

# 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 “**Data Science**”?
- Have you ever written a line of **computer code**?

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

*...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/gds19>

GDS19



ENVS363/563

## Geographic Data Science

Welcome to Geographic Data Science, a course taught by Dr. Dani Arribas-Bel in the Autumn of 2019 at the University of Liverpool.

The timetable for the course is:

- **Lectures:** *Monday 12:00pm-1:00pm, ERB-ERT*
- **Computer Labs:** *Thursdays 1:00pm-3:00pm, CTL-6-PCTC*

# Logistics – Format

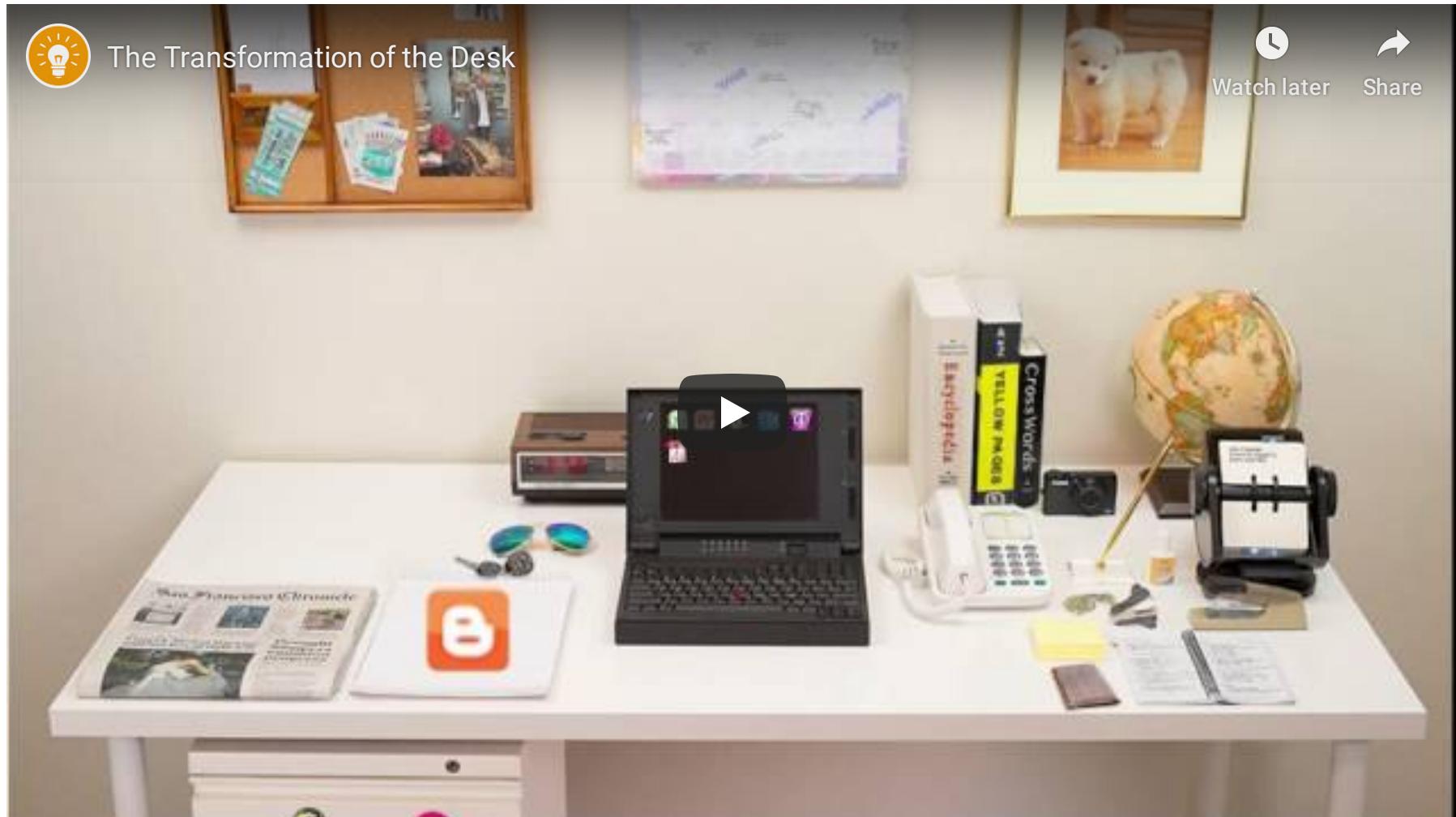
11 weeks of:

- 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

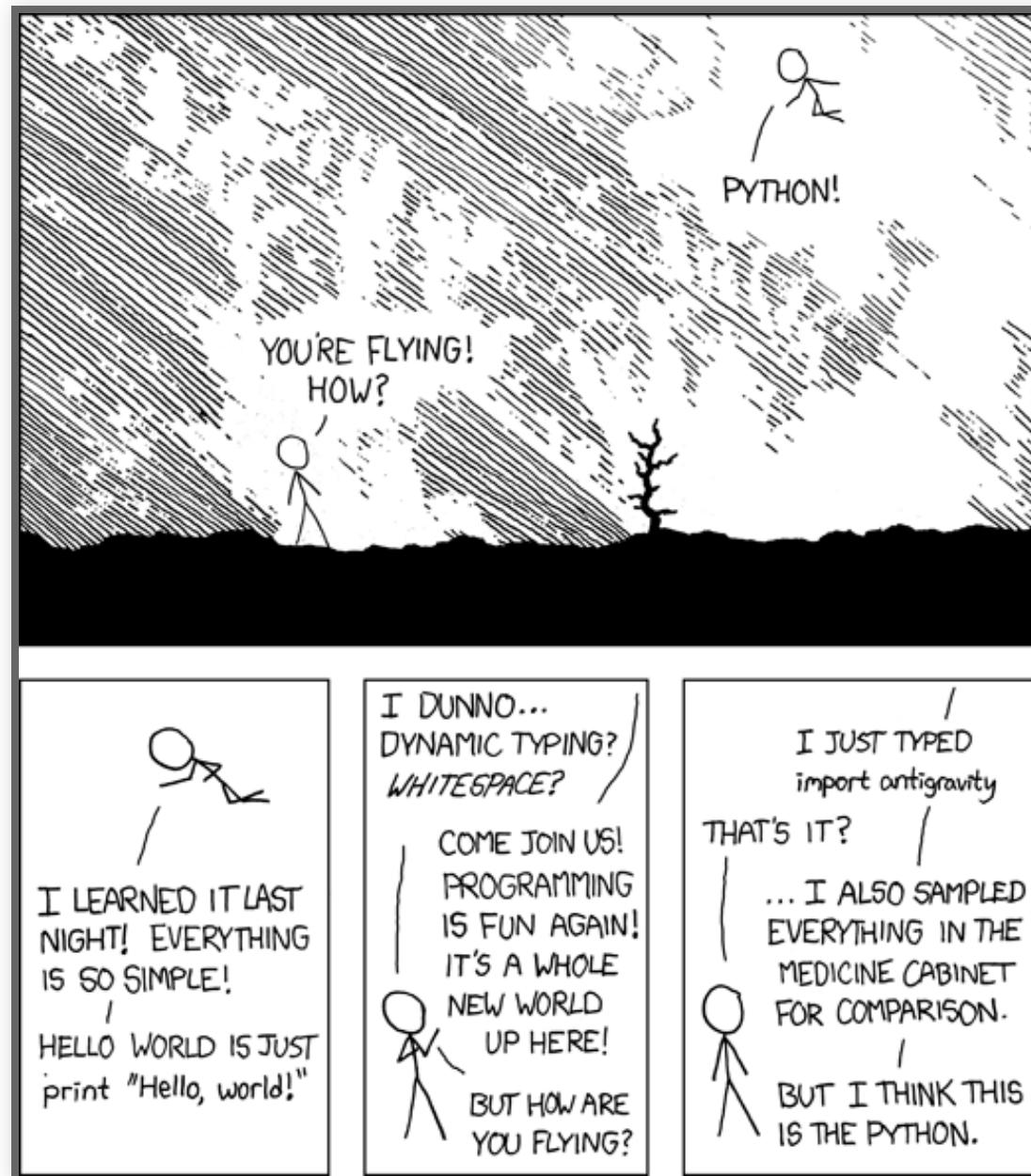
- Weeks 1-3: “big picture” lectures + introduction to computational tools (learning curve)
- Weeks 4-9: “meat” of the course (lots of concepts packed) + Week 7 break
- Weeks 10-11: catch up + prepare an awesome Computational Esssay

# Code



Driving Vs automobile engineering

# 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...)

# Self-directed learning

## Prepare for the labs

- I won't be leading/lecturing at the computer labs
- Go over the notebooks before the lecture and the computer lab -> If the first time you see a notebook is at the lab, you won't be able to follow on
- Bring questions, comments, feedback, (informed) rants to class/labs
- Use the forum (link on VITAL)
- Collaborate (it's NOT a zero-sum win!!!)

# More help!!!

This course is much more about “learning to learn” and problem solving rather than acquiring specific programming tricks or stats wizardry

- 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

- In-lab computer tests: W.5 (25%) and W.10 (25%)
- Computational essay (W.12, 50%)
  - Equivalent to 2,500 word
  - Report (*notebook*) with code, figures (e.g. maps), and text
- Discussion board (5%)

NOTE: recommendation letters only for great students (>70)

# 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:

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

# *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

Statistics + ...

- Computational tools → Programming (hence this course's tutorials!)
- Communication 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)

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  
£10.40



[Green and Black's Organic Dark Chocolate Maya Gold 100 g \(Pack of 5\)](#)  
 5  
£10.95



[Green and Black's Organic Dark Chocolate 100 g \(Pack of 5\)](#)  
 22  
£8.20



[Vivani Organic Dark Chocolate with 85% Coco 100 g \(Pack of 5\)](#)  
 25  
£11.95

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Our matching algorithm helps  
you find the right people.



iOS or Android?  
You can take us to go.

# 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...

London Neighbourhood Guide - Airbnb Neighbourhoods - Mozilla Firefox

London Neigh... Airbnb, Inc. (US) https://www.airbnb.co.uk/locations/london/neighborhoods

Where are you going? Browse Sign Up Log In Help List Your Space

Cities > London Saved Neighbourhoods 0

## Find a Neighbourhood in London

What kind of neighbourhood are you looking for?

Dining X 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.

**Whitechapel/Brick Lane**  
Gritty outside with gallant insides.

**Mayfair**  
Ostensibly decadent evening outings.

**Chelsea**  
Bohemians turned businessmen.

**Fitzrovia**  
Commercial-creative hybrid community.

**Islington**  
Fashionable from day to night.

<https://www.airbnb.co.uk/locations/london/soho>

Uber - London - Mozilla Firefox (Private Browsing)

Where is Uber... Uber - London

https://www.uber.com/cities/london

WANT TO DRIVE WITH UBER? BECOME A DRIVER

LOG IN SIGN UP

UBER LONDON

FARE ESTIMATE +

LONDON

RIDE WITH UBER

Map data ©2015 Google TERMS OF USE

The image shows the Uber London website interface. At the top, there are three car icons, followed by the text "WANT TO DRIVE WITH UBER?" and a "BECOME A DRIVER" button. To the left is a "MENU" icon, and to the right are "LOG IN" and "SIGN UP" buttons. The main feature is a large, stylized "UBER LONDON" logo. Below the logo is a map of the London area, with a prominent blue shaded region indicating the service delivery zone. The map includes labels for various towns and cities such as Aylesbury, Chesham, High Wycombe, Slough, Windsor, Egham, Twickenham, Kingston upon Thames, Croydon, Bromley, Orpington, Sidcup, Dartford, Gravesham, Rochester, Maidstone, and many others. In the bottom left corner, there is a teal button labeled "FARE ESTIMATE" with a plus sign, and below it, a white input field containing the word "LONDON". At the very bottom center is a black button labeled "RIDE WITH UBER". The footer of the page includes the text "Map data ©2015 Google" and "TERMS OF USE".

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

Penny Ln, Liverpool L18 1DE, UK

Walking directions

via A562

49 min  
2.4 miles

Show terrain

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

Penny Ln  
Liverpool 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

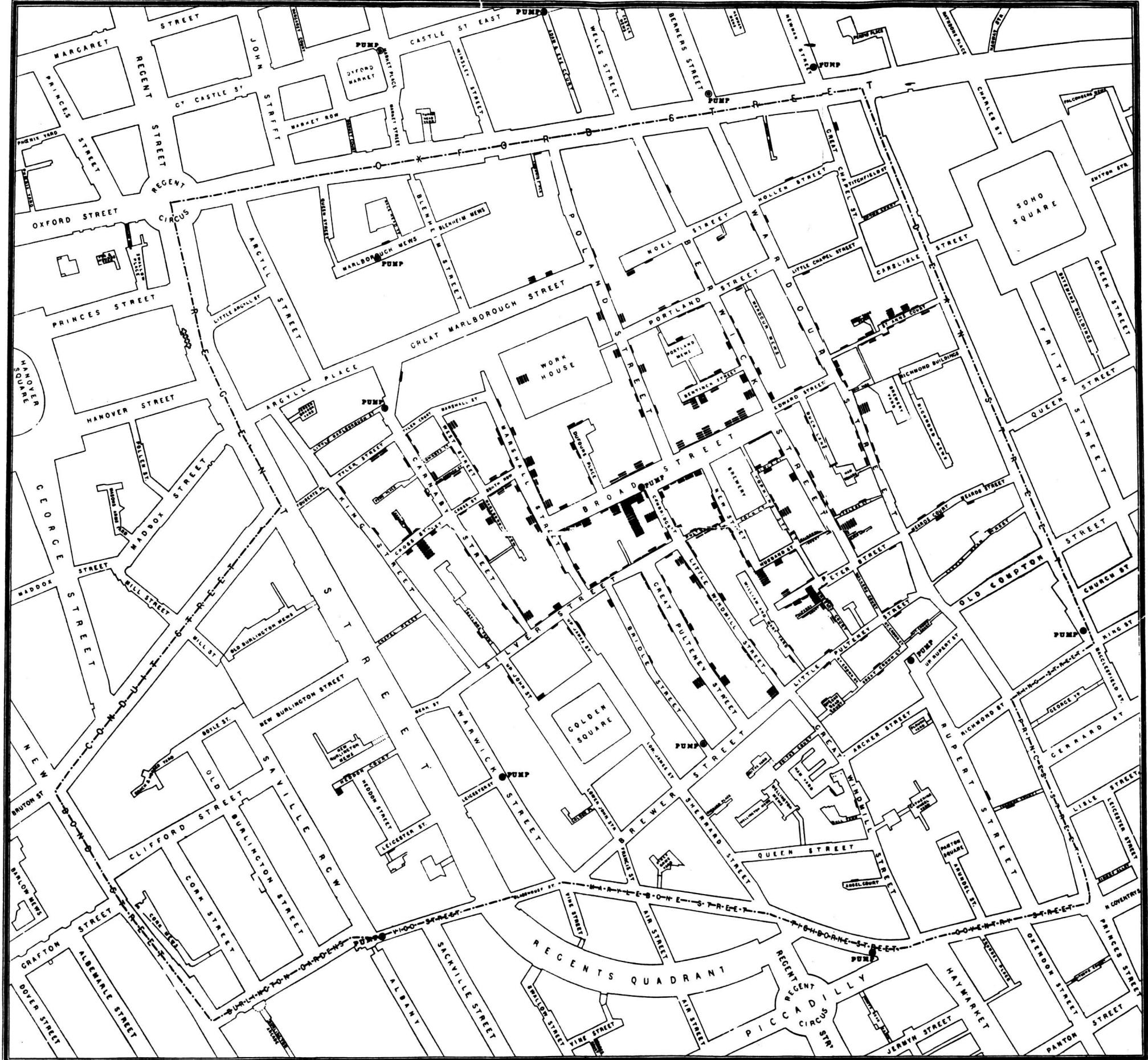
Continue straight onto Brownlow Hill/A5048

Continue to follow Brownlow Hill

325 ft

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

The map shows a walking route from Penny Ln in Liverpool to the University of Liverpool. The route starts at Penny Ln and follows the A562 road westward, passing through the Baltic Triangle and Albert Dock areas. It then turns inland, crossing the River Mersey, and follows Upper Parliament St and A562 through Sefton Park and Aigburth. The route ends at the University of Liverpool. The total distance is 2.4 miles (3.8 km) and takes approximately 49 minutes. The map also shows other major roads like W. Derby Rd, A57, and M62, as well as various landmarks and green spaces.





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