Data Visualisation for Analysis in Scholarly Research

British Library Digital Scholarship Training Programme
September 2015

Mia Ridge @mia_out

While we're getting started…

- Check that the mouse on your laptop works and that you can get online with the browsers Firefox or Chrome
- Unzip ('extract') the file containing the slides and exercise handouts and copy the folder to your desktop
- Dig out your GMail/Google login details (if you have an account)

Timetable

- 10am Start
- 11:30-11:45 Break
- 13:00-14:00 Lunch
- 15:00 Conclude

Links, sources and further reading:
http://www.miaridge.com/2013/01

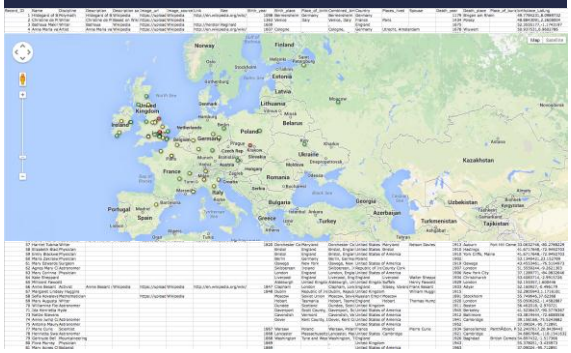
Overview

- Introductions; what is data visualisation?
- History and types of visualisations
- Critiquing visualisations
- Visualisations for scholarly analysis
- Dealing with library and historical data
- Planning and designing visualisations

Data visualisation is the graphical display of quantitative or qualitative information to create insights by highlighting patterns, trends, variations and anomalies.

From this...

...to this



About me

Tool from http://neatline.org/

Introductions

- In a sentence or two, what's your interest in data visualisation?
  - What kinds of data do you work with?
  - What's the goal of any visualisations you're interested in creating?
  - Do you have any potential users in mind?

What is data visualisation?

'**sense-making** (also called data analysis) and **communication**' (Stephen Few)

'...showing quantitative and qualitative information so that a viewer can see **patterns, trends, or anomalies, constancy or variation**' (Michael Friendly)

'...interactive, visual representations of abstract data to **amplify cognition**' (Card et al)

Visualisations as intersection of format and purpose

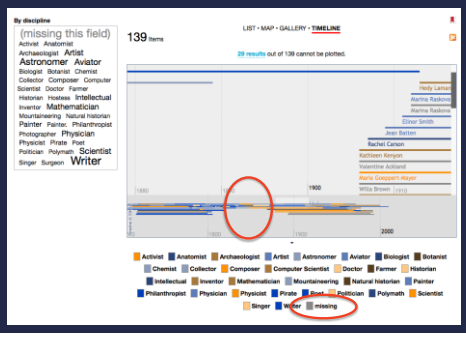
- Product or process? Exploratory or explanatory: find new insights, or tell a story?
- Static or interactive; print or digital?
- Pragmatic, emotive?
- 'Distant reading' - focus on the shape rather than detail of a collection

Data visualisation can help you...

Explore your data

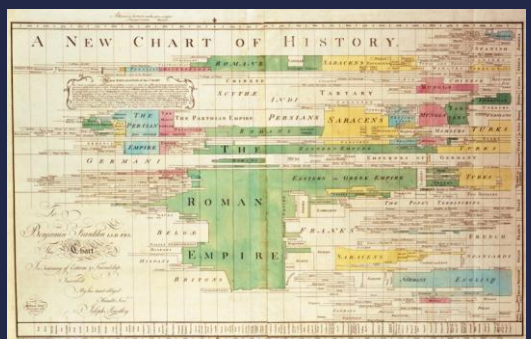
Explain your results

Exploring data

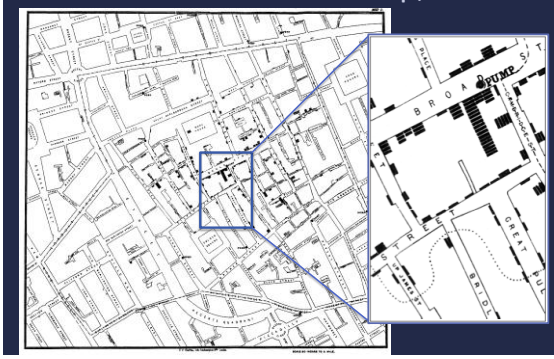


HISTORY AND TYPES OF VISUALISATIONS

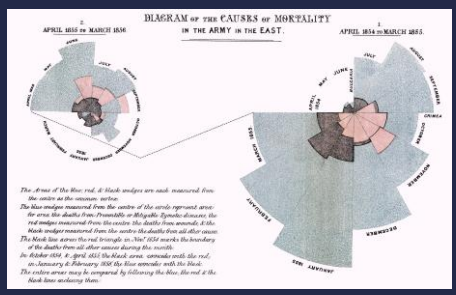
Joseph Priestley, 1769



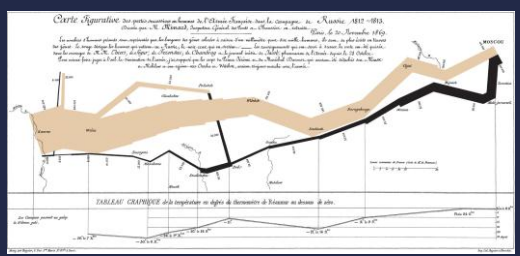
John Snow's cholera map, 1854



Florence Nightingale's petal charts, 1857

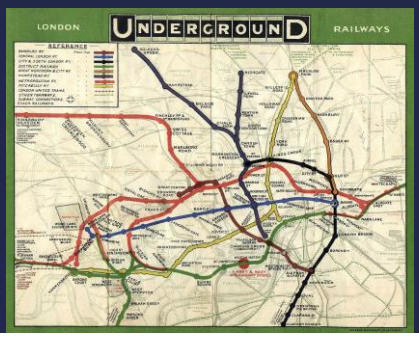


Charles Minard's figurative map, 1869



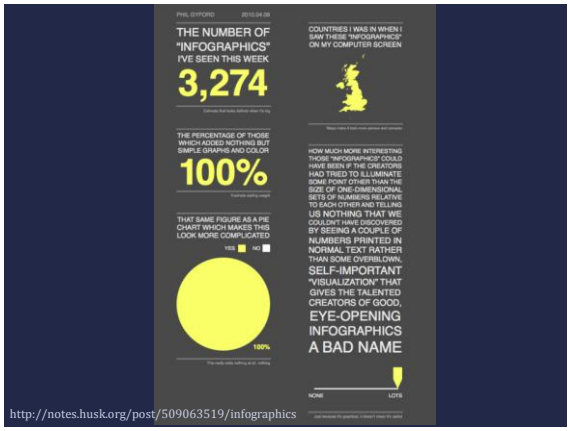
'Figurative Map of the successive losses in men of the French Army in the Russian campaign 1812-1813'. Drawn up by M. Minard, Inspector General of Bridges and Roads in retirement. Paris, November 20, 1869.

The old tube map



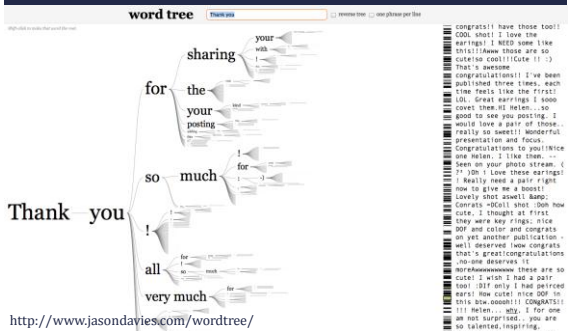
Harry Beck, 1931

Web 2.0 and the mashup, 2006



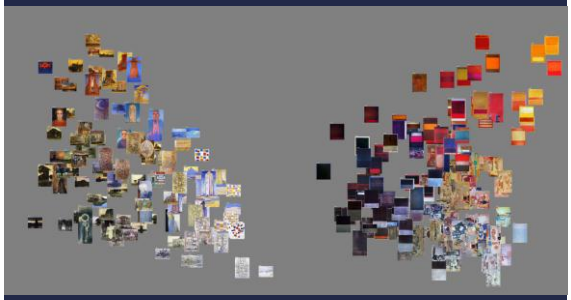
http://notes.husk.org/post/509063519/infographics

Exploring words



http://www.jasondavies.com/wordtree/

Visualising images and video, 2012

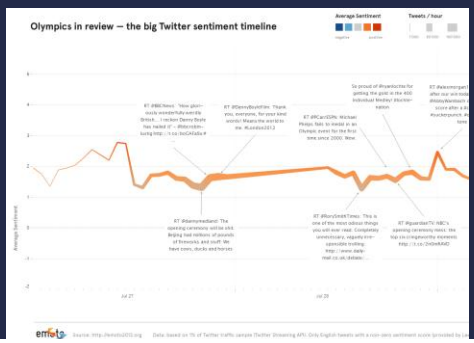

http://www.flickr.com/photos/culturevis/5883371358/
'Mondrian vs. Rothko', Lev Manovich, 2010. images preparation: Xiaoda Wang

Data types

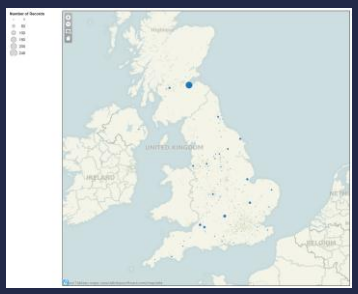
- quantitative
- qualitative
- geographic
- time series
- media
- entities (people, places, events, concepts, things)

CRITIQUING VISUALISATIONS

'sentiment'



Visualisations and 'truthiness'



A sample of publication printing locations 1534-1831 (British Library data)
http://bit.ly/W9VM7D

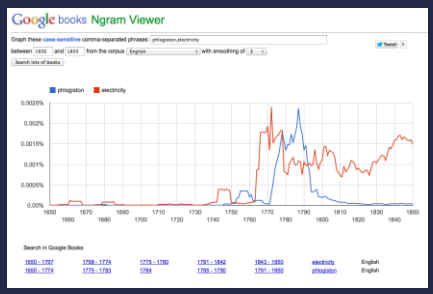
Network visualisations

http://fredbenenson.com/blog/2012/12/05/the-data-behind-my-ideal-bookshelf/

Exercise 1: network visualisations

Instructions on the hand-out.

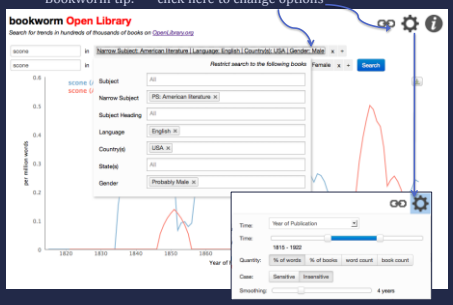
N-grams



http://books.google.com/ngrams/

Exercise 2: comparing N-gram tools

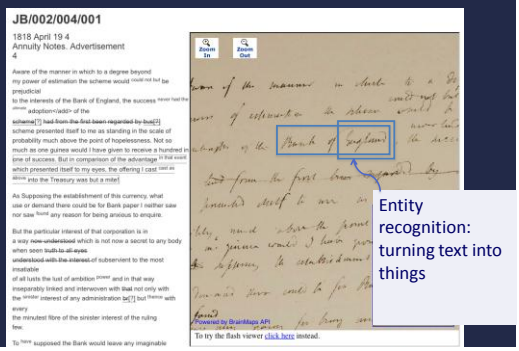
Bookworm tip: click here to change options



Topic modelling

http://discontents.com.au/mining-for-meanings/
http://wraggelabs.com/shed/presentations/nla/#slide-24

Other forms of text analysis

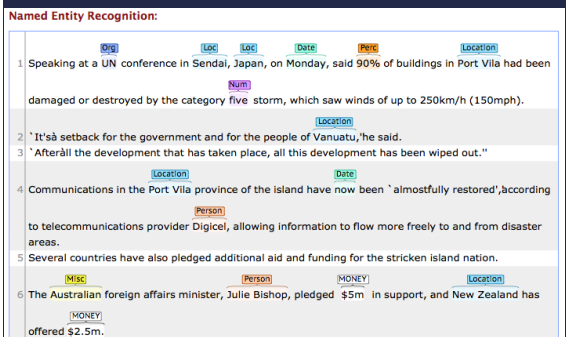


Entity recognition: turning text into things

Exercise 3: trying entity recognition

Instructions on the hand-out.

Entity recognition examples



VISUALISATIONS FOR SCHOLARLY ANALYSIS

Scholarly data visualisations

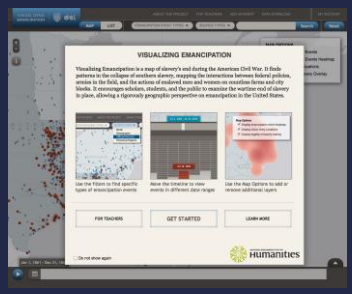
- Visualisations as 'distant reading' where distance is 'a specific form of knowledge: fewer elements, hence a sharper sense of their overall interconnection' (Moretti, 2005)
- Inspiring curiosity and research questions
- But - which questions do they privilege and what do they leave out?

Exercise 4: explore scholarly visualisations

Pair up and discuss together before reporting back.

Instructions on the hand-out.

Visualizing Emancipation

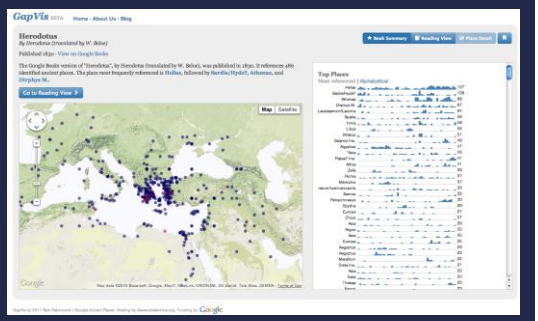


http://www.americanpast.org/emancipation/

Mapping the Republic of Letters

http://www.stanford.edu/group/toolingup/rplviz/rplviz.swf

GAPVis

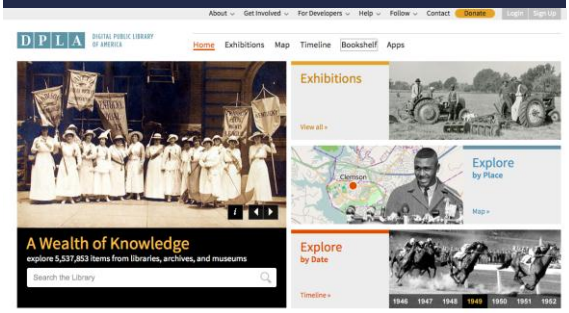


http://gap.alexandriaarchive.org/gapvis/index.html

Digital Harlem

http://digitalharlem.org

Digital Public Library of America

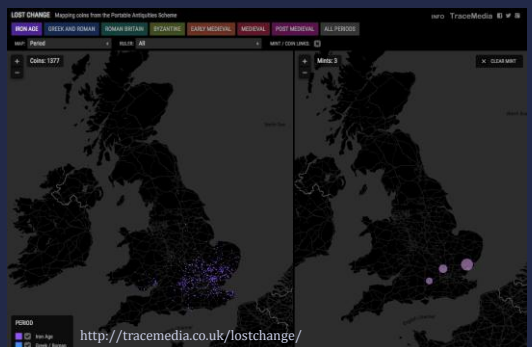


http://dp.la/

Orbis

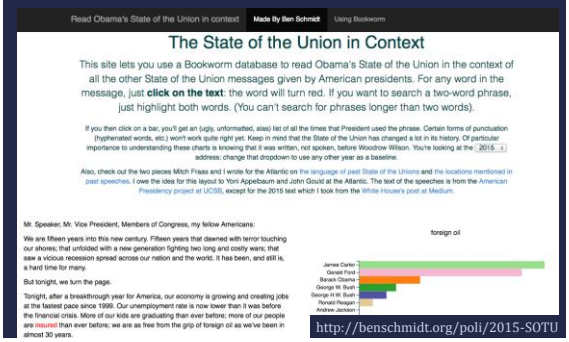
http://orbis.stanford.edu/#mapping

Lost Change



http://tracemedia.co.uk/lostchange/

State of the Union



http://benschmidt.org/poli/2015-SOTU

Comments or questions?

ISSUES WITH HISTORICAL, CULTURAL DATA

Considerations for historical data

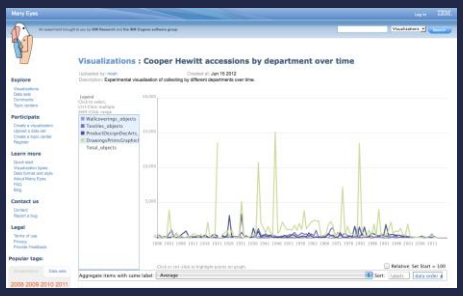
Commercial tools often assume complete, born-digital datasets – no missing fields or changes in data entry over time

- Historical records often contain uncertainty and fuzziness (e.g. date ranges, multiple values, uncertain or unavailable information)
- Includes metadata, data, digital surrogates

Messiness in historical data

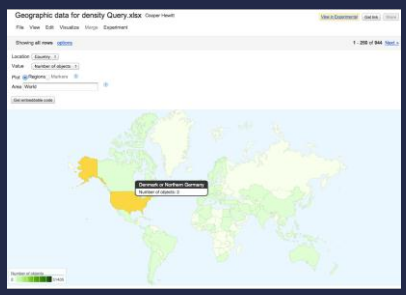
- 'Begun in Kiryu, Japan, finished in France'
- 'Bali? Java? Mexico?'
- Variations on USA:
  - U.S.
  - U.S.A
  - U.S.A.
  - USA
  - United States of America
  - USA ?
  - United States (case)
- Inconsistency in uncertainty
  - U.S.A. or England
  - U.S.A./England ?
  - England & U.S.A.

When were objects collected?



http://ibm.co/OS3HBa

Computers don't cope



Preparing data for visualisations

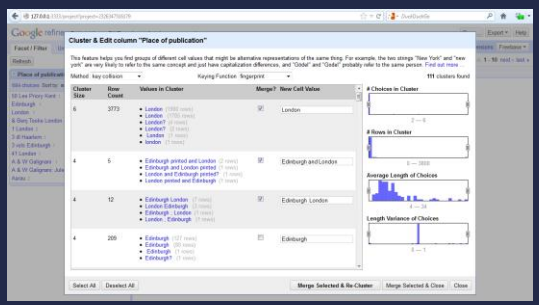
Historical data often needs manual cleaning to:

- remove rows where vital information is missing
- tidy inconsistencies in term lists or spelling
- convert words to numbers (e.g. dates)
- remove hard returns and non-ASCII characters (or change data format)
- split multiple values in one field into other columns (e.g. author name, date in single field)
- expand coded values (e.g. countries, language)

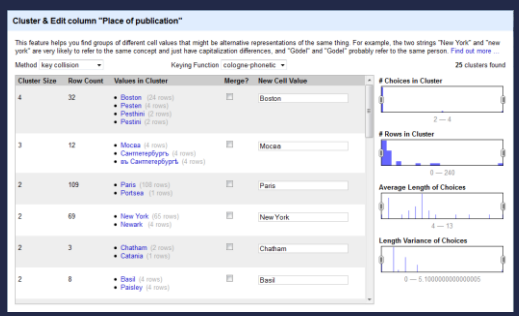
Data Preparation

- Generally needs to be in tables, one row per item, one column per value
- Might need to calculate values in advance
- Data should be made as consistent as possible with tools like
  - Excel
  - OpenRefine http://openrefine.org

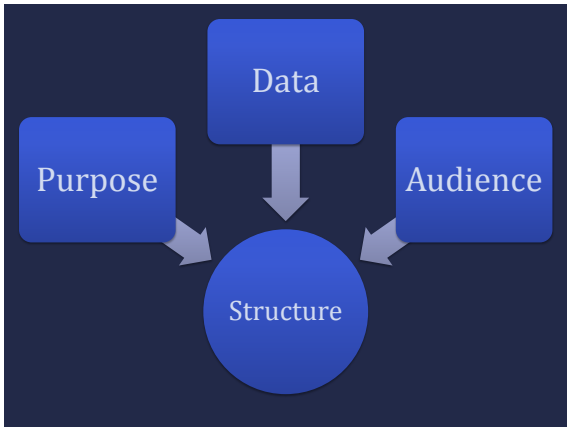
Open Refine



...but be careful



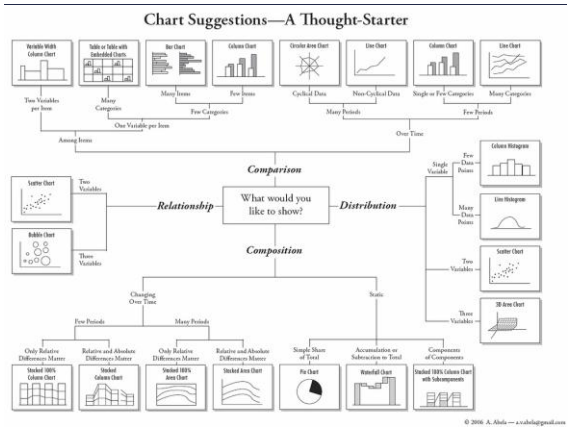
PLANNING VISUALISATIONS



Purpose, data, audiences (revision)

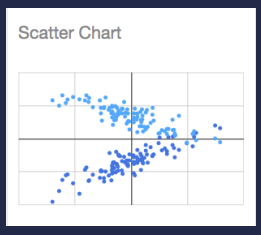
- Intersections of format and purpose
- Data types: quantitative, qualitative, geographic, time series, media, entities (people, places, events, concepts, things)
- Static, interactive; print, digital; product, process
- Exploratory, explanatory: find new insights, or tell a story? Pragmatic, emotive?

Choosing a structure



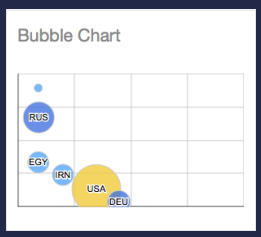
See relationships among data points

- Scatterplot
- Matrix
- Network diagram



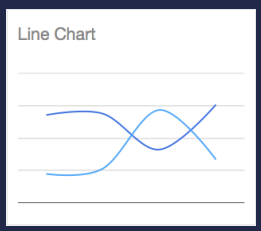
Compare a set of values

- Bar chart
- Bubble chart
- Histogram



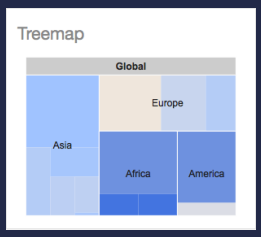
Track change over time

- Line graph
- Stack graph



See the parts of a whole

- Pie chart
- Treemap



Exercise 5: create a chart using Google Fusion Tables

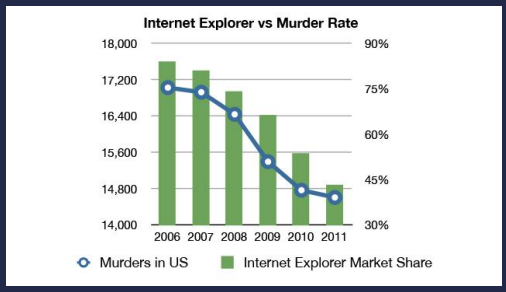
- Instructions on the hand-out
- If you would rather try an exercise in Excel, see instructions for creating simple graphs with Excel's Pivot Tables and Tate's artist data

DESIGNING VISUALISATIONS

Worst practice in data visualisations

Source: http://www.forbes.com/sites/naomirobbins/2013/01/03/deceptive-donut-chart/

Worst practice in data visualisations



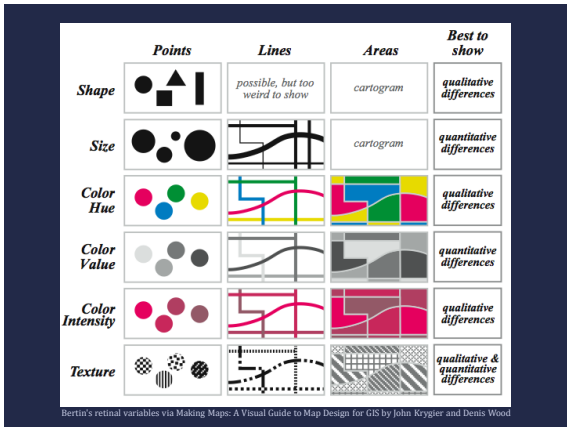
Source: https://twitter.com/altonncf/status/293392615225823232

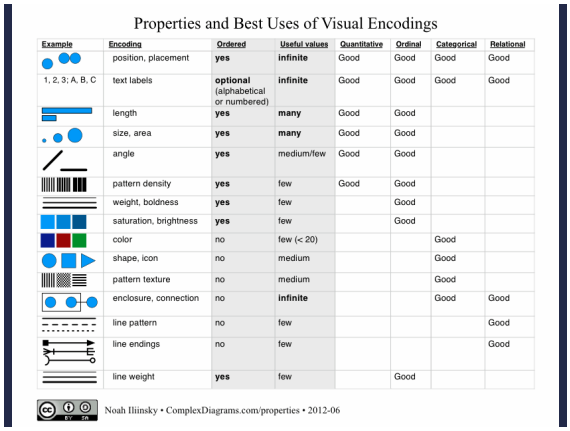
Best practice for design

- How effectively does the visualisation support cognitive tasks?
- The most important and frequent visual queries/pattern finding should be supported with the most visually distinct objects

Visually distinct objects

- Colour (hue, lightness)
- Elementary shape (orientation, size, elongation)
- Motion
- Spatial grouping





Properties and Best Uses of Visual Encodings

Example	Encoding	Ordered	Useful values	Quantitative	Ordinal	Categorical	Relational
	position, placement	**yes**	**infinite**	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	**optional** (alphabetical or numbered)	**infinite**	Good	Good	Good	Good
	length	**yes**	**many**	Good	Good		
	size, area	**yes**	**many**	Good	Good		
	angle	**yes**	medium/few	Good	Good		
	pattern density	**yes**	few	Good	Good		
	weight, boldness	**yes**	few		Good		
	saturation, brightness	**yes**	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	**infinite**			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	**yes**	few		Good		

Noah Iliinsky • ComplexDiagrams.com/properties • 2012-06

Dealing with complex data

- Find a visualisation type that can harbour the data in a meaningful way or reduce the data in a meaningful way.
  - e.g. go from individual values to distribution of values
  - e.g. introduce interaction: overview, zoom and filter, details on demand (Ben Shneiderman)

Do you really need a visualisation?

- Use tables when:
  - doc will be used to look up individual values
  - to compare individual values
  - precise values are required
  - the quantitative info to be communicated involves more than one unit of measure
- Use graphs when:
  - the message is contained in the shape of the values
  - the document will be used to reveal relationships among values

Publishing visualisations

- How can you contextualise, explain any limitations of your visualisations? e.g.
  - provenance and qualities of original dataset;
  - what you needed to do to it to get it into software (how transformed, how cleaned);
  - what's left out of the visualisation, and why?

Tools that don't require programming

- Excel
- Google Fusion Tables, Google Drive
- IBM Many Eyes
- Tableau Public

Exercise 6: geocoding data and creating a map using Google Fusion Tables

- Instructions on the hand-out

Review: planning a visualisation

- With a dataset in mind, consider...
- Exploratory or explanatory? Static or dynamic? Small- or large-scale?
- Choose a type of visualisation (map, timeline, chart, etc)
  - Is your dataset in a suitable format for your visualisation type? How can you clean it?
  - Is more cleaning or transformation needed? You may need to iterate with different versions of your data

If all else fails...

- Sketch out your visualisation on paper to test it
- Iteration is key, and...
- Stubbornness is a virtue!

Exercise 7: taking things further

- Try more visualisations
- Sketch visualisation ideas
- Try visualisation tools

- Instructions on the hand-out

Questions or comments?

References and finding out more

http://bit.ly/UJwgEz

Thank you!