Map Animation

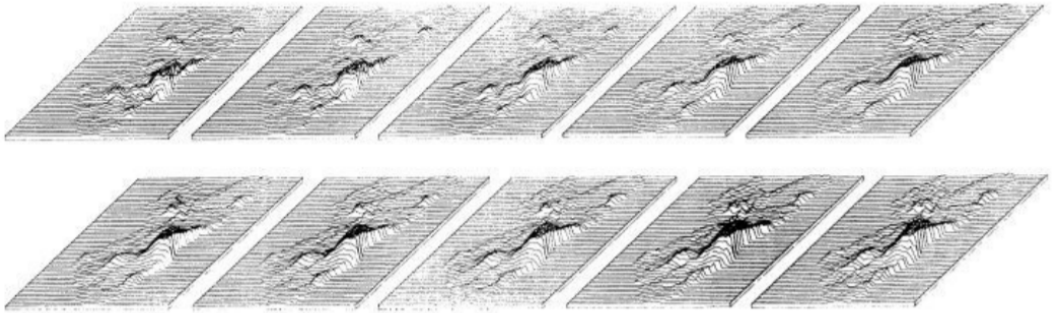
GEOG 5201 – Spring 2022

Outline

- Definition
- Visual variables
  - Basic
  - Additional
- Categories
  - Temporal
  - Non-temporal

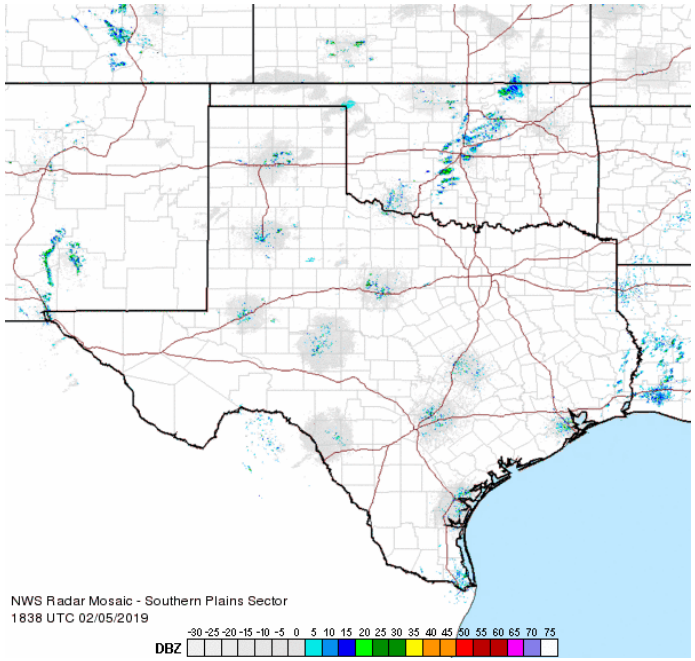
Definition

- Map animation: the use of different motion techniques (largely devised by the film and cartoon industry over the past 100 years) to display data change on a map
- Tobler created one of the first computer-based map animations in 1970 to portray population growth over a specified time in Detroit
- Animated maps are used to visualize a wide range of data topics
  - Weather
  - Health
  - Demographic statistics
  - Travel routes

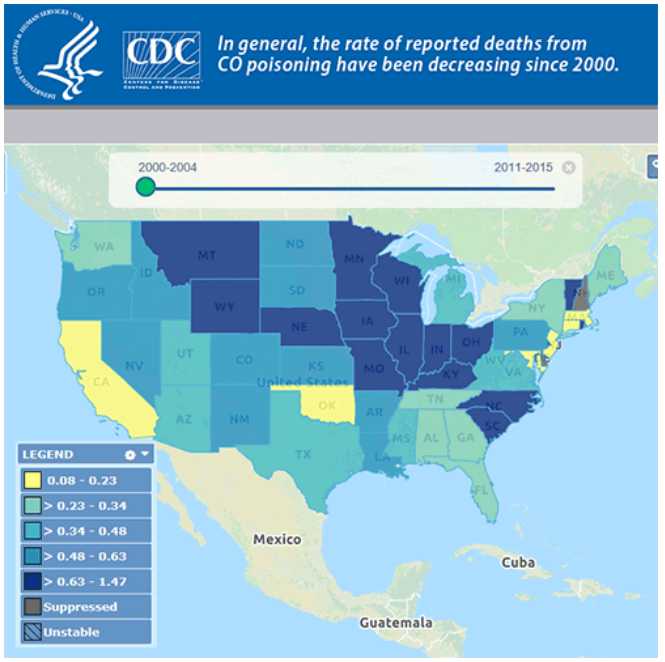


Simulated population growth, Detroit Region. Selection of ten-year interval frames from computer movie. Top row 1910 through 1960, bottom row 1960 through 2000, (non-linear vertical scale).

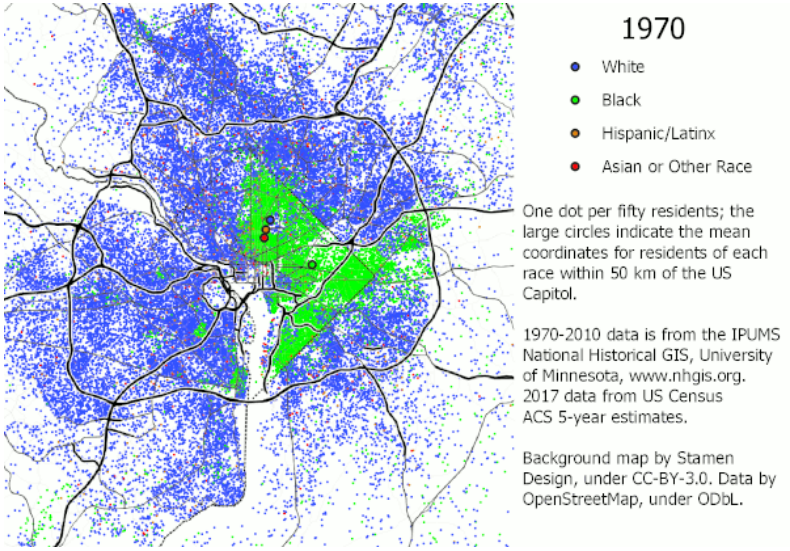
Weather



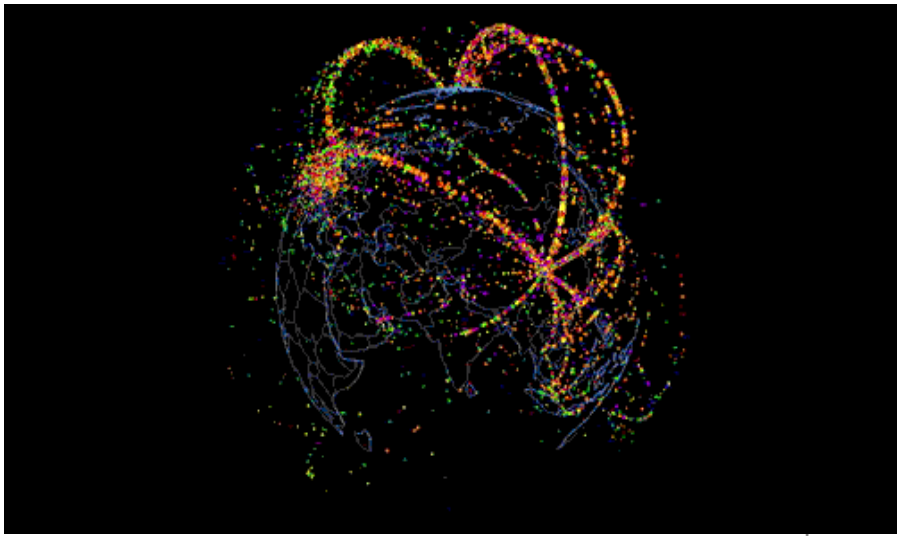
Health



Demographics

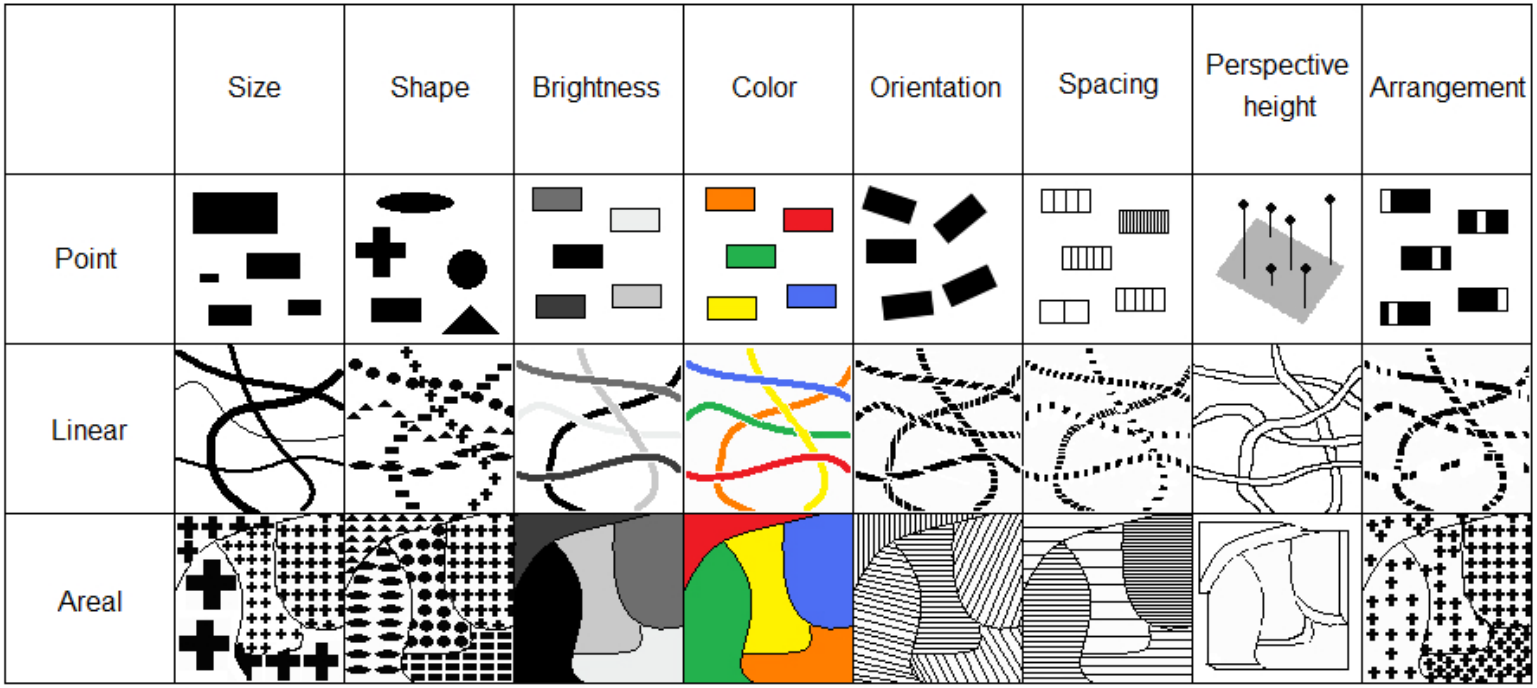


Global trade



Basic Visual Variables

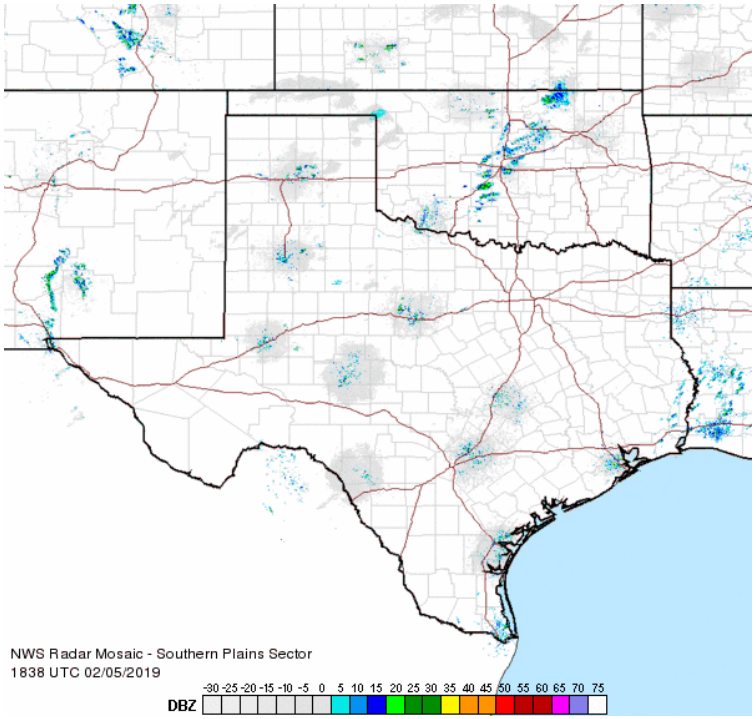
- Any basic visual variable can be applied to animated maps



Question 5-1-1

Which basic visual variable(s) is/are used in the following animated map?

i. Color
ii. Arrangement
iii. Shape
iv. Size

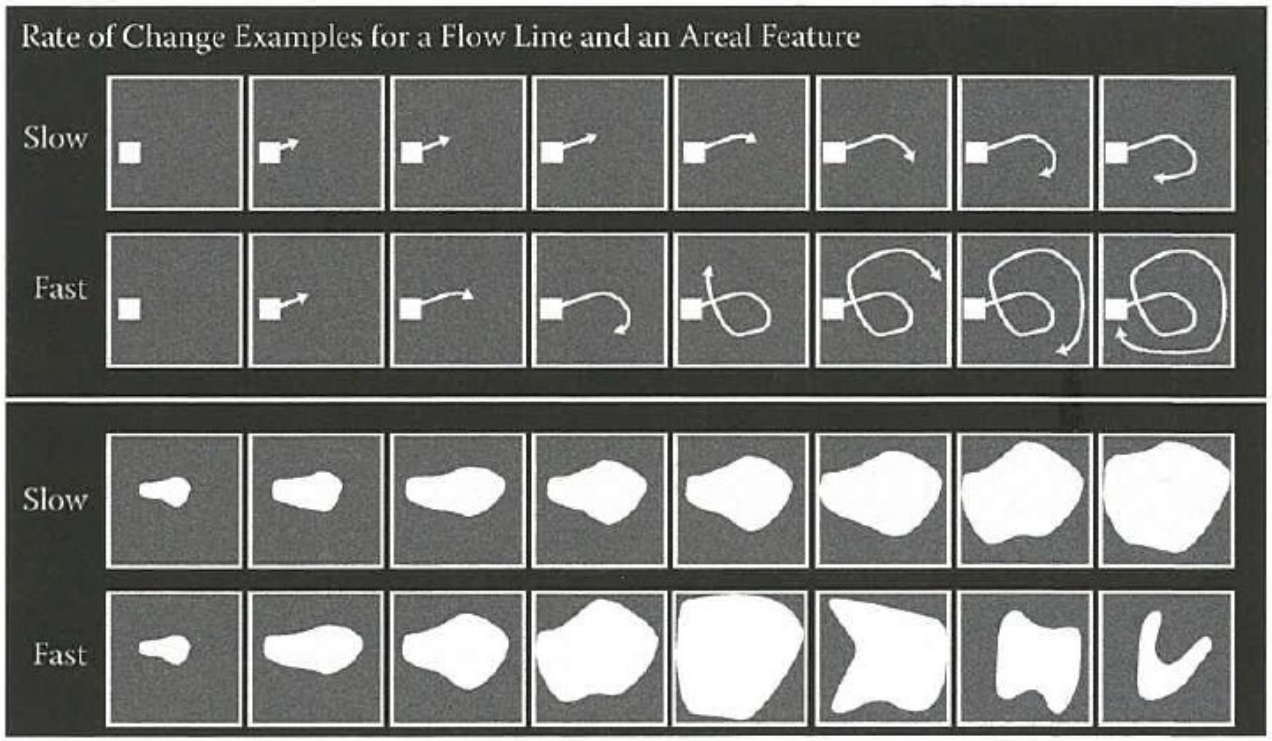


Additional Visual Variables: Duration

- Duration: the length of time that a scene of an animation is displayed
  - Scene: a static map in the animation; also termed a frame
- Can be used to represent quantitative data
  - Example: animated electoral college votes for president, varying the duration of each scene in direct proportion to the magnitude of the victory in each election

Additional Visual Variables: Rate of Change

- Rate of change: how much the map changes between each animated frame
  - Defined as *m*/*d*, where *m* is the magnitude of change (in position and attributes of entities) between scenes, and *d* is the duration of each scene



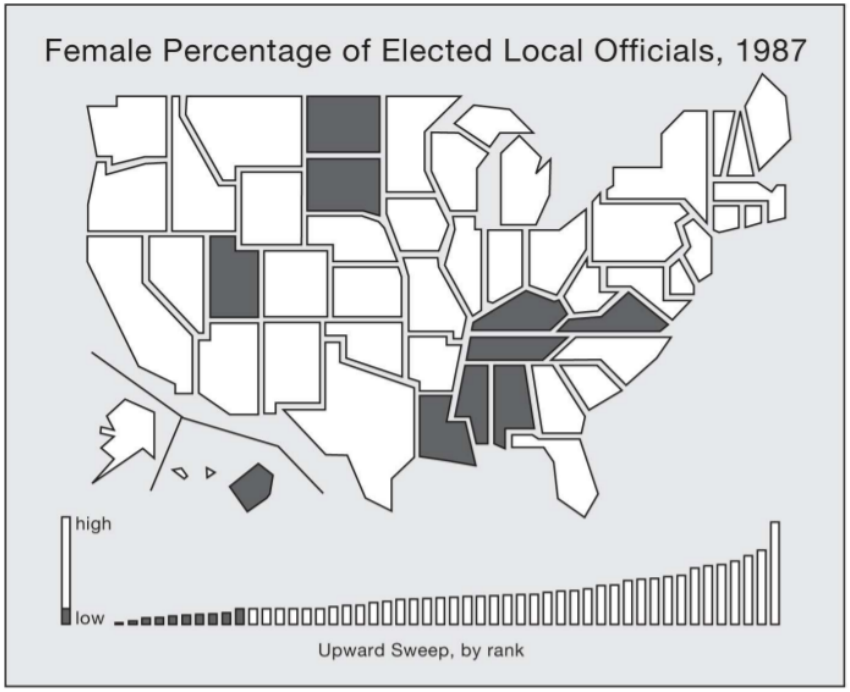
Question 5-1-2

Which of the following indicates a smoother animation?

i. Lower duration of scenes
ii. Lower rate of change
iii. None of the above
iv. Both (i) and (ii)

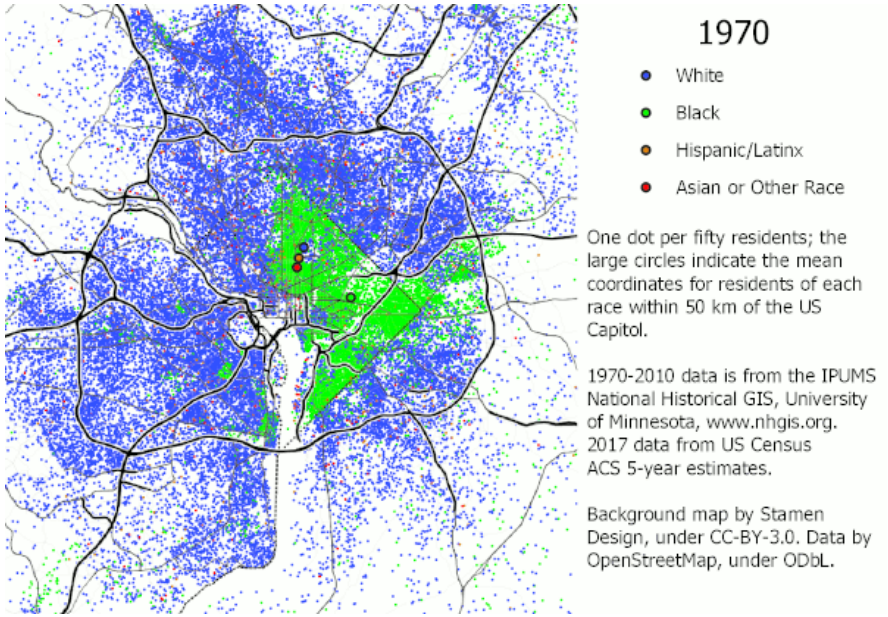
Additional Visual Variables: Order

- Order: the sequence in which frames or scenes are presented
  - Often presented in chronological order
- Rearrange scenes by value can also provide useful information
  - Example: lower female percentages of elected local officials are presented first



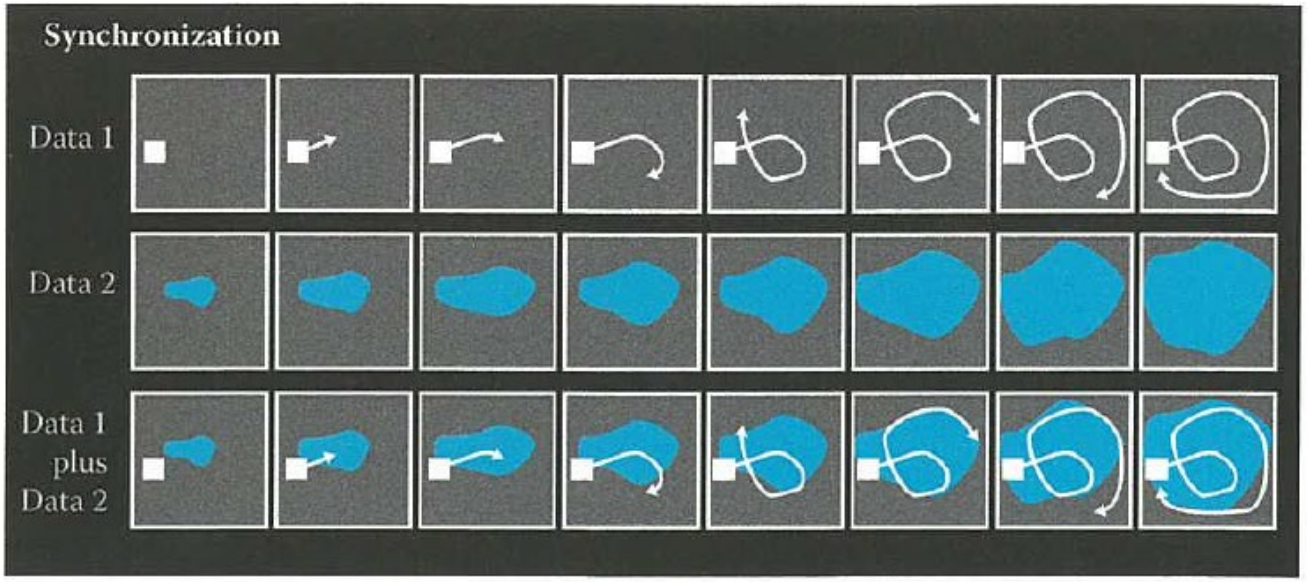
Additional Visual Variables: Display Date

- Display date: the starting time of a temporal sequence
  - Example: in the animated map below, we might note that the scene first appears in 1970



Additional Visual Variables: Frequency and Synchronization

- Frequency: the number of scenes per unit time
  - Also termed temporal texture
- Synchronization: the coincidence (or otherwise) of time series when two or more are displayed at once
  - Example: snowfall and school attendance might be displayed out of sync
  - Useful for highlighting temporal correlations and relationships



Question 5-1-3

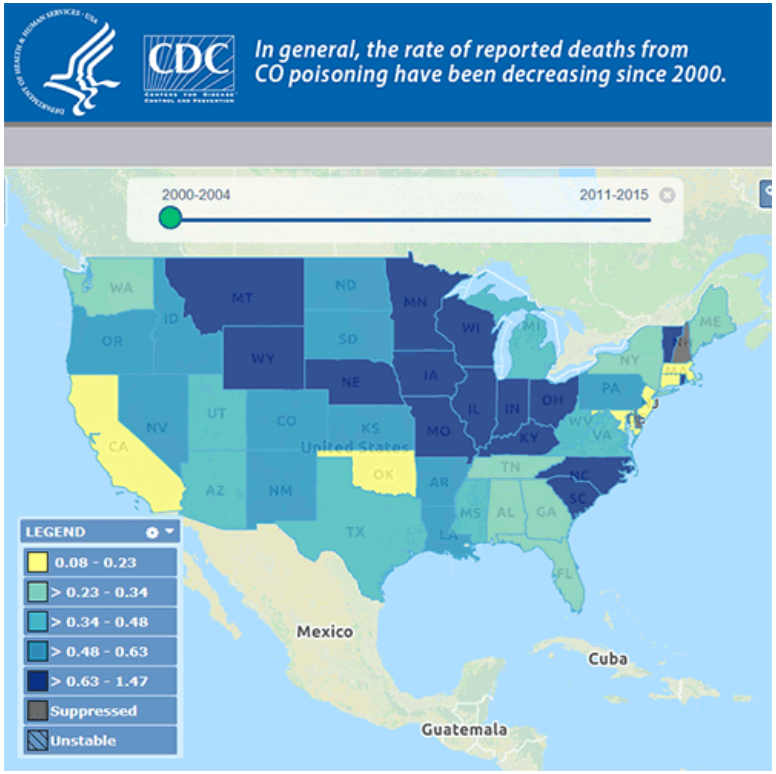
A. What is the relationship between duration and frequency?
B. Can you think of two time series that are synchronized?

Types of Map Animations: Temporal

- Animations emphasizing change over time
  - Change in position
    - Example: a moving point of the mean center of the United States population for each decennial census

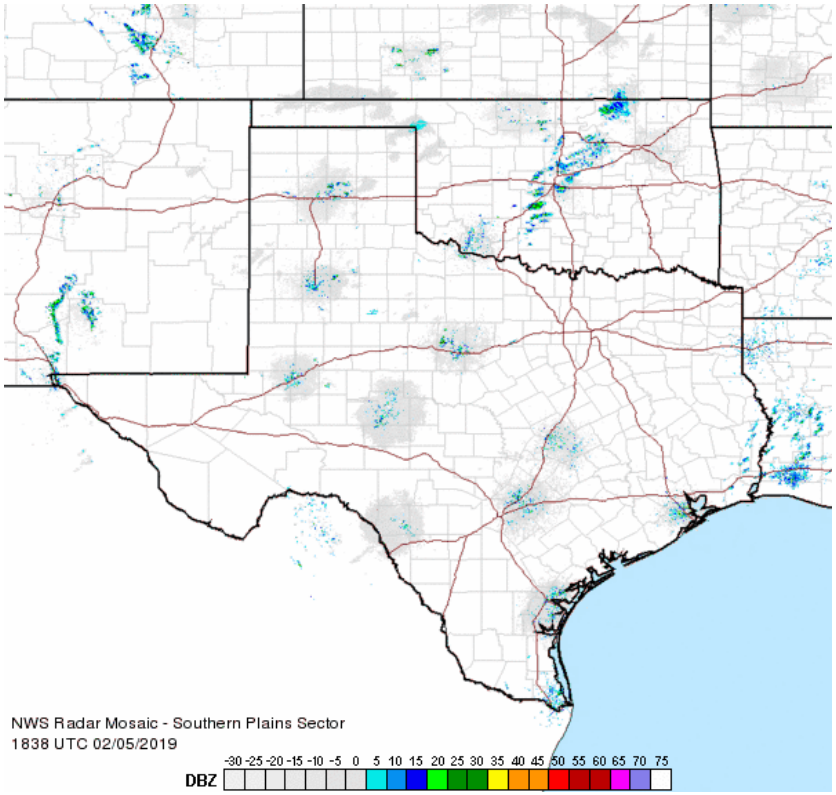
Types of Map Animations: Temporal

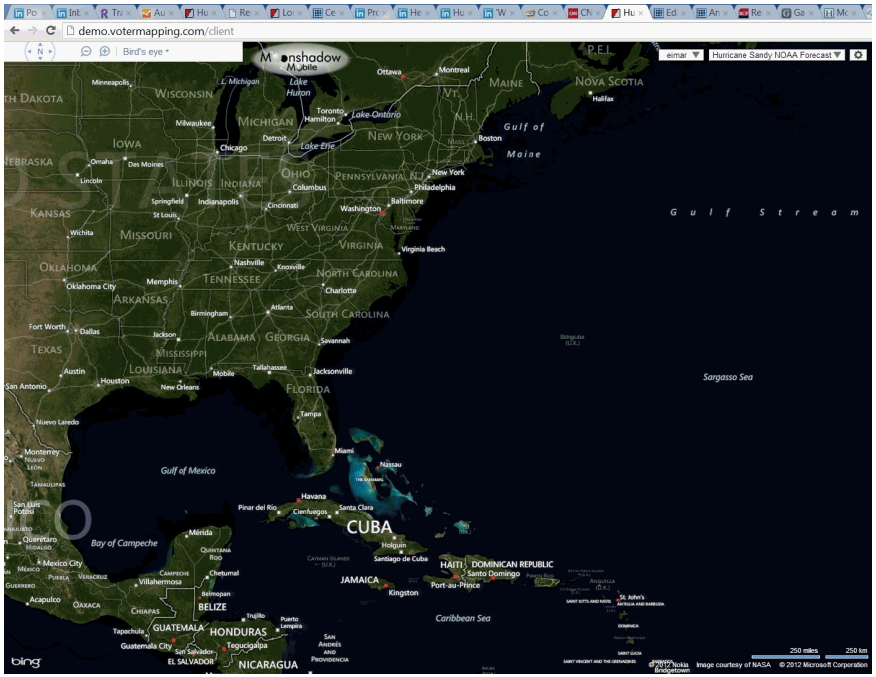
- Animations emphasizing change over time
  - Change in attribute
    - Example: animated choropleth map

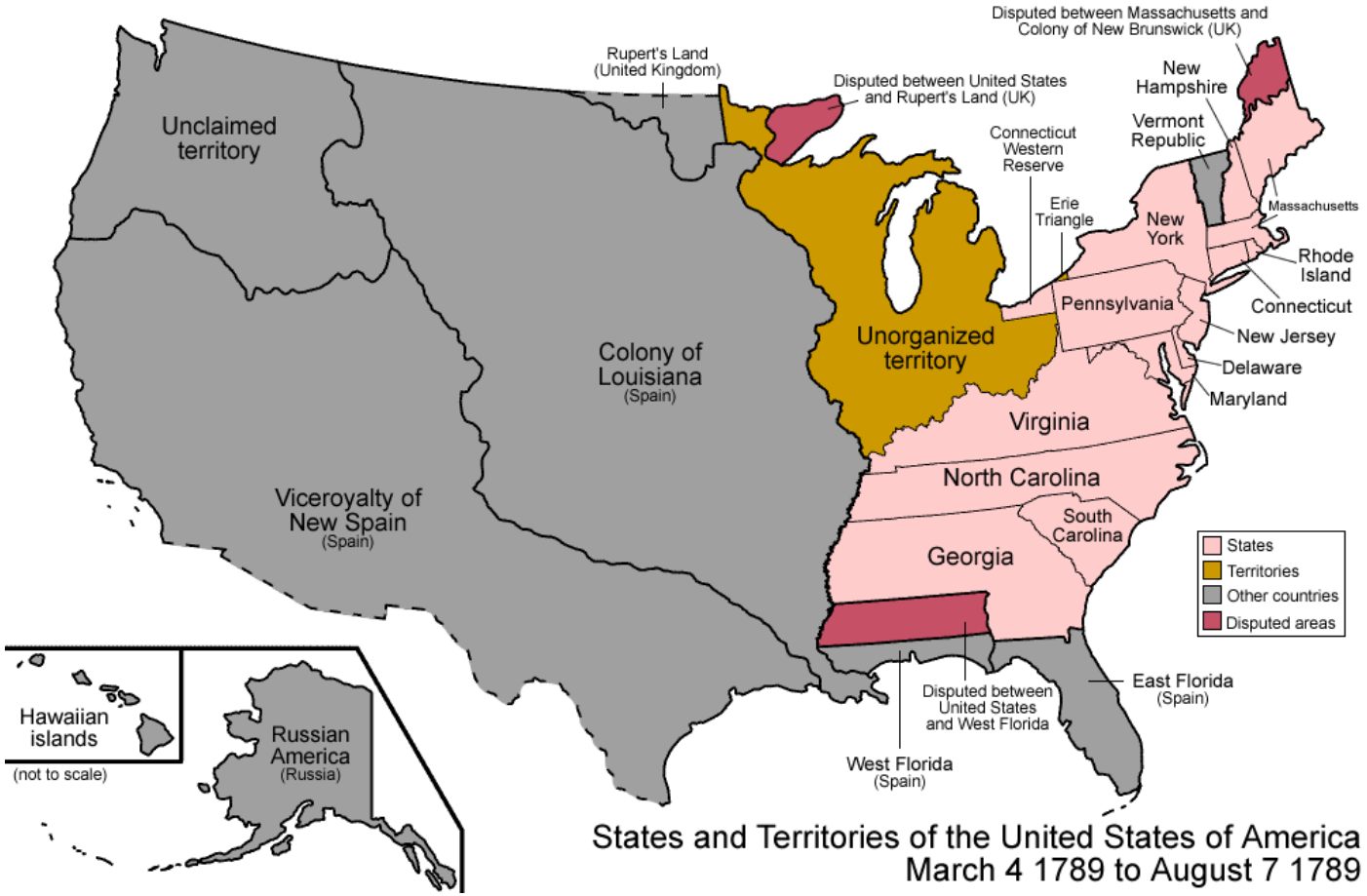


Types of Map Animations: Temporal

- Animations emphasizing change over time
  - Change in shape and size
    - Example: extent of precipitation/hurricanes







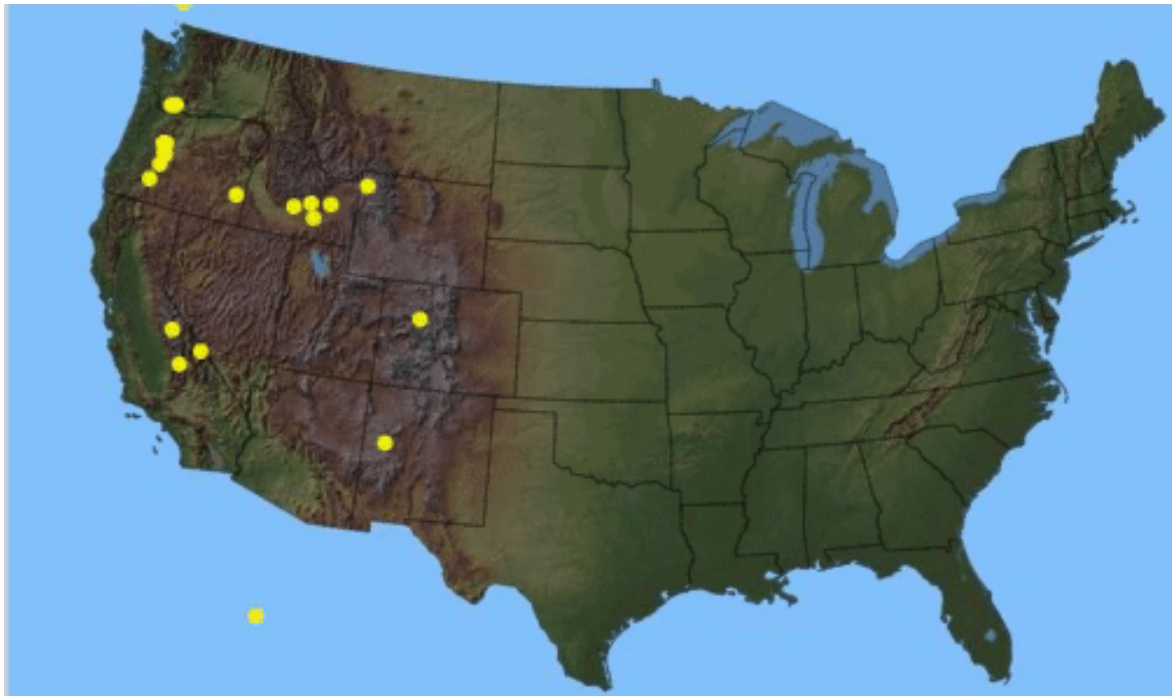
170 Years of America's Evolution In One Animated GIF

Question 5-1-4

Give another example that uses animation to emphasize change in shape and size. You don’t need to attach the source of the animated map.

Types of Map Animations: Non-temporal

- Animations emphasizing location
  - Example: flashing points to emphasize locations of volcanos

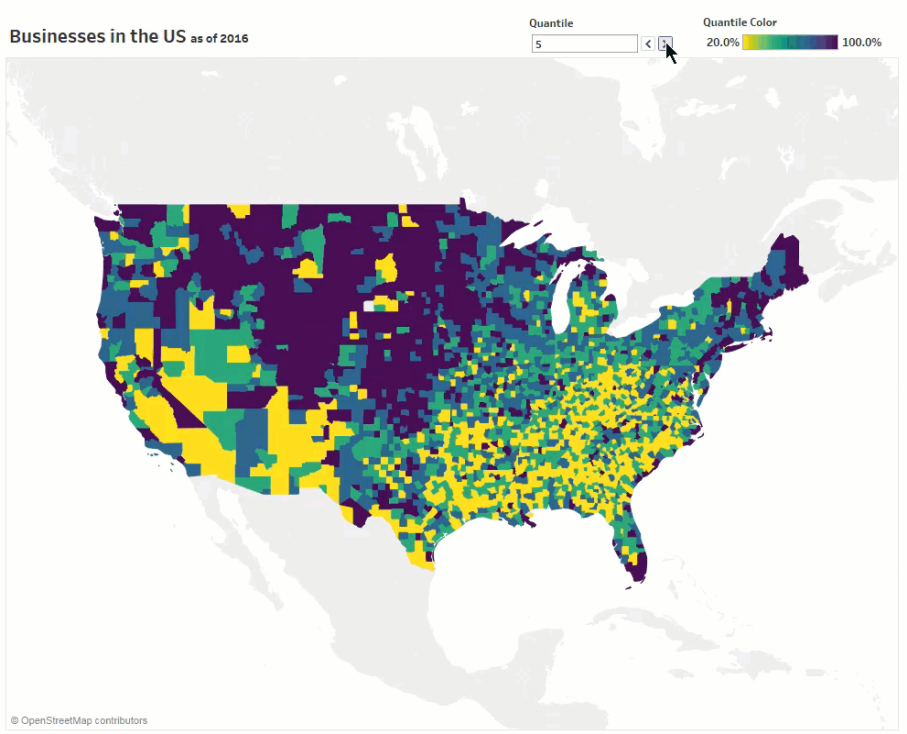


Types of Map Animations: Non-temporal

- Fly-over animations
  - Give the feeling of flying over a 3D surface
  - Example: a low-speed fly-by over Duke University
  - Recall the advantages and disadvantages of 3D visualization

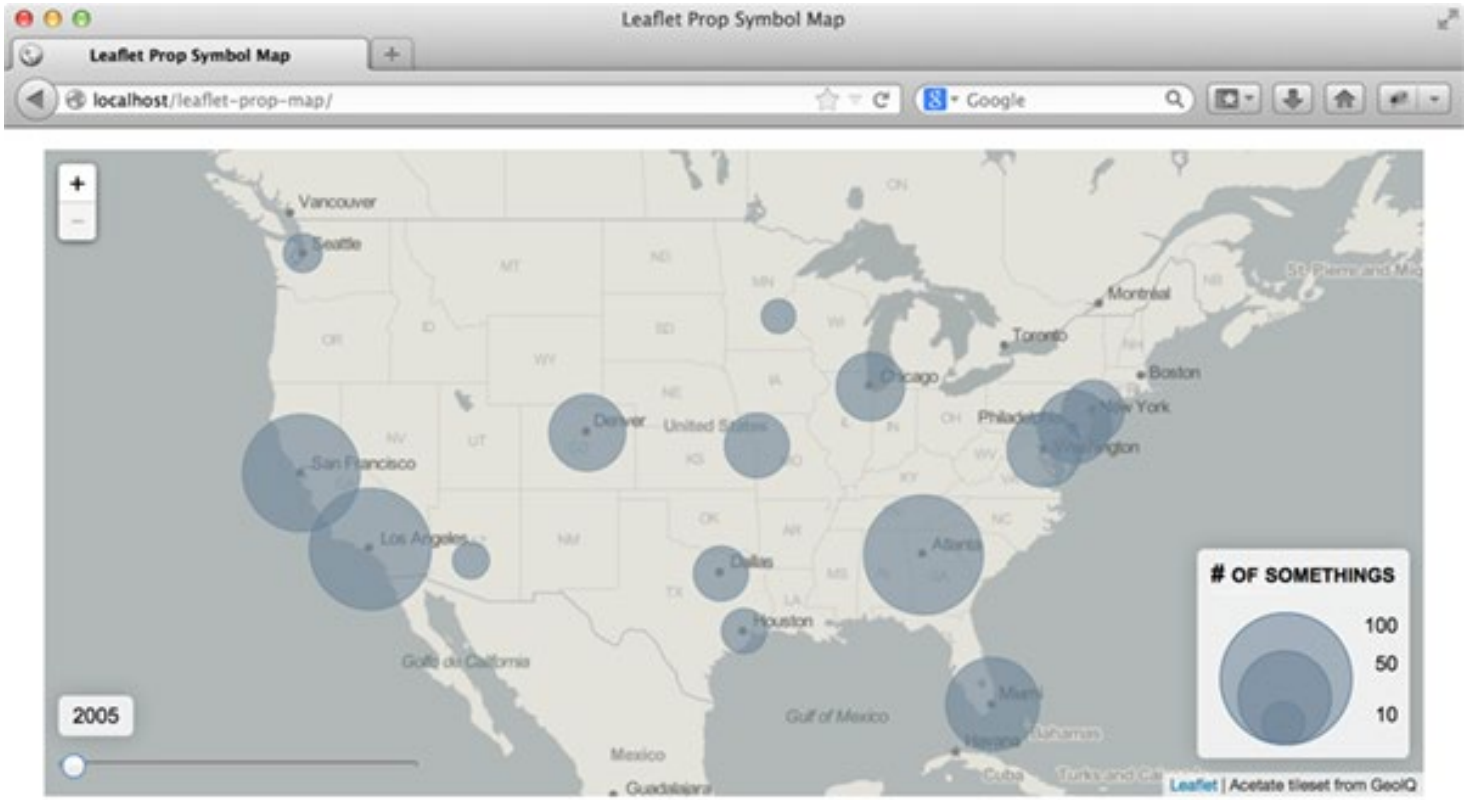
Types of Map Animations: Non-temporal

- Animation emphasizing the spatial distribution of an attribute
  - Example: present data quantiles from low to high



Tips for Designing Animations

- Although this may seem like a “no-brainer,” people do not always interpret animated data accurately
- Keep the animations short
  - Animations that are too long overwhelm the viewer’s short-term memory
  - Perhaps 30 seconds to 1 minute (?)
- Simplify the data
  - Do not use animation to communicate an excessively complex message – no matter how cool it looks
  - Humans can only focus on 3-4 things at any single moment
- Give the map user some control
  - It can be frustrating when there is no option to pause or rewind
  - Pairing buttons with a slider give very good flexibility



Time series with Leaflet and Java by slider

More Map Animation Examples

- New York Times Web traffic June 25th 2009
- World history
- Battle of the Wilderness
- Flight Aware Real time air traffic
- Real time Marine traffic