CPSC 447, Foundations 2

Out: Tue Jan 31 2023. Due: Fri Feb 10 2023, 6pm
Submit through Gradescope, as a file in PDF format, following this Google doc answer template.

Administrative overhead penalty of up to 10% will be imposed if additional processing work is required to handle your assignment, such as: did not follow answer template, unreadable file loaded into Gradescope, pages and questions not matched in Gradescope, etc.

Learning goal

Train yourself in decoding charts so that you can better understand how visual representations can be described using the language and rules of visual encoding and decomposed into low-level graphical components.

General hints

Be specific when describing what a mark / channel encodes. Imagine you are trying to introduce a visualization to a random person on the street: you would not say a point mark in this chart represents something generic like a "data item". You would say a point mark represents something concrete and understandable, like a swarm of bees, or a football player (for example). You will find this precision useful when you deal with complex data.

1 Generate: Two Numbers (3%)

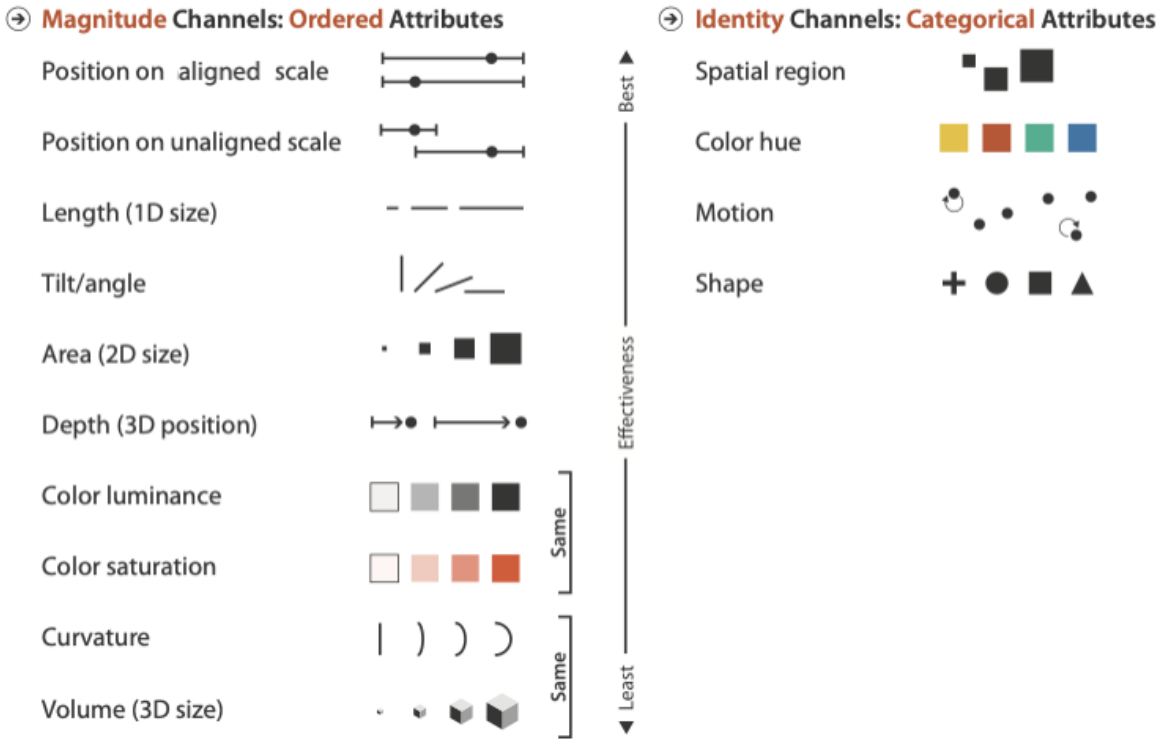
Sketch three different ways to show the two numbers: **8** and **23**, with each sketch using a different combination of marks and channels. Write down the marks and channels used in each of your sketches. If you worked in an in-class group on this problem, provide the names of your group members.

Sketches do **not** need to be polished: very rough sketches are fine as long as they are legible, the point is to show the design idea not to make something elegant. We do **not** expect you to redraw the sketches you made in class in a more polished form, just turn in what you did then. The intent behind sketching assignments is not to create something that looks fully finished. The purpose of sketching is to generate ideas and explore alternative designs quickly, instead of spending time in polishing one design. (Studies shows that polished "sketches" actually discourage people to explore more ideas!) When we tell you to make sketches in this course, we would like you to draw them yourself using drawing software on a tablet, or hand-draw the sketches with paper and pen and then snap a photo with your phone. Even if you have mastered programming libraries like D3 or R, or applications such Tableau and can implement your ideas very quickly, that is not the goal of this assignment.

Rubric: 1% each example, 0.5% sketch and 0.5% mark/channel analysis

2 Marks and Channels: Name Them (12%)

For each example below, state which visual channels are used for which attributes, and which marks are used for which items (points, lines, interlocking areas).
Choose from the following channel types - except no need to distinguish between the different kinds of color channels (hue & saturation & value), since we haven't covered those yet:

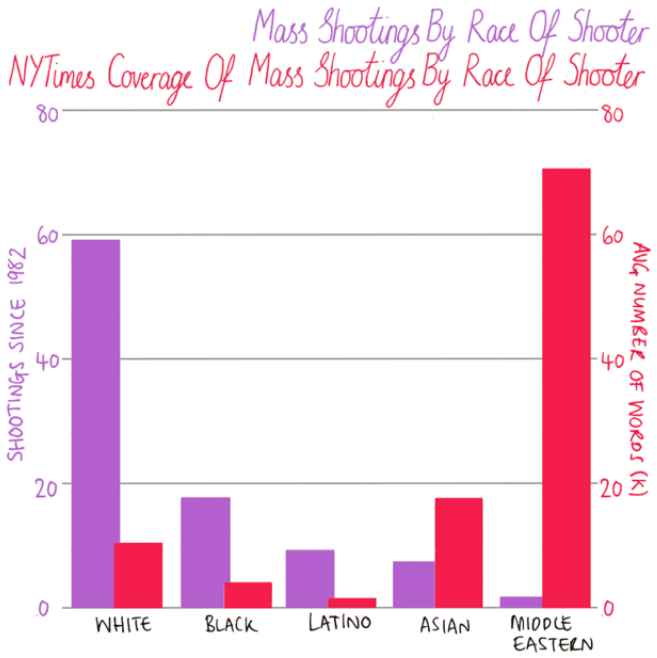


- math view: geometric primitives have dimensions

Points 0D Lines 1D Interlocking Areas 2D

- constraint view: mark type constrains what else can be encoded
  - points: 0 constraints on size, can encode more attributes w/ size & shape
  - lines: 1 constraint on size (length), can still size code other way (width)
  - interlocking areas: 2 constraints on size (length/width), cannot size or shape code
    - interlocking: size, shape, position
- quick check: can you size-code another attribute
  - or is size/shape in use?

2.1 Shooting Media Coverage

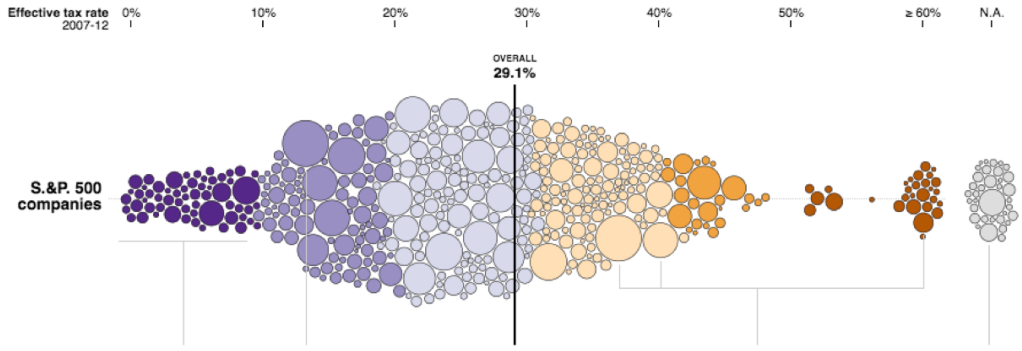


More info: https://twitter.com/MonaChalabi/status/1158779046693679106?s=20

2.2 Sunsquatch

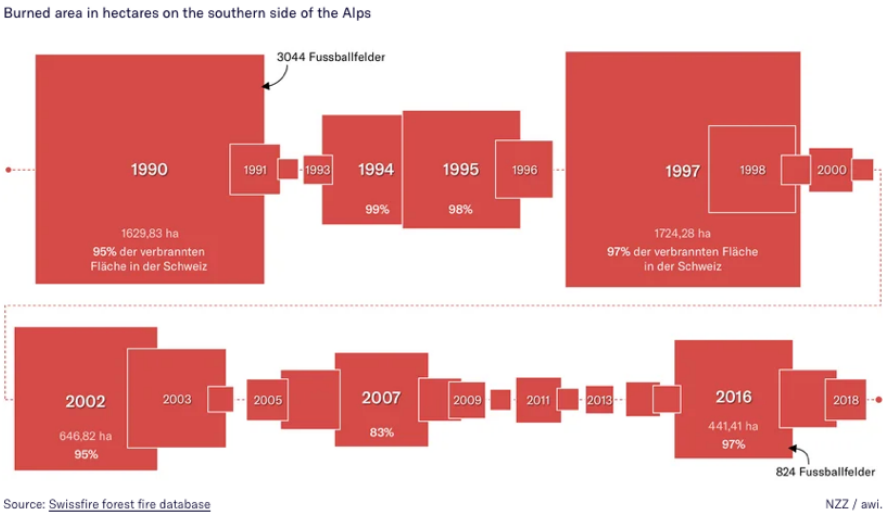
More info: https://flowingdata.com/2017/08/20/sunsquatch-the-only-eclipse-map-you-need/

2.3 Tax rates

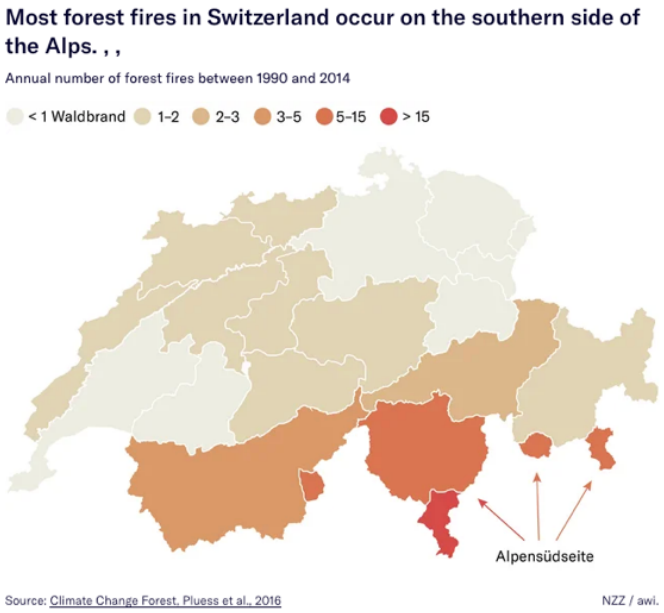


More info: https://archive.nytimes.com/www.nytimes.com/interactive/2013/05/25/sunday-review/corporate-taxes.html

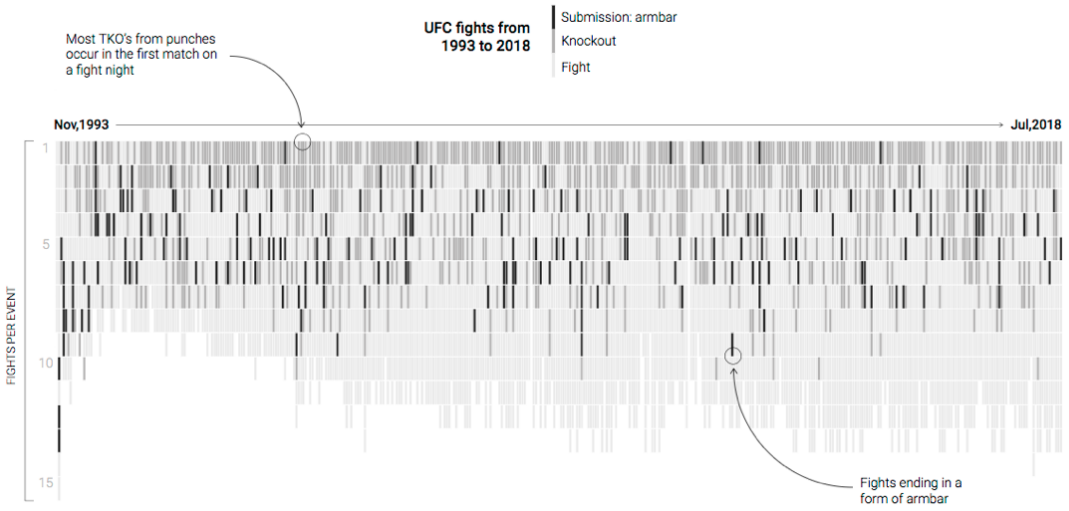
2.4 Alpen Forest Fires



2.5 More Alpen Forest Fires

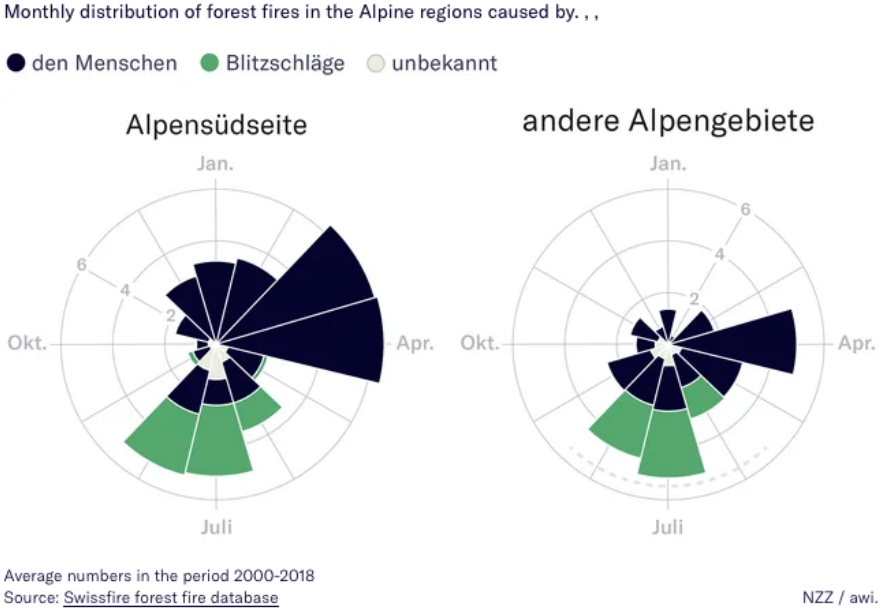


2.6 UFC Fights

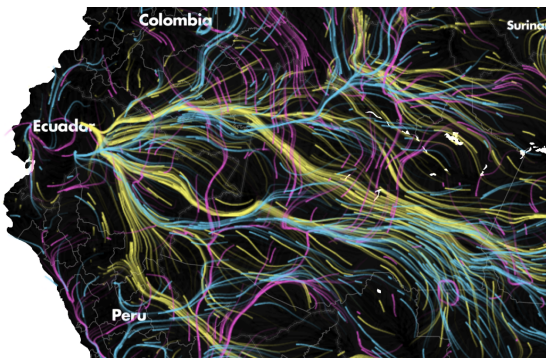


https://multimedia.scmp.com/infographics/sport/article/3010883/bruce-lee-and-mixed-martial-arts

2.7 Yet More Alpen Forest Fires



2.8 Migrations



https://maps.tnc.org/migrations-in-motion/#5/-7.101/-67.939

Do click through to see the complete version of this example.

Rubric: 1.5% each; 1% mark/channel, 0.5% matching item/attribute.

3 Decode: Marks & Channels (40%)

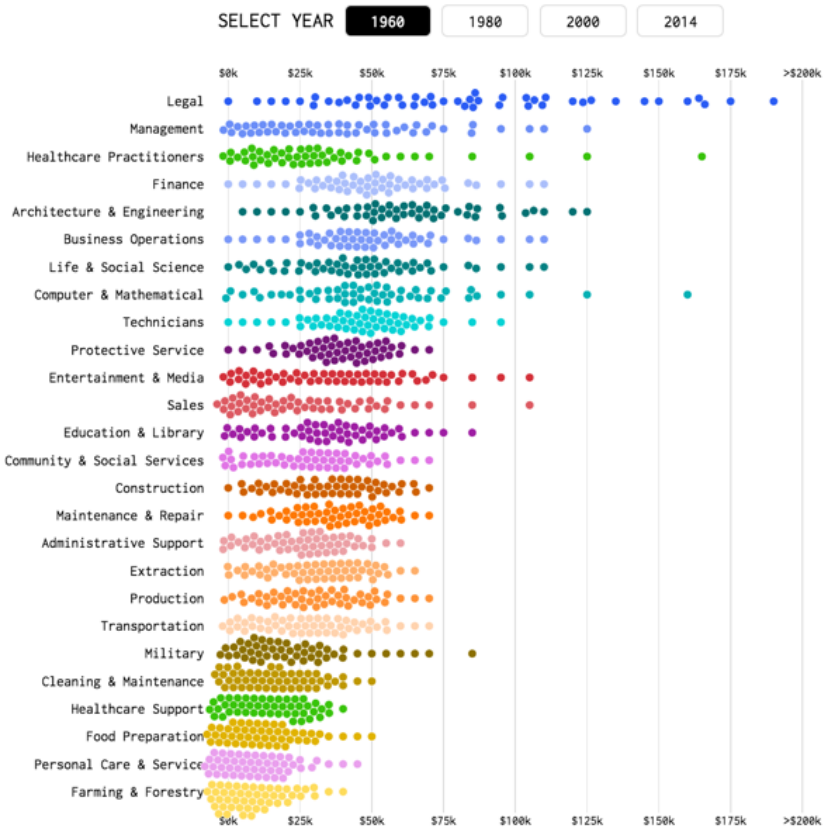
Instructions: For each of the 5 charts following, you will identify data **items** and the **marks** used to encode them, and data **attributes** and the **channels** used to encode them. For each chart, fill in

- Visual channels used?
  - Channel X encodes attribute Y
  - Channel X encodes attribute Y
  - ....
- Marks used?
  - Mark of type X encodes item Y
  - Mark of type X encodes item Y
  - ....

Note that underneath each charts there is a link to a web page providing details about the project, including information about the data and in many cases supporting interactivity. However, for now, just encode what you see in the static image in this document; you might notice that interactivity is being used a lot for emphasis (hover highlight, animated transitions, reordering, details popups, small multiples zooming).

Think about how you would reconstruct the dataset underlying this picture. Assume one mark per item, think of items as rows of a table (or nodes or links in a network). Assume each channel is showing an attribute, where channel is a column in a simple data table or network. Remember that multiple channels could redundantly encode the same attribute. Notice that a mark is not every single bit of ink on the page - for example, labels and annotations are not marks in the sense that we're doing this analysis!

3.1 Income

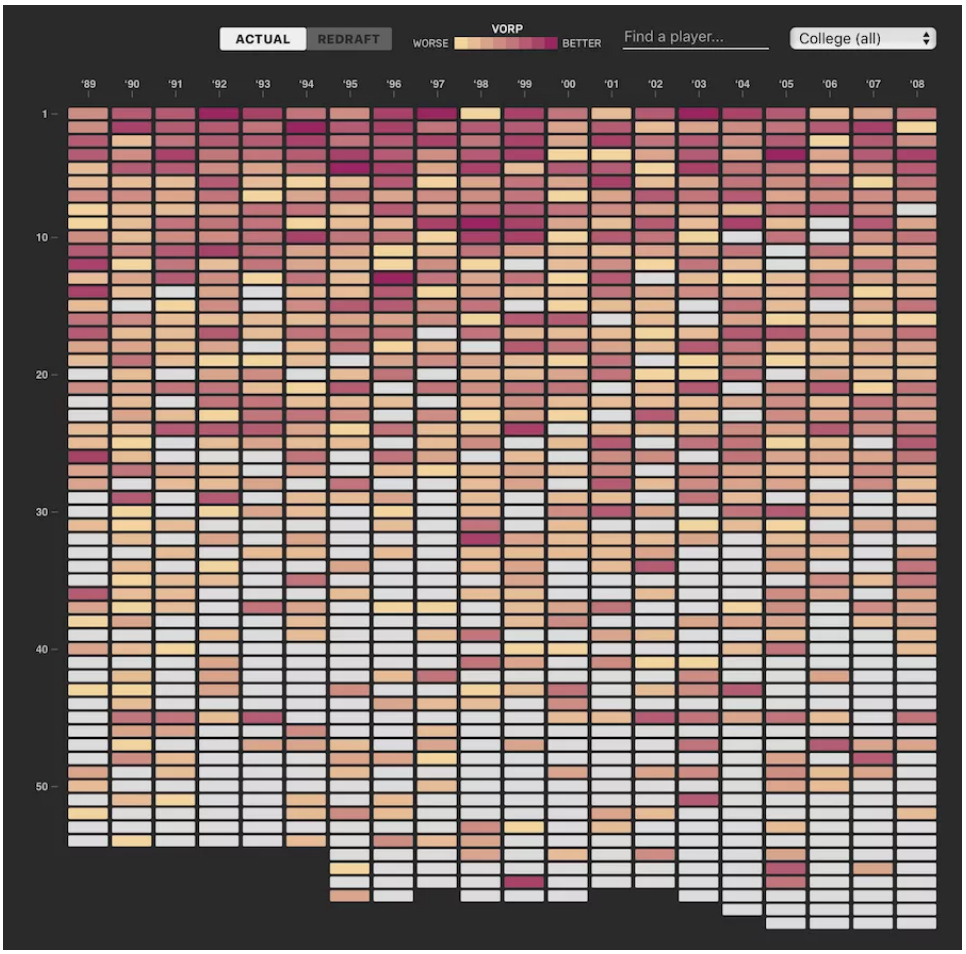


https://flowingdata.com/2016/06/28/distributions-of-annual-income/

3.2 Ukko

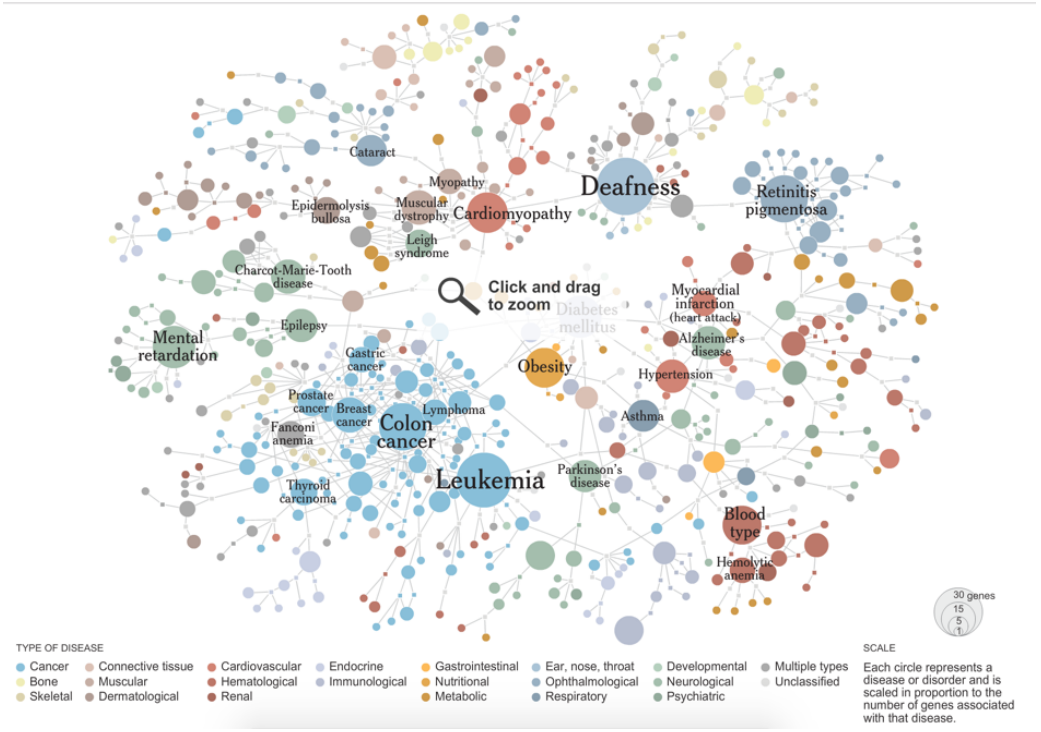
https://project-ukko.net/map.html

3.3 Draft



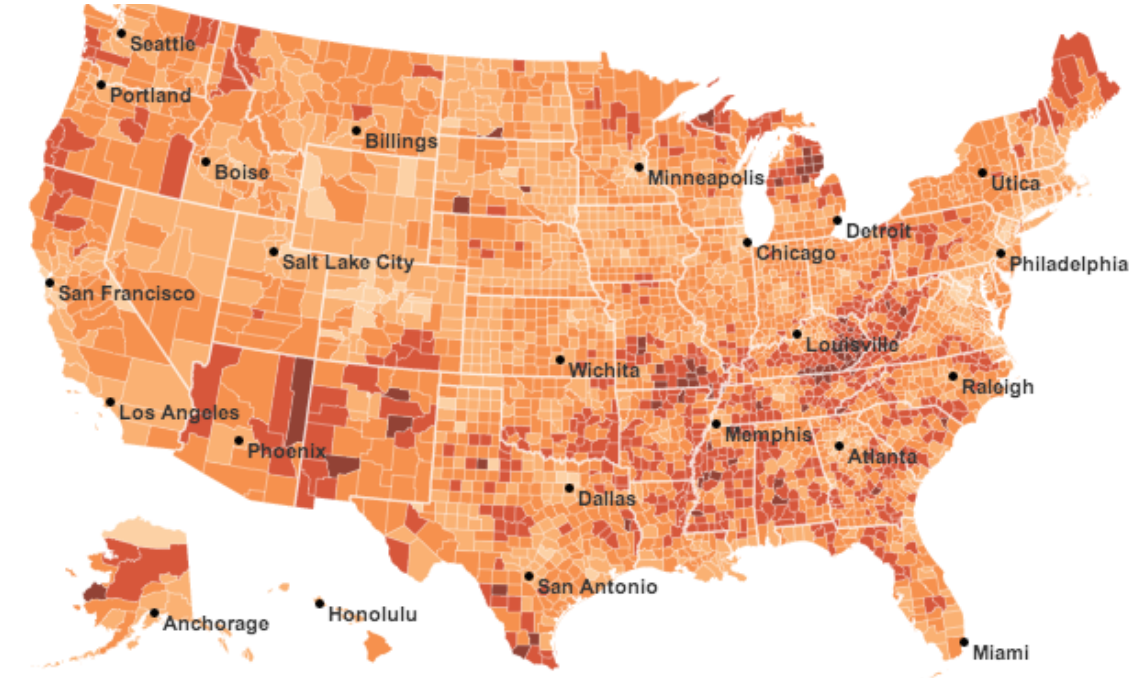
https://pudding.cool/2017/03/redraft/

3.4 Disease



https://archive.nytimes.com/screenshots/www.nytimes.com/interactive/2008/05/05/science/20080506_DISEASE.jpg

3.5 Entitlements



https://archive.nytimes.com/www.nytimes.com/interactive/2012/02/12/us/entitlement-map.html

Exercise Credit: adapted from Bertini, NYU Tandon
Rubric: 8% each

4 Generate: Table Alternatives (24%)

Table A (left)

	Age	Best 100 m	Furthest Jump	Sex
Amy	16	13.2	5.2	F
Basil	18	12.4	4.2	F
Clara	14	14.1	2.5	F
Desmond	22	10.01	6.3	M

Table B (right)

	BPM T1	BPM T2	BPM T3
Amy	90	130	150
Basil	70	110	109
Clara	60	140	141
Desmond	84	100	108

4.1 Sketch a suitable visual encoding for Table A. The sketch should include all of the items and attributes for that table as a static visual encoding: do not assume any interaction will take place. You may use a single view, or multiple views.

Analyze the sketch, considering whether it is suitable according to alignment between

- attribute types and channel choices (in terms of expressiveness and effectiveness)
- semantics of the attributes (an important part of data abstraction), and
- information density.

4.2 Same as above, for Table B. Note that 'BPM' stands for Beats Per Minute, a measure of heart rate.

4.3 Sketch a different visual encoding for Table A. Try to address any limitations you identified in your previous analysis.

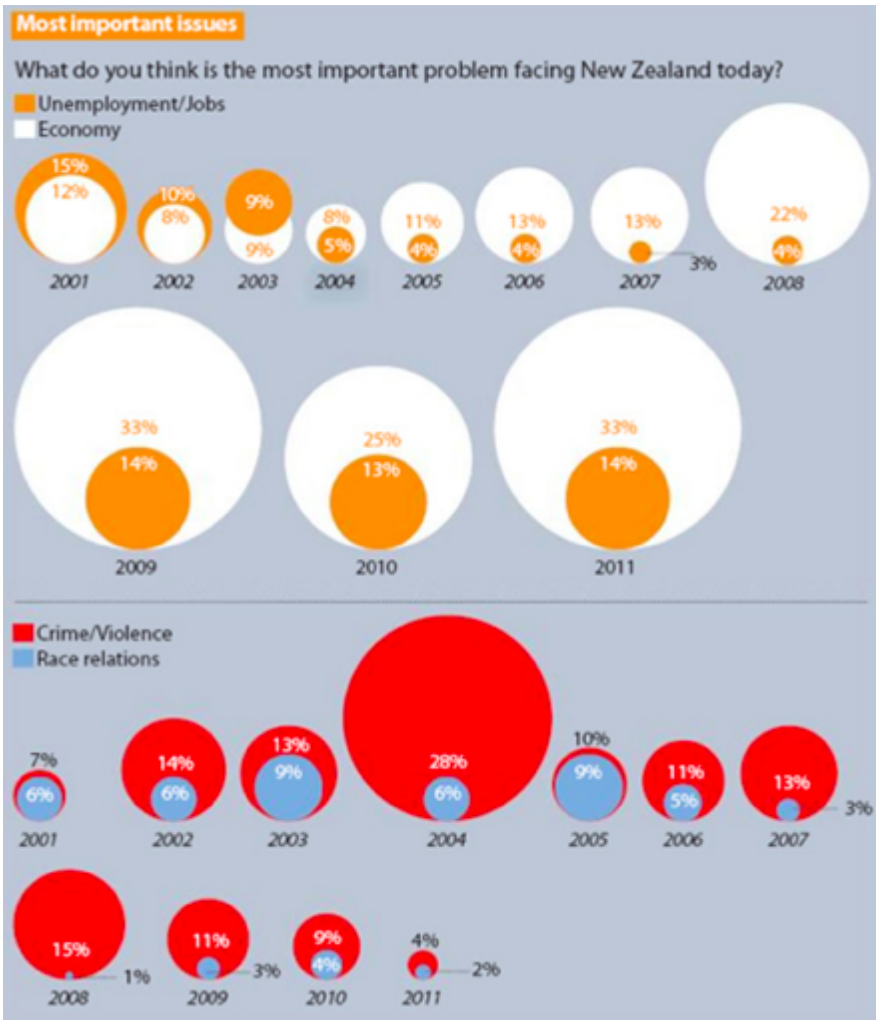
4.4 Same as above, for Table B.

Do your best to create reasonable designs that you can justify. However, if your analysis adequately explains why a design is unsuitable, you will receive full credit for both. Sketches do not need to be polished: very rough sketches are fine as long as they are legible. The point is to show the design idea, not to make something polished. (See above, as with Q1.)

Rubric: 6% each table: 3% sketch/design & 3% analysis.

5 Redesign: New Zealand Table (21%)

Consider this visual encoding from a newspaper:



Answer the following questions:

5.1 Describe the data abstraction in the abstract language covered in this class (dataset type, attribute types, number of levels for categorical attributes, ranges for quantitative attributes).

5.2 How is this data visually encoded (in terms of marks/channels)?

5.3 If the numeric labels were not visible, would you be able to decode the data precisely? Why or why not?

5.4 Develop one better alternative design to visualize this data. Show it with a sketch. Provide a brief rationale for why it is better in terms of a task that is poorly supported by their design (make sure to use {action,target} pairs to describe the task abstractly).

Rubric: 5.1 (4%), 5.2 (6%), 5.3 (1%), 5.4 (10%): (5%) sketch, explanation (5%)