Geographic Data Science - Lecture I

Introduction

Dani Arribas-Bel

Today

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

This course

Quiz

- Can you think of a real-world context where data and statistics are being used to make a difference?
- Have you ever heard the term "**Big Data**"?
- Have you ever heard the term "**Data Science**"?
- Have you ever written a line of computer code?

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

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...but in a fun way!

Philosophy

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

Logistics - Website

http://darribas.org/gds16

GDS16

`ENVS363/563`

Geographic Data Science

Welcome to Geographic Data Science, a course taught by Dr. Dani Arribas-Bel in the Autumn of 2016 at the University of Liverpool.

The timetable for the course is:

- **Lectures**: `TBA`
- **Computer Labs**: `TBA`

Locations

`TBA`

Contact

Dani Arribas-Bel `D.Arribas.Bel [at] liverpool.ac.uk`

Logistics - Format

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

Logistics - Content

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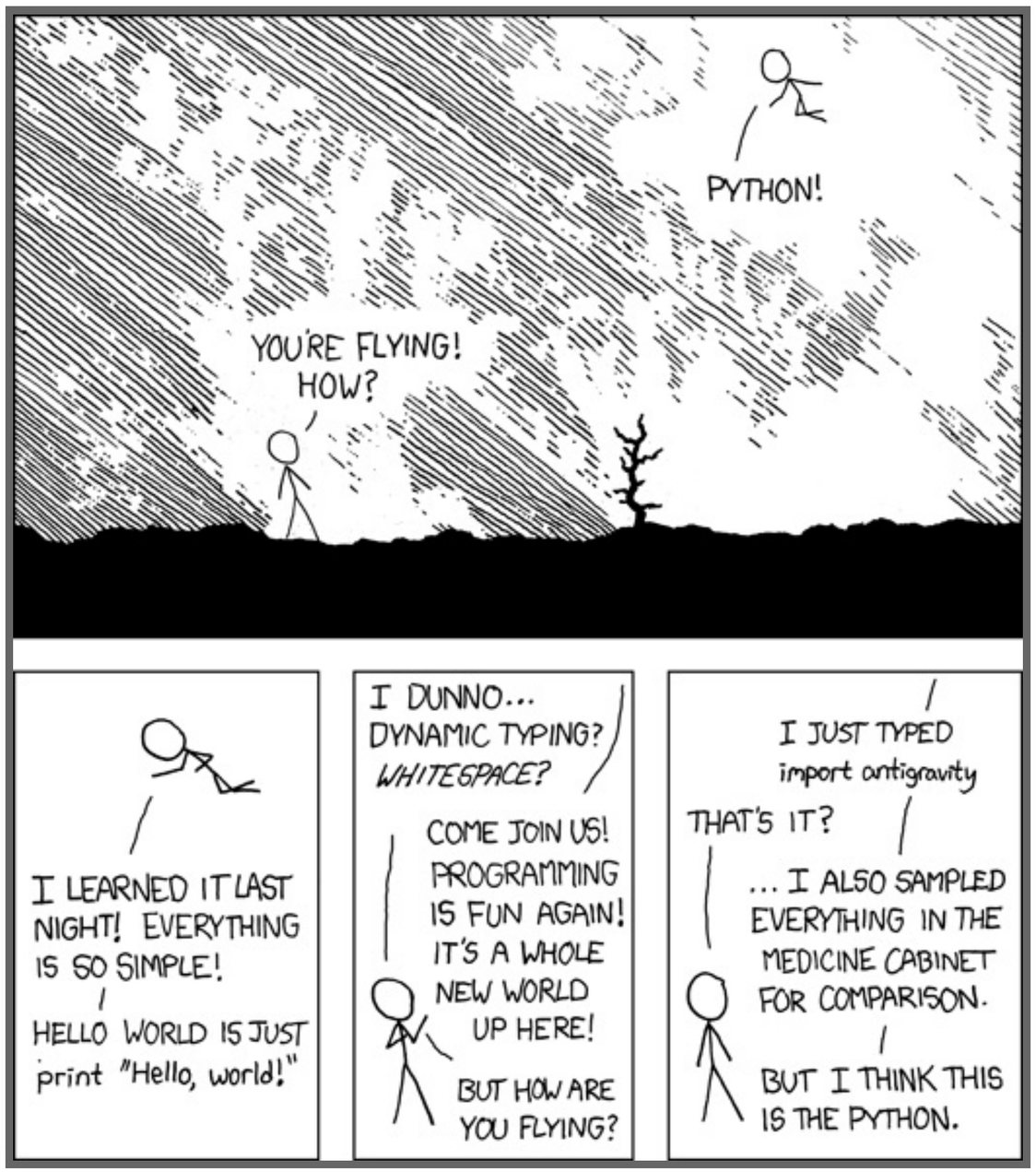
- **Weeks 4-8**: "meat" of the course (lots of concepts packed)
- **Weeks 9-11**: catch up + prepare an awesome Assignment II

Code

"Even if you won't be a poet, you need to know how to write"

Python


PYTHON!
YOU'RE FLYING! HOW?
I LEARNED IT LAST NIGHT! EVERYTHING IS SO SIMPLE!
HELLO WORLD IS JUST print "Hello, world!"
I DUNNO... DYNAMIC TYPING? WHITESPACE?
COME JOIN US! PROGRAMMING IS FUN AGAIN! IT'S A WHOLE NEW WORLD UP HERE!
BUT HOW ARE YOU FLYING?
I JUST TYPED import antigravity
THAT'S IT?
... I ALSO SAMPLED EVERYTHING IN THE MEDICINE CABINET FOR COMPARISON.
BUT I THINK THIS IS THE PYTHON.

Python

- **General purpose** programming language
- Sweet spot between *"proof-of-concept"* and *"production-ready"*
- Industry standard: **GIS** (Esri, QGIS) and **Data Science** (Google, Facebook, Amazon, Netflix, The New York Times, NASA…)

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Prepare for the labs

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- Bring questions, comments, feedback, (informed) rants to class/labs
- Use the forum (link on VITAL)
- Collaborate with your peers (it's **NOT** a zero-sum win!!!)

More help!!!

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- Learn to **ask** questions (but don't expect exact answers all the time!!!)
- **Help** others as much as you can (the best way to learn is to teach)
- **Search** heavily on Google + Stack Overflow

Assignments

- Mark (mostly) based on two assignments, due:
  1. Week 7 (47.5%)
  2. Week 12 (47.5%)
- Coursework
- **Equivalent** to 2,500: report (*notebook*) 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 and storage
- Connectivity
- Geospatial technology

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**:

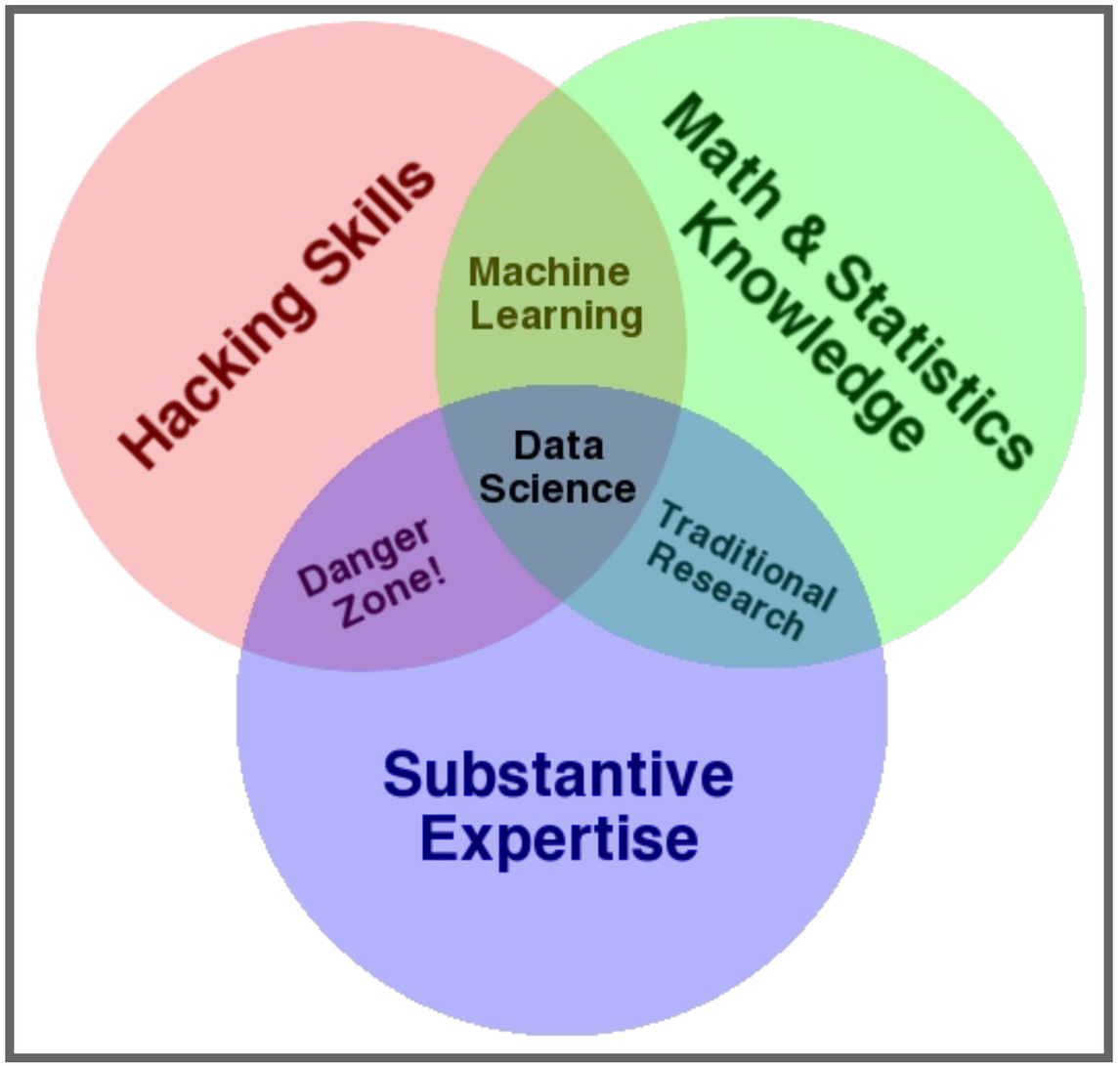
- Data --> Information --> Knowledge --> Action

Data Science

Methods, tools and techniques to turn data into actionable knowledge

Data Science

Source: Drew Conway



Data Science

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Statistics + ...

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Some examples...

Frequently Bought Together

Total price: £32.97

Add all three to Basket

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)

4.5 stars 15

£10.40

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

5 stars 5

£10.95 Prime

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

4.5 stars 22

£8.20 Prime

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

4.5 stars 25

£11.95 Prime

Have an account? Sign in

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*

About OkCupid | Legal | © Humor Rainbow, Inc.

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…

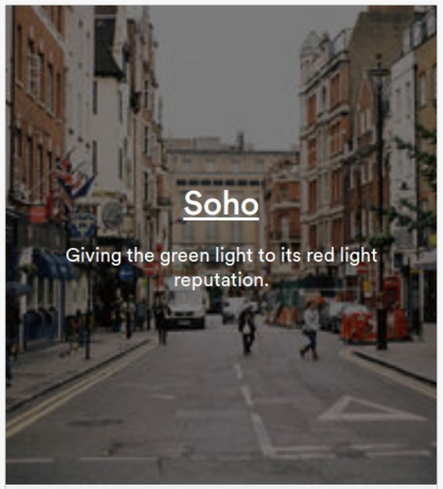
Find a Neighbourhood in London

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



Soho

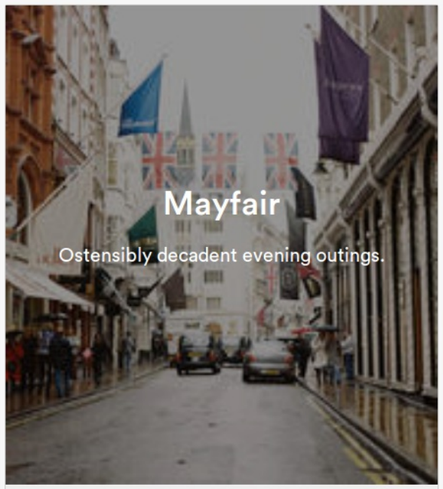
Giving the green light to its red light reputation.

Eclectic • Open-minded • China Town • Lgbt Friendly

Whitechapel/Brick Lane

Gritty outside with gallant insides.

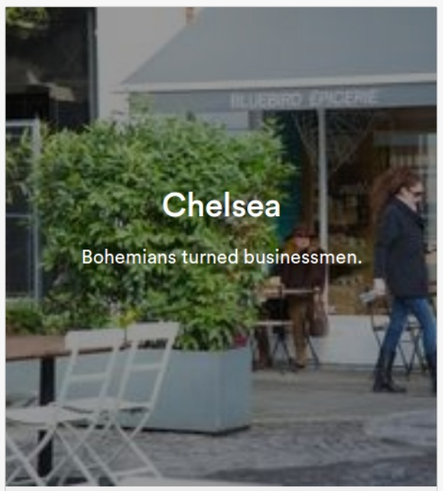
Buzzing • Curry • Arty • Graffiti



Mayfair

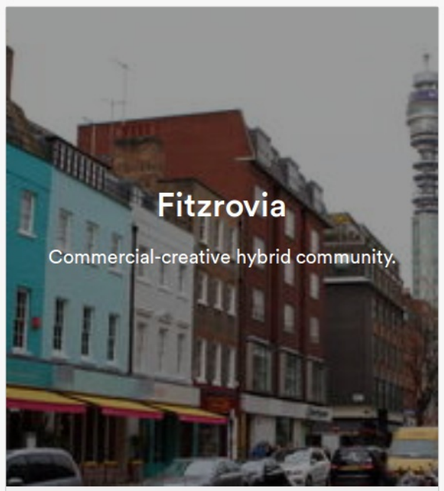
Ostensibly decadent evening outings.

Luxury Shopping • Ballrooms • Heart Of London • Fashionable



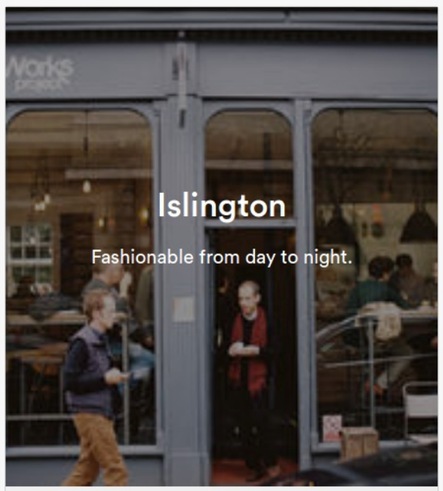
Chelsea

Bohemians turned businessmen.



Fitzrovia

Commercial-creative hybrid community.



Islington

Fashionable from day to night.

WANT TO DRIVE WITH UBER? BECOME A DRIVER

MENU

UBER

LOG IN SIGN UP

LONDON

FARE ESTIMATE +

LONDON

Google

Map data ©2015 Google | TERMS OF USE

Penny Ln, Liverpool L18 1DE, UK to University of Liverpool, Liverpool - Google Maps - Mozilla Firefox

enny Ln, Live... ×

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

lking directions

via A562 — 49 min

v terrain — 2.4 miles

caution - may involve errors or sections not suited for walking

ıny Ln

rpool L18 1DE, UK

Head southwest on Penny Ln toward Russell Rd

79 ft

Turn right onto Russell Rd

0.2 mi

Turn left onto Smithdown Rd/A562

1.3 mi

Slight right to stay on Smithdown Rd/A562

Continue to follow A562

364 ft

Turn right toward Smithdown Ln

325 ft

Continue onto Smithdown Ln

0.2 mi

Turn left to stay on Smithdown Ln

0.5 mi

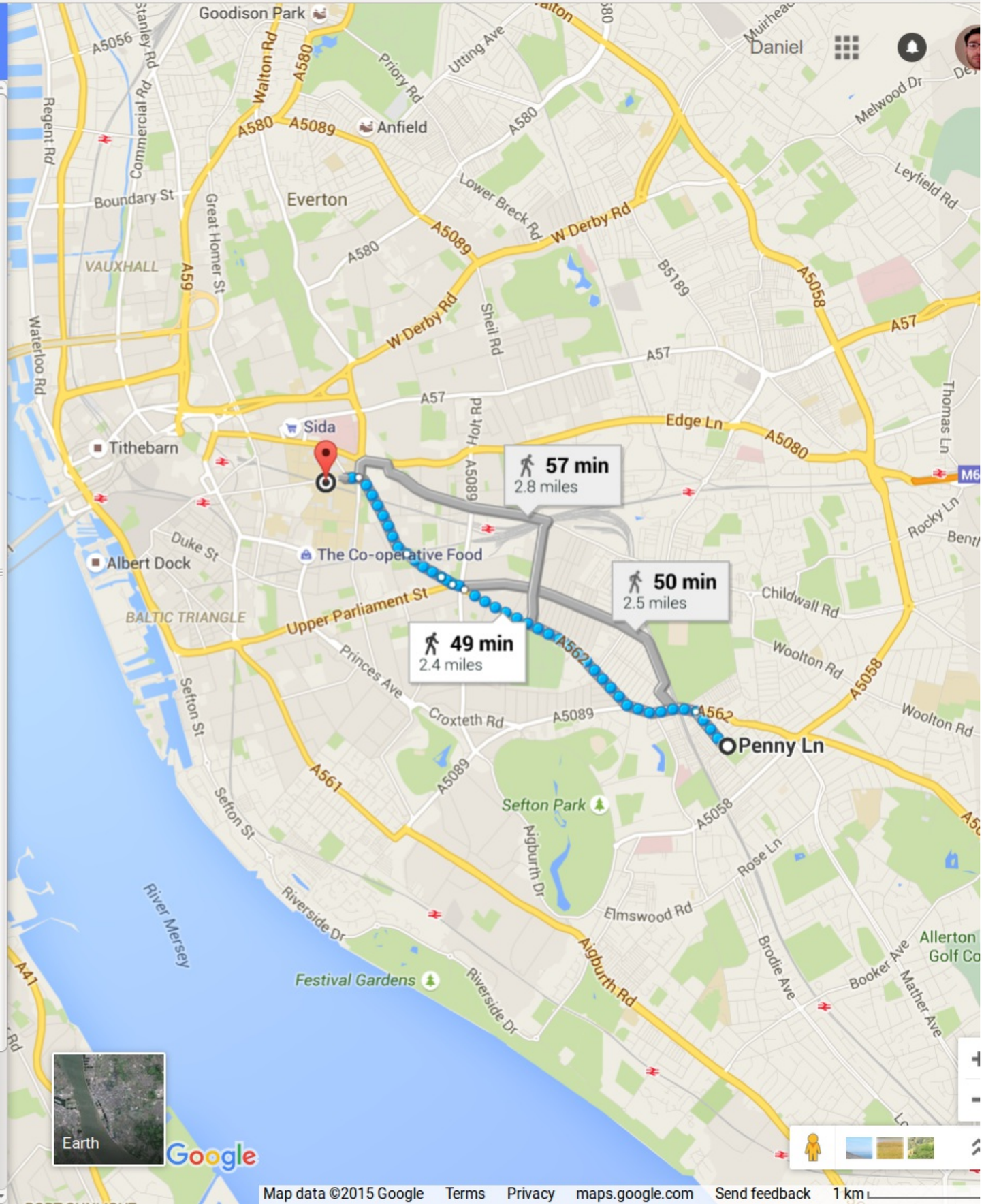
Continue straight onto Brownlow Hill/A5048

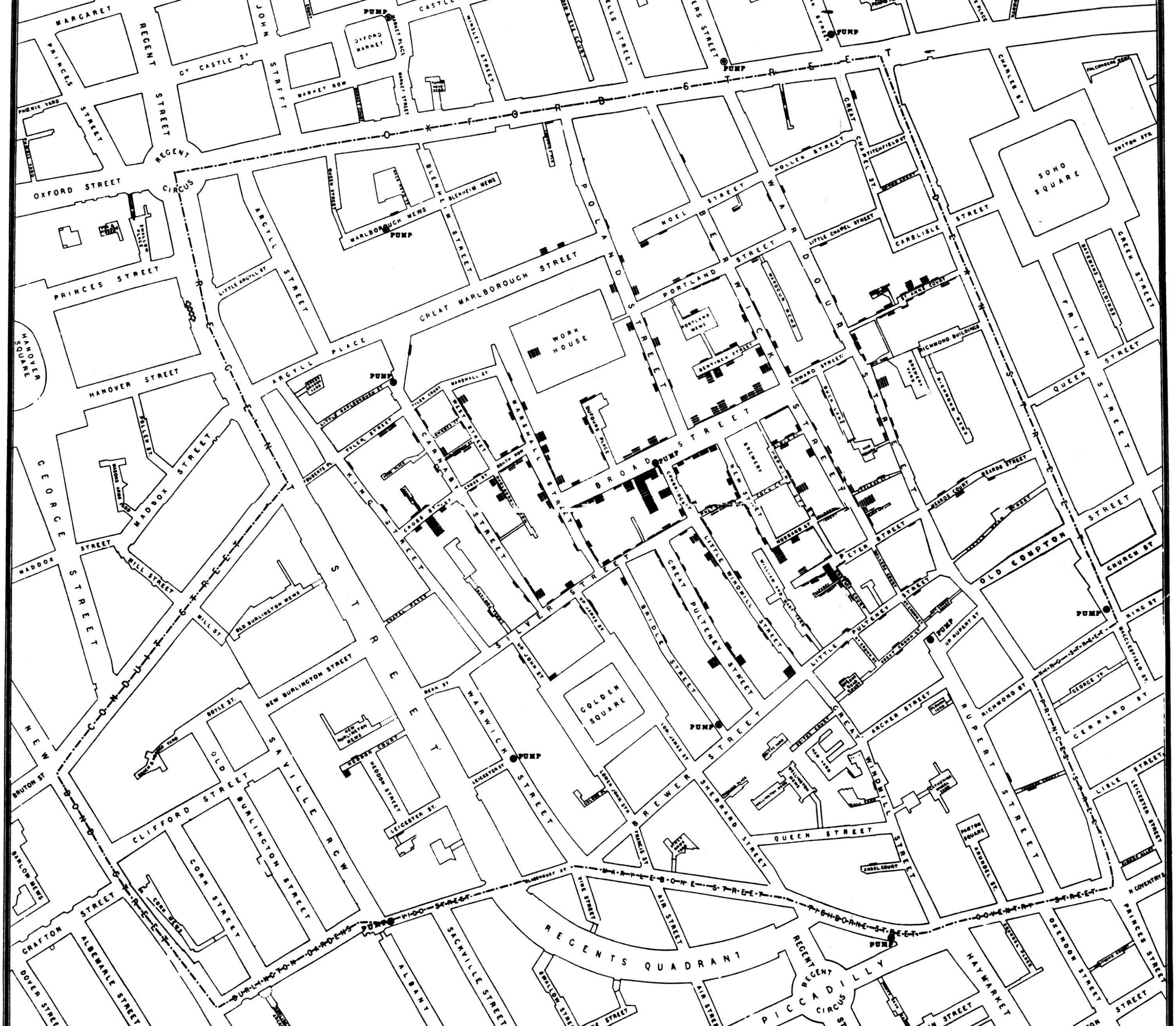
Continue to follow Brownlow Hill

325 ft

versity of Liverpool

rpool, Merseyside L69 3BX, United Kingdom





OXFORD STREET
REGENT CIRCUS
REGENT STREET
OXFORD STREET
PRINCES STREET
HANOVER STREET
HANOVER SQUARE
GEORGE STREET
MADDOX STREET
MILL STREET
NEW BOND STREET
CONDUIT STREET
BRUTON ST
BARLOW MEWS
GRAFTON STREET
ALBEMARLE STREET
DOVER STREET
CLIFFORD STREET
CORK STREET
OLD BURLINGTON STREET
NEW BURLINGTON STREET
SAVILLE ROW
BURLINGTON GARDENS
VIGO STREET
ALBANY
SACKVILLE STREET
REGENTS QUADRANT
PICCADILLY
REGENT CIRCUS
HAYMARKET
OXENDON STREET
PRINCES STREET
MARYLEBONE STREET
TICHBORNE STREET
COVENTRY STREET
N COVENTRY ST
LISLE STREET
LEICESTER STREET
GERRARD ST
RUPERT STREET
RICHMOND ST
ARCHER STREET
GREAT WINDMILL STREET
QUEEN STREET
SHERRARD STREET
BREWER STREET
GOLDEN SQUARE
WARWICK STREET
SILVER STREET
BRIDLE STREET
GREAT PULTENEY STREET
LITTLE WINDMILL STREET
LITTLE PULTENEY STREET
PETER STREET
OLD COMPTON STREET
CHURCH ST
KING ST
MACCLESFIELD ST
GEORGE YD
PRINCES STREET
KING STREET
CARNABY STREET
MARSHALL STREET
BROAD STREET
WORK HOUSE
DUFOURS PLACE
PORTLAND STREET
BERWICK STREET
WARDOUR STREET
NOEL STREET
HOLLEN STREET
GREAT CHAPEL ST
CARLISLE STREET
LITTLE CHAPEL STREET
SOHO SQUARE
CHARLES ST
FRITH STREET
QUEEN STREET
GREEK STREET
RICHMOND BUILDINGS
EDWARD STREET
BENTINCK STREET
PORTLAND MEWS
WARDOUR MEWS
ST ANNS COURT
MARLBOROUGH MEWS
BLENHEIM MEWS
BLENHEIM STREET
ARGYLL STREET
ARGYLL PLACE
LITTLE ARGYLL ST
GREAT MARLBOROUGH STREET
TYLER STREET
MARSHALL ST
WEST STREET
CROSS STREET
KING STREET
MARKET ROW
MARKET PLACE
WINSLEY STREET
OXFORD MARKET
GT CASTLE ST
JOHN STREET
MARGARET
PRINCES STREET
PHOENIX YARD
PUMP

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