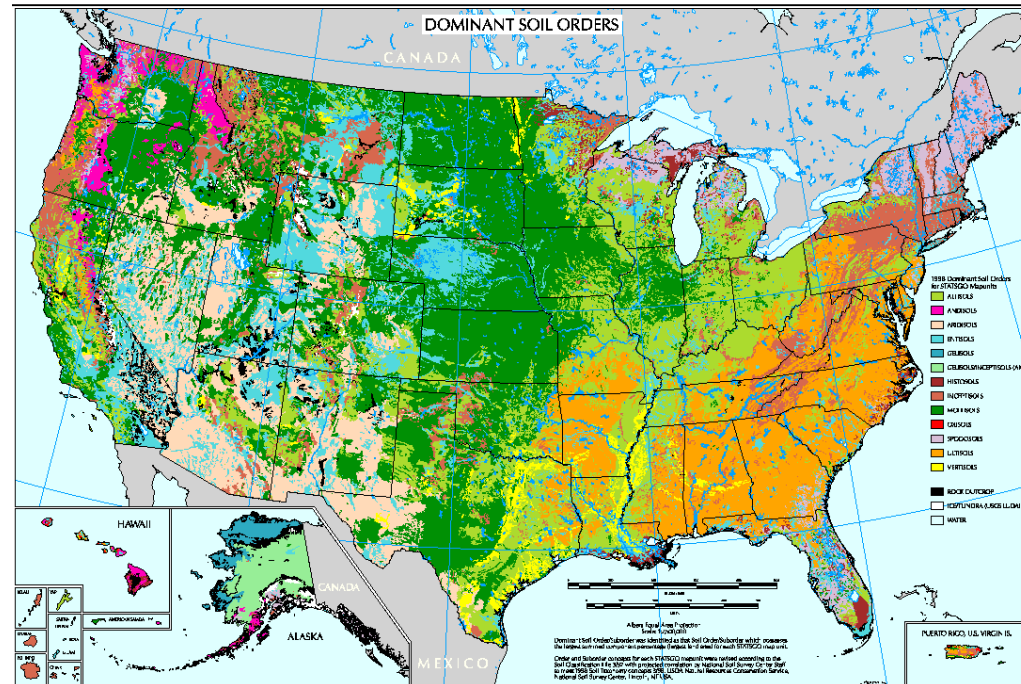
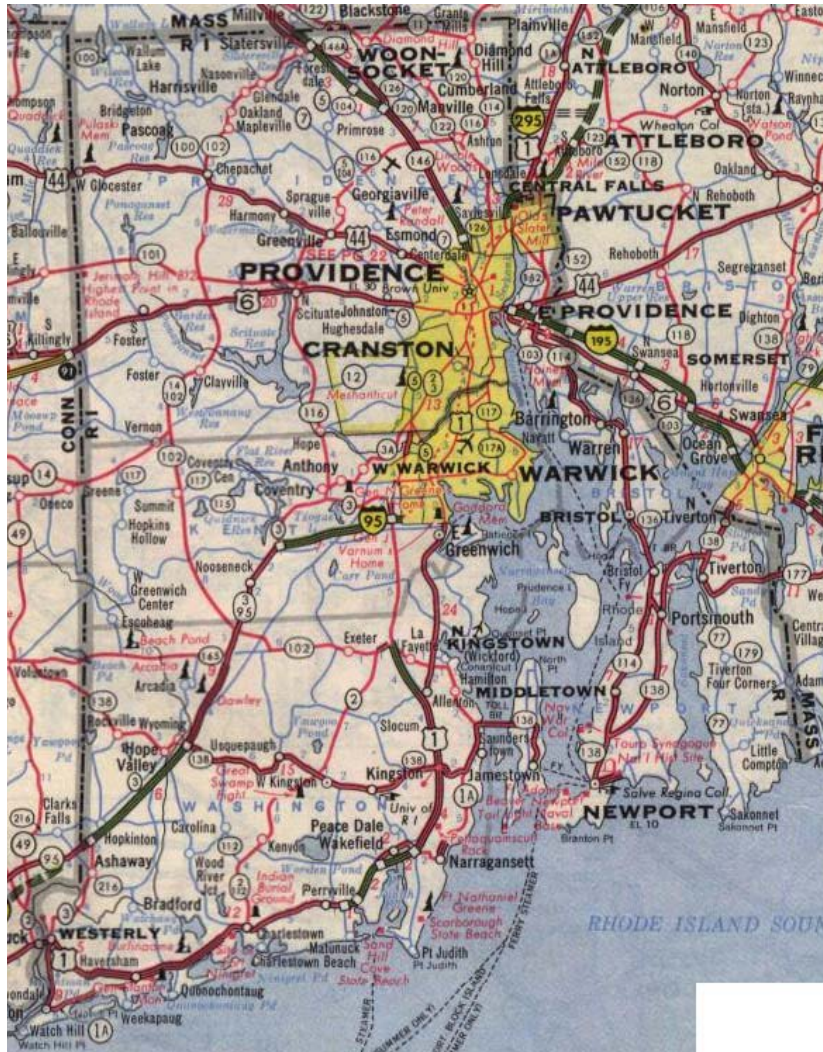




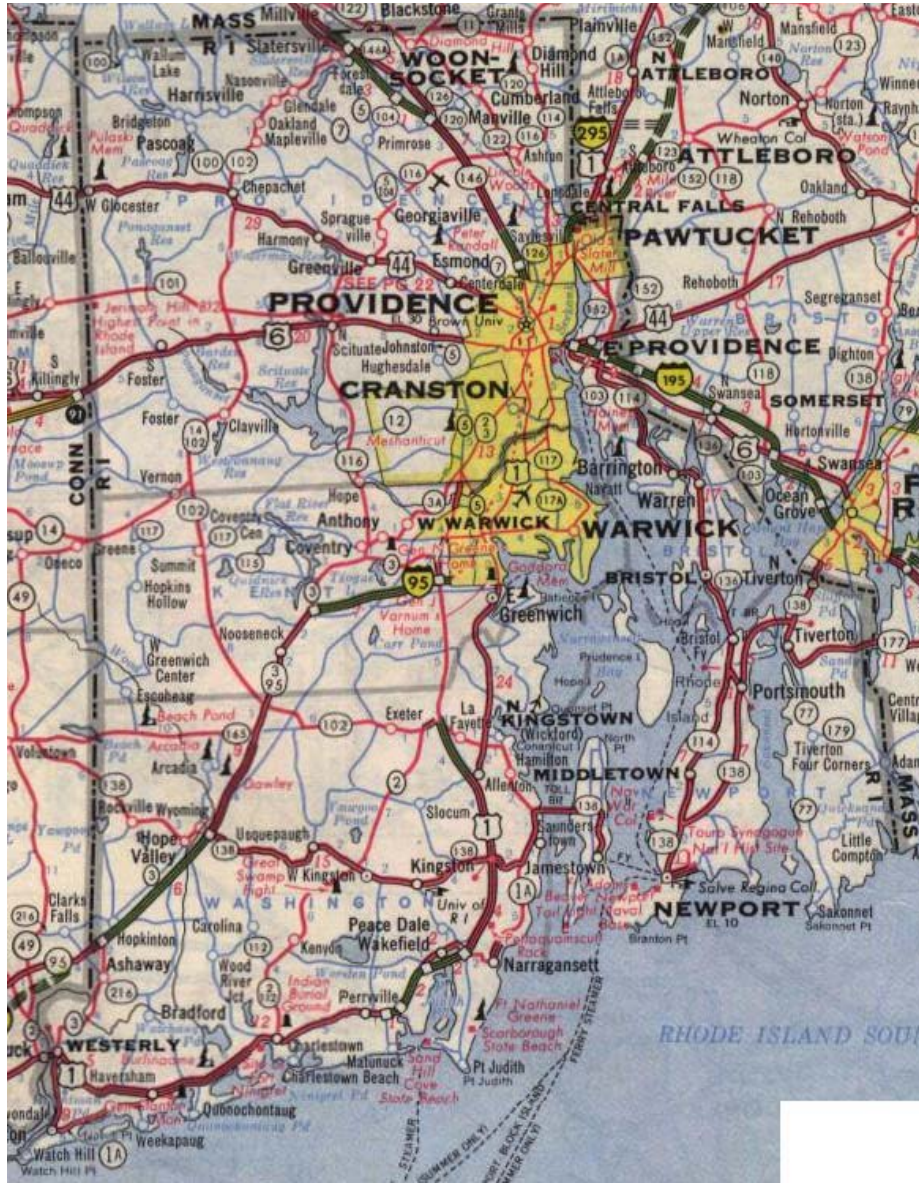
# Geog 126: Maps in Science and Society

Early Thematic Cartography

# General-reference maps versus thematic maps



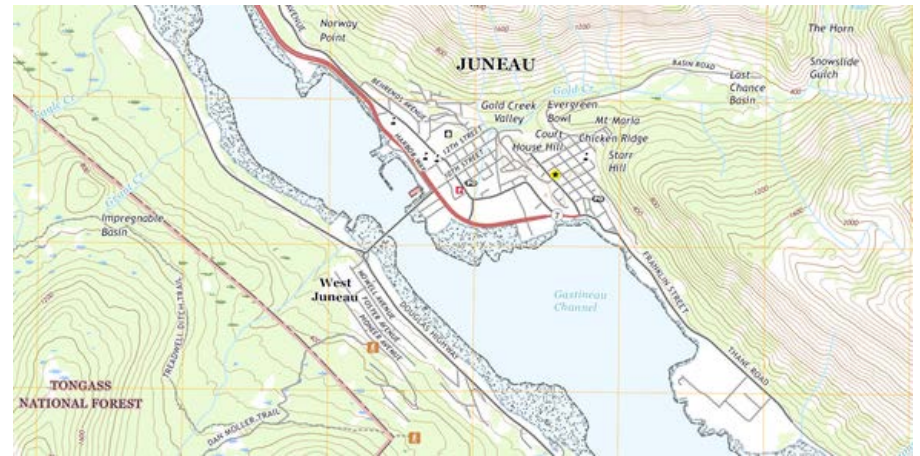
# General-reference maps



- Emphasize location of spatial phenomena
- Principal goal is navigation and cartometry
- Go back to cartography's origins
- Examples include:
  - Road maps
  - Google Maps
  - Openstreetmap.org
  - USGS Topo maps

# USGS Topographic Maps: Content

- Topography
- Hydrology
- Land cover/use
- Roads and transportation
- Human settlements
- Place and feature names
- Geodetic base and control
- Cadastral information and land divisions
- Boundaries
- Imagery

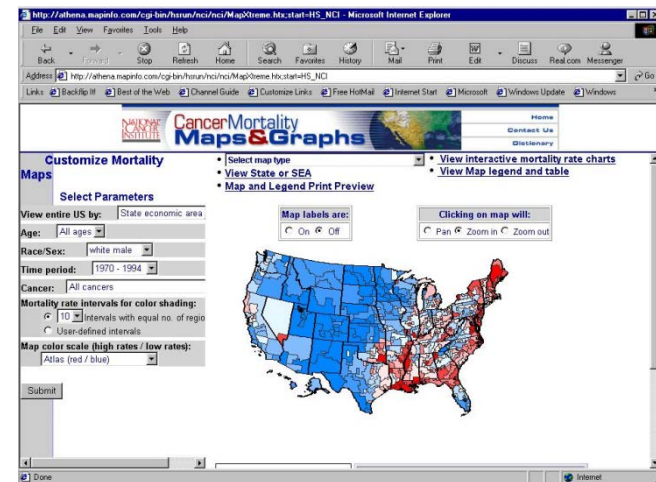


# The thematic map

- Also called the “statistical map,” “single-topic map,” or the “special-purpose” map
- Less literal than a general-reference map
- Two groups of thematic maps: qualitative and quantitative
- Goal is primarily information transfer
- More recent than general purpose

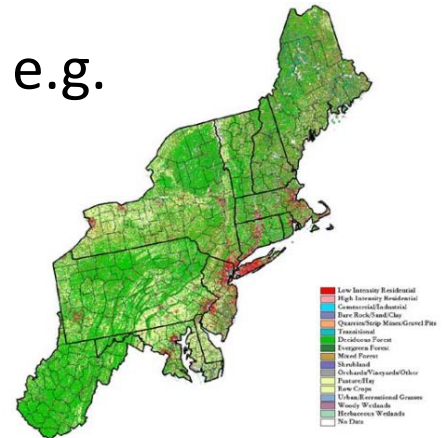
# Attributes

- Attributes in geography are spatially dependent variables
- Geographic attributes are specific statistics tied to geographic locations
- Locations can be points, lines, polygons
- Examples include:
  - Population density
  - Tax rates
  - Health data (lung cancer rate)
  - Air pressure, temperature
- Thematic maps depict geographic attributes



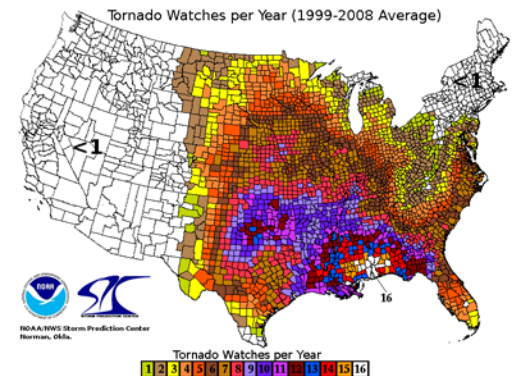
# The 2 kinds of thematic maps

- **Qualitative** thematic maps
  - Show the spatial distribution or location of *a set of classes*
    - **Land use**
    - **Soil types**
    - **Languages**
    - **Geology**
  - These maps are concerned with groups, names, types (nominal data)
  - Many systematic national mapping efforts, e.g. National Land Cover database



# The 2 kinds of thematic maps

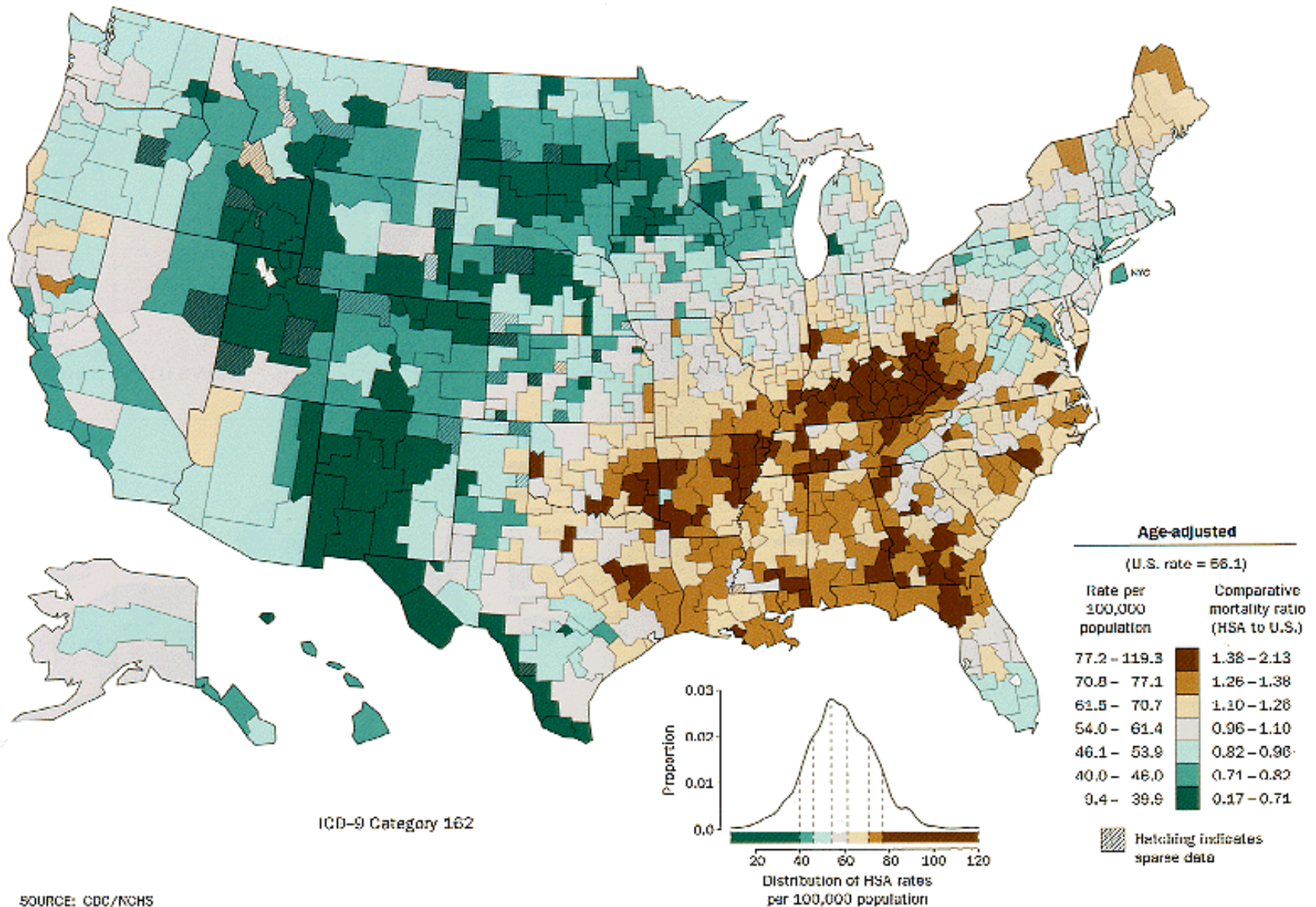
- **Quantitative** thematic maps
  - Spatial aspects of *numerical* data
    - Corn yield
    - Per Capita Income
    - Number of Tornadoes
    - Population Density
  - These maps are concerned with **amounts**, or **quantities**





# Lung cancer in white males, by Brewer

## Qualitative or Quantitative?

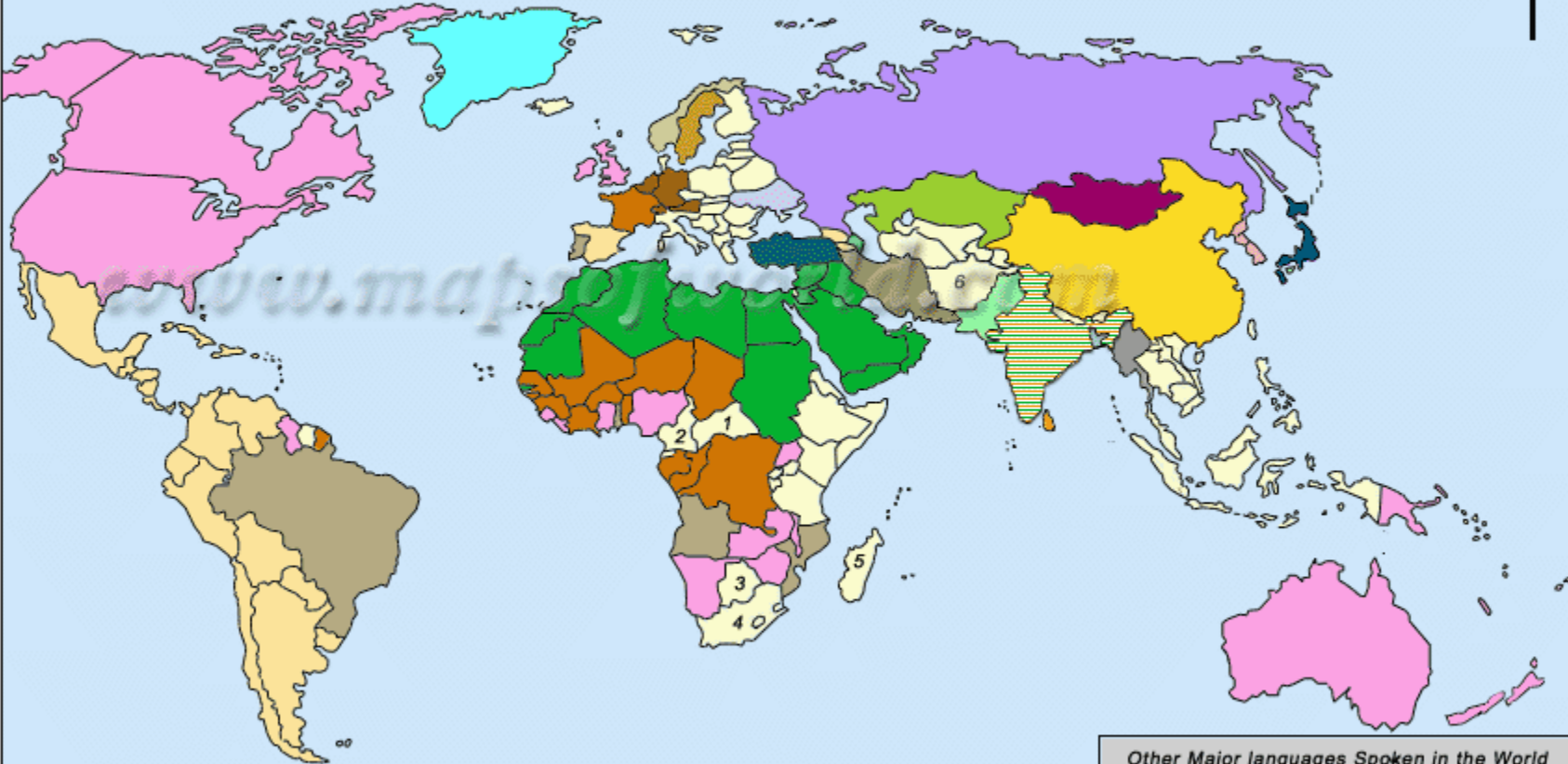


# Qualitative or Quantitative?

## Languages of the WORLD



- Burmese*
- Norwegian*
- Swedish*
- Bengali*
- Mongolian*
- Inuit*
- Ukrainian*
- Turkic*
- Kazakh*
- Persian*
- Korean*
- English*
- French*
- Spanish*
- Portuguese*
- German*
- Russian*
- Chinese*
- Sinhala*
- Japanese*
- Arabic*
- Urdu*
- Multi Lingual*
- Others*

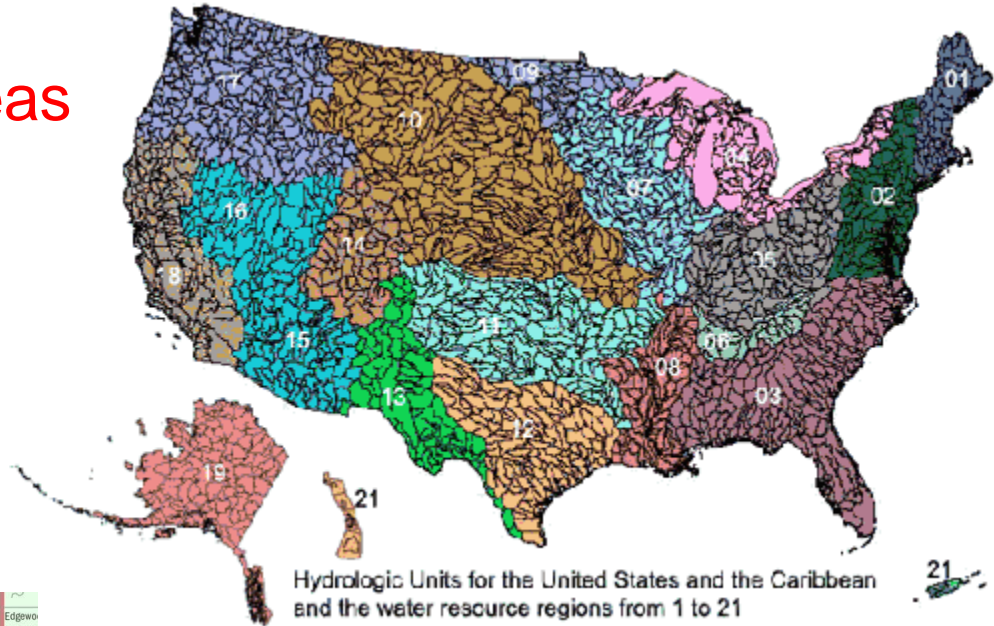


- Other Major languages Spoken in the World*
- |                     |                      |
|---------------------|----------------------|
| 1. French & Sango   | 4. English & Others  |
| 2. French & English | 5. Malagasy & French |
| 3. Setswana         | 6. Pashto & Dari     |

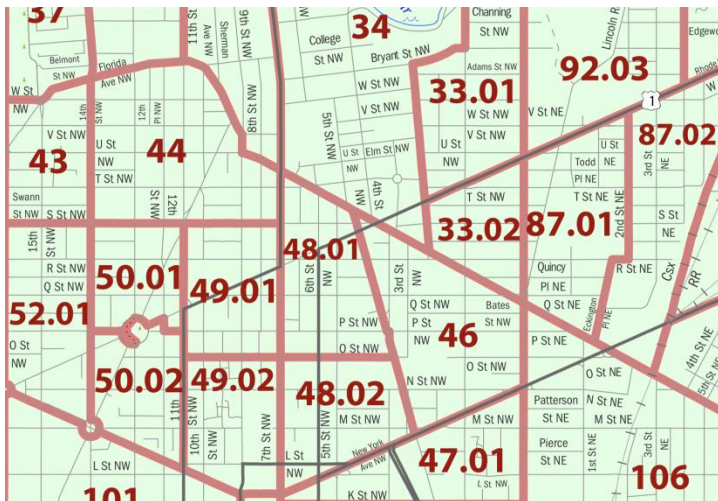
Map not to Scale

# Geographical Units

Real points, lines, **areas**  
Fiat Boundaries



Hydrologic Units for the United States and the Caribbean and the water resource regions from 1 to 21



Some important historical general-  
reference maps

# Ptolemy's map of the world (circa 150)





# The Madaba Mosaic

- Circa 590 AD
- Madaba is the 5<sup>th</sup> largest city in Jordan
- The mosaic is an index map of the biblical region (earliest map of Jerusalem)
- Consists of 2 million pieces of colored stone
- Re-discovered in 1896
- Floor decoration for a Greek Orthodox church
- Features and placenames in Greek



# The Madaba Mosaic





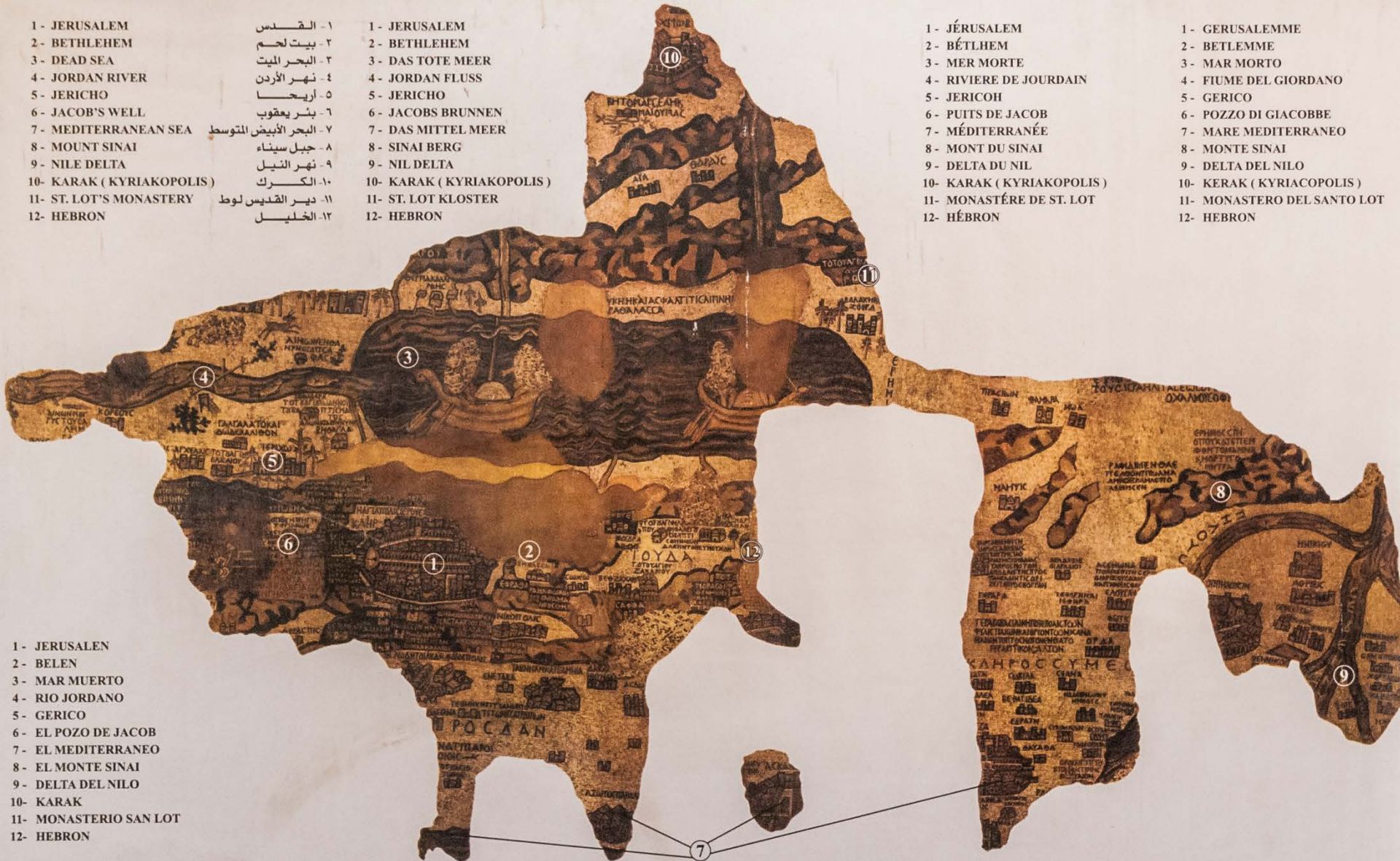
# Photomosaic

- 1 - JERUSALEM      ١ - القدس
- 2 - BETHLEHEM    ٢ - بيت لحم
- 3 - DEAD SEA      ٣ - البحر الميت
- 4 - JORDAN RIVER   ٤ - نهر الأردن
- 5 - JERICHO        ٥ - أريحا
- 6 - JACOB'S WELL   ٦ - بئر يعقوب
- 7 - MEDITERRANEAN SEA ٧ - البحر الأبيض المتوسط
- 8 - MOUNT SINAI   ٨ - جبل سيناء
- 9 - NILE DELTA     ٩ - نهر النيل
- 10 - KARAK ( KYRIAKOPOLIS ) ١٠ - الكرك
- 11 - ST. LOT'S MONASTERY ١١ - دير القديس لوط
- 12 - HEBRON        ١٢ - الخليل

- 1 - JERUSALEM
- 2 - BETHLEHEM
- 3 - DAS TOTE MEER
- 4 - JORDAN FLUSS
- 5 - JERICHO
- 6 - JACOBS BRUNNEN
- 7 - DAS MITTEL MEER
- 8 - SINAI BERG
- 9 - NIL DELTA
- 10 - KARAK ( KYRIAKOPOLIS )
- 11 - ST. LOT KLOSTER
- 12 - HEBRON

- 1 - JÉRUSALEM
- 2 - BÉTLHEM
- 3 - MER MORTE
- 4 - RIVIERE DE JOURDAIN
- 5 - JERICOH
- 6 - PUIS DE JACOB
- 7 - MÉDITERRANÉE
- 8 - MONT DU SINAI
- 9 - DELTA DU NIL
- 10 - KARAK ( KYRIAKOPOLIS )
- 11 - MONASTÈRE DE ST. LOT
- 12 - HÉBRON

- 1 - GERUSALEMME
- 2 - BETLEMME
- 3 - MAR MORTO
- 4 - FIUME DEL GIORDANO
- 5 - GERICO
- 6 - POZZO DI GIACOBBE
- 7 - MARE MEDITERRANEO
- 8 - MONTE SINAI
- 9 - DELTA DEL NILO
- 10 - KERAK ( KYRIACOPOLIS )
- 11 - MONASTERO DEL SANTO LOT
- 12 - HEBRON



- 1 - JERUSALEN
- 2 - BELEN
- 3 - MAR MUERTO
- 4 - RIO JORDANO
- 5 - GERICO
- 6 - EL POZO DE JACOB
- 7 - EL MEDITERRANEO
- 8 - EL MONTE SINAI
- 9 - DELTA DEL NILO
- 10 - KARAK
- 11 - MONASTERIO SAN LOT
- 12 - HEBRON

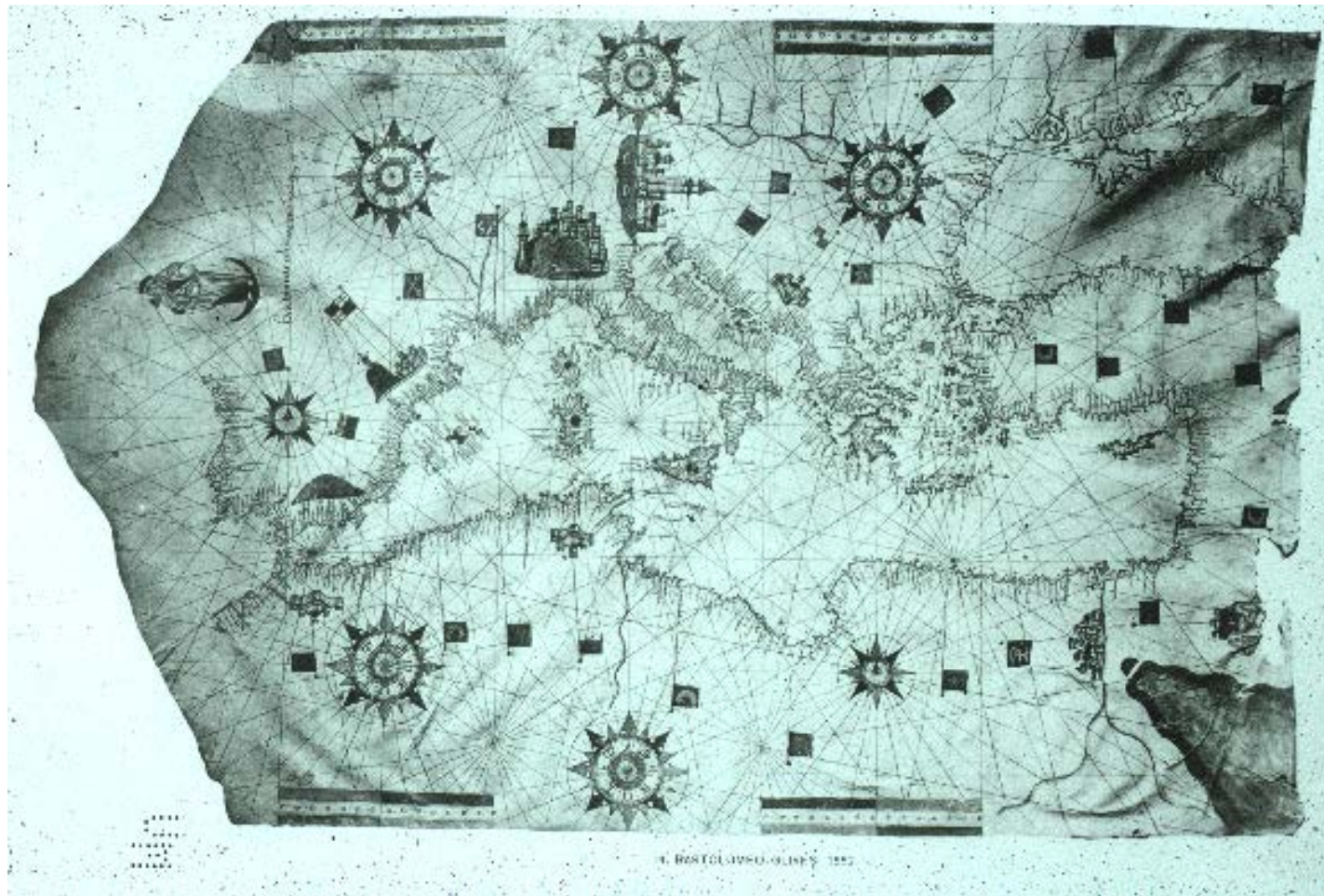
# Jerusalem on the Madaba Map



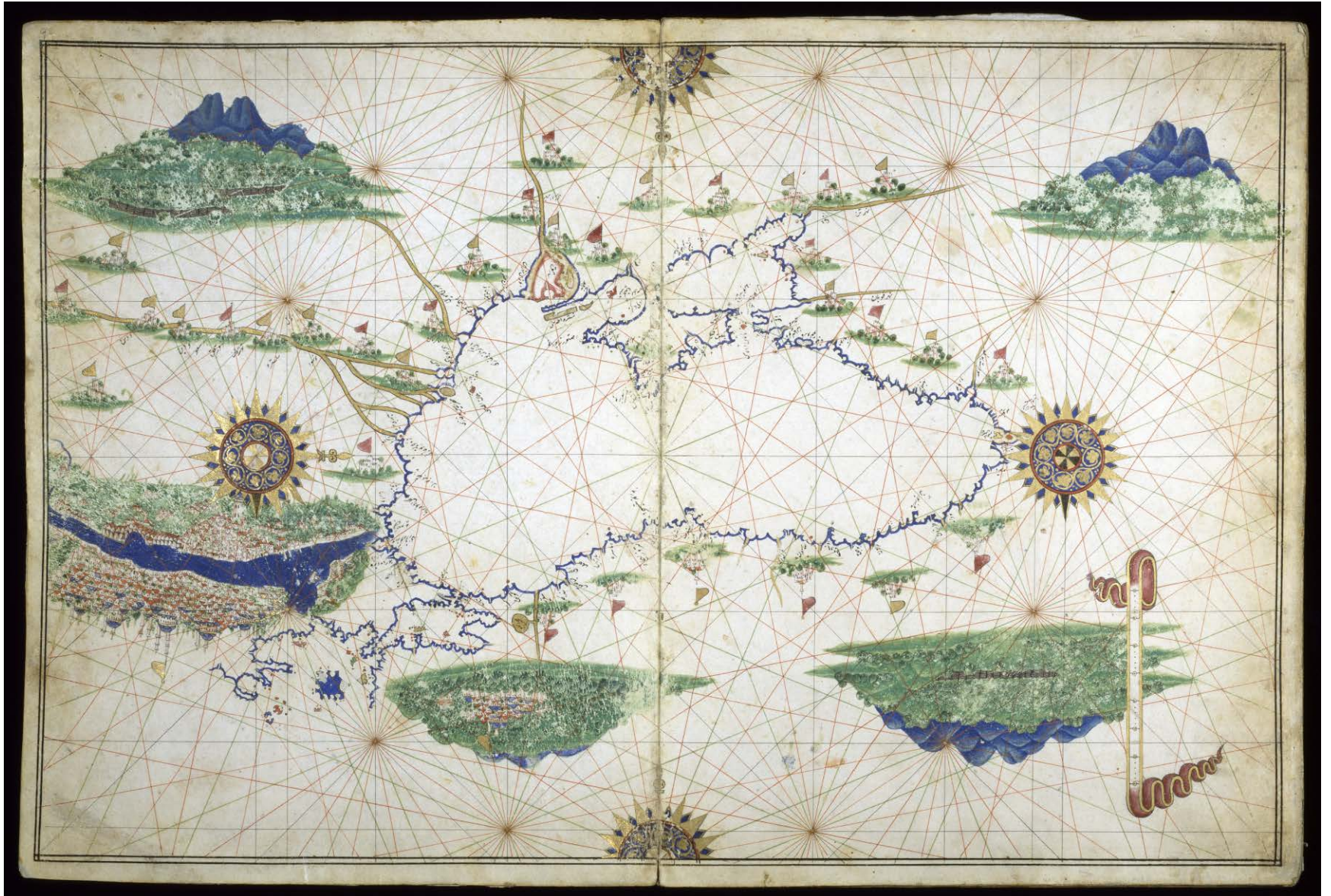
# Portolans

- 14<sup>th</sup> Century European navigation charts
- Meant to be used by mariners
- Good shoreline depictions
- Reflect the extent of European travels at that time (not global, no America)
- Show compass roses centered on key ports, cities etc.

# Portolan navigation charts

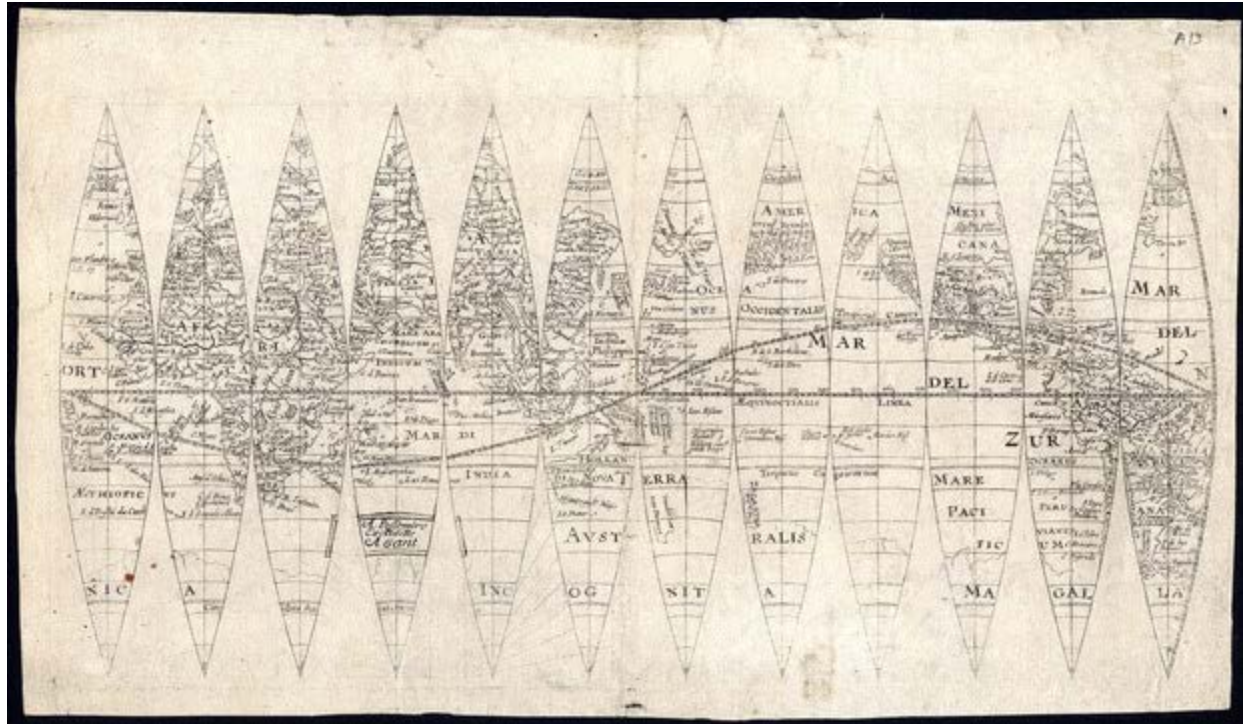


# 16th-century Turkish portolan map of the Black Sea



# Globes as Reference Maps

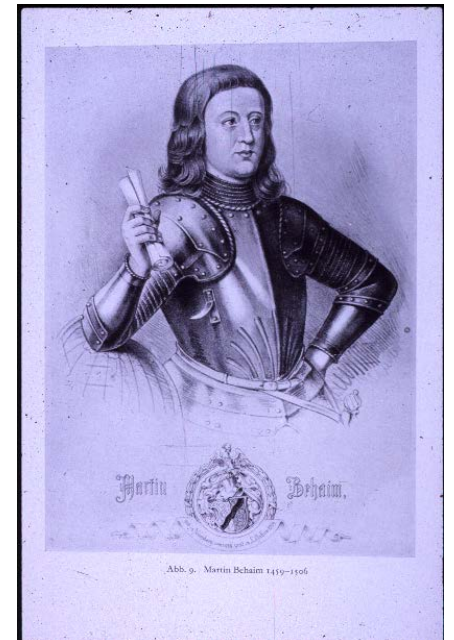
- True globes
- Gores



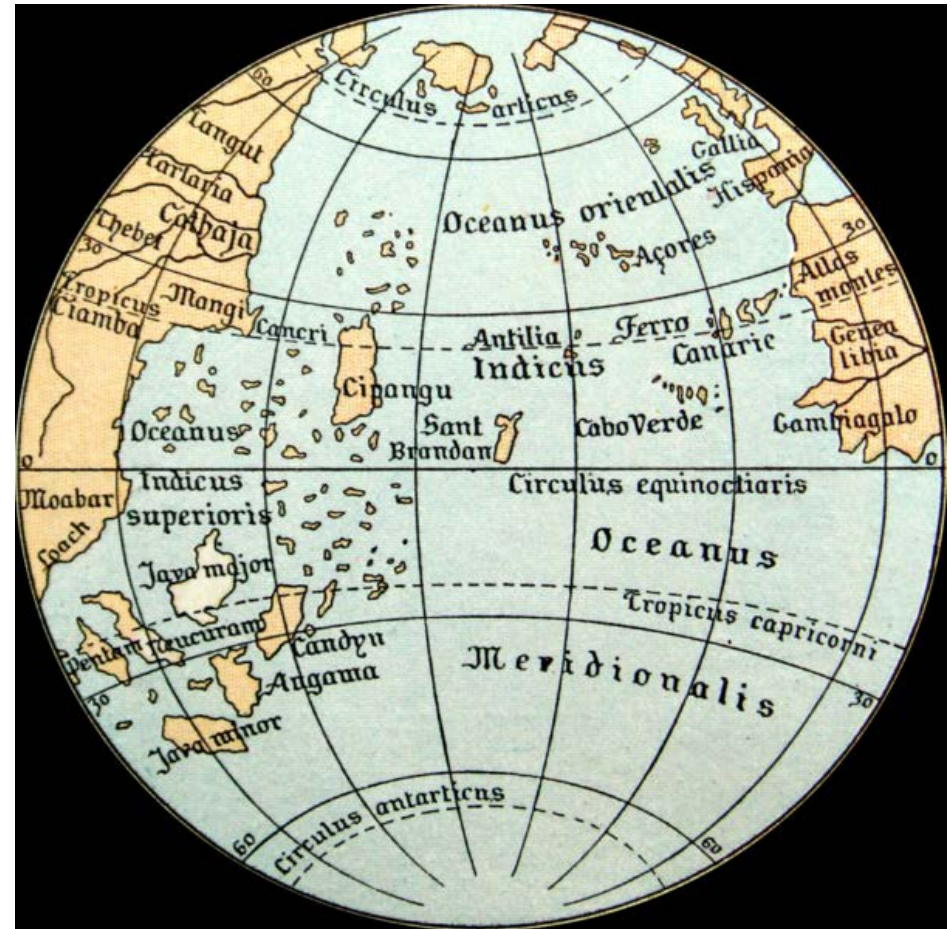
Adrian Possemirs, 1680

# Martin Behaim

- Created an important early globe
- 1492 (significant year...)
- The globe is still preserved in Nuremberg, Germany



# Martin Behaim's 1492 Globe





# Post-Columbus



- Ortelius' Atlas "Theater of the World"
- 1570s, Flemish Geographer

# Ortlelius: The "Atlas" 1570



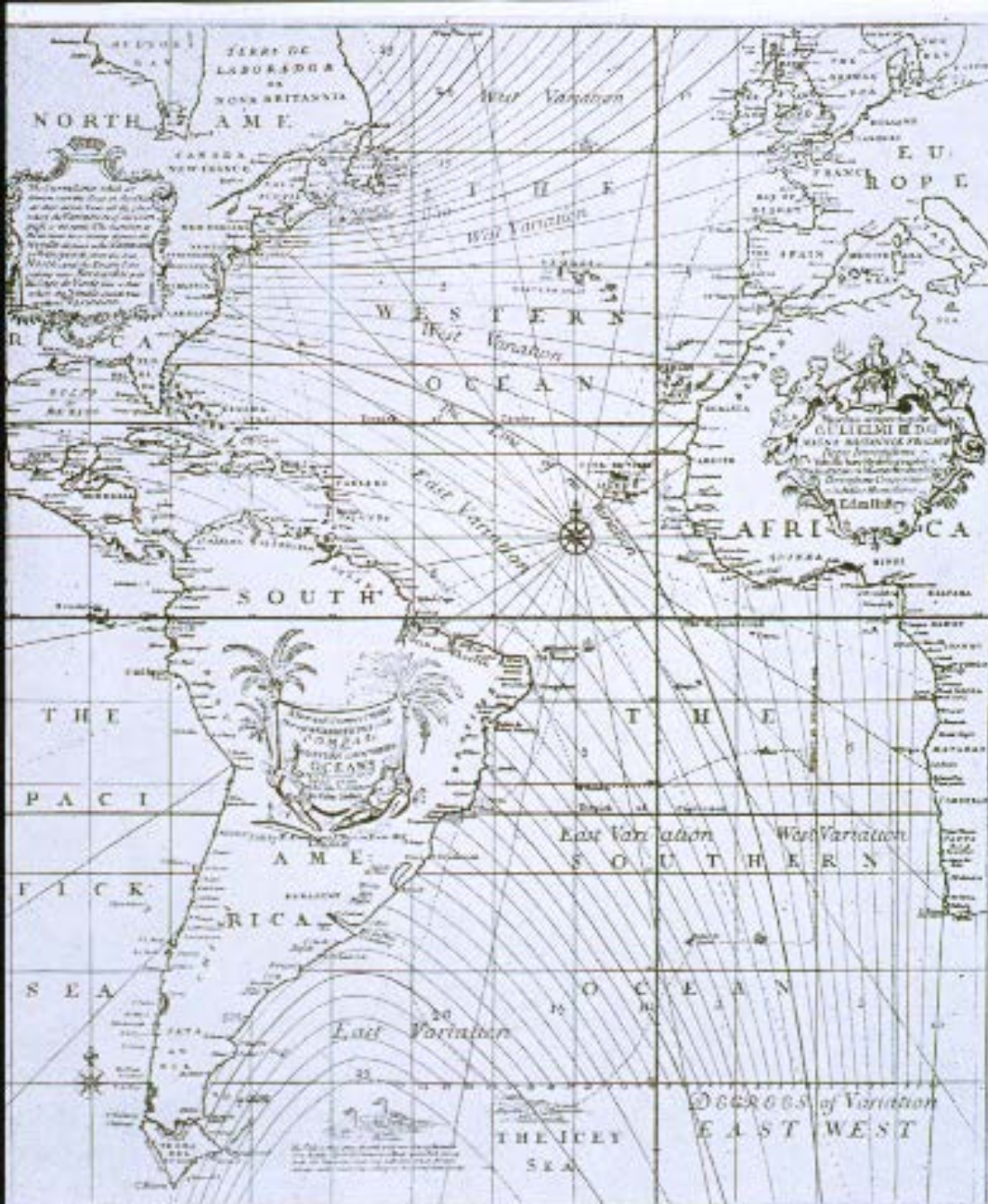
# Some early thematic maps

[www.math.yorku.ca/SCS/Gallery/milestone/sec5.html](http://www.math.yorku.ca/SCS/Gallery/milestone/sec5.html)

# Thematic Cartography

- Earliest examples from 1700's
- Edmond Halley
  - English Scientist
  - Charts on Trade Winds, published 1686...
  - Isogonic charts, earliest use of contours



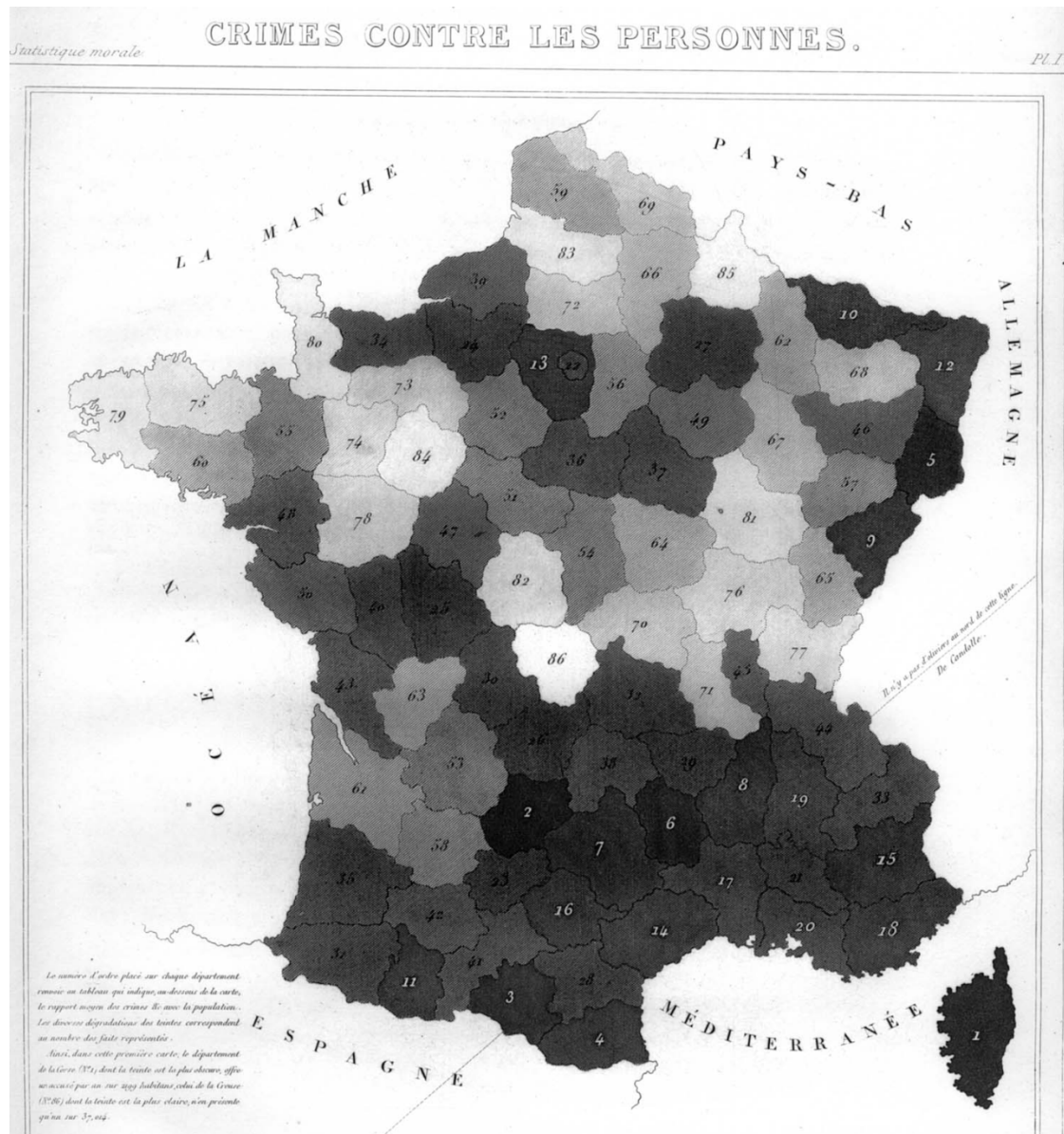


## Edmond Halley, 1701

- An “isogonic” map
- Isogonic or “Halleyan” lines connect points of equal magnetic declination
- Invisible attribute!

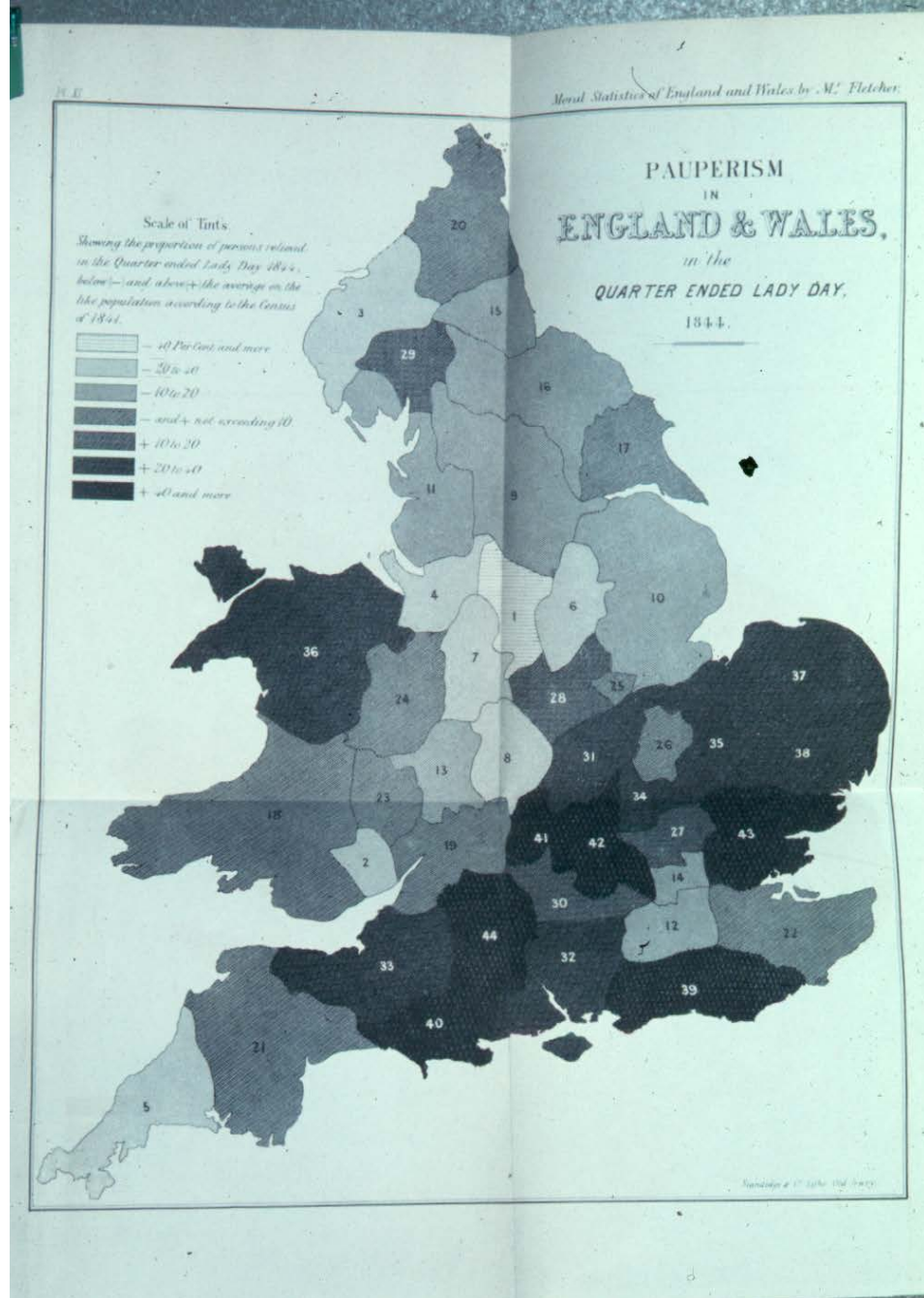
FIG. 5. "A New and Correct Chart showing the Variations of the Compass in the Western and Southern Oceans," ca. 1701 by Edmond Halley. From a copy in the Library of the Royal Geographical Society, London, reproduced by permission of the Society.

# Guerry's map of crimes against persons in France (1833)

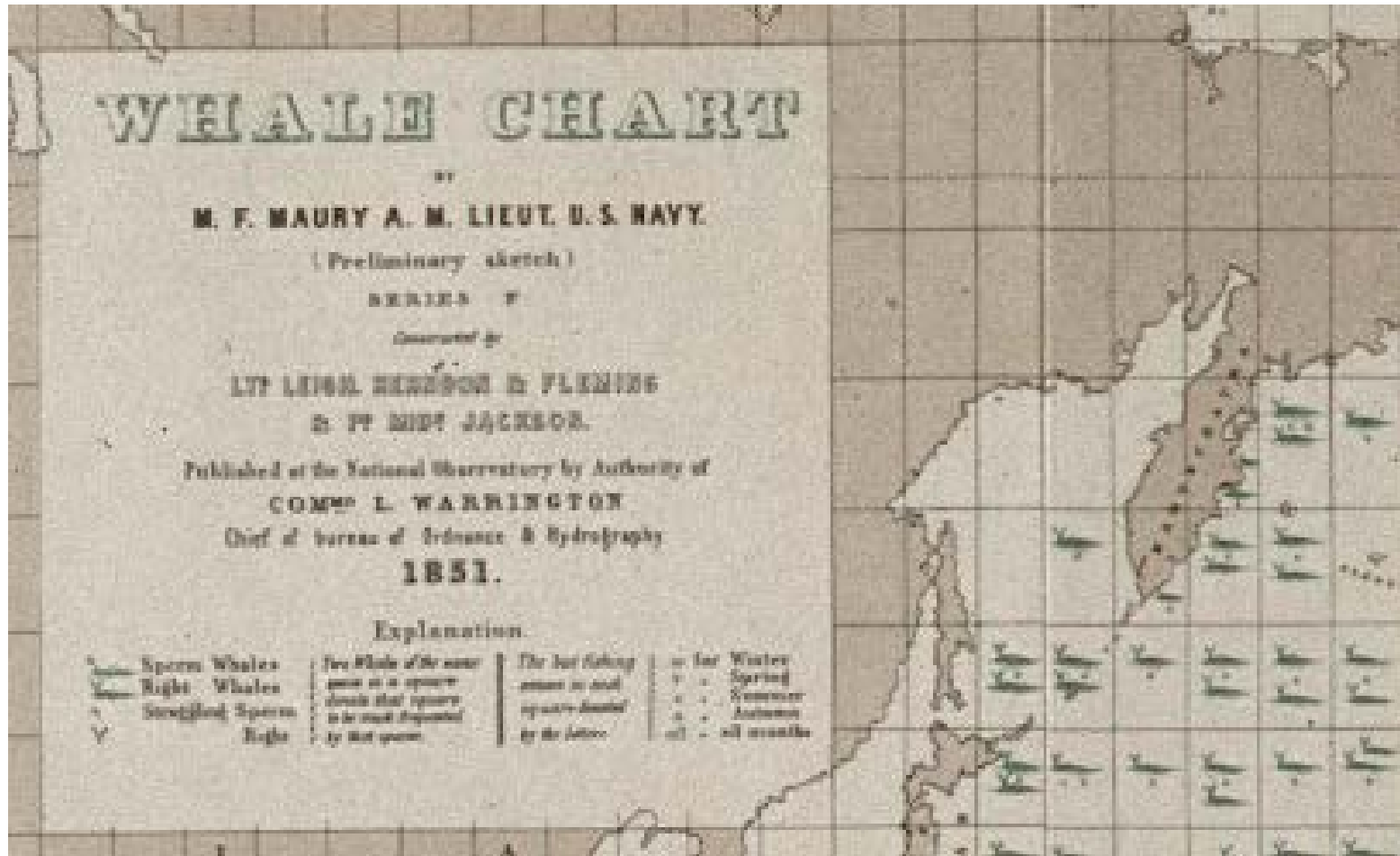


# Joseph Fletcher 1844

- First “choropleth” map
- “Pauperism” in England & Wales



# Maury's 1851 map of whale sightings



- US Navy
- Use of pictographic symbols



Discovered by Whalers

# WHALE CHART

M. F. MAURY A. M. LIEST, U. S. NAVY.

(Preliminary sketch)

SERIES V

NUMBER 9

LIEUTENANT MERRISON & FLEMING  
& FITZ JACOBSON.

Published at the National Observatory by Authority of

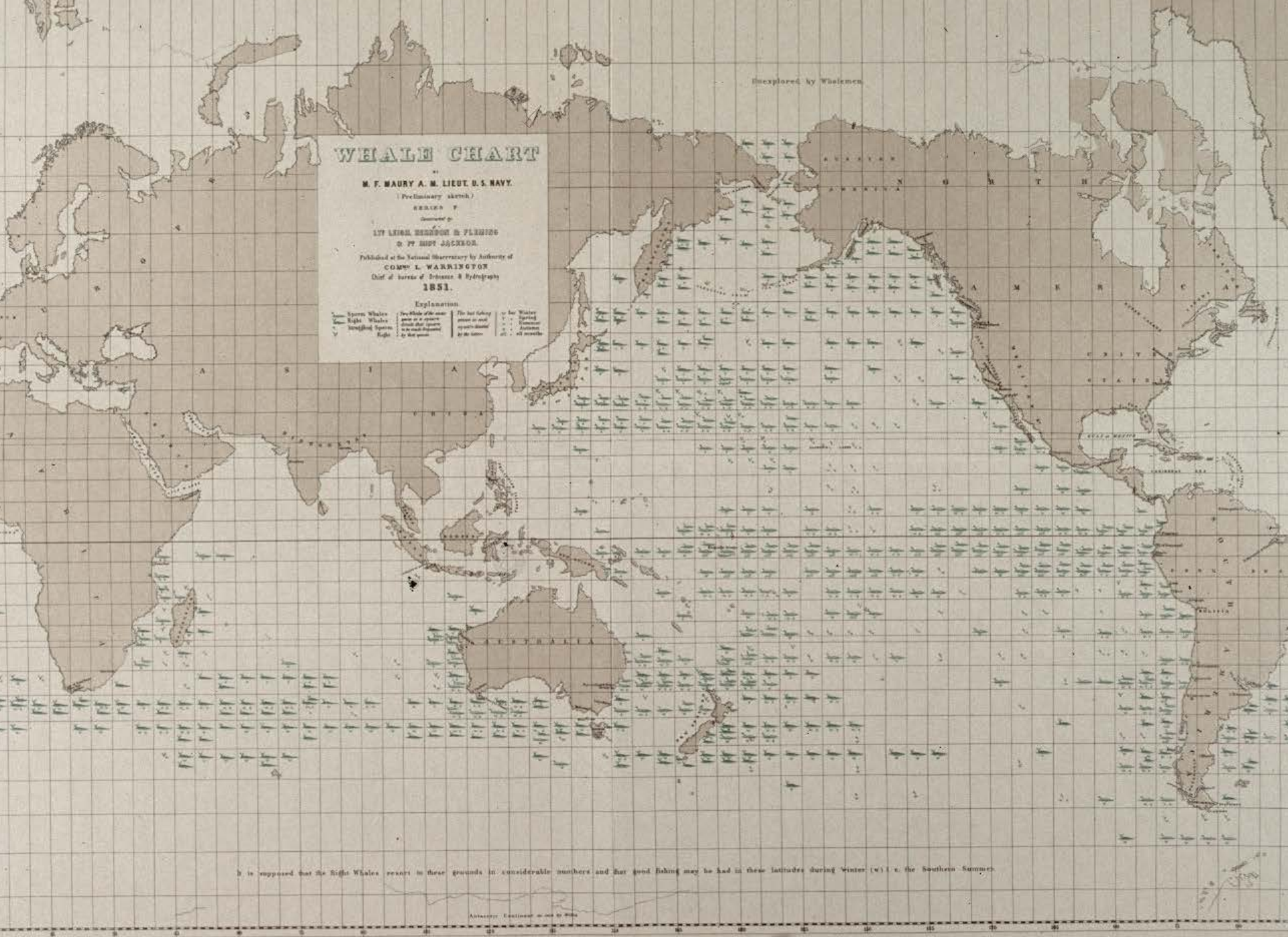
COMD' R. WASHINGTON

Chief of Bureau of Ordnance & Hydrography

1851.

### Explanation

Open Whale	Two Whales at one	The best fishing	for Whales
Right Whale	seen in a group	ground in each	Spring
Knifed Open	in the month	month	Summer
Right	by the sea	of the year	Autumn
			of the year



It is supposed that the Right Whales resort to these grounds in considerable numbers and that good fishing may be had in these latitudes during Winter (W) & the Southern Summer.

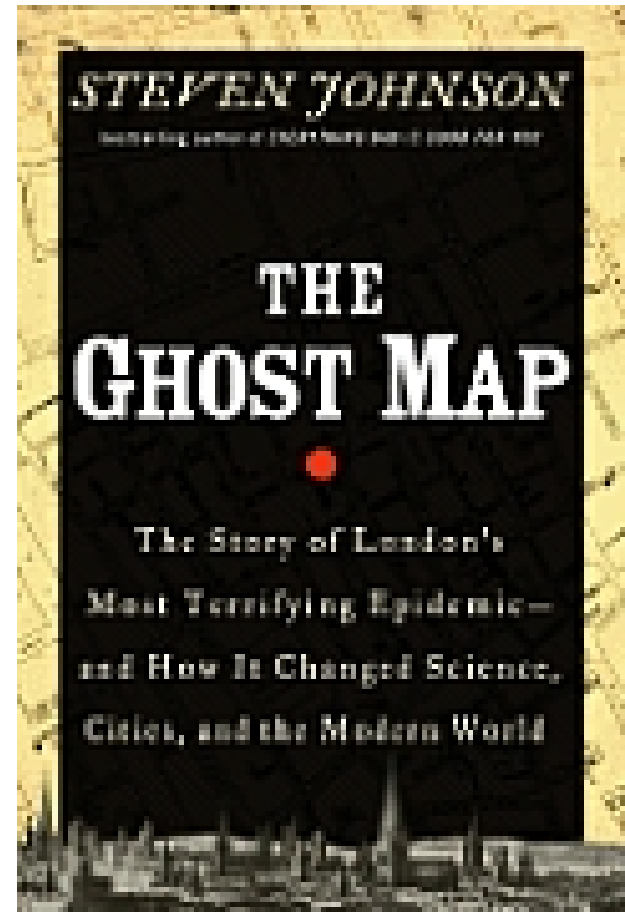
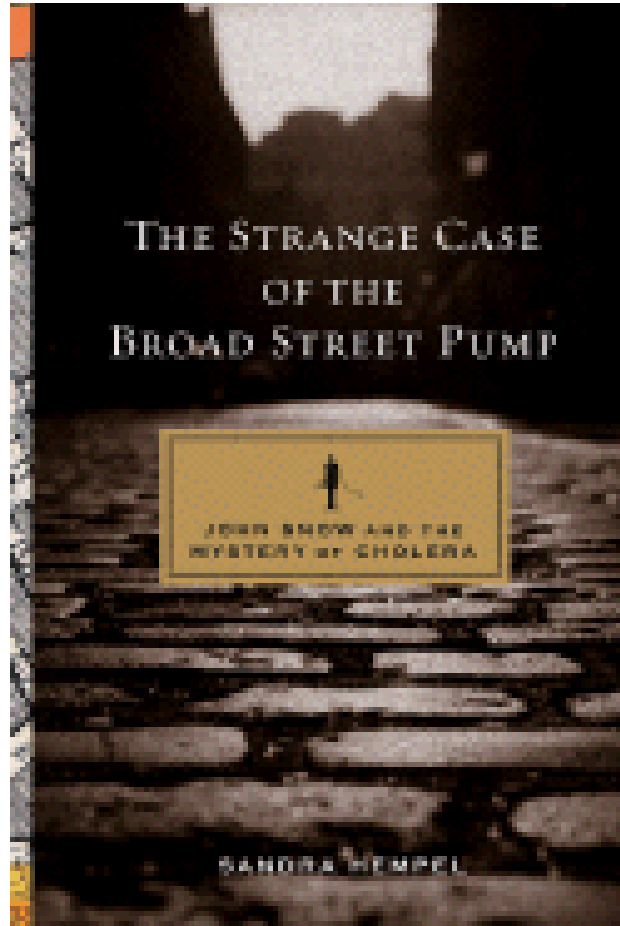
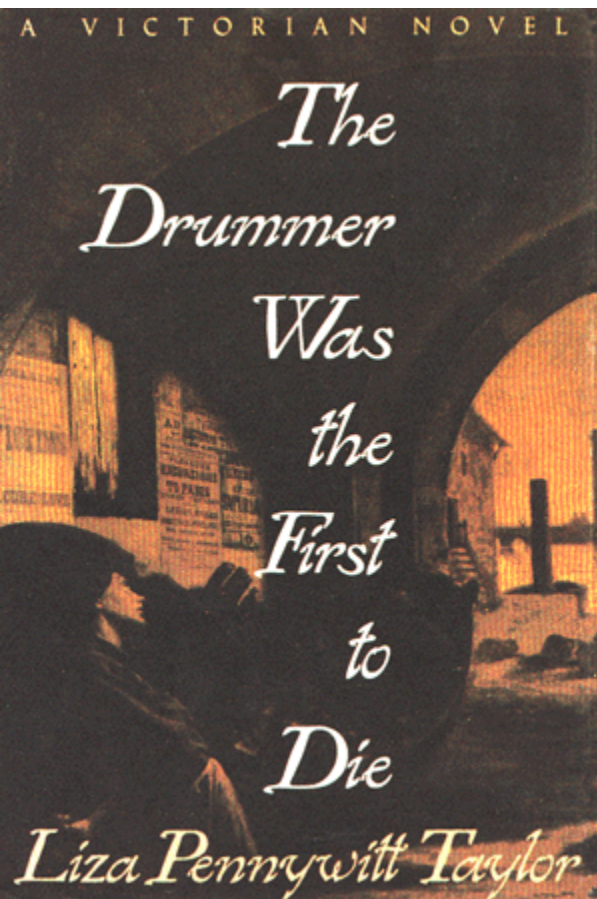
Antarctic Continent shown by Dotted

# John Snow's 1854 map of Cholera

- Shows the frequency and spatial distribution of cholera cases in a London neighborhood
- Revealed the source was a contaminated water pump



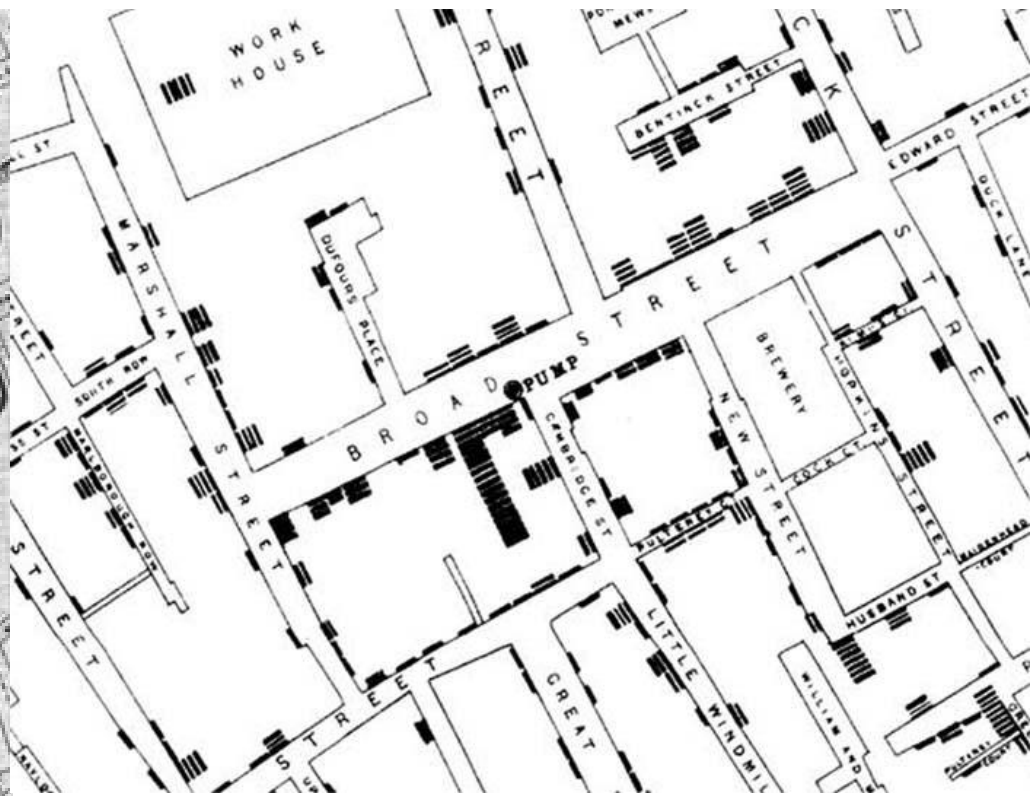
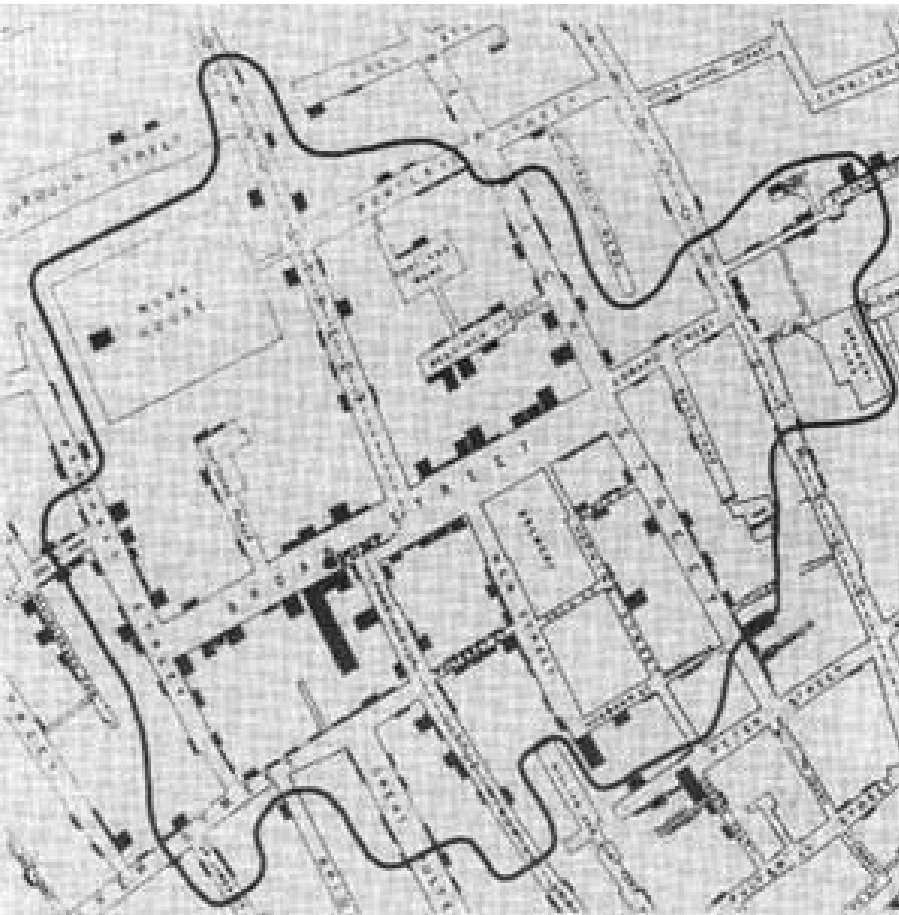
# The Snow Map



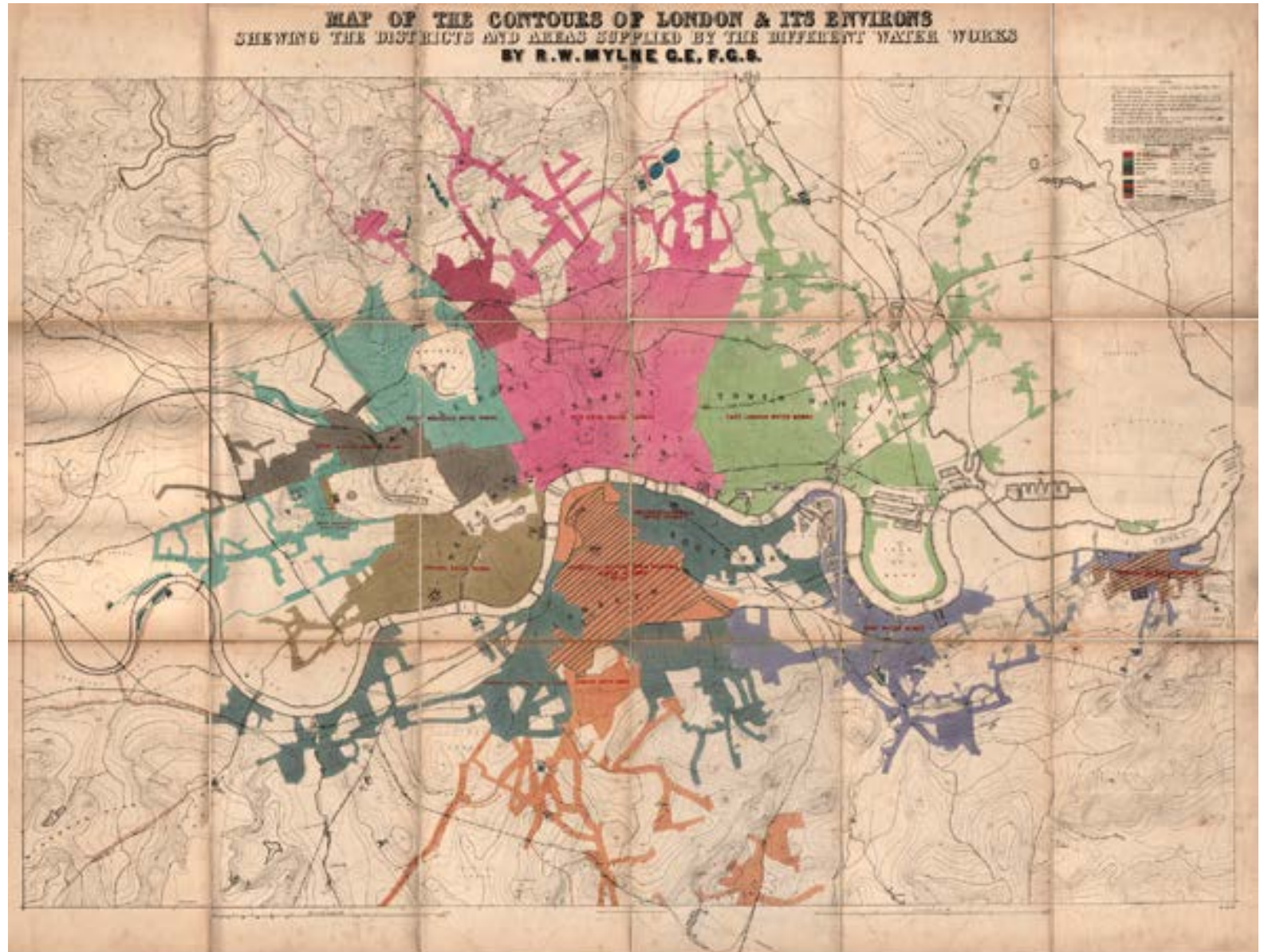
# The Broad Street Pump



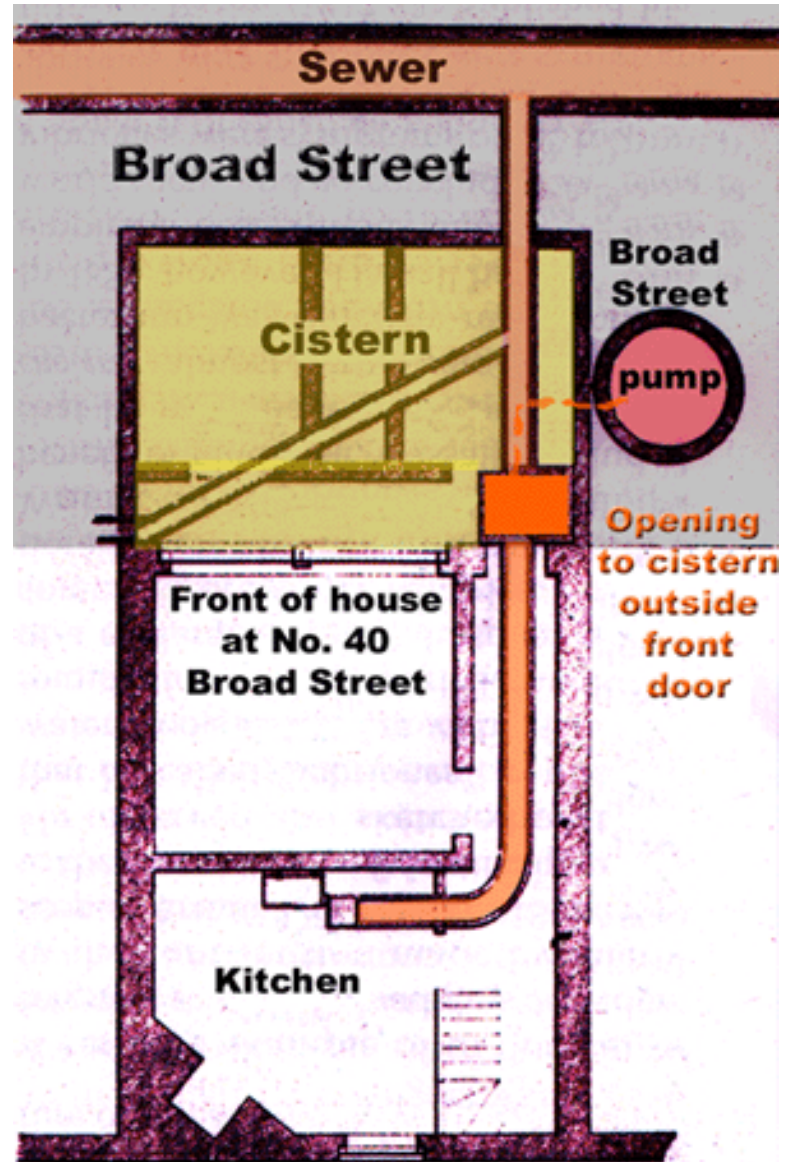
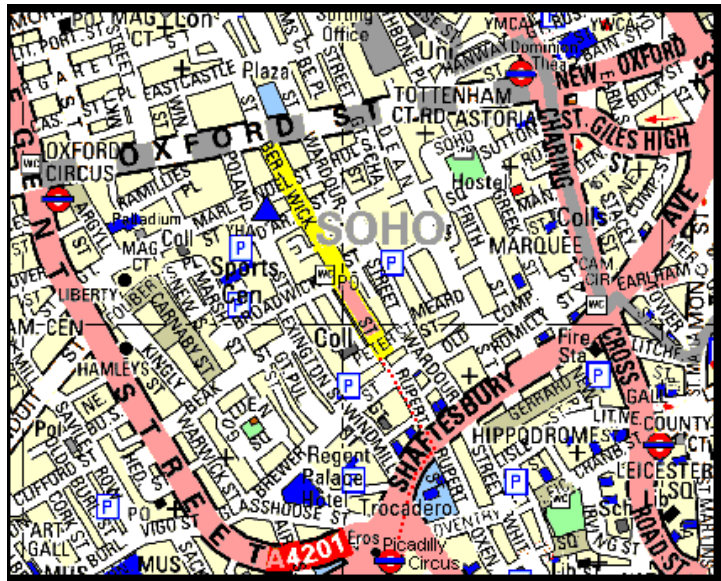
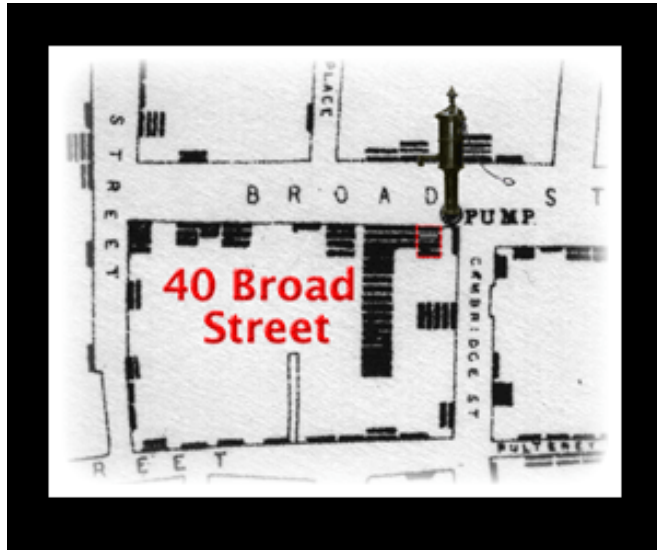
# The Cholera Epidemic of 1854



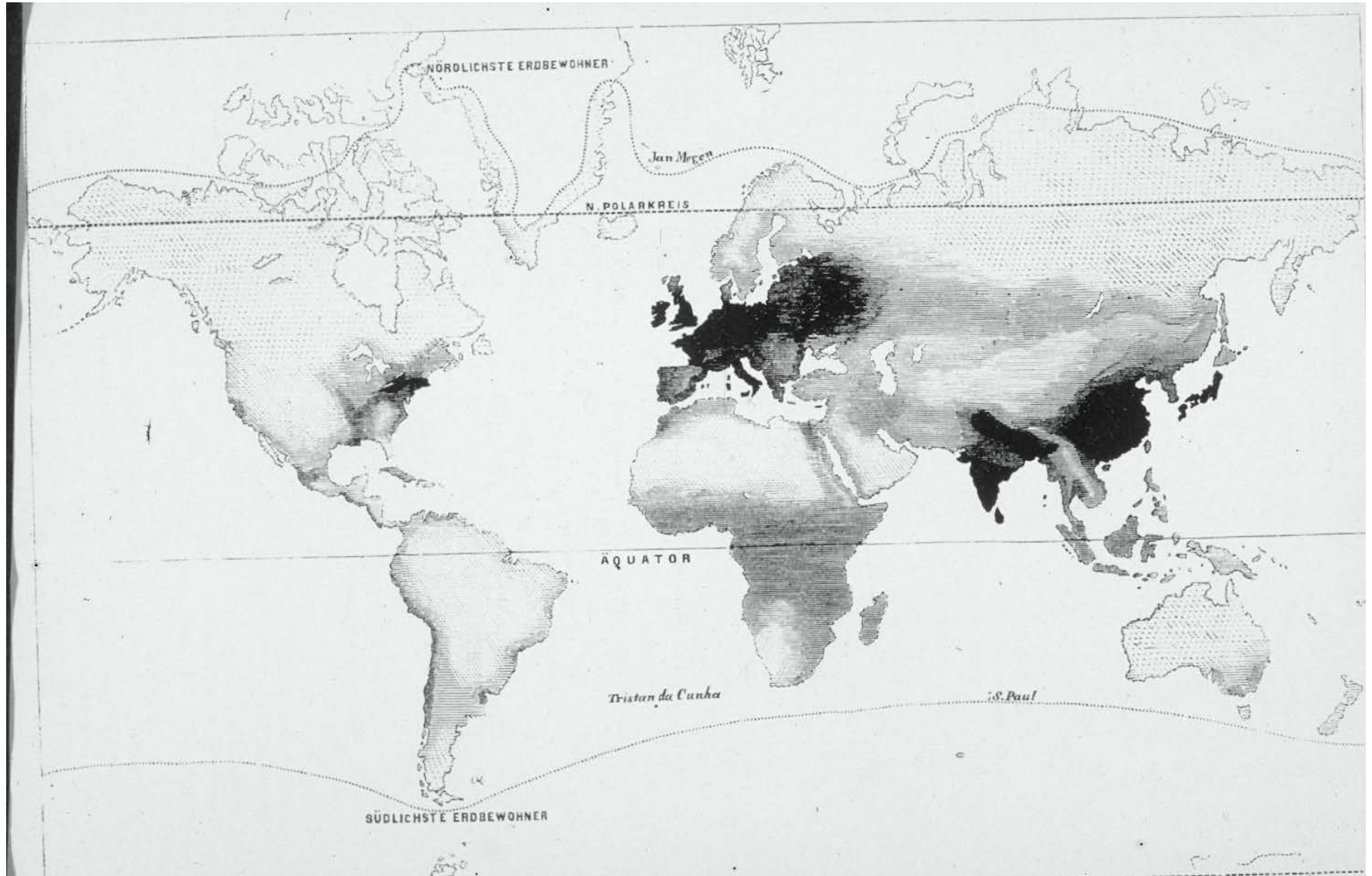
# London Waterworks 1856



# The Index Case



# Petermann's 1859 map of world population density

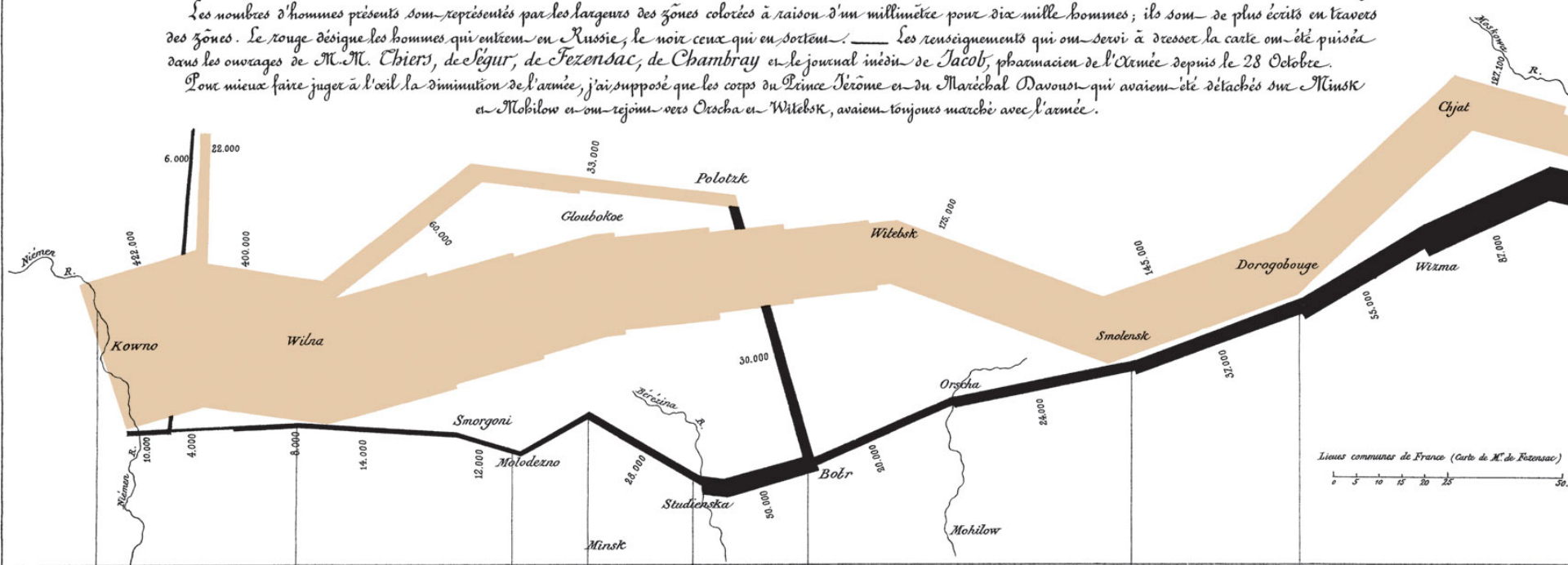




# Minard's 1861 map of Napoleon's march to Moscow

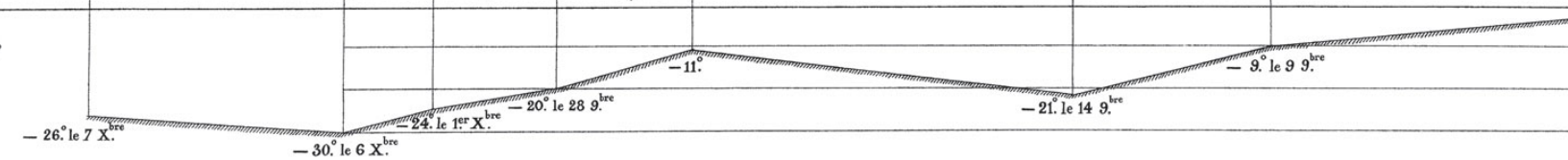
*Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.*  
 Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Chiers, de Légar, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout, qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

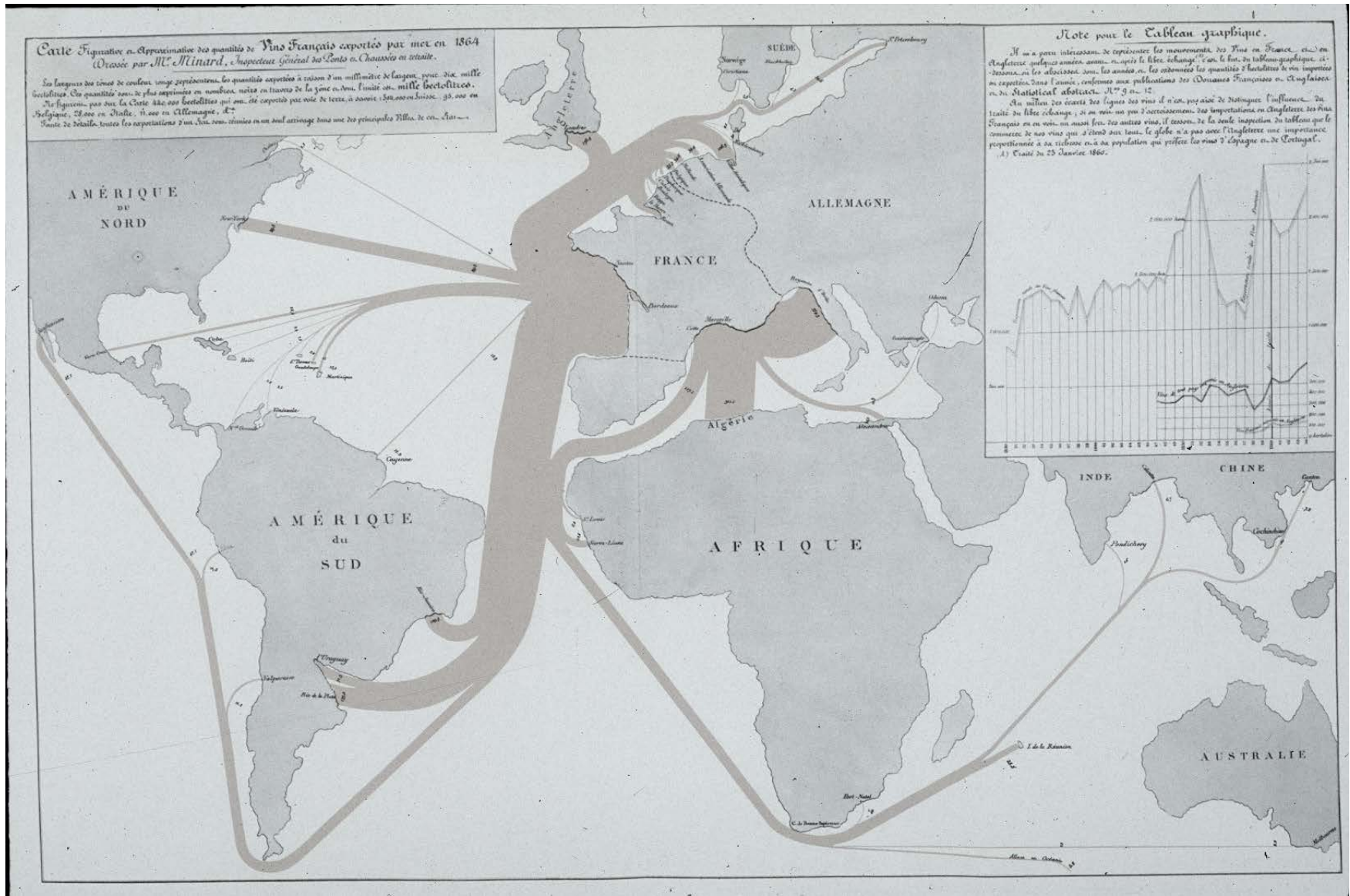


*TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.*

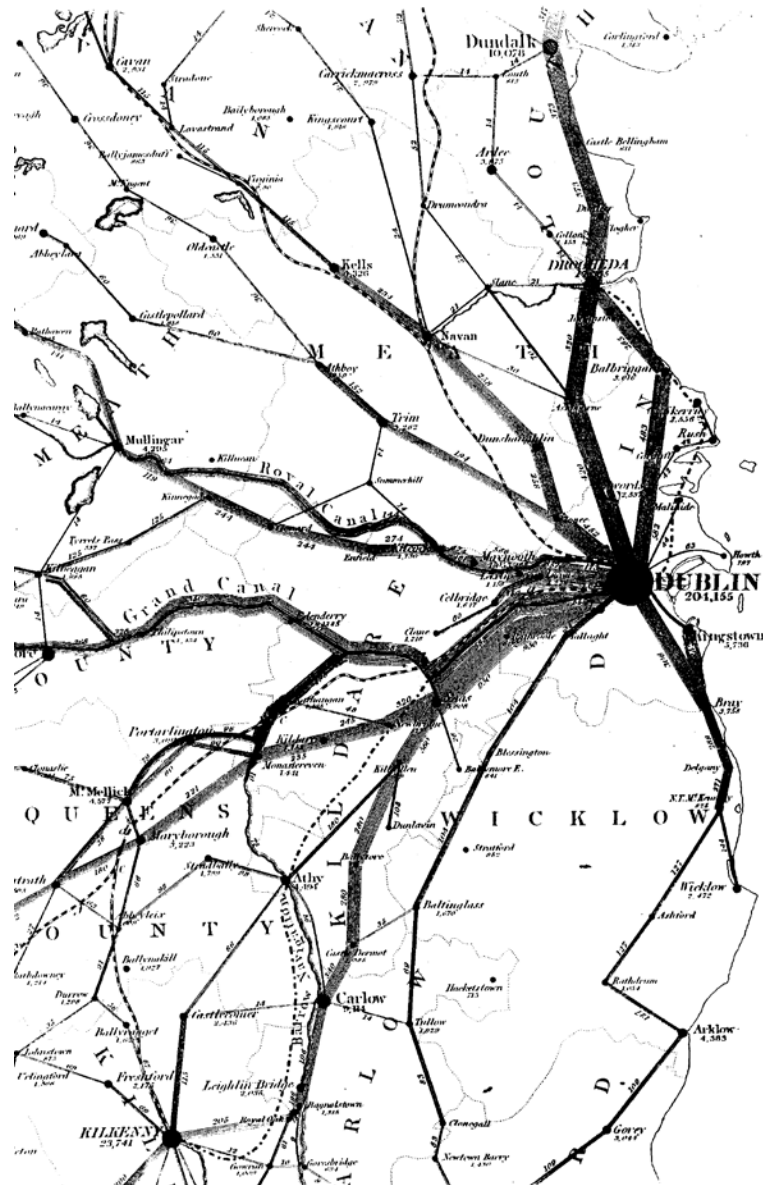
Les Cosaques passent au galop le Niemen gelé.



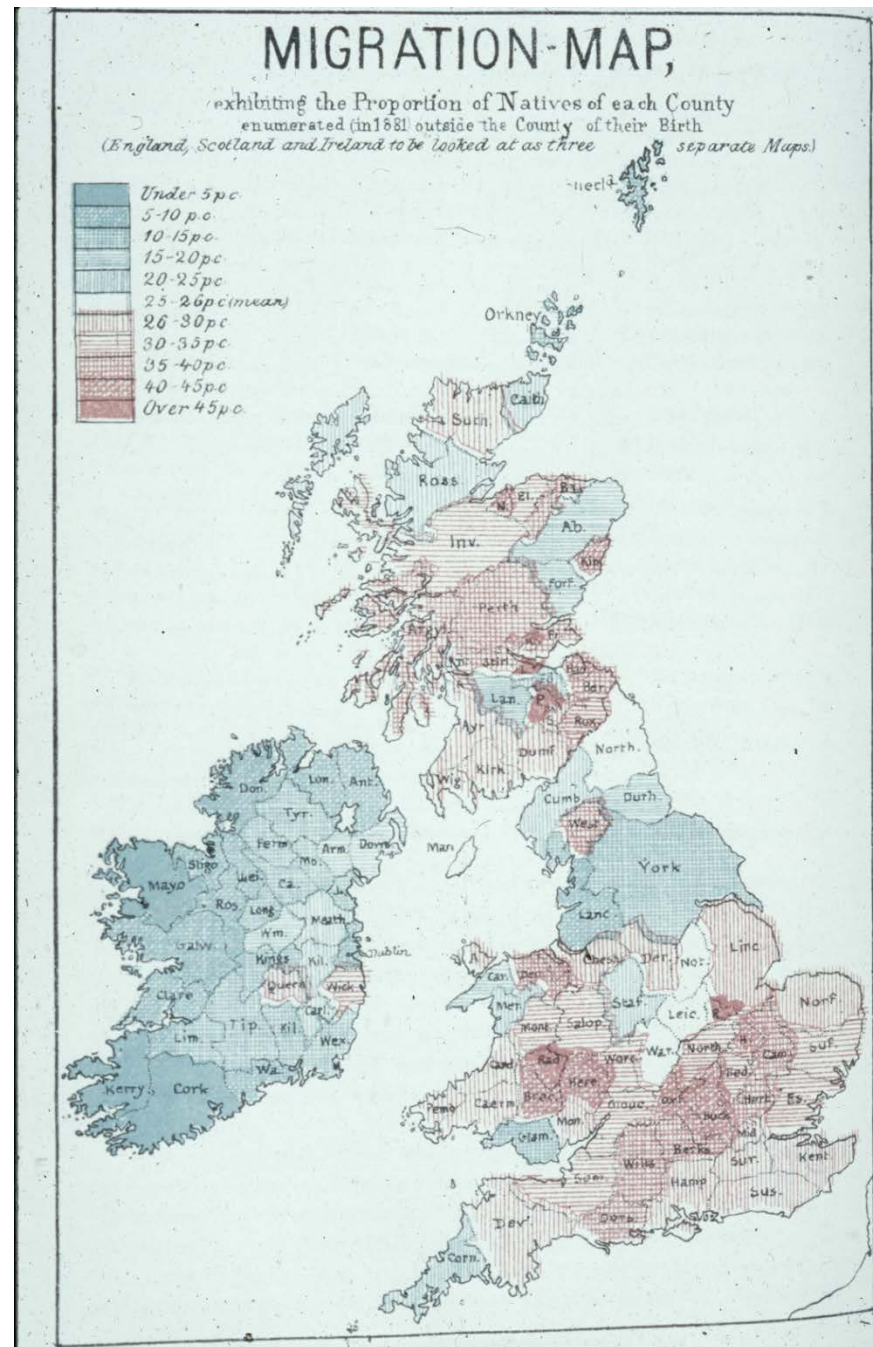
# Thematic map of wine exports from France, 1861 by C.J. Minard



# Harness 1888 Flow of Passengers on Irish Railroads



# Ethnography



# Ethnographische Karte von Nordamerika.

Borghaus' Physikal. Atlas

37. Abtheilung, Ethnographie N° 47.



Geologische Karte  
 von  
**DEUTSCHLAND**  
 und den umliegenden Ländern  
 nach den  
 Bestimmungen des Reichs-Geologischen Instituts  
 1850



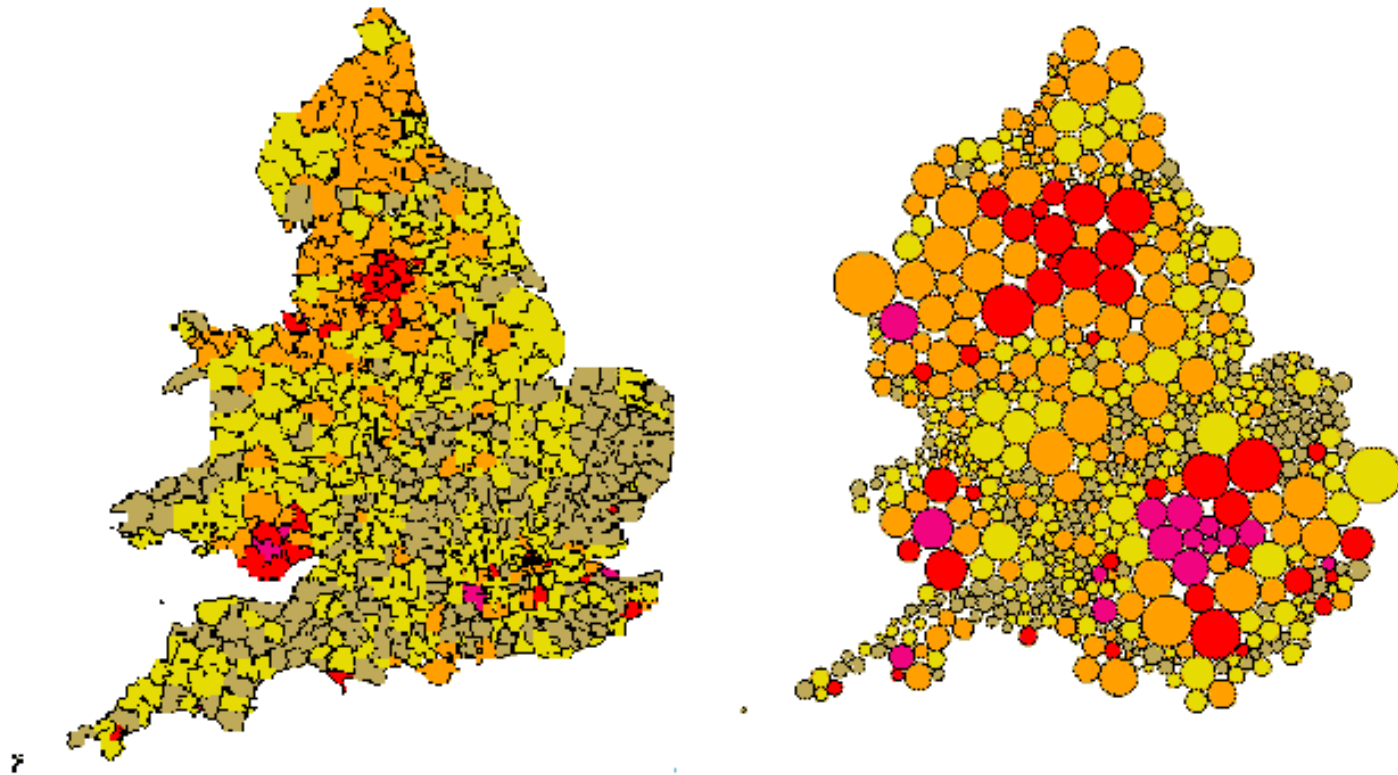
**Legende**

Gebirge	Flüsse	Seen	Sümpfe
Wälder	Straßen	Städte	Dörfer
Inseln	Kanäle	Häfen	Buchten
Gletscher	Brücken	Inseln	Buchten
Gebirge	Flüsse	Seen	Sümpfe
Wälder	Straßen	Städte	Dörfer
Inseln	Kanäle	Häfen	Buchten
Gletscher	Brücken	Inseln	Buchten

Verlag v. Neumann, Neudamm. Geologische Karte von Deutschland und den umliegenden Ländern nach den Bestimmungen des Reichs-Geologischen Instituts 1850.

# Cartograms

COMPARISON OF A TRADITIONAL MAP AND CARTOGRAM REPRESENTATIONS OF THE PERCENTAGE OF THE MALE POPULATION OF WORKING AGE IN 1891



# Geodemographics

## Applying geodemographics

Display in GMS Group
Filter by Ward
Show Public
Help
Show in GMS Group

**Select GMS Group**

- Census Output Areas
- 1a Younger blue collar
- 1b Younger blue collar
- 1c Older blue collar
- 2a Traditional communities
- 2b Settled in the city
- 3a Village life
- 4a Prosperous younger families
- 4b Prosperous older families
- 4c Shopping centre
- 4d Working suburbs
- 5a Senior communities
- 5b Older suburbs
- 5c Public housing
- 6a Settled households
- 6b Least advantaged
- 6c Young families in tenement homes
- 6d Ripping households
- 7a Rural communities
- 7b Afro-Caribbean communities

Schools

Wards

Risk Communities

Background Mapping

**Supergroup Descriptions**

**Supergroup 1: Blue collar communities**

This supergroup with proportions far above the national average are:

- (1) % households that are tenanted
- (2) % households resident in public sector rented accommodation

This supergroup with proportions far below the national average are:

- (3) % households which are flats
- (4) % people between 16 and 24 with higher education qualification

**Supergroup 2: City living**

This supergroup with proportions far above the national average are:

- (1) % people between 16 and 24 with higher education qualification
- (2) % households with one person who is not in employment
- (3) % people not born in the UK
- (4) % households resident in private/other rented accommodation
- (5) % households which are flats

This supergroup with proportions far below the national average are:

- (1) % households which are detached
- (2) % households with non-dependent children
- (3) % of resident population aged 5-14

**Supergroup 3: Suburbia**

This supergroup with proportions far above the national average are:

- (1) % households with 2 or more cars
- (2) % people aged 16-24 in employment who have moved from home
- (3) % people aged 16-24 in employment working in agriculture and fishing
- (4) % households which are detached

This supergroup with proportions far below the national average are:

- (1) Population density (number of people per hectare)

See information: <http://www.localdata.org.uk/>



# History of Academic Cartography

- Cartography at US universities is relatively new
- One seminal figure...

# Arthur Robinson

- Hired in 1945 at the University of Wisconsin (Ph.D. Ohio State)
  - Established a cartography program at UW
  - Published “The Look of Maps”
  - Started first American journal in cart, “The American Cartographer”
  - His graduate students went on to spread the word

# Arthur Robinson

- What's his most famous achievement?

# Arthur Robinson

- What's his most famous achievement?



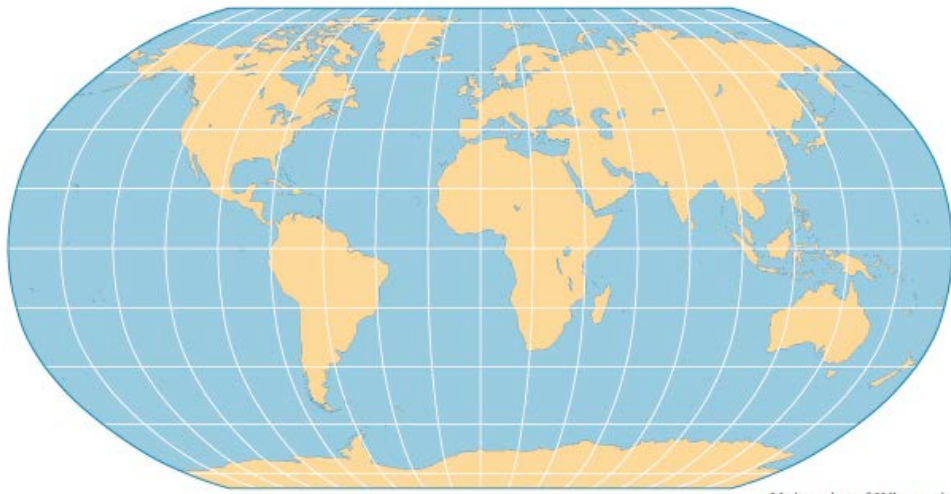
# Arthur Robinson

- The Mercator Problem



# Arthur Robinson

- The Robinson Projection



University of Wisconsin



# Thematic cartography

- Relatively recent
- Can be quantitative or qualitative attribute
- Most methods invented for particular problems
- What about statistical graphics and visual analytics?