Lecture 20
Map Projections and Dot Maps

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DATASCI 112

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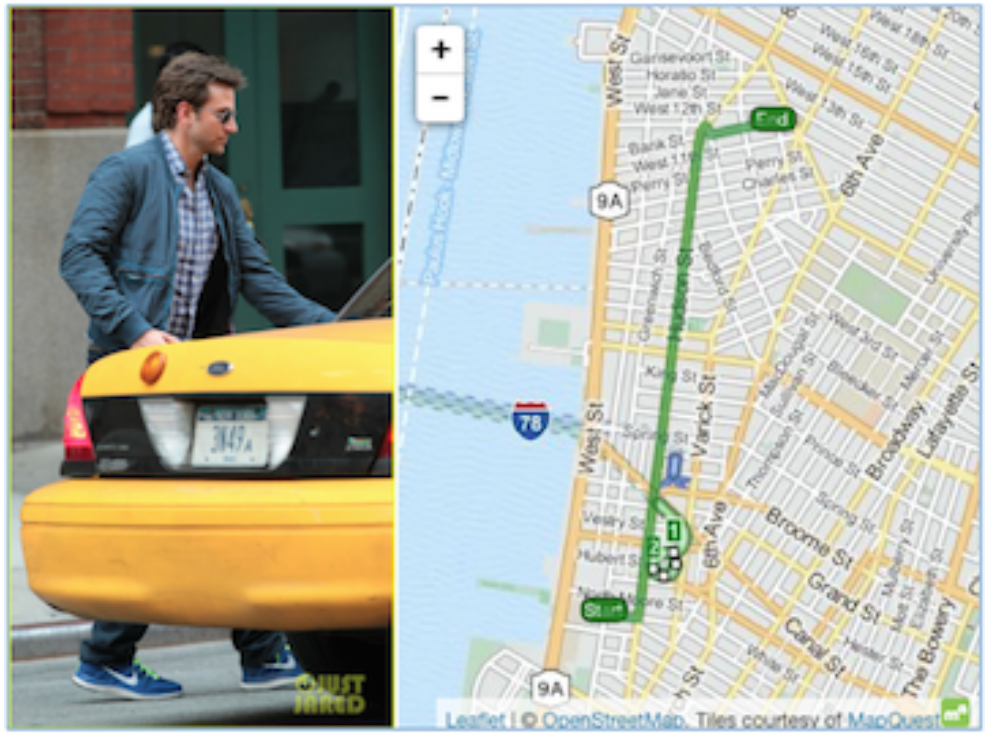


Source: NYC Cab Dataset

1. The Power of Maps

2. Map Projections

3. Making Dot Maps

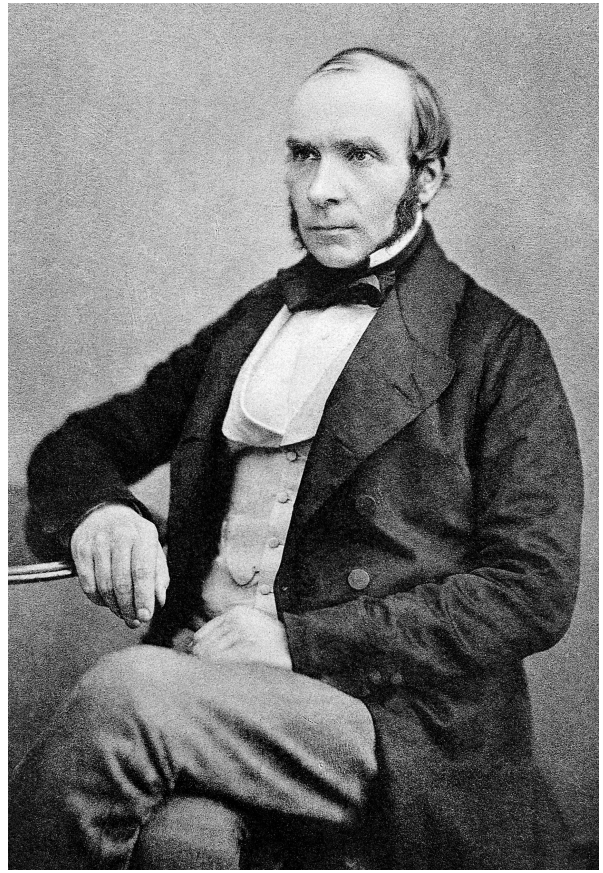
1 The Power of Maps

2 Map Projections

3 Making Dot Maps

Who is John Snow?

Jon Snow
(281–302 AC)

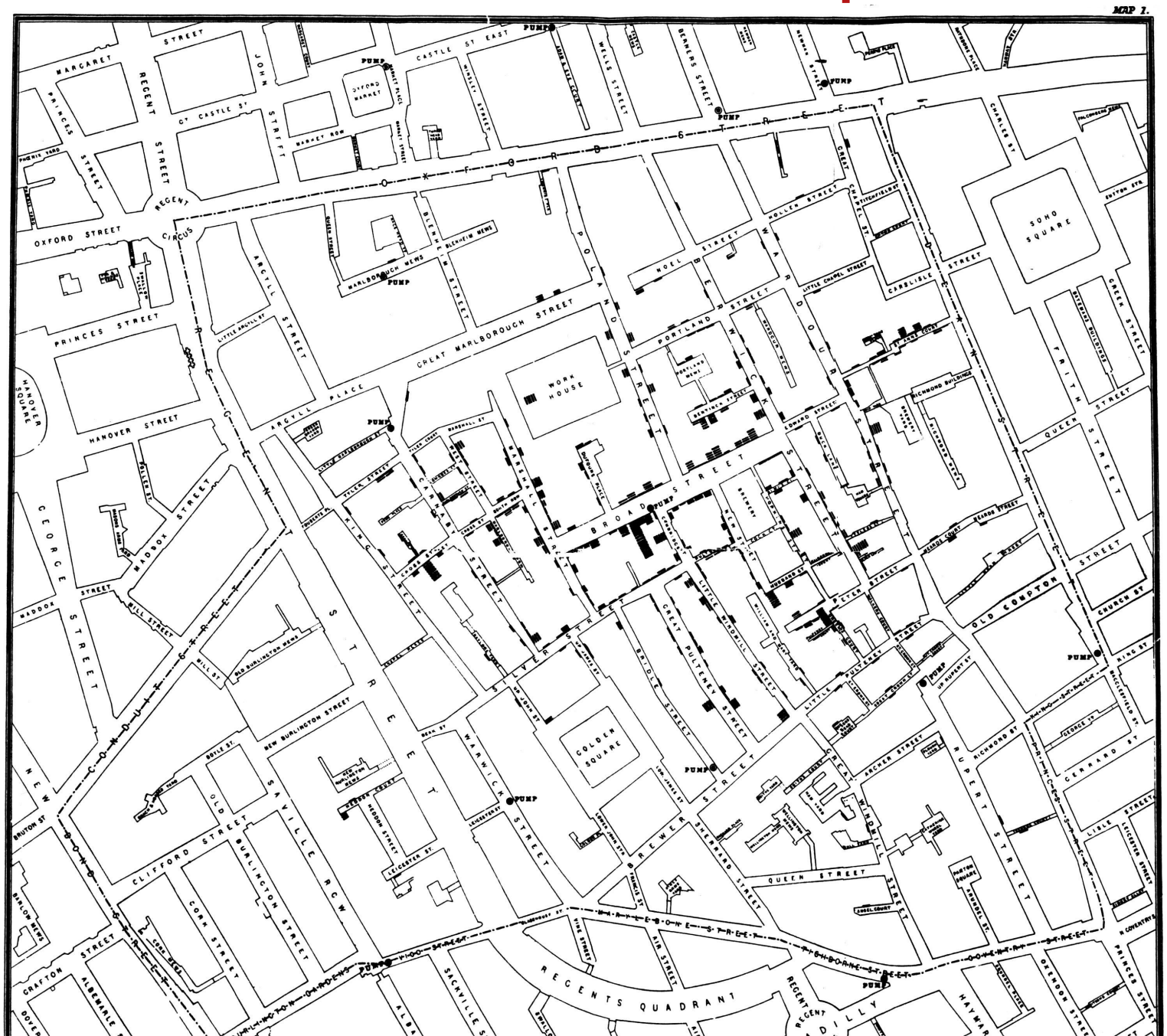


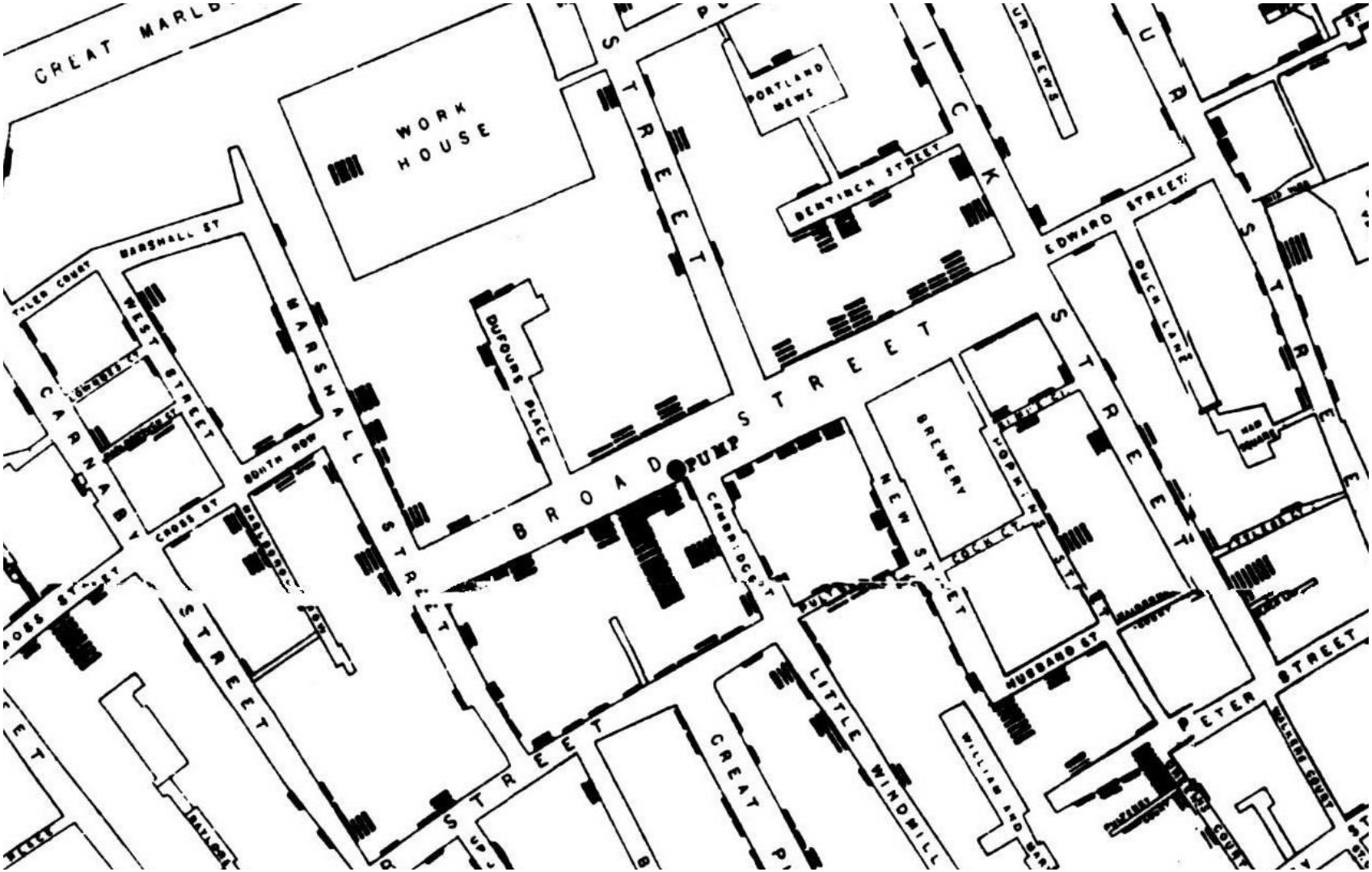
John Snow
(1813–1858)

1854 Broad Street Cholera Outbreak

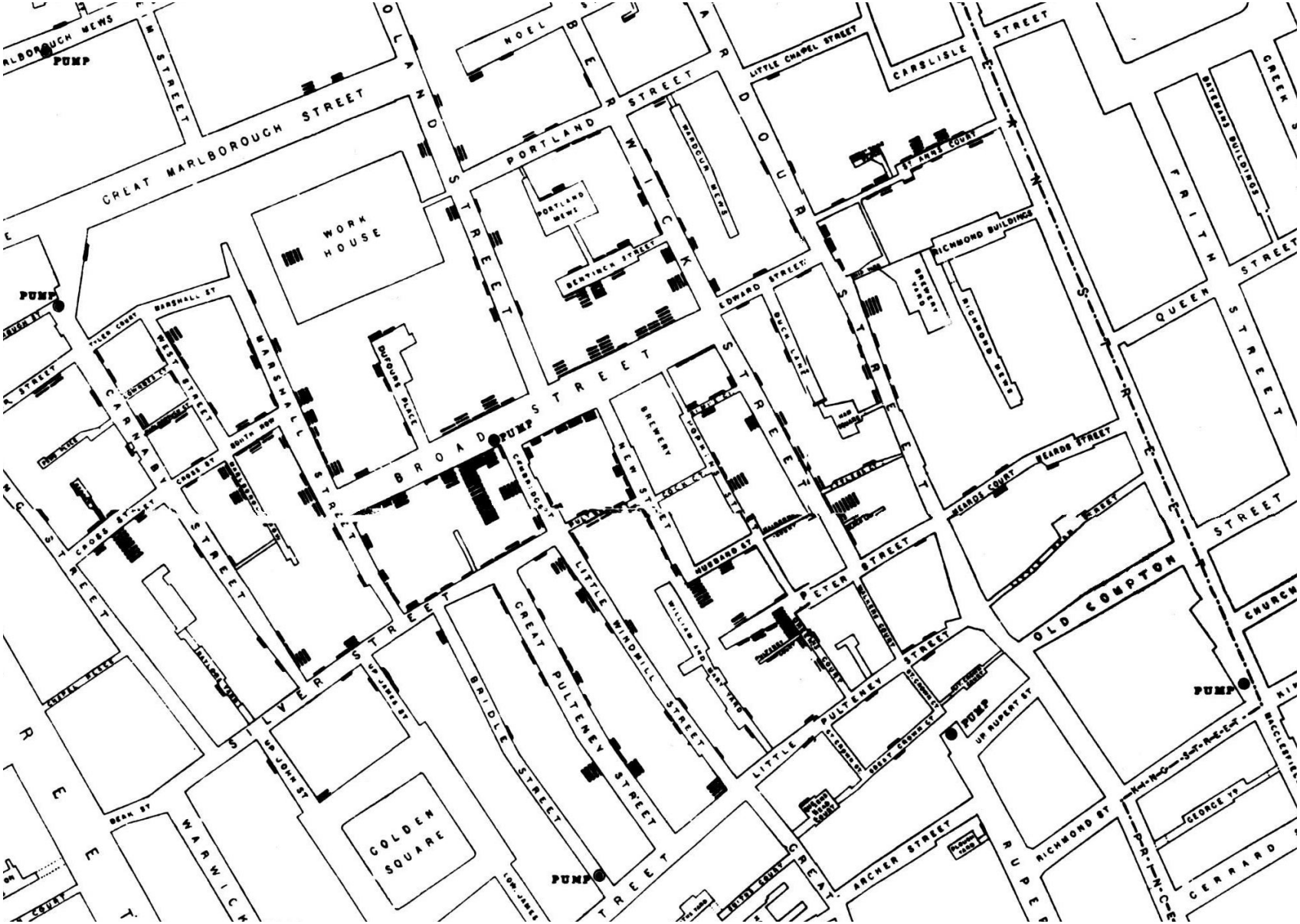
- In 1854, London was hit by a severe cholera outbreak.
- At the time, the cause of cholera was not known. There were two theories: the germ theory and the miasma theory.
- John Snow decided to investigate the cause, and he started by making a **dot map**.

John Snow's Dot Map





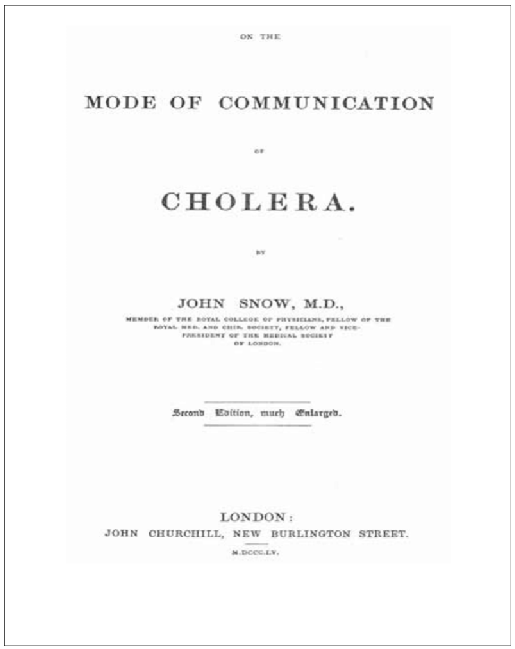
Each “dot” (thin black box) represents a cholera case.



Snow observed that cholera cases centered around the Broad Street water pump.

Snow's Analysis

Snow followed up on the insight with careful, on-the-ground detective work.



ON THE

MODE OF COMMUNICATION

OF

CHOLERA.

BY

JOHN SNOW, M.D.,

MEMBER OF THE ROYAL COLLEGE OF PHYSICIANS, FELLOW OF THE ROYAL MED. AND CHIR. SOCIETY, FELLOW AND VICE-PRESIDENT OF THE MEDICAL SOCIETY OF LONDON.

Second Edition, much Enlarged.

LONDON:
JOHN CHURCHILL, NEW BURLINGTON STREET.
M.DCCC.LV.

There were only ten deaths in houses situated decidedly nearer to another street-pump. In five of these cases the families of the deceased persons informed me that they always sent to the pump in Broad Street, as they preferred the water to that of the pumps which were nearer. In three other cases, the deceased were children who went to school near the pump in Broad Street....

The End of the Story

In the end, Snow was able to build a strong case that the Broad Street pump was the source of the cholera outbreak.

The result of the inquiry, then, is, that there was been no particular outbreak or prevalence of cholera in this part of London except among the persons who were in the habit of drinking the water of the above-mentioned pump well....In consequence of what I said, the handle of the pump was removed on the following day.

Snow's analysis established cholera as a waterborne disease and affirmed the germ theory of disease.

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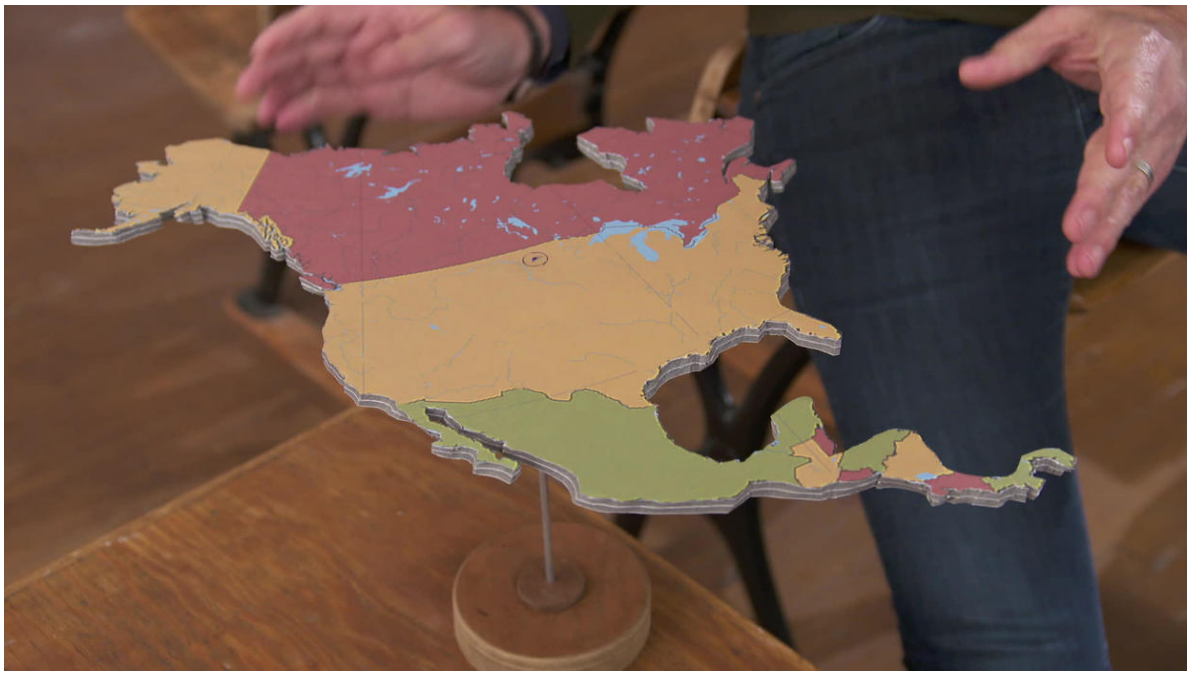
Geographical Center of North America

In 1930, a USGS employee took a cutout of the map of North America and balanced it on the top of a pin.



They found that the center was a town called Rugby, ND.

Dispute with Robinson, ND

Meanwhile, Bill Bender of Robinson, ND (100 miles to the south of Rugby) claimed that the center of North America was under his bar, Hanson's Bar.

They trademarked the phrase "Geographical Center of North America".

A Third Contender

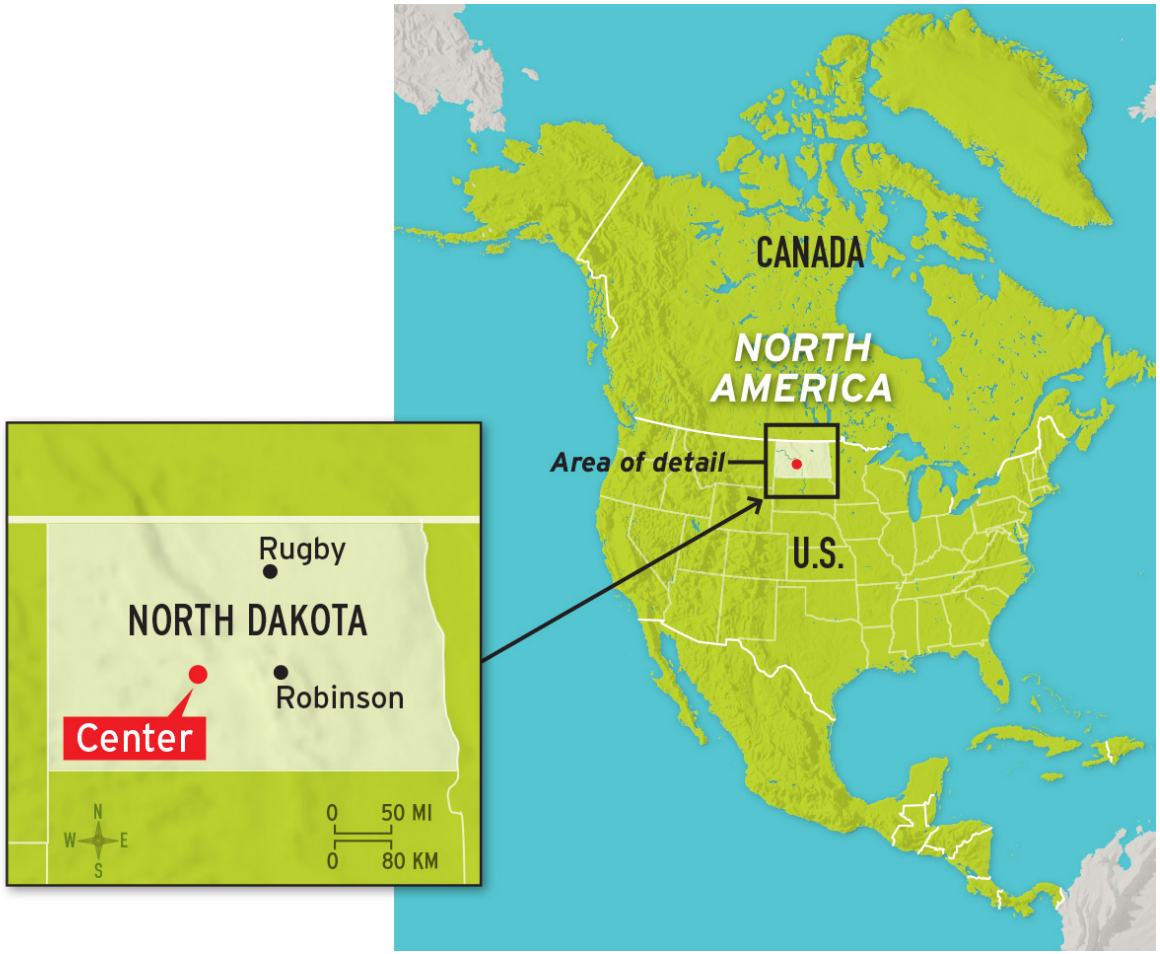
Peter Rogerson, a professor of Geography and Biostatistics, got wind about this debate.

He took latitudes and longitudes from all around North America, and used those coordinates to find the center.

“You have to take into account that the Earth’s surface is curved.”

He found that the geographical center was in a town called… Center, ND (no joke!).

The Geographical Center

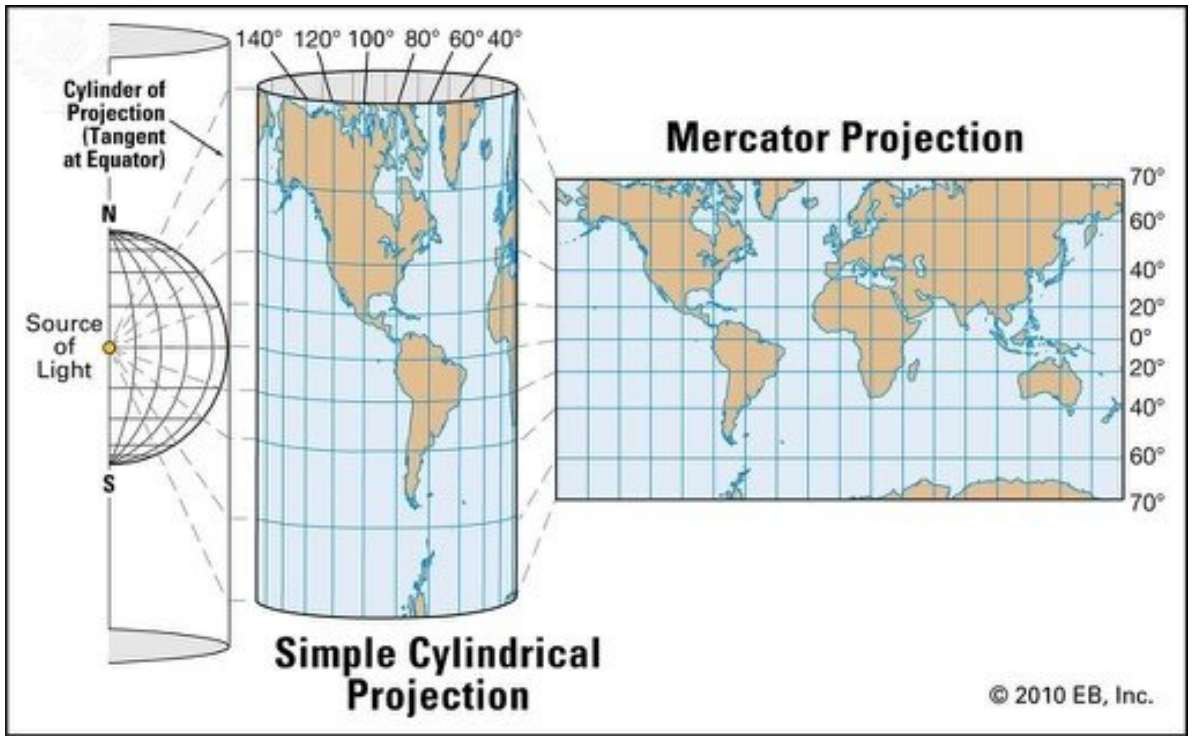


The controversy started because of the way the Earth's surface was flattened. Depending on which way you flatten, you'll get a different center.

Map Projection

Map projection refers to the way the curved surface of the Earth is represented as a flat surface.

One of the earliest projections was proposed by Gerardus Mercator in 1569.

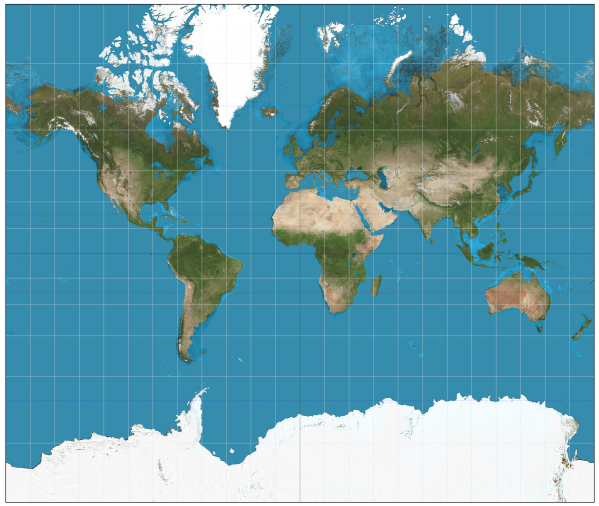


The West Wing on Map Projections

(Click on the image to watch the clip.)

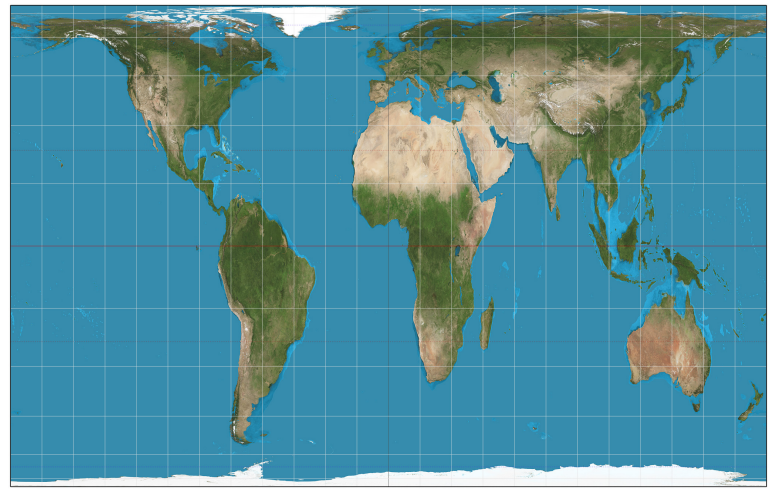
Mercator

(angle-preserving)



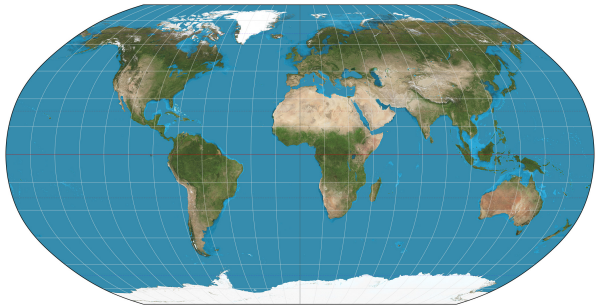
Gall-Peters

(equal-area, but distorted shapes)



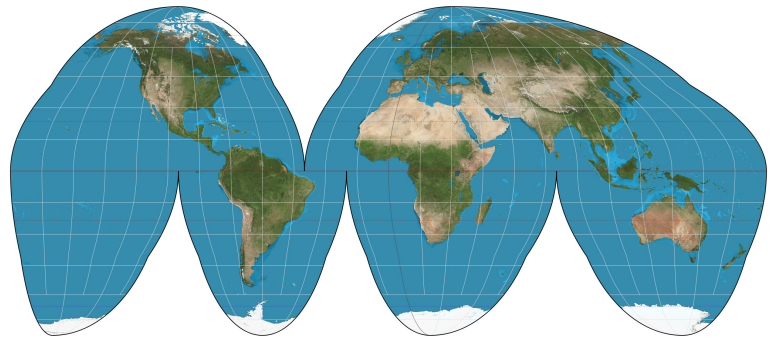
Robinson

(not equal-area or angle-preserving, but a compromise)



Goode homolosine

(equal-area with minimal distortion)



Moral: No projection is perfect. Every projection has tradeoffs.

What Your Favorite Map Projection Says About You

MERCATOR

YOU'RE NOT REALLY INTO MAPS.

ROBINSON

YOU HAVE A COMFORTABLE PAIR OF RUNNING SHOES THAT YOU WEAR EVERYWHERE. YOU LIKE COFFEE AND ENJOY THE BEATLES. YOU THINK THE ROBINSON IS THE BEST-LOOKING PROJECTION, HANDS DOWN.

DYMAXION

YOU LIKE ISAAC ASIMOV, XML, AND SHOES WITH TOES. YOU THINK THE SEGWAY GOT A BAD RAP. YOU OWN 3D GOGGLES, WHICH YOU USE TO VIEW ROTATING MODELS OF BETTER 3D GOGGLES. YOU TYPE IN DVORAK.

GOODE HOMOLOSINE

THEY SAY MAPPING THE EARTH ON A 2D SURFACE IS LIKE FLATTENING AN ORANGE PEEL, WHICH SEEMS EASY ENOUGH TO YOU. YOU LIKE EASY SOLUTIONS. YOU THINK WE WOULDN'T HAVE SO MANY PROBLEMS IF WE'D JUST ELECT *NORMAL* PEOPLE TO CONGRESS INSTEAD OF POLITICIANS. YOU THINK AIRLINES SHOULD JUST BUY FOOD FROM THE RESTAURANTS NEAR THE GATES AND SERVE *THAT* ON BOARD. YOU CHANGE YOUR CAR'S OIL, BUT SECRETLY WONDER IF YOU REALLY *NEED* TO.

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Let’s recreate John Snow’s cholera map in Colab, using our knowledge of map projections.