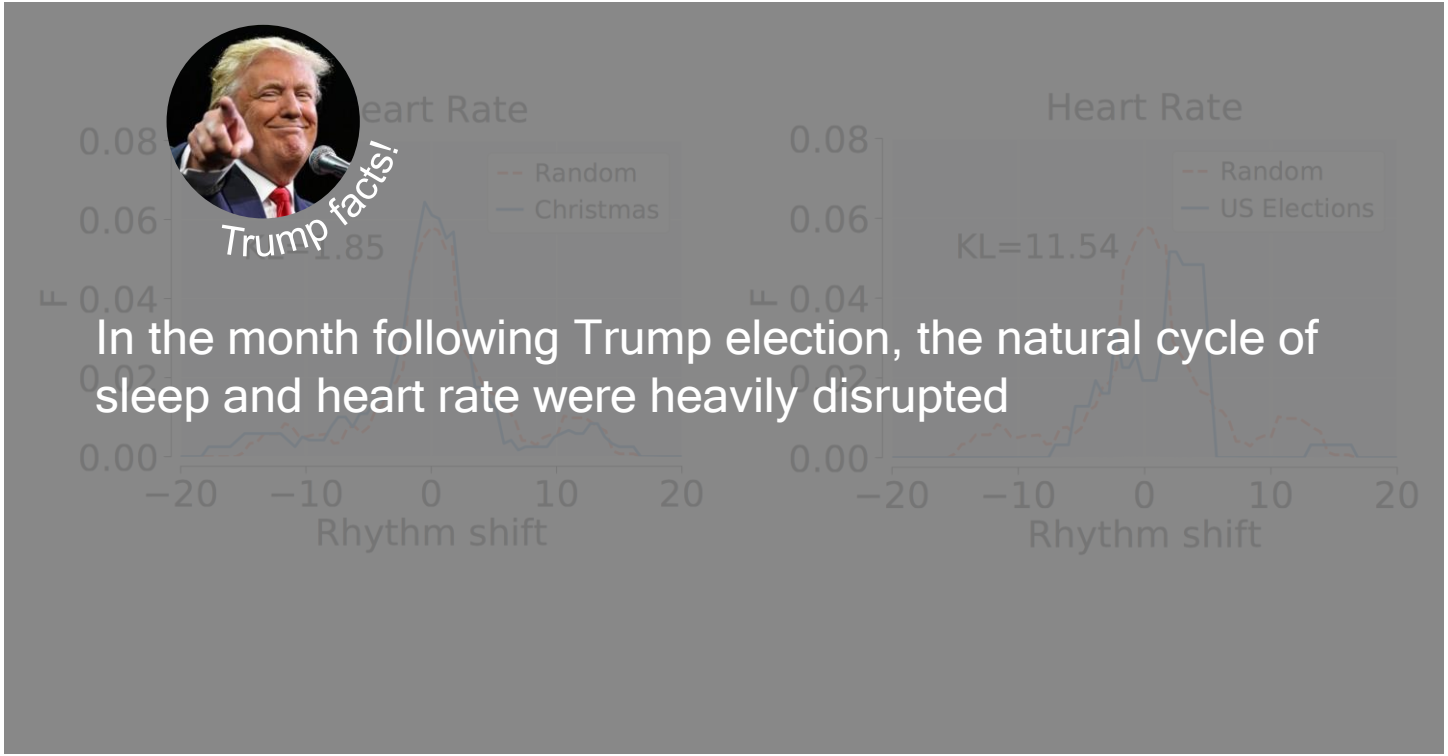


Rhythm disruption - results





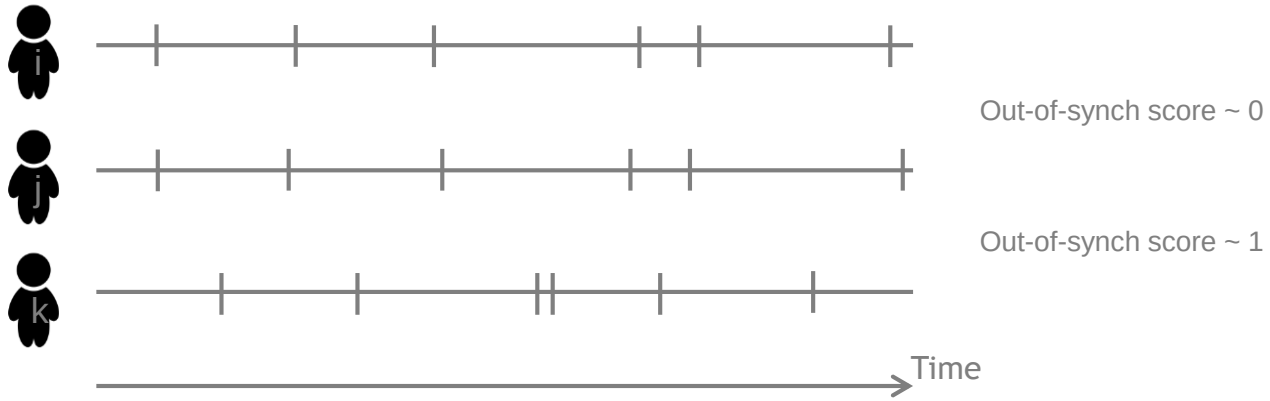
Rhythm disruption - results



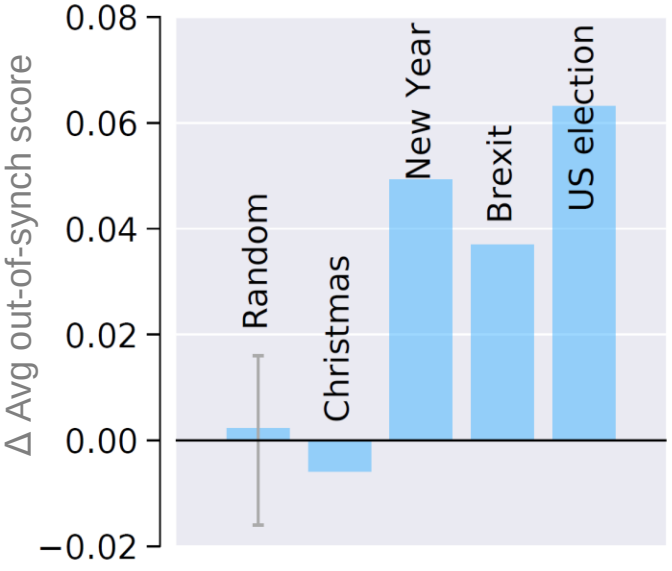
In the month following Trump election, the natural cycle of sleep and heart rate were heavily disrupted

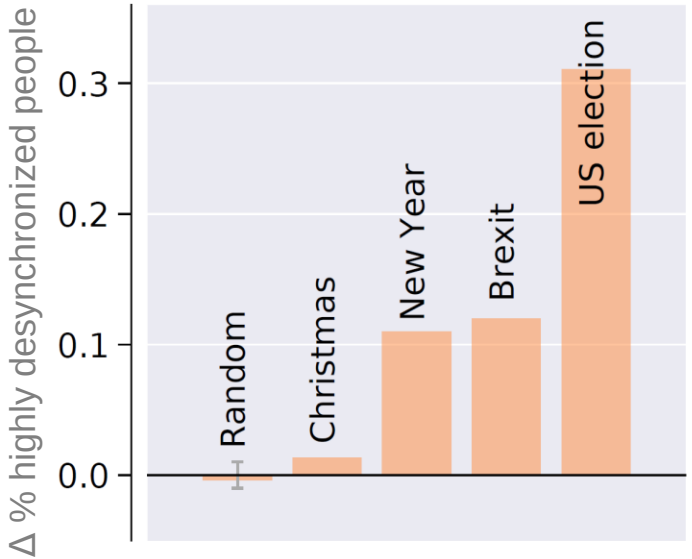
Synchronicity

Synchronicity disruption - results

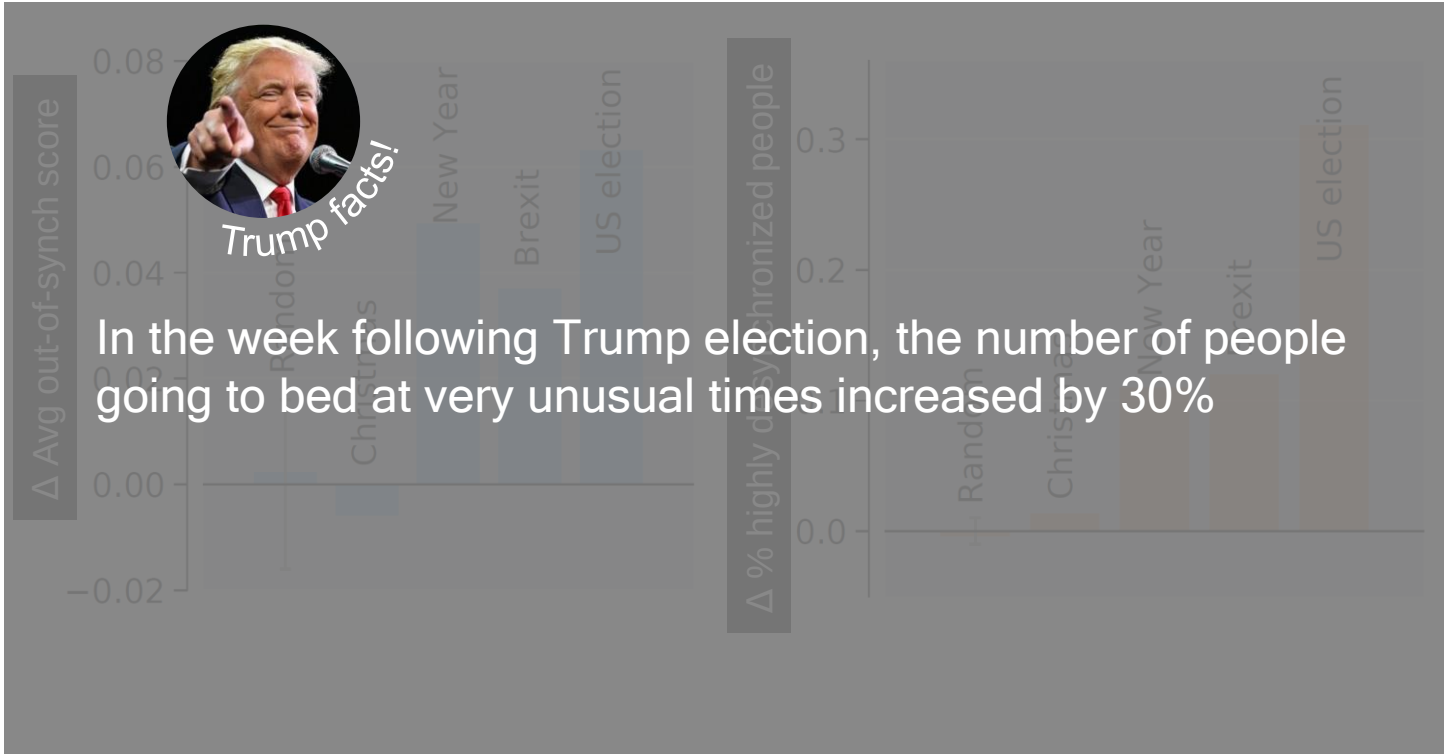


Synchronicity disruption - results





Synchronicity disruption - results



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Your life in a grocery bag

Large-scale analysis of food consumption in the city

NOKIA Bell Labs

[EPJ'19] Large-scale and high-resolution analysis of food purchases and health outcomes

Essential part of our life

- Health
- Habits
- Culture

- Complex domain
- Long-term effects
- Lack of data

[EPJ'19] Large-scale and high-resolution analysis of food purchases and health outcomes

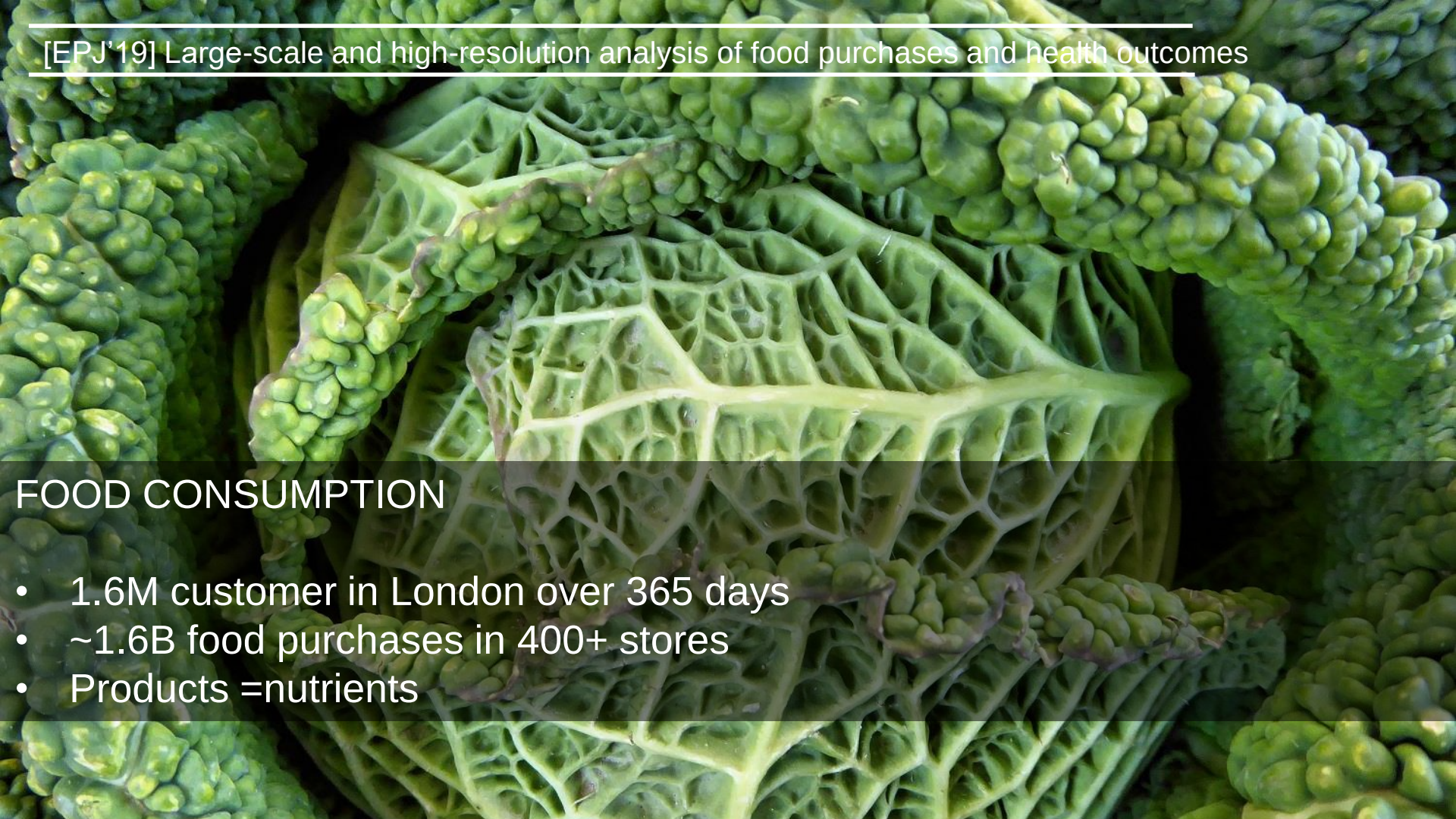
Lifestyle diseases

80% deaths in Western World

300k premature deaths in EU by obesity

€70B spent in EU yearly

[EPJ'19] Large-scale and high-resolution analysis of food purchases and health outcomes



FOOD CONSUMPTION

- 1.6M customer in London over 365 days
- ~1.6B food purchases in 400+ stores
- Products =nutrients

Is everything we eat associated with cancer? A systematic cookbook review

FREE

Jonathan D Schoenfeld ✉, John PA Ioannidis

The American Journal of Clinical Nutrition, Volume 97, Issue 1, 1 January 2013, Pages 127–134, https://doi.org/10.3945/ajcn.112.047142

Published: 28 November 2012 **Article history** ▾

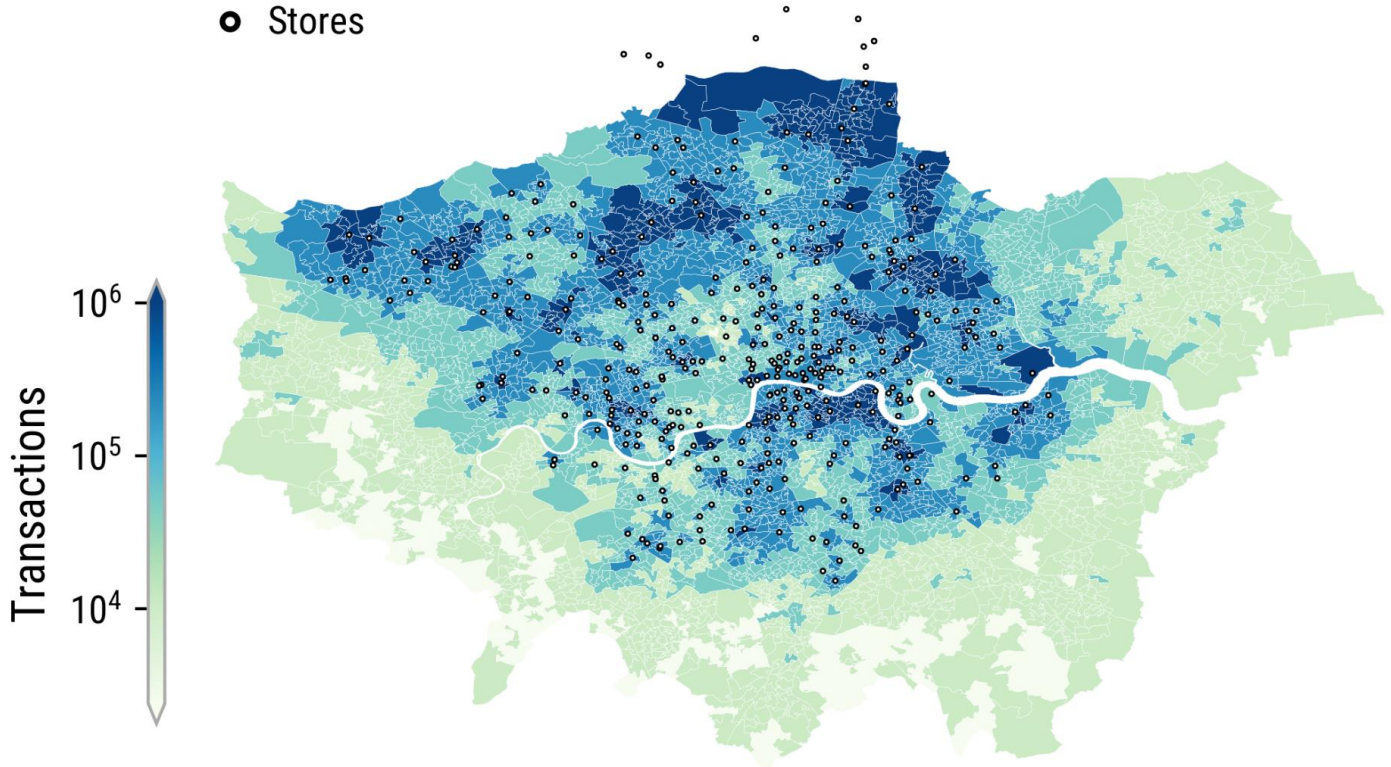
The American Journal of CLINICAL NUTRITION

"Associations with cancer risk or benefits have been claimed for most food ingredients. Many single studies highlight implausibly large effects, even though evidence is weak"

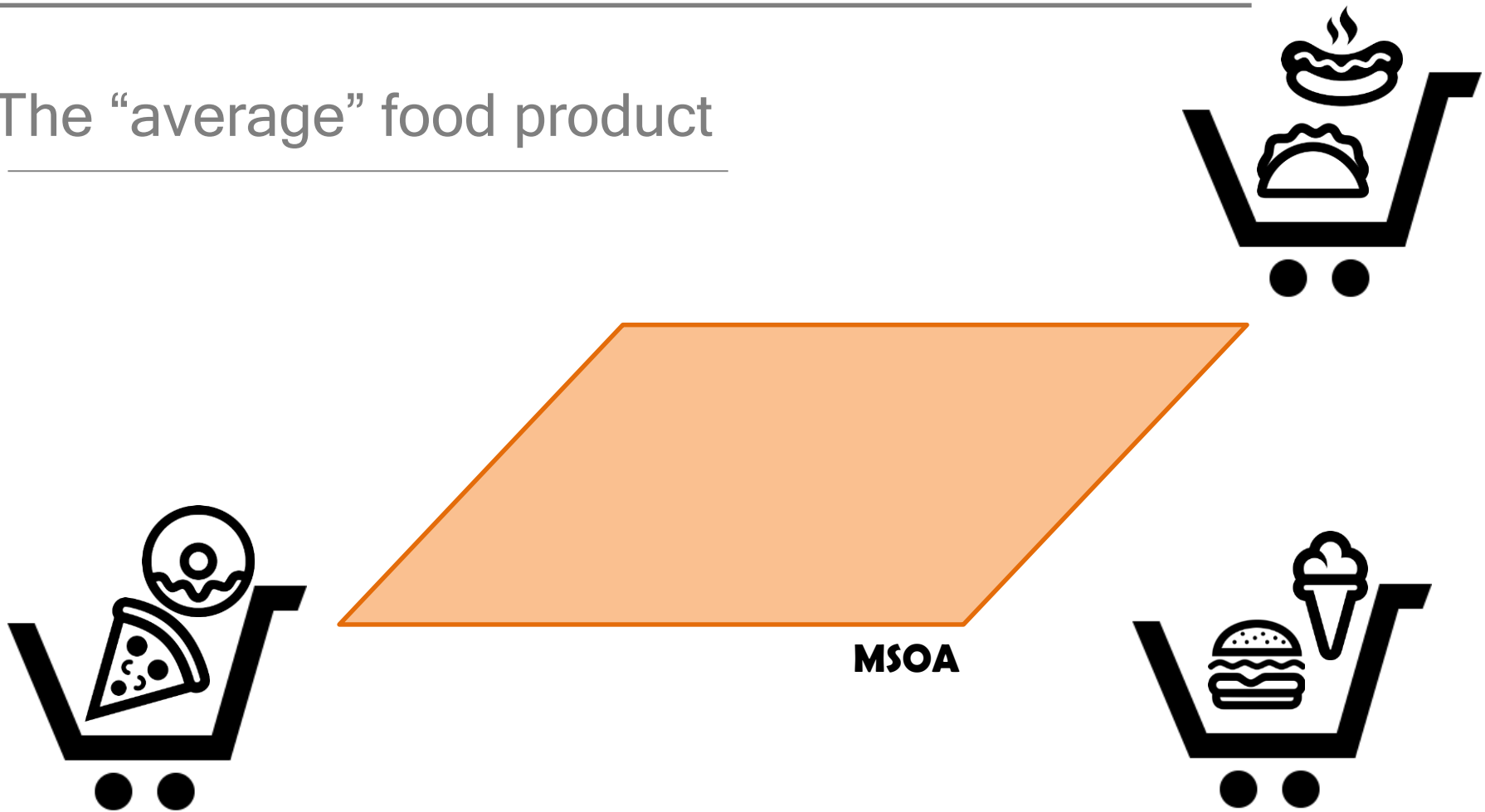
[EPJ’19] Large-scale and high-resolution analysis of food purchases and health outcomes

No large-scale data

Penetration

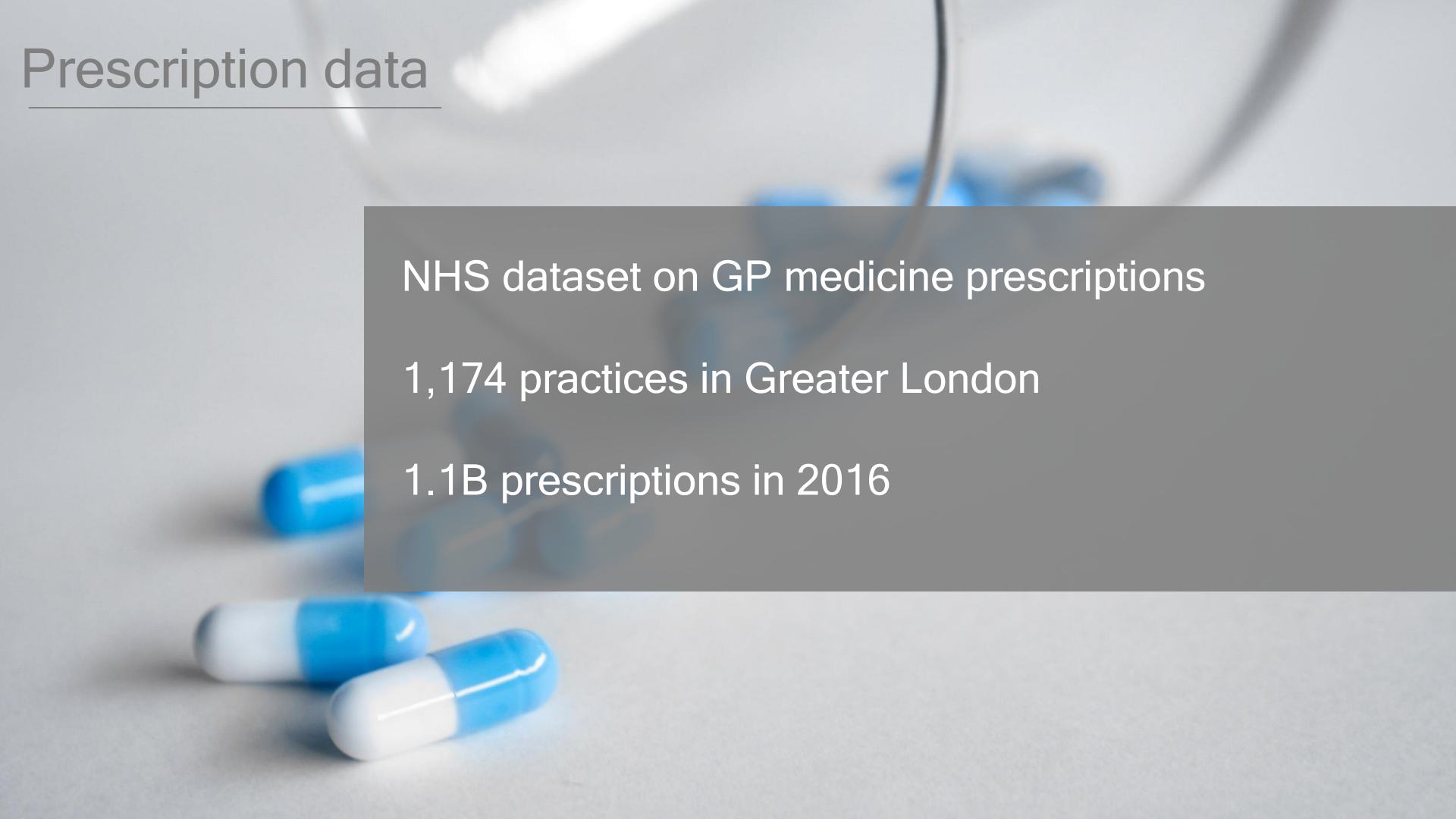


The "average" food product



Dataset coming soon:
"Large-scale and high-resolution analysis of food purchases and health outcomes"

Prescription data

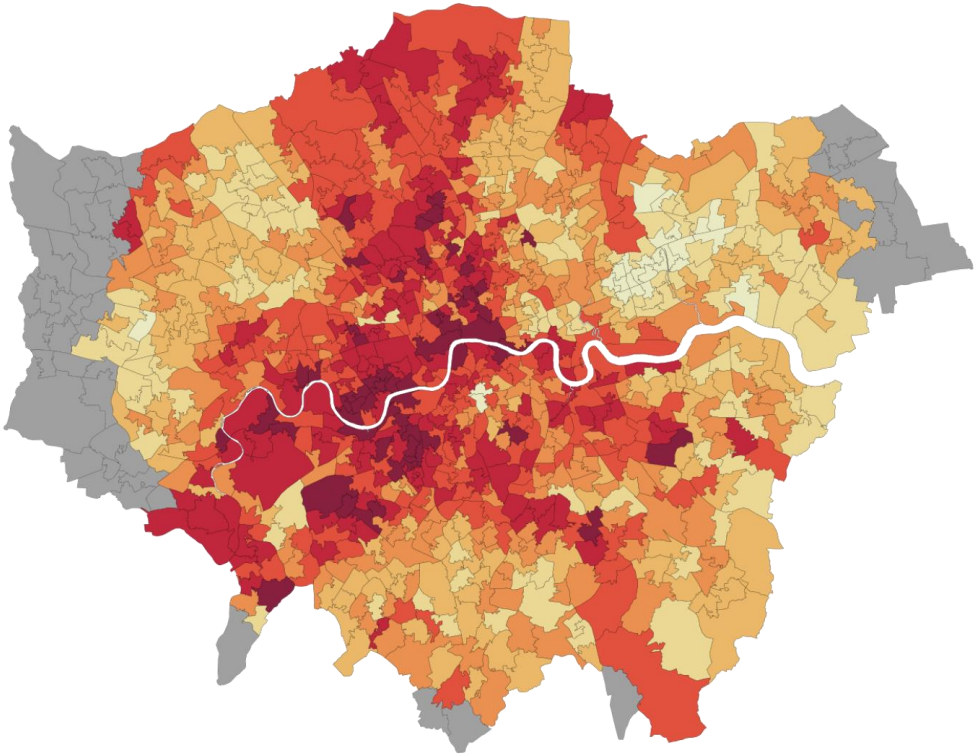


NHS dataset on GP medicine prescriptions

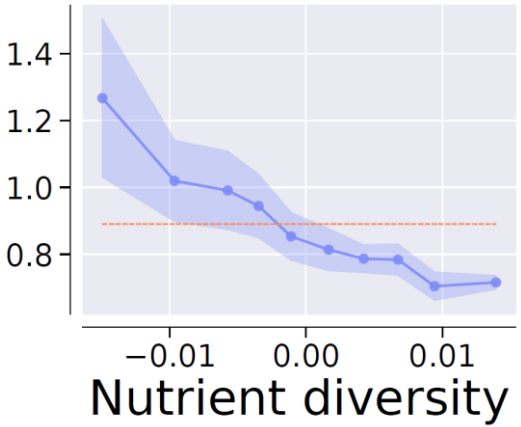
1,174 practices in Greater London

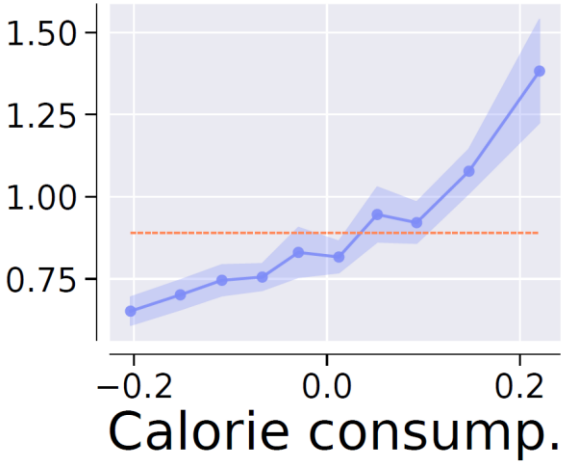
1.1B prescriptions in 2016

Map of Nutrient Diversity



You can **predict diabetes** from nutrient diversity & calories, for example

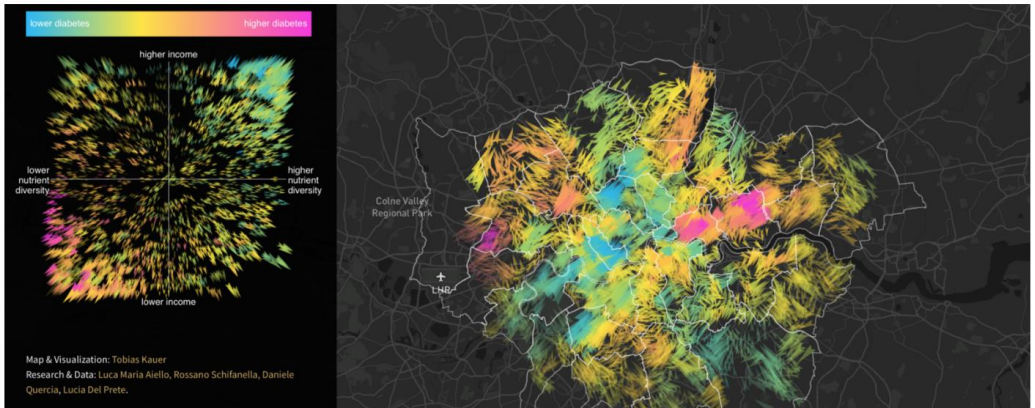




What can we learn from billions of food purchases derived from fidelity cards?

danielequercia
May 16 · 2 min read

By combining 1.6B food item purchases with 1.1B medical prescriptions for the entire city of London for one year, we discovered that, to predict health outcomes, socio-economic conditions matter less than what previous research has shown: despite being of lower-income, certain areas are healthy, and that is because of what their residents eat!



[EPJ’19] Large-scale and high-resolution analysis of food purchases and health outcomes

http://goodcitylife.org/food/

Self-representation

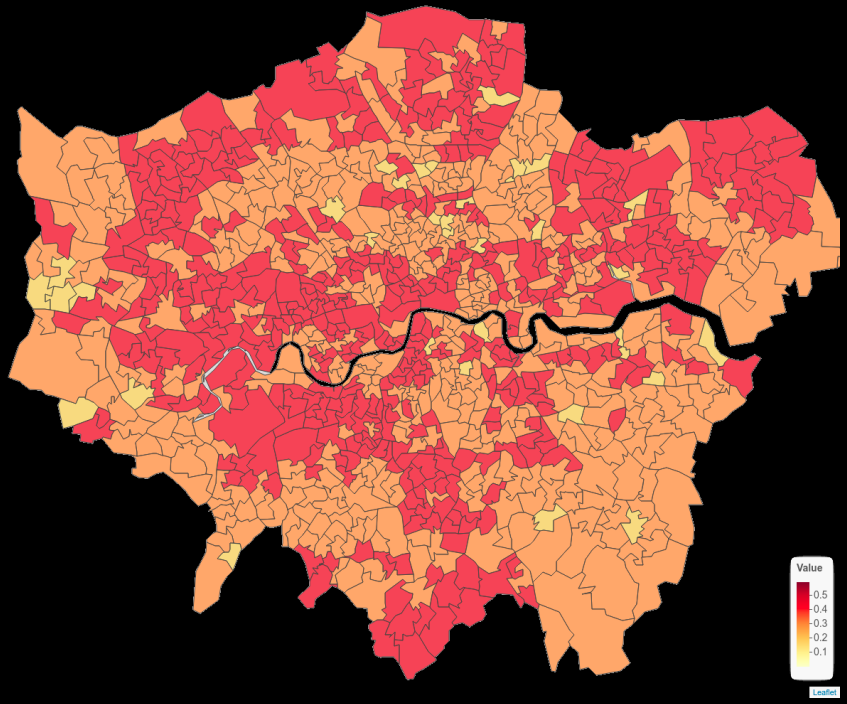
What we eat

vs.

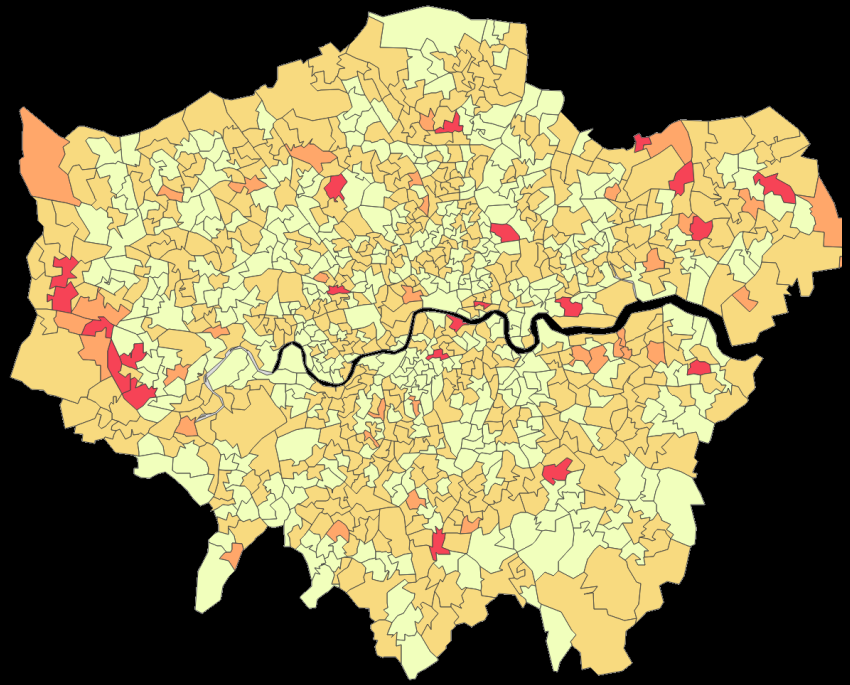
What we share

Food consumption vs. online representation: **soup**

Tesco



Social media

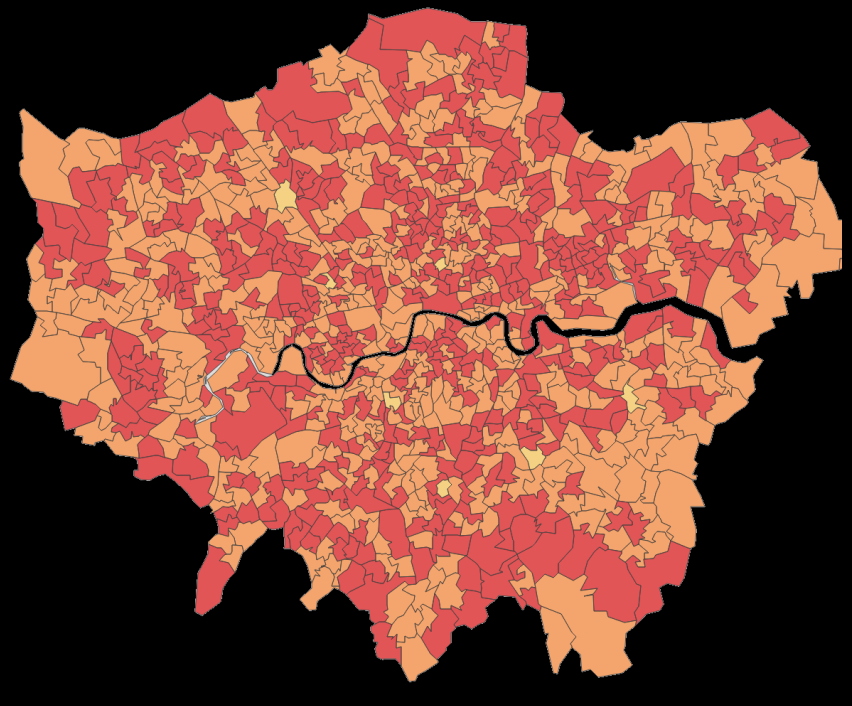


Food consumption vs. online representation:

alcohol

Tesco

Social media



Quercia
@danielequercia

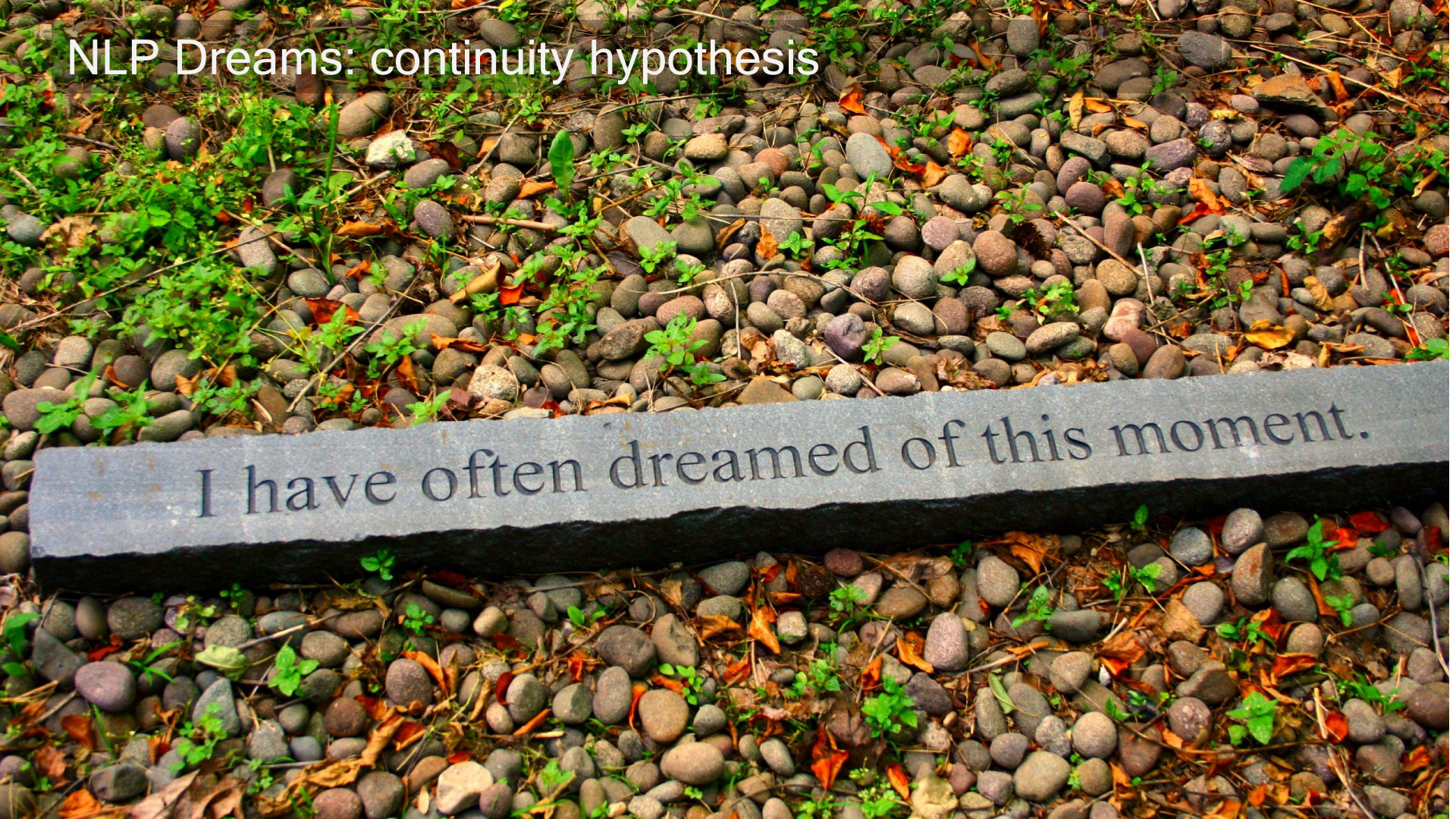
Dear epidemiologists and doctors, we need your help! We have built algorithms that reliably extract symptoms and diseases out of geo-referenced social media posts for the entire world. Do you know anyone interested in collaborating ? Cc @soc_dynamics

10:15 PM - 4 Jun 2019

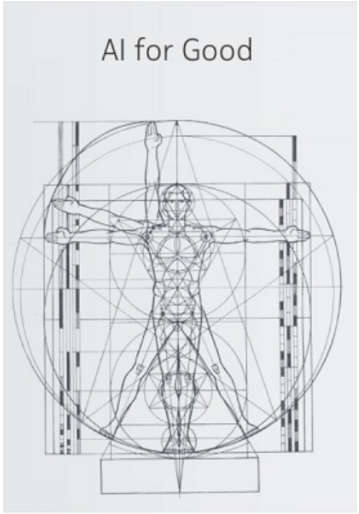
[*ACM cscw'14*] Aesthetic Capital: What Makes London Look Beautiful, Quiet, and Happy?

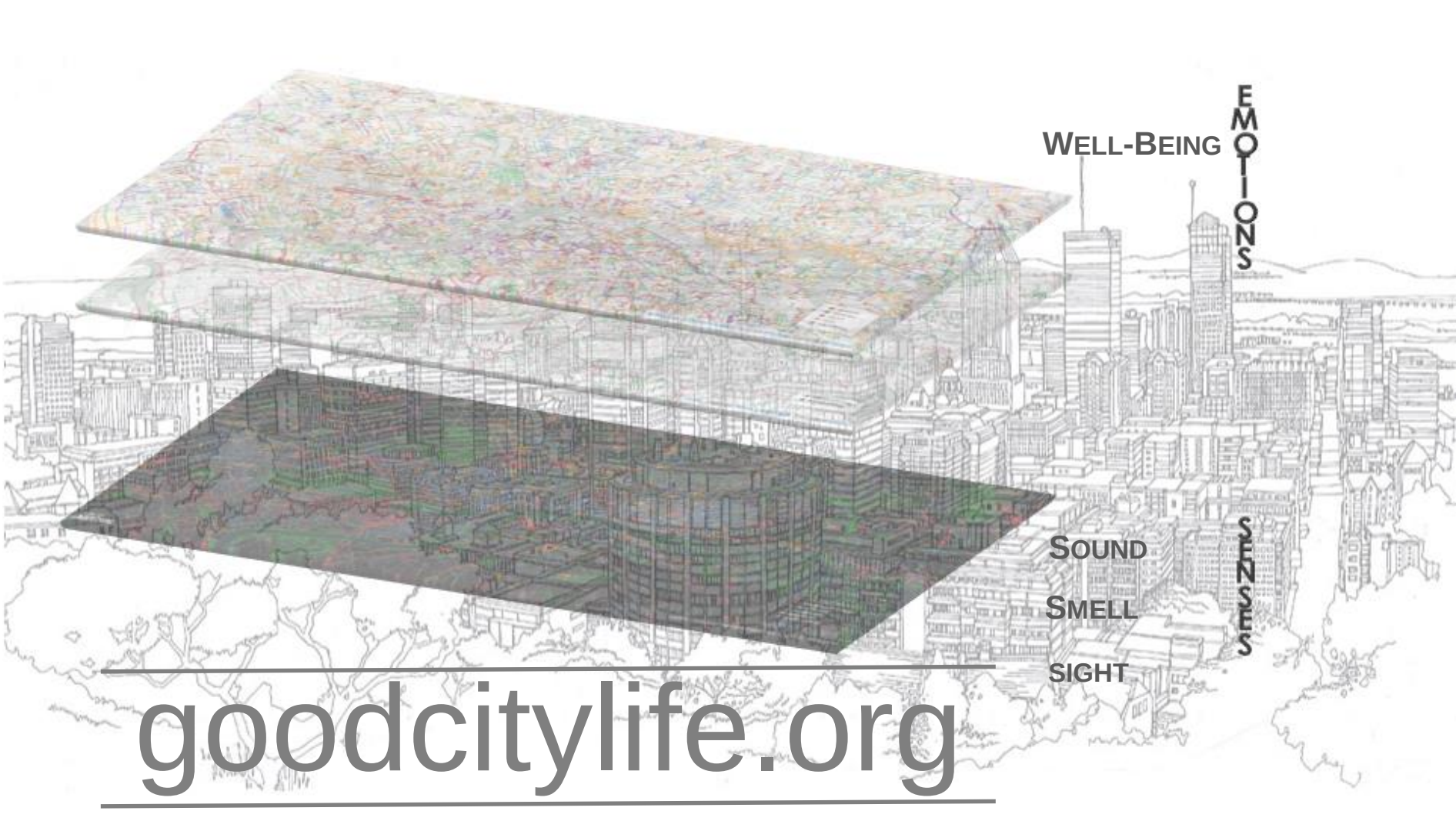
Satellite Data

NLP Dreams: continuity hypothesis



DEMOS





goodcitylife.org