Geographic Data Science - Lecture I

Introduction

Dani Arribas-Bel

Today

- This course
- The (geo-)data revolution
- (Geo-)Data Science

This course

Quiz

- Have you ever heard the terms **"Big Data"** and **"Data Science"**?
- Have you ever written a line of computer code?
- How would you define in one sentence "Data Science"?
- Do you think **"Geographic Data Science"** is closer to GIS or Statistics?

More stats than a GIS course, more GIS than a stats course...

...but in a fun way!

Structure

11 weeks of:

- **Prep. materials**: videos, podcasts, articles... 1h. approx. (most recommended!)
- **1h. Lecture**: concepts, methods, examples
- **2h. Computer practical**: hands-on, application of concepts, Python (highly *employable*)
- **Further readings**: how to go beyond the minimum

IMPORTANT: Week 7 has no class! [Labs are booked so I recommend you spend the lab time working on your first assignment]

Website

http://darribas.org/gds15

`ENVS363/563`

Geographic Data Science

This is the course website for Geographic Data Science, taught by Dani Arribas-Bel in the Autumn of 2015 at the University of Liverpool.

The timetable for the course is:

- **Lectures**: Thursdays - 12:30/13:30, `MATH-029`.
- **Computer Labs**: Thursdays - 15:00/17:00, `CTL-6-PCTC-Blue` (with the exception of Week 3, Thursday Oct. 15th, which is at `GUILD-SUTC` and `ELEC-304`).

Locations

- `MATH-029`: Mathematics Building, Room 029, Building Ref: 206 Grid. Ref: E6 on the campus map.
- `CTL-6-PCTC-Blue`: Central Teaching Laboratory, PC Centre, Blue Zone. Building Ref: F6 on campus map.
- `GUILD-SUTC`: Guild of Students, Pc Centre. Building Ref: 406. Grid Ref: D4 on campus map.
- `ELEC-304`: Electrical Engineering, Room 304. Building Ref: 235. Grid Ref: E7 on the

Philosophy

- (Lots of) **methods** and techniques
  - General overview
  - Intuition
  - Very little math
- Emphasis on the **application**
- Close connection to **"real world"** applications
- **FUN**

Assignments

- Mark based on two assignments, due:
  1. Week 8 (50%)
  2. Week 13 (50%)
- Coursework
- **Equivalent** to 2,500: report with **code**, **figures** (e.g. maps), and **text**

The (geo-)data revolution

The (geo-)data revolution

Exciting times to be a:

- Geographer
- Map fan
- Data fan

The world is being **"datafied"**...

"Datafication"

Quantification of phenomena through the systematic recording of data

"taking all aspects of life and turning them into data" Cukier & (Mayer-Schoenberg)

Examples: credit transactions, public transit, tweets, facebook likes, spotify songs, etc.

"Datafication"

Many implications:

- Opportunities for optimization of systems (Industrial IoT, planning systems...)
- **Window** into human **behaviour** (this course)
- Issues with **intentionality** and **privacy**
- ...

Why now?

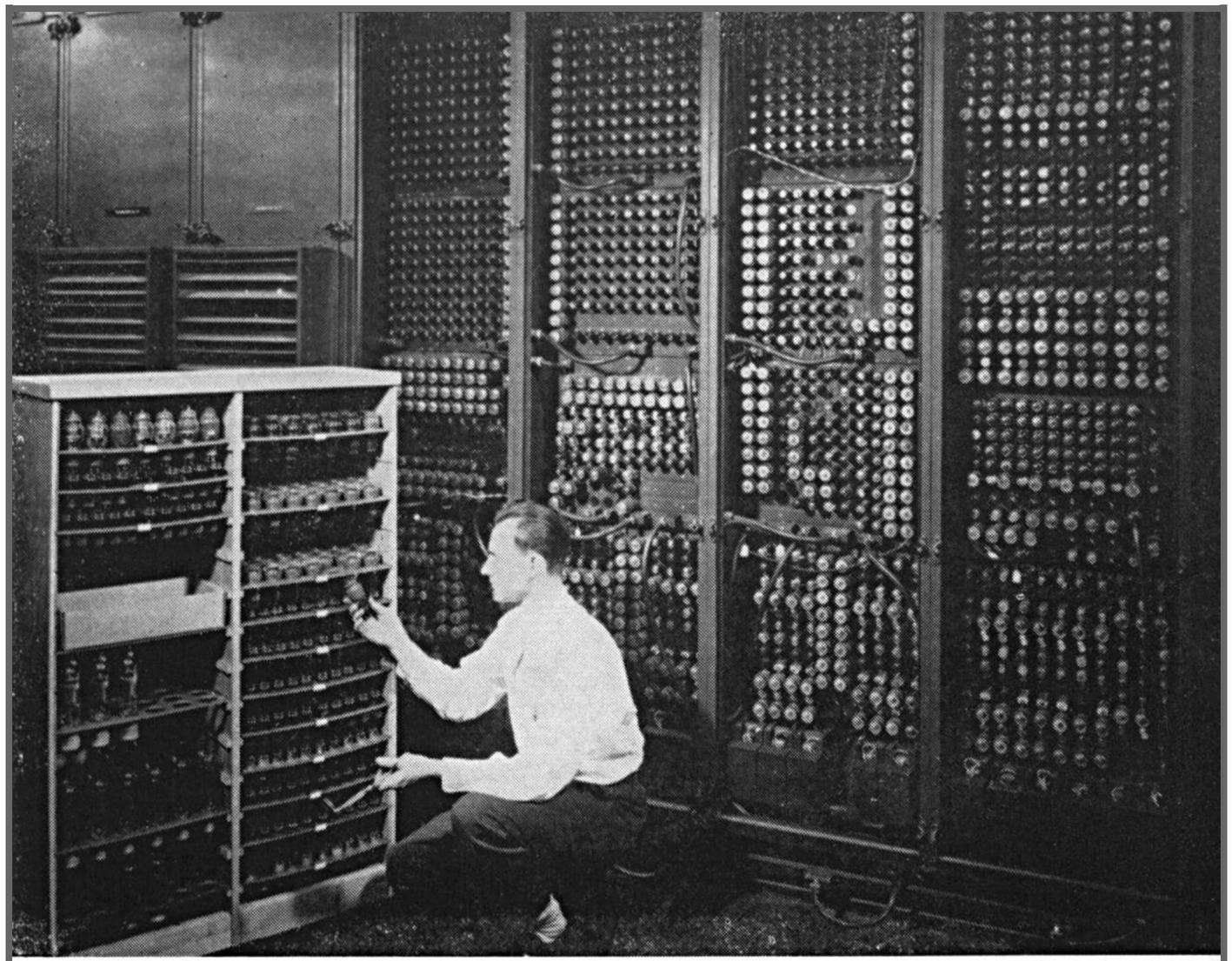
Why now?

Advances in:

- Computing power
- Communication
- Geospatial technology

Why now? --> Computing power

Source



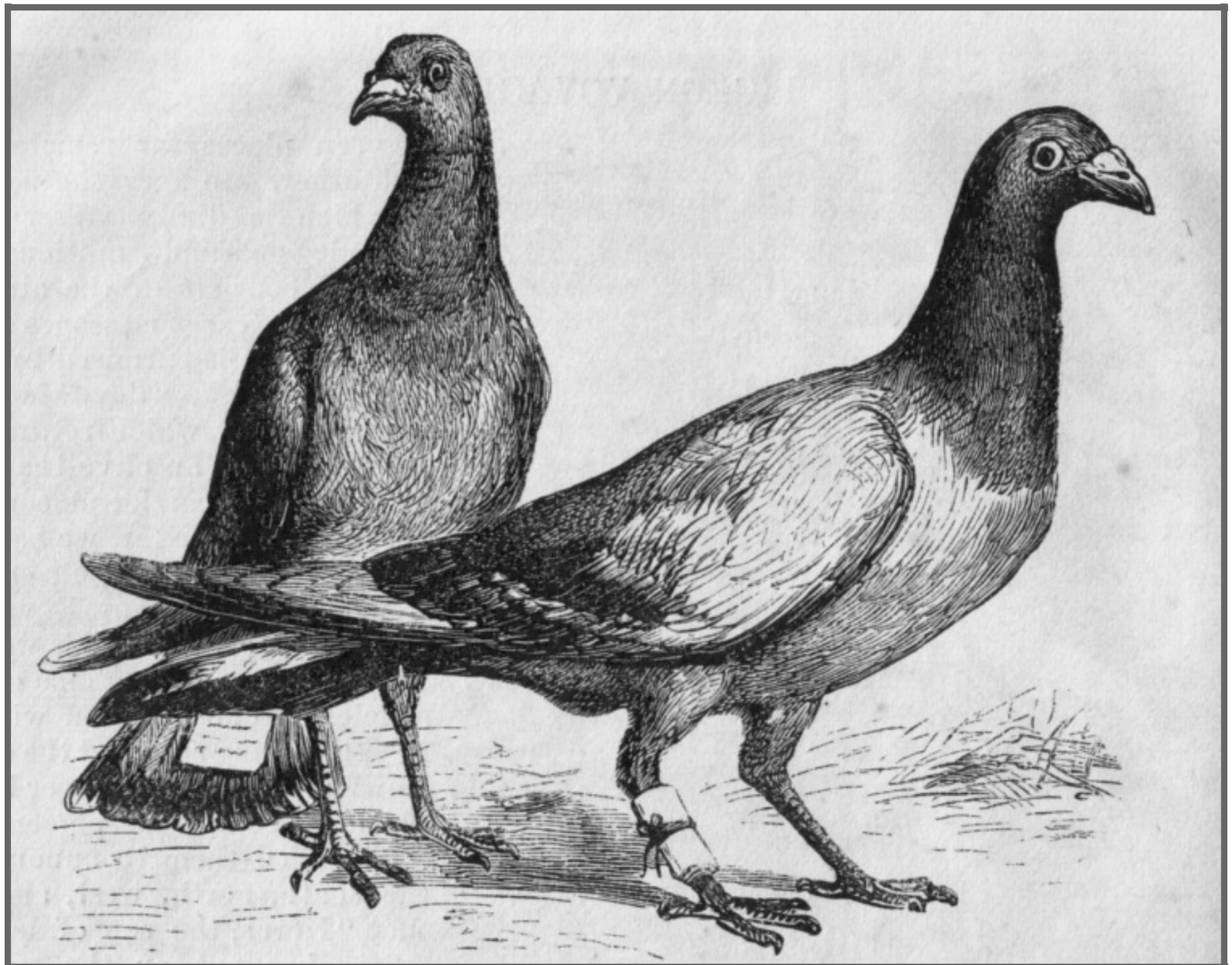
Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

Why now? --> Computing power

Source

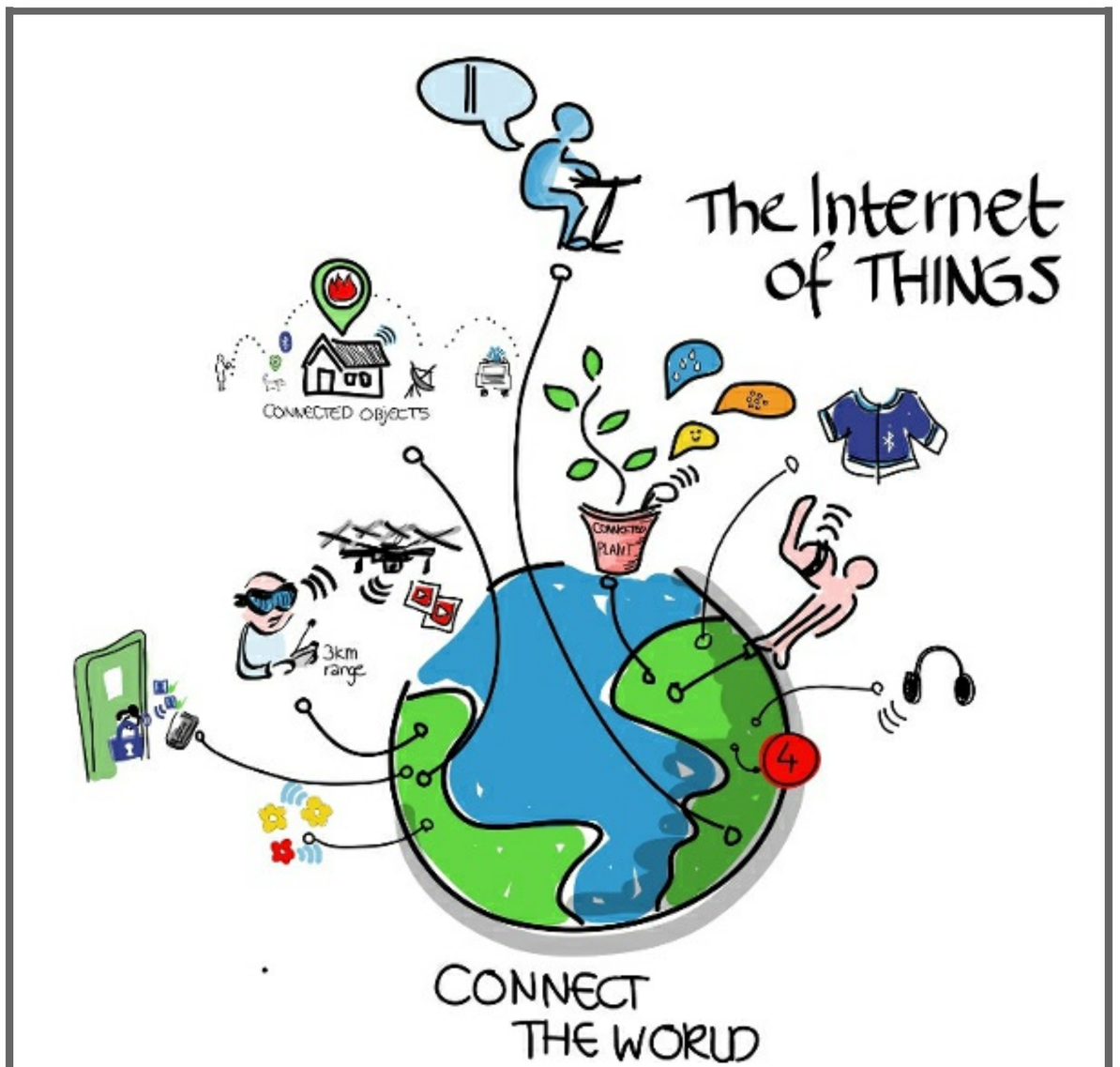
Why now? -->
Communication

Source



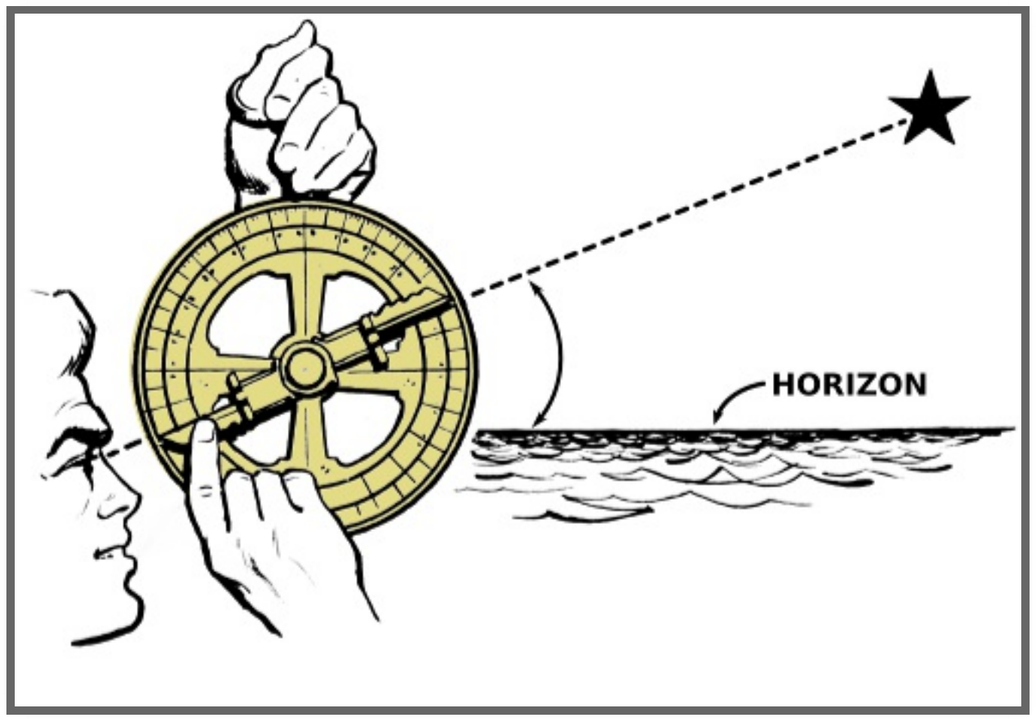
Why now? -->
Communication

Source



Why now? --> Geospatial technology

Source



Why now? --> Geospatial technology

Source

The (geo-)data revolution

The confluence of the three (computing, communication and geospatial) is creating large amounts of data.

Now, **data in itself is not very valuable**:

- Data --> Information --> Knowledge --> Action

Data Science

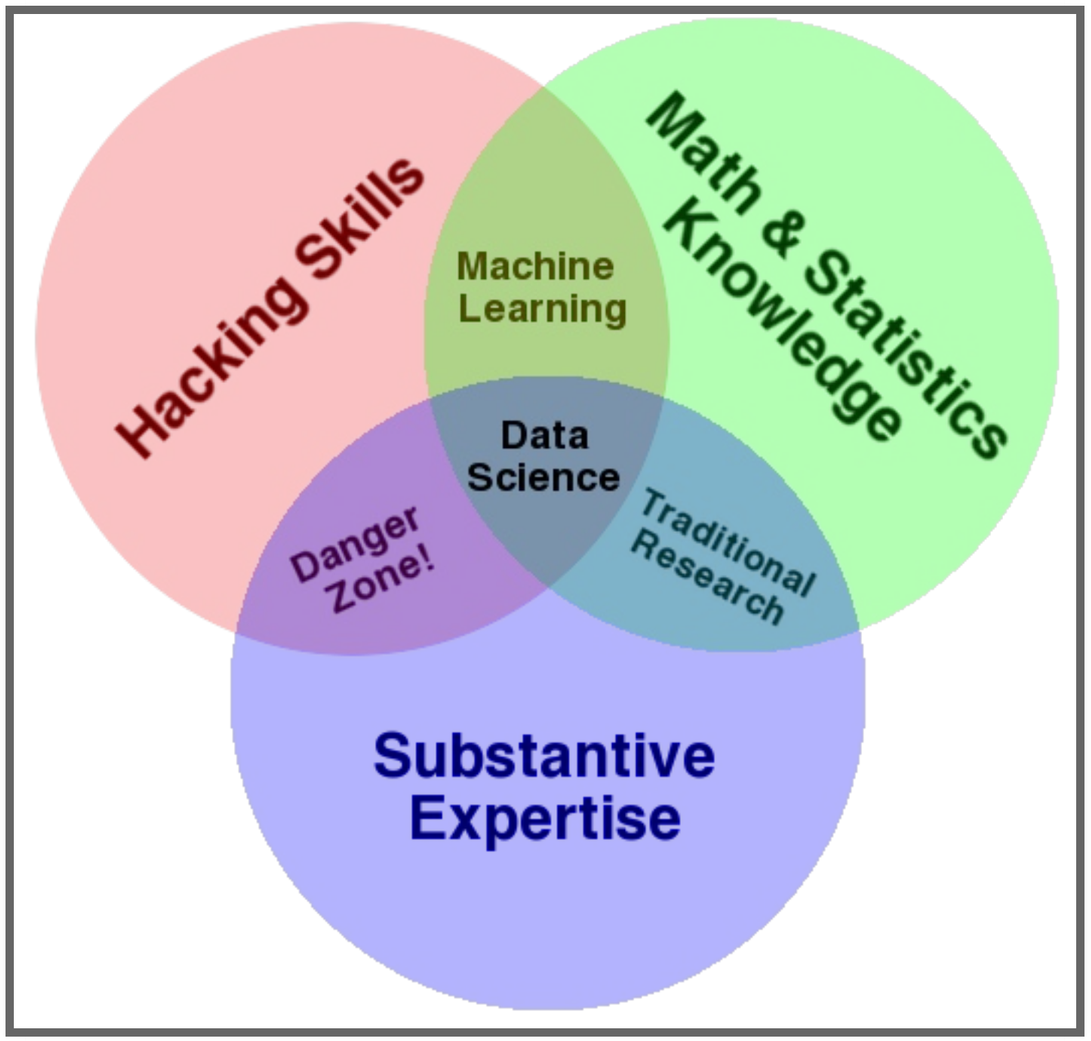
*Methods, tools and techniques to turn data into **actionable** knowledge*

But wait, isn't statistics just that?

Not only...

Data Science

Source: Drew Conway



Data Science

Statistics is a *very* important part of DS...

... but not the only one:

- **Computational tools** --> Programming (hence this course's tutorials!)
- **Comunication skills** --> "Story telling" (hence this course's assignments)
- **Domain expertise** --> Theories about why the data are the way they are (hence the rest of your degree)

Data Science

- Not all new (standing on the shoulders of giants)
- "The data becomes key part in the product"
- Focus on actionability and solving particular problems

Some examples...

Frequently Bought Together

Total price: £32.97

Add all three to Basket

i These items are dispatched from and sold by different sellers. Show details

- **This item:** Green and Black's Organic Dark Chocolate 85 Percent Cocoa 100 g (Pack of 5) £11.62 (£2.32 / 100 g)
- Green and Black's Organic Ginger Dark 100 g (Pack of 5) £10.40 (£2.08 / 100 g)
- Green and Black's Organic Dark Chocolate Maya Gold 100 g (Pack of 5) £10.95 (£2.19 / 100 g)

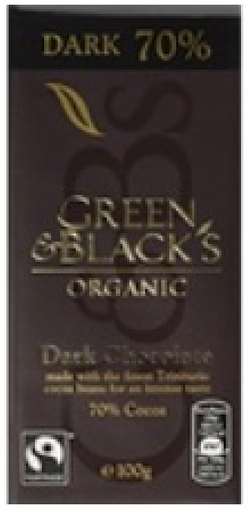
Customers Who Bought This Item Also Bought

Green and Black's Organic Ginger Dark 100 g (Pack of 5)

15

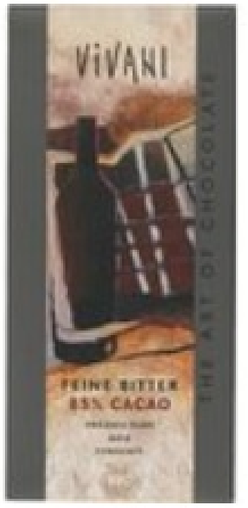
Green and Black's Organic Dark Chocolate Maya Gold 100 g (Pack of 5)

5



Green and Black's Organic Dark Chocolate 100 g (Pack of 5)

22



Vivani Organic Dark Chocolate with 85% Coco 100 g (Pack of 5)

25

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Total price: £32.97

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Amazon

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15

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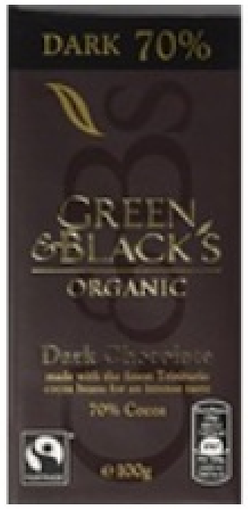

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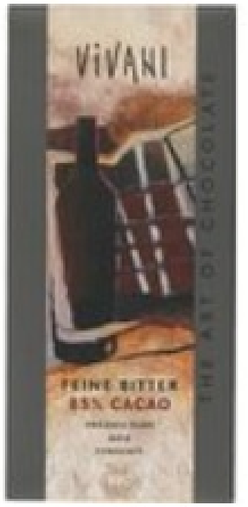

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okcupid

Join the best free dating site on Earth.

I am a Straight Woman Continue

Signing up takes two minutes and is totally free.

Our matching algorithm helps you find the right people.

iOS or Android?
You can take us to go.

"The Google of online dating" – *The Boston Globe*

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MENU

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LOG IN

SIGN UP

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FARE ESTIMATE +

LONDON ×

MENU

UBER

LOG IN

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LONDON

FARE ESTIMATE +

LONDON ×

Geo-Data Science

Geo-Data Science

- A (very) large portion of all these new data are inherently **geographic** or can be traced back to some location over space.
- Spatial is special.
- Some of the methods require an explicitly spatial treatment --> (Geo-)Data Science

Some examples...

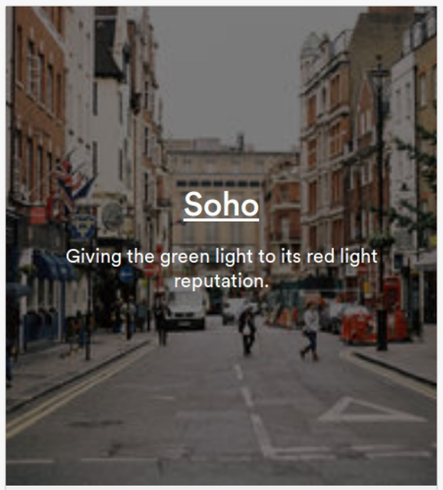
Find a Neighbourhood in London

What kind of neighbourhood are you looking for?

Dining × | Artsy 7 | Nightlife 9 | Shopping 15 | Loved by Londoners 11 | Touristy 14

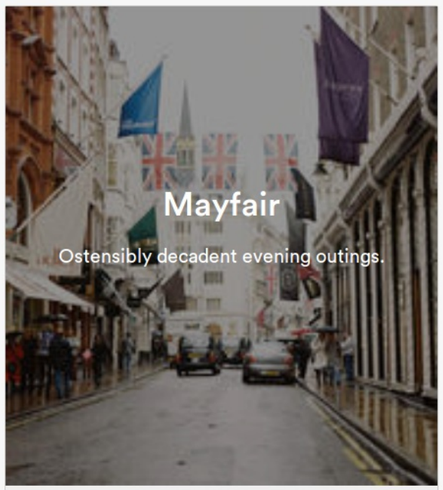
Great Transit 13 | Museums & the Arts 10 | Peace & Quiet 7 | Along the River Thames 5 | West End 7

23 neighbourhoods match **Dining**. See all listings

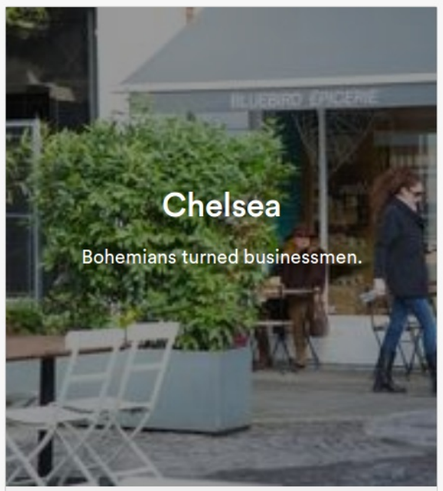


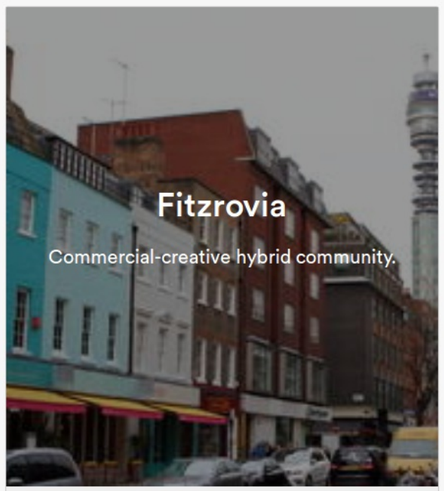
Eclectic • Open-minded • China Town • Lgbt Friendly

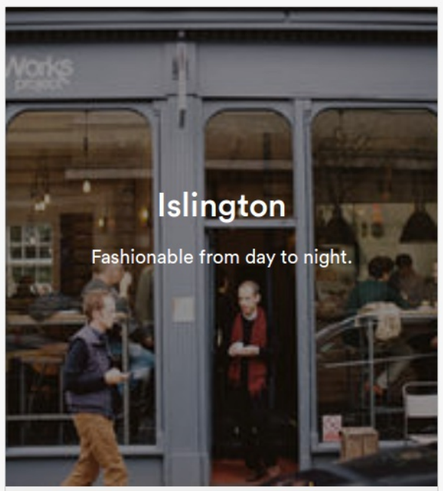
Buzzing • Curry • Arty • Graffiti



Luxury Shopping • Ballrooms • Heart Of London • Fashionable







London Neighbourhood Guide - Airbnb Neighbourhoods - Mozilla Firefox
ondon Neigh... ×
Airbnb, Inc. (US) | https://www.airbnb.co.uk/locations/london/neighborhoods
airbnb Where are you going? Browse Sign Up Log In Help List Your Space
s London Saved Neighbourhoods

Find a Neighbourhood in London

What kind of neighbourhood are you looking for?

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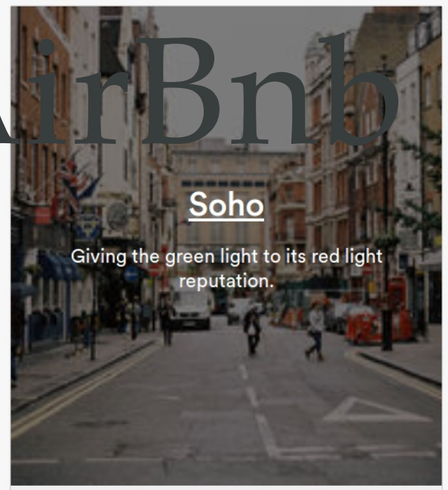
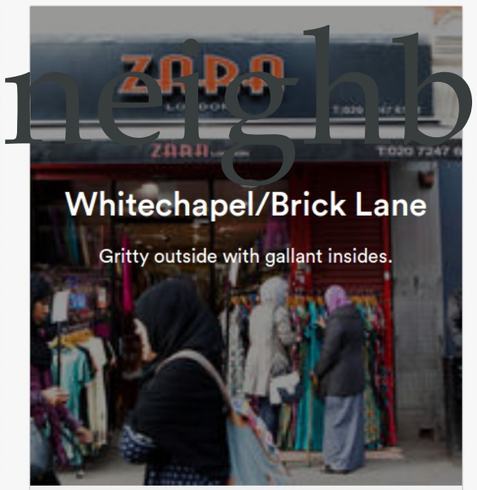
AirBnb neighborhoods



Soho

Giving the green light to its red light reputation.

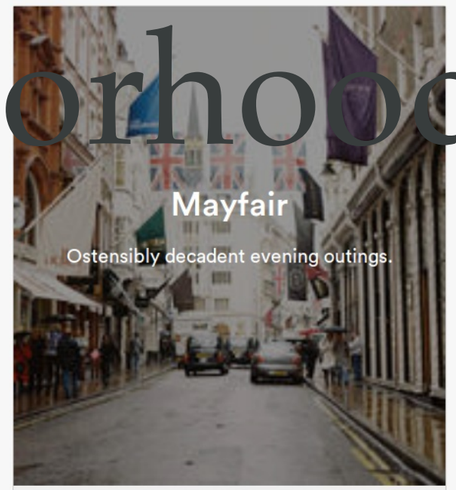
Eclectic • Open-minded • China Town • Lgbt Friendly



Whitechapel/Brick Lane

Gritty outside with gallant insides.

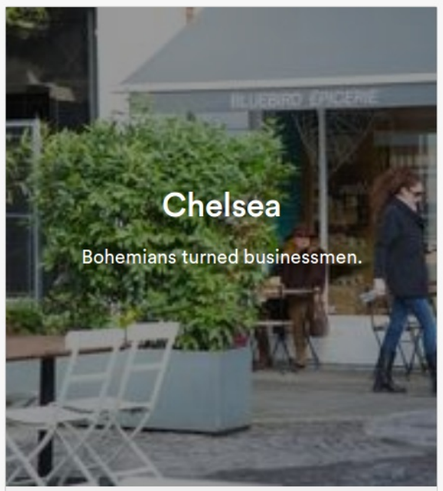
Buzzing • Curry • Arty • Graffiti



Mayfair

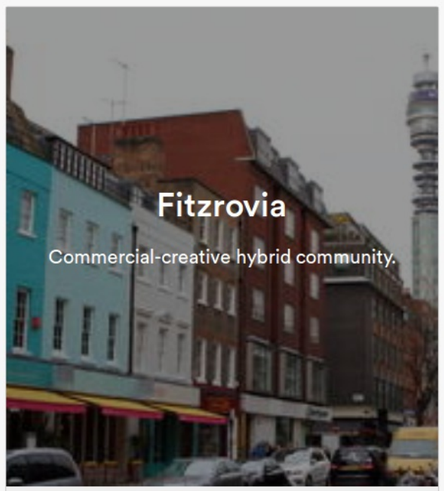
Ostensibly decadent evening outings.

Luxury Shopping • Ballrooms • Heart Of London • Fashionable



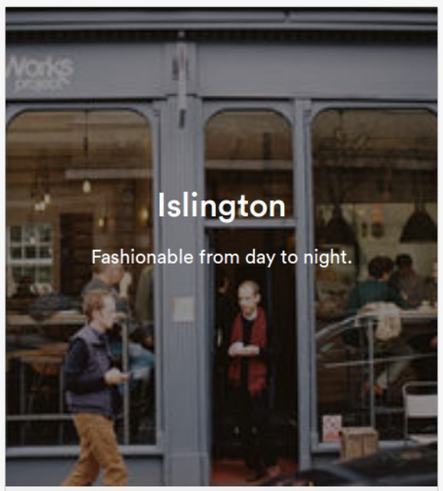
Chelsea

Bohemians turned businessmen.



Fitzrovia

Commercial-creative hybrid community.



Islington

Fashionable from day to night.

//www.airbnb.co.uk/locations/london/soho

Penny Ln, Live... ×

https://www.google.co.uk/maps/dir/Penny+Ln,+Liverpool+L18+1DE,+UK/University+of+Liverpool,+Liverpool/@53.3974201,-2.9788596,13z

Walking directions

via A562 — 49 min

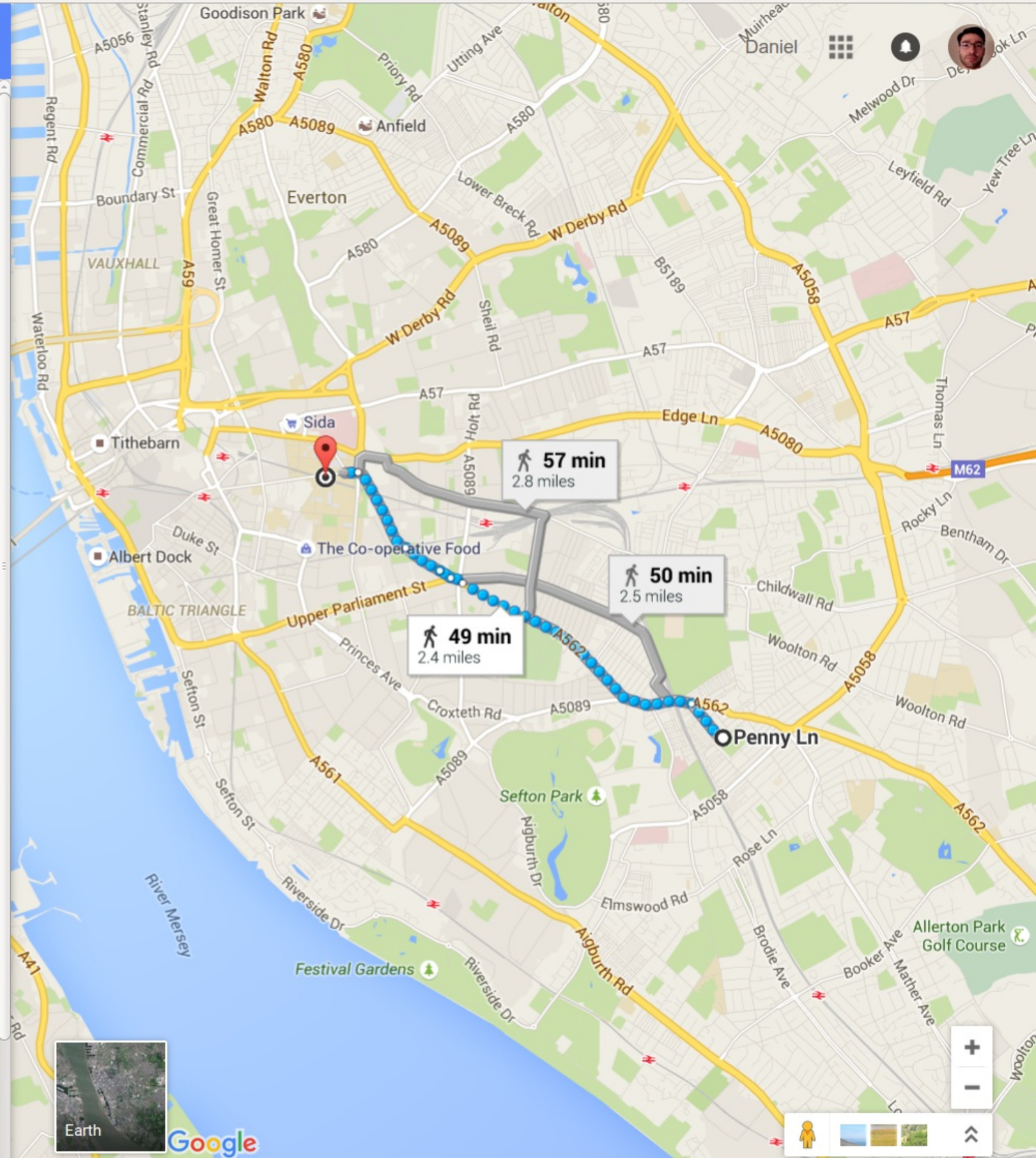
Show terrain — 2.4 miles

Use caution - may involve errors or sections not suited for walking

Penny Ln
Liverpool L18 1DE, UK

1. Head southwest on Penny Ln toward Russell Rd
   79 ft
2. Turn right onto Russell Rd
   0.2 mi
3. Turn left onto Smithdown Rd/A562
   1.3 mi
4. Slight right to stay on Smithdown Rd/A562
   Continue to follow A562
   364 ft
5. Turn right toward Smithdown Ln
   325 ft
6. Continue onto Smithdown Ln
   0.2 mi
7. Turn left to stay on Smithdown Ln
   0.5 mi
8. Continue straight onto Brownlow Hill/A5048
   Continue to follow Brownlow Hill
   325 ft

University of Liverpool
Liverpool, Merseyside L69 3BX, United Kingdom



Penny Ln, Live... ×

https://www.google.co.uk/maps/dir/Penny+Ln,+Liverpool+L18+1DE,+UK/University+of+Liverpool,+Liverpool/@53.3974201,-2.9788596,13z

Google Maps routing

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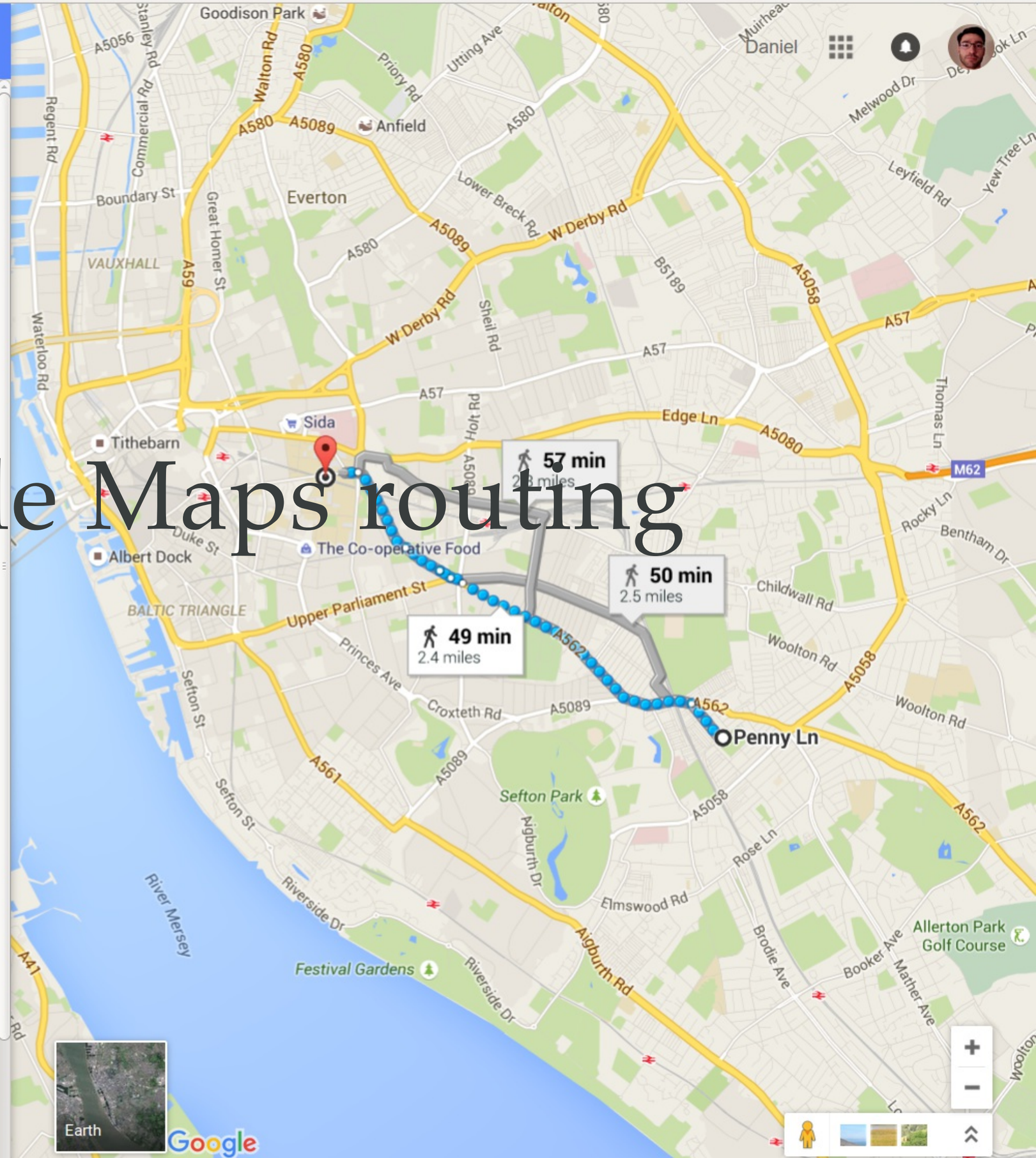

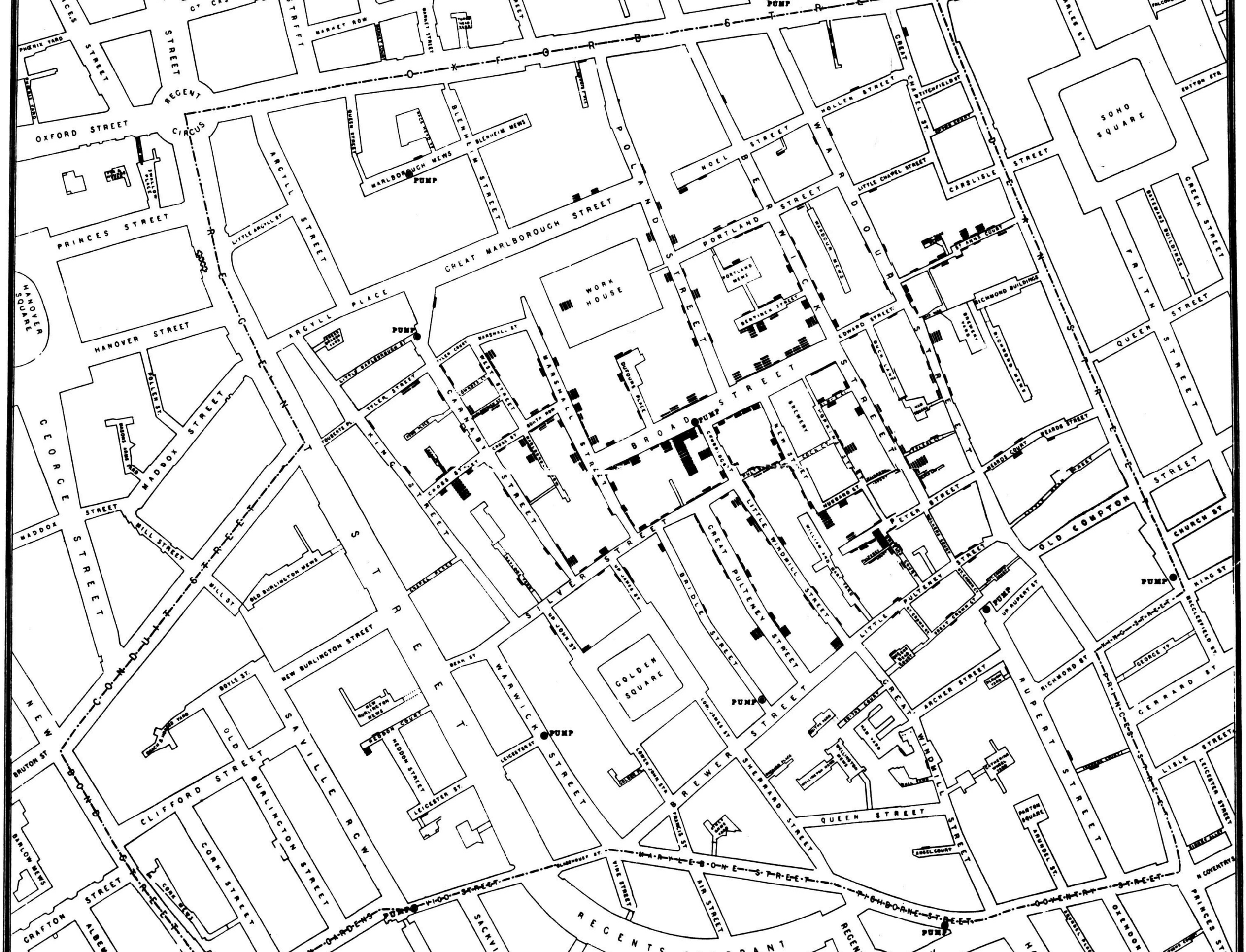
OXFORD STREET
REGENT
CIRCUS
PRINCES STREET
HANOVER SQUARE
HANOVER STREET
GEORGE STREET
MADDOX STREET
HILL STREET
NEW BURLINGTON STREET
BOYLE ST.
OLD BURLINGTON STREET
CLIFFORD STREET
BRUTON ST
BARLOW MEWS
CORK STREET
CORK ST
BURLINGTON STREET
SAVILLE ROW
CRAFTON STREET
ALBEMARLE STREET
ARGYLL STREET
LITTLE ARGYLL ST
ARGYLL PLACE
GREAT MARLBOROUGH STREET
MARLBOROUGH MEWS
QUEEN STREET
BLENHEIM STREET
BLENHEIM MEWS
POLAND STREET
WORK HOUSE
PUMP
LITTLE MARLBOROUGH ST
TYLER STREET
TYLER COURT
MARSHALL ST
WEST STREET
CHAPLIN ST
KING STREET
CROSS STREET
COOKE ST
SOUTH ROW
MARSHALL STREET
DUFOURS PLACE
BROAD STREET
NOEL STREET
PORTLAND MEWS
BENTINCK STREET
BENTINCK MEWS
WARDOUR STREET
EDWARD STREET
DUKE LANE
BREWERY
NEW STREET
HUGHES
PETER STREET
WALKER STREET
HOLLEN STREET
GREAT CHARLES STREET
LITTLE CHAPEL STREET
CARLISLE STREET
SOHO SQUARE
ST ANNE COURT
RICHMOND BUILDINGS
RICHMOND MEWS
BERWICK STREET
GREEK STREET
QUEEN STREET
BEARDS COURT
OLD COMPTON
CHURCH ST
KING ST
GEORGE ST
RICHMOND ST
ARCHER STREET
GREAT WINDMILL STREET
LITTLE WINDMILL STREET
GREAT PULTENEY STREET
BRIDLE STREET
LITTLE PULTENEY
UP RUPERT ST
UP JAMES ST
UP JOHN ST
LOWER JOHN ST
GOLDEN SQUARE
WARWICK STREET
LEICESTER ST
NEWDIGATE PLACE
HEDDON COURT
HEDDON STREET
BEAK ST
SHERRARD STREET
FRANCIS ST
VINE STREET
AIR STREET
REGENTS
RUPERT STREET
PRINCES STREET
BECCLESFIELD ST
GERRARD ST
LISLE STREET
LEICESTER STREET
PARTON STREET
ARUNDEL ST
ANGEL COURT
QUEEN STREET
HAMILTON PLACE
PICCADILLY
HAMILTON STREET
ST JAMES'S
CHURCH
PRINCES
OXENDON
PRINCES STREET
N COVENTRY ST
PUMP

John Snow's cholera map

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