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# The Growth of a Nation

## CS171 Data Visualization Final Project

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## Introduction

The century from 1800 to 1900 marked one of incredible growth for the United States. It experienced a population explosion of over 1500%, its land population increased by over 400% and by 1900 it had developed 215,000 miles in a rail network that was unrivaled throughout the world. My goal in this data visualization is to show the growth in these areas throughout the 19th century.

## Background Motivation

During a vacation in early 2015, I experienced multiple forms of transportation including air, ship and bus travel. As I marveled my ability to travel from New Hampshire to Florida in 3 hours, I thought back to the history of transportation and how the early growth of the railroads in the country led to a revolution that has made world travel a trivial event. Upon returning from vacation, out of curiosity I looked up travel time in the early 1800's and was reminded that prior to the railroads, my trip from New Hampshire to Florida would have taken three to four weeks of what was undoubtedly uncomfortable travel. During this vacation, I was already thinking about what my topic would be for this course and after returning and starting to do some research and leaving with unanswered questions, I thought this would be the perfect option for a data visualization.

## Project Objectives

The primary goal of this data visualization is to show a visual progression across North America and show the amount of growth sustained during that century in state, land, population and railroads. I primarily want to see the population growth as it related to the railroads. We know that before the railroads, the only way to get from east to west coast was via covered wagon which took months and had very high risk. How much did the new train lines influence population increases? How long did it take? Were people still primarily in the cities or did they move outward? How far beyond the train lines did people move? Did populations increase because the trains were coming or because they were already there? These are some of the questions that I want to answer with this visualization.

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# Data and Processing

## Sources

**US Outlines json:** [Mike Bostock's US Atlas](#) + [QGIS](#)

**State Outlines json:** [Eric Celeste's US GeoJSON files](#) + [QGIS](#)

**US Railroads json:** [Mike Bostock's US Atlas](#) + [QGIS](#)

**US Population data:** [University of Virginia Historical Census Browser](#)

**US Railroad data:** [1900 Railmap at Perry-Casteneda Map Collection at Texas](#)

**US Railroad data:** [American Railroads: Their Growth and Development at Central Pacific Railroad Photographic History Museum](#)

**US Railroad data:** [Library of Congress Railroad Collection](#)

**Latitudes and Longitudes data:** [findlatitudelongitude.com](#)

## Data Processing

As of today, 29 March, this project has involved a considerable amount of data manipulation before even getting the project off the ground. By starting to think about this project in January, I was able to start data crunching long before learning the d3 skills to develop the project. The biggest part of this was manipulating the railroad data. Due to the sheer amount of rail lines (215,000 miles by the year 1900), I opted to focus on primary trunk lines and left out smaller lines that were local and didn't go far. Doing this though, I still had to start with the existing shapefiles available for railroads today and using the software program QGIS, I was able to delete extraneous lines and shrink the data set down to trunk lines. I then manipulated the lines to be broken down according to decade built. After the final work in QGIS, I used the software tool ogr2ogr to convert the files to GeoJSON format suitable for working with in d3.

In addition to working with the rail data, I also had to collect and manipulate city data and then add latitude and longitude data to it. The geojson county files from Eric Celeste were already formatted with ID's and names which will allow me to map county census data to the county graphical objects. I also had to go through and create various US outlines as the currently available files for the outline of the US are obviously for all 50 states + territories which were obviously incorrect for the years being observed.

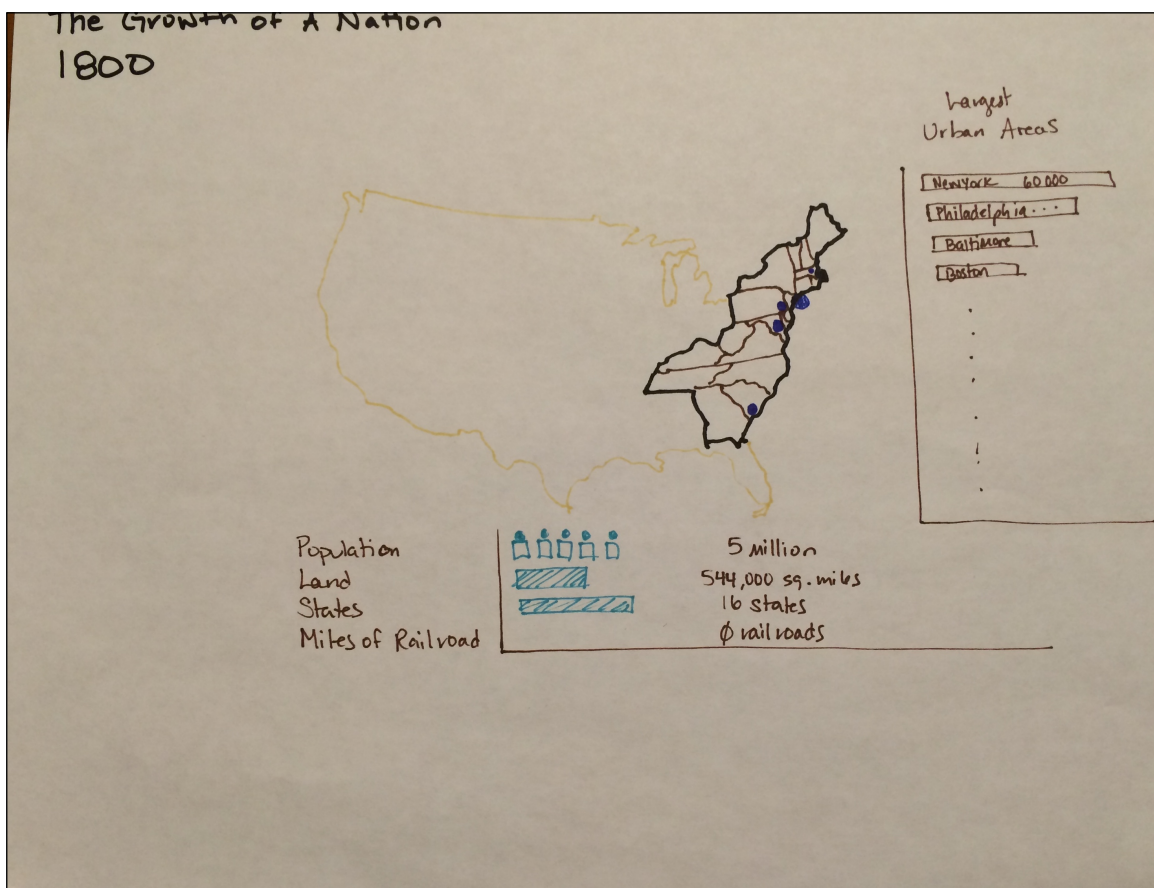
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# Visualization Design

## Design Areas

### Primary Map Area

The primary area for viewing will be the central map area. This will be the area seen in the images below with the map in it. It will include current US outlines, states and counties for the country at the date selected. In the images, the US outlines can be seen in black, with states in brown. Also in this area will be the railroads which are visible in purple. Also visible are the cities in blue which will be bubbles that vary in size based on current population. Cities shown will be in the top 100 largest urban areas based on census data.

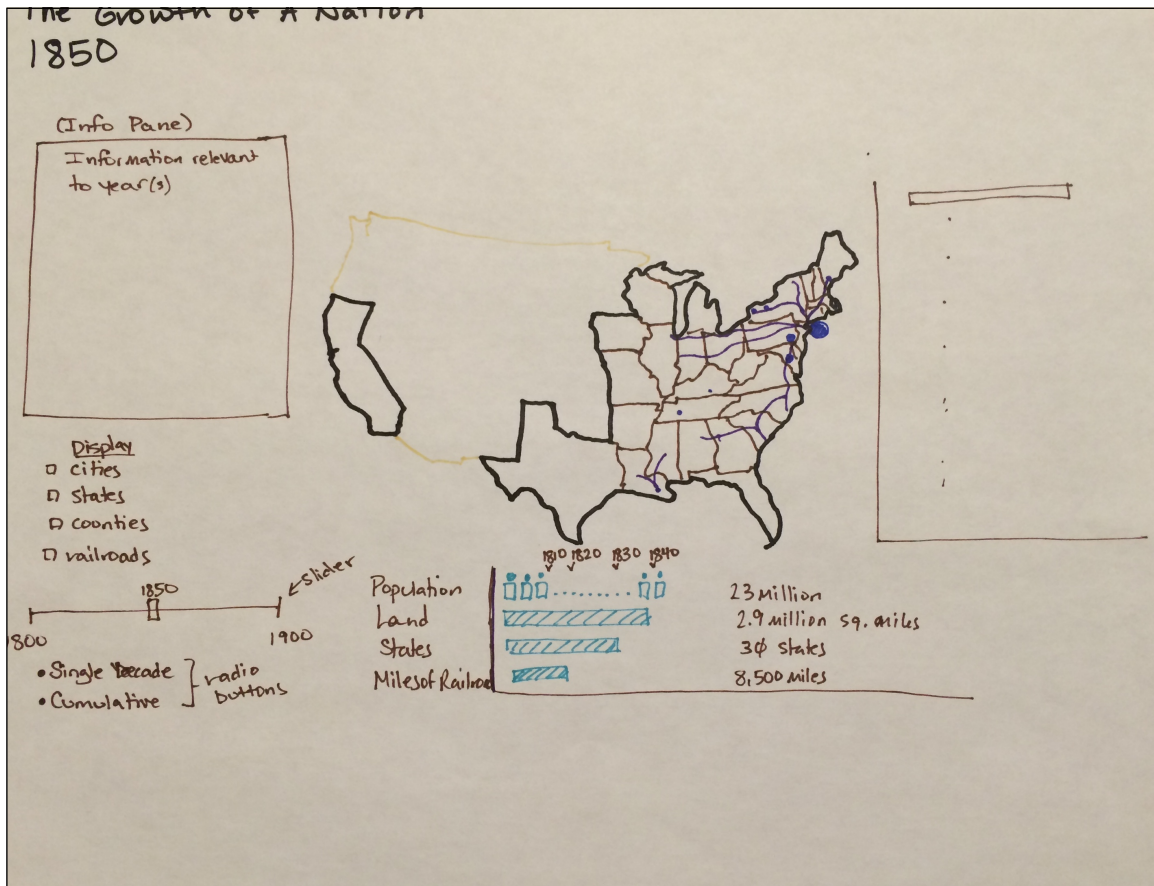


*Growth of a Nation Sketch for 1800, with map, city and summary data areas*

### City/Urban Areas

On the right hand side of the screen will be a listing of largest cities in the US as of that year. This will use a sideways bar chart to show relative population sizes for these cities. I may also expand this to include state populations, population densities or other quantitative data

that is relative to this experience. In this field, when a bar is selected, it will make the city in the primary map area “pop” momentarily to give the user an idea of where it is located rather than trying to guess. This is particularly beneficial to users who aren’t familiar with American geography.



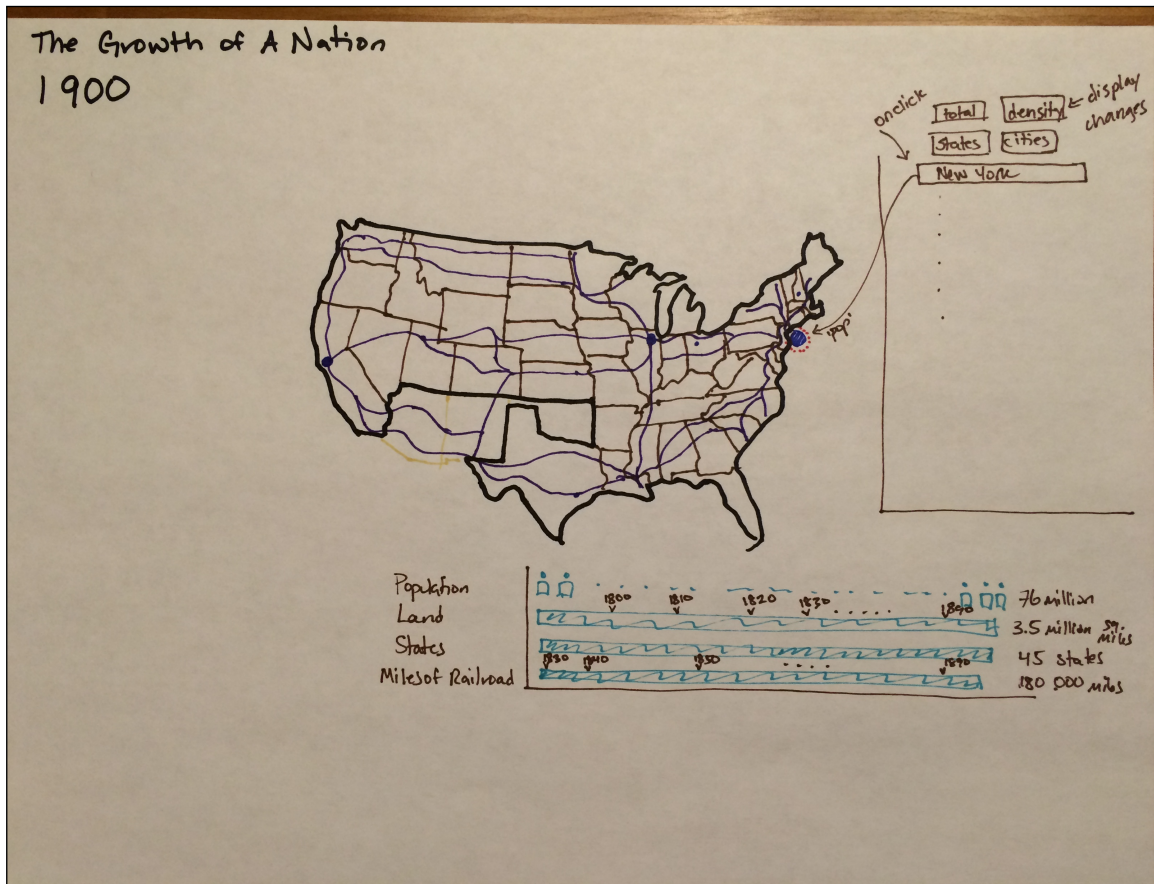
*Growth of a Nation Sketch for 1850, with info, map, city manipulation and summary data areas*

### Growth over Time Area

At the bottom of the vis, there will be a summary bar that shows the growth over time with relative values. This will include things like population, land area, number of states and miles of railroad. These values will show not only current day values, but will have markers showing where they were in each previous decade. An example is visible in the 1850 sketch where the year markers are visible for the population entry.

## Info Pane Area

On the left-hand side of the vis will be an info pane area that displays information relevant to the currently selected year. This may be information about states acquired, railroad expansion or population growth.



*Growth of a Nation Sketch for 1900, with info, map, and city areas*

## Data Manipulation Area

In the bottom left area of the vis will be all of the data manipulation tools. This will include things such as the time bar to move from one year to the next, and also visual filters to give better insight into the data. Users will be able to view all options or they could view just city population data or just county data. This solves the problem of city bubbles becoming too large to show nearby county areas.

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# Features

## Features Critical for Success

### US Map

The biggest feature that must be implemented for a successful project is the map area in the center of the page. This map must support a time progression showing the growth of the population by county during the years from 1800 to 1900 in 10 year increments. This will be color coded to show the growth over time.

### City/State Data

This is the area to the right of the screen. My initial thought is to have this display city data but it could also be used to show state data or county level data. I'm leaning toward city but this may change based on the end result. There needs to be something in that column that drills into local data, rather than the population as a whole and it needs to use the bar charts to display relative values and be click-able to show users the specific geographic regions referred to.

### General Information Pane

This is the area at the bottom of the screen. In addition to the map area which will show growth over time, this area also needs to show growth over time with country statistics. Numbers/lines/people will increase over time to show the relative growth. These will be linear.

## Features Nice to Have

### Detailed Information Pane

The information pane would be really nice if it had a large set of information pieces to add to the vis. It's interesting to see the progression over time but it would be even better if it provided a background. For example, in one decade, 35,000 more people were leaving California each year than entering because of the end of the gold rush. I want to be able to explain why the population decreases during that time. I also want to include information about how the railroads impacted immigration. Including information that explains WHY things happened would be fantastic.

### Initial Info Screen

I'd like to add an informational intro screen that displays while all of the data is being loaded. This would include a short summary of what the visualization is about and also hide the time it takes to load all of the data.

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## Zoom Ability

I would like to add functionality that allows the user to zoom into 6 sections of country to see things closer up. This zoom would be for northeast, southeast, north mid central, south mid central, northwest and southwest.

## Proposed Schedule

As of today, the proposed schedule is as follows. This may evolve over time as things change.

Date	
3 April	Proposal due (this document), Repository set up.
10 April	Initial framework design complete and setup. All javascript classes and basic structure completed. Must have a loadable web page with spaces for the svg elements.
17 April	Milestone 1 - Data acquisition mostly complete, data structure in place, working visualization. This is an assignment to be turned in including process book (this document) and existing code. Must have a basic structure that can progress through the years and show city data that changes in the right pane population statistics updating in the map pane and overall data visible in bottom pane.
24 April	Must be mostly working except for final finishing touches.
1 May	Finishing touches, final process book, video completed, website completed.
5 May (Tuesday)	Final due date.

## Project Location Information

**Repository Location:** <http://www.github.com/laurenwood/laurenwood.github.io>

**Website Location:** <http://laurenwood.github.io>

## Project Structure

index.html	The initial page
\libs	
d3.js	Used for svg elements
jquery.js	Required for bootstrap
bootstrap.js	Library for page layout
queue.js	Used for loading the (many) data files
\css	
fonts.googleapis.com	Nice free fonts
bootstrap.min.css	Again, more bootstrap stuff to bring it together
myStyle.css	My personal style sheet to control style



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\js

mapVis.js	svg object that will display the map
infoVis.js	svg object that displays the left info pane
controlVis.js	svg object that displays the control panel
chartVis.js	svg object that displays the city chart on right
summaryVis.js	svg object that displays the overview chart

## Data Structure

### SVG Paths

country outlines	A set of paths that show US country outline based on year
state outlines	All of the state outlines
county outlines	All US county outlines
railroad lines	The railroad trunk lines by year

### Data Objects

```
data_by_state*
  state
    ID           Unique ID (key)
    postcode     Two letter state code (AL, AK, AZ)
    city (array)
      ID         Unique ID (key)
      name       Name of the city
      latitude   Latitude of the city
      longitude  Longitude of the city
      years (array) Population of the city by year
        1800
        .
        1900
    county (array)
      ID         Unique ID(key)
      name       Name of the county
      years (array) Population of the county by year
        1800
        .
        1900
```

\* Note: This structure may change over time as development progresses.

## Sources

Photo from front page: **“First Locomotive on the New Haven, Derby and Ansonia Railroad.**

The engineer standing by the engine was Mr. Whitlock, afterward Master Mechanic of

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the road. The locomotive was facing West, a short distance from the union point of the Derby and Hartford and New Haven Railroads. This track and the brick buildings have been removed. Photographed about 1871." <http://www.tylercitystation.info/track-3---nhd-extra.html>