11a: Manipulate, facet, reduce

Ideas to improve visualizations

Recap: How to design viz idioms

Figure 3.7. *How to design vis idioms: encode, manipulate, facet, and reduce.*
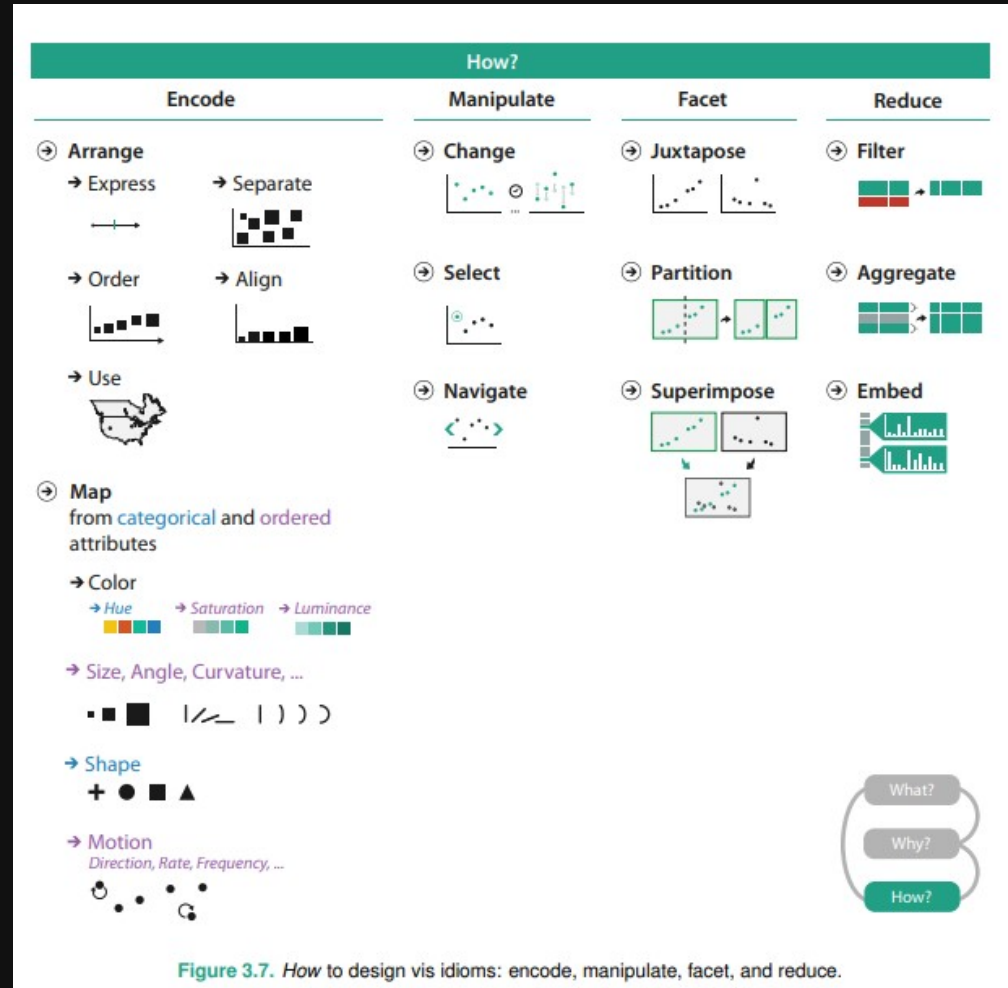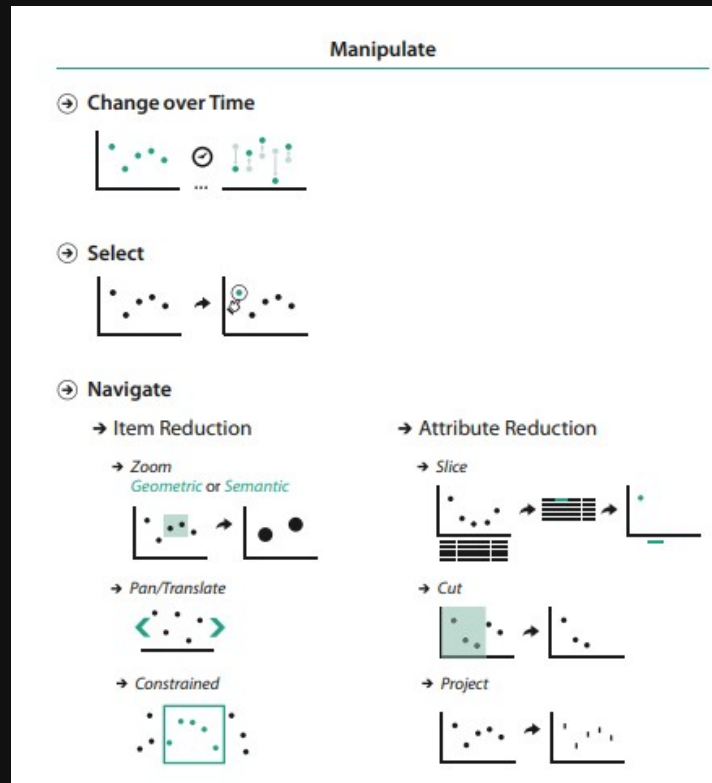
Visualization Interactivity

A lot of the viz design techniques discussed below requires interactivity to be baked into the visualization idiom.

- View Manipulation — Change / Selection / Navigation
- Faceting — Juxtapose / Partition / Layering
- Reduction — Filter / Aggregate / Embed

View manipulation

Why do view manipulation?

To help navigate the dataset.
To highlight specific data, draw attention to insights / trends, etc.

Change encoding (over time)

Basically change how the viz idiom is constructed. E.g:

- Change the chart encoding (e.g. bar chart to line chart)
- Change specific channel encodings (e.g. color schemes, symbol marks)
- Change the arrangement
- Change dataset
- Reorder the data

Adjacency matrix, Mike Bostock, Les Miserables dataset

Projection transitions, Mike Bostock

Sunburst to icicle, Noah Veltman

Selection

Selecting a datapoint, or a subset / superset of data

- Highlighting
- Tooltipping
- Brushing

Blo.cks.org: Complex tooltip (SVG), d3noob

D3 Graph Gallery: Interactivity, Brushing

ObservableHQ: Brushing Collection

Navigation (item reduction)

Navigating levels (subsets and supersets of the current view), i.e. going up and down the ladder of abstraction. Techniques:

- Zooming
- Panning
- Guided (constrained) navigation

We've gone through examples in the geospatial space, but this can also be applied to other types of charts.

Lifemap (Leaflet + raster tiles), University of Lyon

Scale of the Universe 2

Navigation (dimension reduction)

An intuitive common understanding is taking a 3D dataset and turning it into a a 2D visualization via the below techniques. Of course these can be applied to higher dimentsions.

- Slicing
- Cutting
- Projecting

3D slicer, free open source compute platform for slicing 3D images.

Visualizing quaternions, 3Blue1Brown (Ben Eater) - Amazing!

View faceting
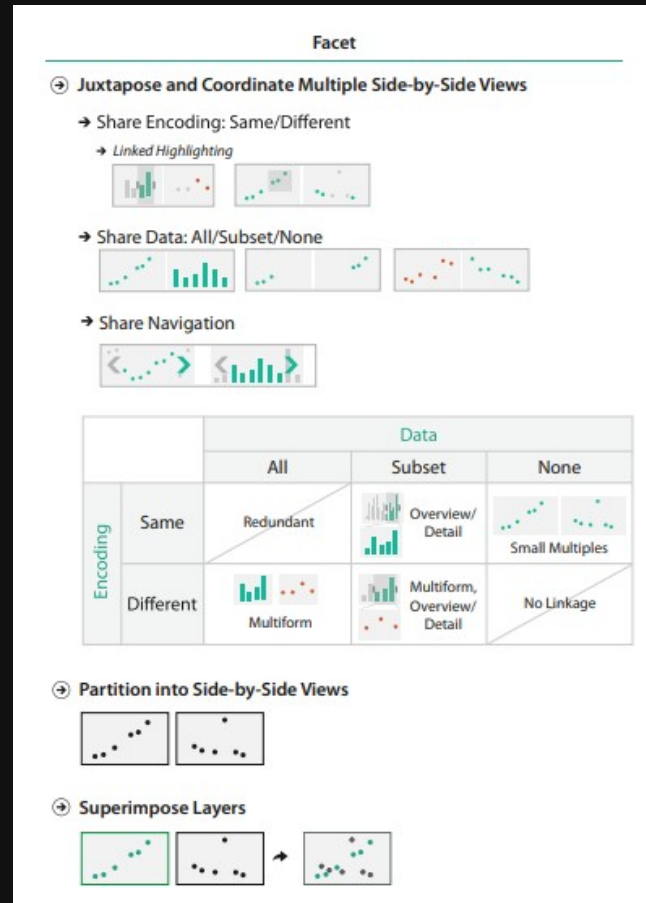
Why facet?

Multiple views juxtaposed side by side (instead of presented over time!) allow us to compare two views simultaneously.

Drawback is of course display space and working memory constraints.

Multiform Visualizations

Showing the data (all or subset) through different chart encodings.
Usage of linked highlighting shows how one view is linked to
another.

Population.io, World Data Bank

Covid19 Surveillance Dashboard, University of Virginia

Small Multiples

Show entirely different partitions of the data through the same viz encoding.

Thank Edward Tuft for popularizing sparklines and small multiples.

How Pew Research Center uses small multiple charts, Peter Bell

Global Technology Tracker, Bloomberg (Sparklines!)
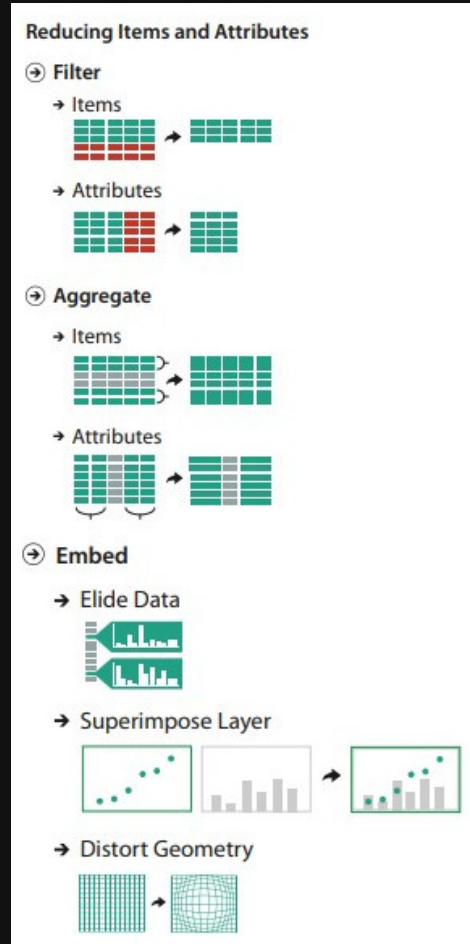
Scottish politics, The Guardian

Layering

Superimposing layers of data on top of one another.

MarineTraffic

Onemap.gov.sg

View reduction

Reducing Items and Attributes

➔ Filter
→ Items
→ Attributes

➔ Aggregate
→ Items
→ Attributes

➔ Embed
→ Elide Data
→ Superimpose Layer
→ Distort Geometry

Why reduce?

Often to reduce visual clutter in your visualizations and make it easier to understand.

Filtering (item or attribute)

Use an interface option to show/hide a data items or attributes.

Shipmap.org

Aggregate

Group data elements to create new derived attributes.

D3 Graph Gallery: Histogram

D3 Graph Gallery: Boxplot

ObservableHQ: Hexbin example

Dimension reduction

Dimension reduction is often necessary for dealing with extremely large datasets, breaking the data down into feature vectors.

Reading: Dimensionality Reduction for Data Visualization

Embed (focus + context)

Focus–plus–context enables viewers to see the object of primary interest presented in full detail (**focus**) while at the same time getting a overview–impression of all the surrounding information (**context**).

Elide - ObservableHQ: Focus + context, Mike Bostock

Superimpose - Reading: Top 5 learnings for visualizing data in Augmented Reality (AR), Sebastian Sadowski

Distort - Fisheye distortion, Mike Bostock

Questions?

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