Introduction

Trainer introduction
What is this workshop about?

Freelance Data Visualisation Specialist
Website editor, trainer, lecturer, design consultant, author, researcher...

2015 GOLD
2016 SILVER

Delegates
4385

Countries
19

Events
209
Regardless of your role, domain, background, skills...

This workshop will help you to know what to think, when to think and how to think about creating the most effective data-driven designs in the most efficient way.

Teaching challenges: Multi-disciplinary capabilities (“7 hats”)

Teaching challenges: Tool tutorials. Which ones, what level?
Learning challenges: Look beyond the ‘surface’ of the examples

The Washington Post
The New York Times
the guardian
FINANCIAL TIMES
South China Morning Post
FiveThirtyEight
THE WALL STREET JOURNAL

Objectives: The art & science of data visualisation design

Challenge your existing thinking about how you most effectively and efficiently create data visualisations and infographics

Enlighten you with an appreciation of the many different capabilities and creative techniques in use today, increasing your design sophistication

Equip you with an understanding of the critical thinking that will help you to make the most effective design decisions in the most efficient way

Inspire you to think creatively and empathetically about how you can embrace this subject through exposure to examples and useful resources

Introduction
What is data visualisation about?
How do you define it?
The representation and presentation of data to facilitate understanding

Data: The ‘raw material’

The representation and presentation of data to facilitate understanding
A definition of data visualisation (for communication)...

The representation and **presentation** of data to facilitate understanding
A definition of data visualisation (for communication)...

The representation and presentation of data to facilitate understanding

Facilitating understanding: “User-centred”

“*It’s a common mistake to think that charts are just a fancy way of showing numbers. They’re not. They’re tools for understanding.*”

Robert Kosara

Facilitating understanding: “User-centred”

Perceiving

Interpreting

Comprehending

What does it show?
Where is big, medium, small?
How do things compare?
What relationships exist?

CLEAR COMMUNICATION

What does it mean?
Is it good or bad?
Meaningful or insignificant?
Unusual or expected?

SUBJECT KNOWLEDGE

What does it mean to me?
What are the main messages?
What have I learnt?
Any actions to take?

AUDIENCE RECEPTIVENESS

Facilitating understanding: “Designer-centred”

More style over substance?

Graphic from https://mobile.twitter.com/pie_says_no/status/860193996848672768

Graphic from http://larryferlazzo.edublogs.org/2012/08/30/the-best-visualizations-of-how-people-spend-their-days/
Facilitating understanding: “Designer-centred”

What value does the visual offer? “A visual for visual’s sake”


Facilitating understanding: All part of the same game

Charts, Graphs, Interactives, Infographics, maps ...

Images from (clockwise from top left) Visualisations by Moritz Stefaner et al, Jonathan Corum, Accurat, and ‘Politizane’

Exercise 1

Instinctive critical evaluations

Spend a total of 10 minutes assessing each of the following data visualisations/infographic designs, and then submit your evaluation of each using the relevant method described...

What one word describes how you initially feel about it?

How much do you like the visualisation (1-10)?

How effective does it facilitate understanding (1-10)?

Think about the main factors that influenced your ratings?
**Instinctive critical evaluations (Google Form)**

[Google Form Link](https://goo.gl/forms/zDxT0BOsh2vGEDL83)

**Instinctive critical evaluations (Guide)**

- Disliked it but achieved understanding
- Disliked it and didn’t achieve understanding
- Liked it but didn’t achieve understanding
- Liked it and achieved understanding

**Top 10 salaries at Google**

- Search
- Group Product Director
- Engineering Director
- Product Management Director
- Group Product Manager
- Search Product Manager
- Lead Software Engineer
- Senior Software Engineer
- Staff Software Engineer
- Senior Manager

Range from $41,000 to $241,000 per year
Workflow

A four-stage process for efficient and effective visualisation design

Data visualisation design is a game of decisions

To make the best decisions you need to be familiar with all your options and aware of the things that will influence your choices.

THINGS YOU COULD DO

THINGS YOU WILL DO
"Communicating with numbers is, in many ways, just like communicating with words. You make decisions about what to emphasize and what to downplay, and about how to convey a full understanding of the subject at hand."

Christopher Ingraham

Exercise 2

What information do you need?

A question of context: What information do you need?

Imagine receiving a meeting invite from your manager to discuss a visualisation task she wants you to undertake.

Brainstorm as many questions as possible that you think you might need to ask to give you a clear understanding of the nature and requirements of this task.

Design workflow: Effective decisions, efficiently made

The four stages

- Stage 1: Formulating your brief
- Stage 2: Working with data
- Stage 3: Establishing your editorial thinking
- Stage 4: Developing your design solution
Design workflow: Effective decisions, efficiently made
Process (adaptable, flexible) not procedure: Constraints have more effect than rules

STAGE 1
Formulating your brief

What is a ‘brief’?

Stage 1
Formulating your brief
Stage 2
Working with data
Stage 3
Establishing your editorial thinking
Stage 4
Developing your design solution

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STAGE 1.1

Formulating your brief:
CONTEXT

Reason: What has triggered this process?
Identifying and articulating the motivation

Curiosity: ‘An eagerness to know or learn something’

“What are the main takeaways from the General Election?”
“What are the recommended investment opportunities in Asia?”
“What are the key insights from our staff survey results?”
“What are the financial projections through to 2020?”
“What is the 2017 headcount forecast broken down by type of staff and showing arrivals/departures?”
“What percentage of Liverpool FC’s matches during the 2015/16 season have been relaxing?”

“What is the pattern of success or failure in the movie careers of a range of notable actors?”

Reason: What has triggered this process?
Curiosity = ‘An eagerness to know or learn something’

Reason: What has triggered this process?

A curiosity may require several further proxy questions to answer it.

“What percentage of Liverpool FC’s matches during the 2015/16 season have been relaxing?”

Analytical question 1...
Analytical question 2...
Etc.

“What is the pattern of success or failure in the movie careers of a range of notable actors?”

Analytical question 1...
Analytical question 2...
Analytical question 3...
Analytical question 4...
Analytical question 5...
Etc.

Circumstances
### Circumstances: Factors and requirements

**PEOPLE**
- Stakeholders: Who is ultimate customer? Who are the influencers, interferers, SMEs?
- Audience: What's their knowledge (informed or layperson)? Receptive or indifferent?

**CONSUMPTION**
- Setting: Rapid or prolonged? Consumed remotely or live?
- Frequency: One-off project or a regular/repeated task?

**CONSTRAINTS**
- Pressures: Timescales? Financial? Market influence: to emulate or distinguish?
- Rules: Restrictions about space/size, style (colour, type, logo), platform compatibility?

**DELIVERABLES**
- Format: Is the output for print, web, presentation, video, tool, physical? All?
- Size: How much work will be involved? How many 'things' need to be created?

**RESOURCES**
- Creators: What skills/knowledge? Individual or team?
- Technical: What software, hardware, and technical infrastructure exists?
**Frequency:** One-off project or a regular/repeated task?

**Pressures:** Timescales/milestones, costs, market influence?

**Rules:** Size/space restrictions, style guidelines, platform needs?

**Format:** Output for print, digital, presentation, video? All?
**Size:** How much work? How many ‘things’ to be created?

![Size Diagram](image)

**Creators:** What skills/knowledge? Individual or team?

![Creators Diagram](image)

**Technical:** What software, hardware, infrastructure exists?

![Technical Diagram](image)

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**Formulating your brief:**

**VISION**
Purpose:

To shock adults about the need to improve their diets in order to change their behaviour.

To inform policy makers about the latest BMI value forecasts by country in order to influence decision-making.

To enable health analysts to explore historical BMI values by region in order to facilitate discovery.

To explain to kids about the importance of exercise in order to enlighten and educate.

Purpose map: 'Experience' & 'Tone'

<table>
<thead>
<tr>
<th>EXPLANATORY</th>
<th>EXHIBITORY</th>
<th>EXPLORATORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>sequence</td>
<td>locate</td>
<td>display</td>
</tr>
<tr>
<td>refine</td>
<td>material</td>
<td>manipulate</td>
</tr>
<tr>
<td>refine</td>
<td>material</td>
<td>participate</td>
</tr>
</tbody>
</table>

Purpose: What does success look like?

Identifying and articulating what type of understanding you're hoping to achieve.
Purpose map: ‘Explanatory’ experience

Purpose map: ‘Exploratory’ experience

Purpose map: ‘Exploratory’ experience

Purpose map: ‘Exploratory’ experience
**Purpose map: ‘Exploratory’ experience**


**Purpose map: ‘Exhibitory’ experience**

Visualisation by Krisztina Szűcs: http://szucskrisztina.hu/spotlight_krisztinaszucs.jpg

**Purpose map: ‘Exhibitory’ experience**

Visualisation by Andy Kirk et al.: http://filmographics.visualisingdata.com/
Purpose map: ‘Exhibitory’ experience

Through what experience will understanding be facilitated?

- Designer tells
- Viewer receives
- Explanatory

- Designer displays
- Viewer discovers
- Exhibitory

- Designer enables
- Viewer discovers
- Exploratory

Purpose map: Defining ‘Experience’

Purpose map: ‘Reading’ tone

“A visualization is more effective than another visualization if the information conveyed by one visualization is more readily perceived than the information in the other visualization.”

Jock Mackinlay

Purpose map: The TONE

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“There’s a strand of the data viz world that argues that everything could be a bar chart. That’s possibly true but also possibly a world without joy.”

Amanda Cox, New York Times
“I have this fear that we aren’t feeling enough.”
Through what tone of voice will understanding be facilitated?

Analytical efficiency  Aesthetic seduction
Precision reading  Big-picture reading
Suppress emotion  Amplify emotion
Reading data  Feeling data

STAGE 2

Working with data
Stage 1
Formulating your brief

Stage 2
Working with data

Stage 3
Establishing your editorial thinking

Stage 4
Developing your design solution

Working with data: 4 key dimensions

Data acquisition: Obtain the raw material

Data examination: Organise and familiarise

Data transformation: Tidy, prepare and enhance

Data exploration: Discover its potential

STAGE 2.1

Working with data: ACQUISITION

Acquisition: From where, by whom, and how?

CURATED BY YOU
Primary data
Data capture mechanism
Extracted from pdf
Web scraper/extractor

CURATED BY OTHERS
Issued to you
System report or export
Download from the web
3rd party services
Using an API
Acquisition: From where, by whom, and how?

1. SurveyMonkey
   - http://www.surveymonkey.com/mp/take-a-tour/

2. Tabula
   - http://tabula.technology/

3. Import.io
   - https://import.io/
Considerations: Research, availability, effort ('Filmographics')

STAGE 2.2
Working with data: EXAMINATION

Examining data: Meaning, type, size, & condition
**Meaning:** Developing an intimacy with data  
*It is more than just a data point*

**Phenomenon:** What is it about? What item of an activity or what attribute of an entity does it relate to?

**Representativeness:** From where has it originated?  
How was it collected and by whom? Does it have integrity?  
Does it have uncertainty? Is it a sample, a sub-set or the whole?

**Representativeness:** Uncertainties, assumptions, models

**Type:** More than just words or numbers, “TNOIR”

<table>
<thead>
<tr>
<th>Type</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative (Textual)</td>
<td>Quotes, Tweets, URLs</td>
</tr>
<tr>
<td>Categorical (Nominal)</td>
<td>Countries, Gender, Teams</td>
</tr>
<tr>
<td>Categorical (Ordinal)</td>
<td>Gold, Silver, Bronze</td>
</tr>
<tr>
<td>Quantitative (Interval)</td>
<td>Temperature (C/F), Shoe sizes, BMI</td>
</tr>
<tr>
<td>Quantitative (Ratio)</td>
<td>Measurements, Prices, Age, Distance, Population, Duration</td>
</tr>
</tbody>
</table>

© 2017 Visualising Data Ltd
**Type:** Handling 'Textual' data

Visualisation by Washington Post: [http://wp.me/p1KqoP-2c](http://wp.me/p1KqoP-2c)

**Type:** Handling 'Textual' data


**Size:** How big? How many? What range?


36 countries
11 QoL indicators

**Size:** How big? How many? What range?

Visualisation by Krisztina Szücs: [http://szucskrisztina.hu/spotlight_krisztinaszucs.jpg](http://szucskrisztina.hu/spotlight_krisztinaszucs.jpg)

Avatar > $1000M
(Budget + Gross)
Size: How big? How many? What range?

Condition: Identifying issues with data quality

- Missing records (“what isn’t there?”)
- Missing values (“what are these gaps, zeroes?”)
- Erroneous values (“this total doesn’t add up?”)
- Duplicates (“this is in twice?”)
- Out-of-date values (“that’s an old code?”)
- Uncommon characters (üéæś, line breaks, rogue spaces)
- Date issues (US vs UK, Excel & 1900)
- Inconsistent values (“FEMALE, F, Female”)

Condition: Being realistic about data quality

“This is one of the first questions we should ask about any dataset: what is missing? What can we learn from the gaps?”

Jer Thorp

“Every number we publish is wrong but it is the best number there is”

Andrew Dilnott, Chair of the UK Statistics Authority

Examination: Summary

Browse through your data to develop an intimate familiarity with its meaning & physical properties

Meaning: Representative? What’s missing? What phenomenon?
Scan: Scroll, navigate up/down/left/right
Look: Data types, value size/range, condition
Inspect: Sort, filter, pivot, adv filter, basic charts
Describe: Max, Min, Avg, Median, Count, Len
Interrogate: Deeply consider a single, random record of data
Notes: Issues, questions, tasks, ideas
STAGE 2.3

Working with data: TRANSFORMATION

Enhance your data’s potential: Create

Data at 9:10am

- Transform: Getting your data into shape for analysis

- Reports by 9:30am

Enhance your data’s potential: Convert

- Data source: http://www.tdcj.state.tx.us/death_row/dr_executed_offenders.html

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Enhance your data’s potential: **Consolidate**

### ADJUSTING FOR TICKET PRICE INFLATION

<table>
<thead>
<tr>
<th>Year</th>
<th>Avg. Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>$1.88</td>
</tr>
<tr>
<td>2017</td>
<td>$2.42</td>
</tr>
<tr>
<td>2018</td>
<td>$2.15</td>
</tr>
<tr>
<td>2019</td>
<td>$2.12</td>
</tr>
<tr>
<td>2020</td>
<td>$2.05</td>
</tr>
</tbody>
</table>

#### HOW TO USE THIS FIGURE

If the data can be adjusted for ticket price inflation, there will be a dropdown box in the upper right-hand corner of the screen titled "Adjust". Its default selection is "Actual," which makes the current data you see on the screen show actual box office revenues (i.e., unadjusted dollars).

When you click on this drop-down menu, there are several options. The first is "Actual," which, if selected, will translate the figures on this page into estimated total sales. All other options in the dropdown box tell specific years' figures presented daily to translate those dollars into a given year's dollars. For example, if you selected the four-year box, those dollars are what I imagine have been adjusted to 1995, assuming that 1995 was the year the comparable tickets were sold.

#### HOW WE ADJUST FOR INFLATION / EST. TICKETS

In 2016, the $1.88 of the estimated number of tickets sold for a given movie by having the box office gross and dividing it to the average ticket price at the time it was released. To adjust it for inflation (i.e., we want it right here made in this year), you then multiply the estimated number of tickets sold by the average ticket price of the year you are converting to.

In some cases, we are able to obtain the actual number of tickets sold and we use that figure to base adjustments off of. Apart from box office reported grosses, usually this is the case with older movies, especially those released in the 50s and 60s (I hate with the devil).

Some movies have been released several times over the decades, and we do account for this. For example, Frozen White was released in 2013, but half of its lifetime gross is from re-releases in the 90s and 80s, so each of these releases is adjusted according to the year it earned for money.

### Transformation: Summary

Consider ways to modify and refine your data so it is in optimum condition for analysis

Clean: Clear out any superfluous data, address quality issues
Create: New calculations, groupings, formats
Convert: Keywords, sentiments, standardise
Consolidate: Append, expand, enhance (data, other media)

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**STAGE 2.4**

**Working with data:**

**EXPLORATION**
**Exploratory analysis:** What unknowns can you find?

**Statistics:** Describe what's there

**Visualisation:** Shows what’s there & what’s not there

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**Exploratory analysis:** What unknowns can you resolve?

**Deductive (hypothesis) vs. Inductive (discover)**

Inductive discoveries might be found 'by chance' through seeing your data from all angles.
Exploratory analysis: It can’t answer all our questions…

It can reveal to us *what* is interesting but not *why* and often it just tells us *what new questions* we need to ask.

Exercise 3

Visualising the Olympics (1): Working with data

- **Familiarise yourself with the Excel file, “Exercise3-Olympics.xlsx”**

  - **Examination:** Browse through the table of data, acquainting yourself with the key properties of the data: type, size, relationships, condition
  - **Transformation:** Identify any transformation tasks you think you might need to undertake (clean, create, convert, consolidate)
  - **Exploration:** Consider some of the different ways you could undertake exploratory data analysis on this data and about this subject?
STAGE 3

Establishing your editorial thinking

The role of editorial thinking

Having a discerning eye for what analysis you are going to visually portray. The question of how comes later…

“Given all the things we could show, what will we show?”

Exercise 4

Brainstorming questions
Imagine you have an unlimited amount of Lego data, list as many analysis questions as possible you would find interesting...

A chart offers visual answer(s) to a data question

How has the percentage of different colours of Lego pieces sold changed by year between 1975 and 2014?

Defining editorial perspectives: Angle & Framing

ANGLE: How has the percentage of different colours of Lego pieces sold changed by year?

FRAMING: Between 1975 and 2014

Defining editorial perspectives: Angle & Framing

ANGLE: How has the percentage of different colours of Lego pieces sold changed by region?

FRAMING: Between 1975 and 2014
ANGLE: How has the total number of different colours of Lego pieces sold changed by region?

FRAMING: Between 1975 and 2014

ANGLE: How has the total number of different colours of Lego pieces sold changed by region?

FRAMING: Only bricks, coloured white, grey or black in North America for the years 1984, 1994, 2004 and 2014

ANGLE: What view(s) of your data is most relevant: to what data question are you attempting to provide an answer?

FRAMING: What data to show? What data to leave out?

FOCUS: Is there anything you want to emphasise?

ANGLE: What view(s) of your data is most relevant: to what data question are you attempting to provide an answer?

FRAMING: What data to show? What data to leave out?

FOCUS: Is there anything you want to emphasise?
“A photo is never an objective reflection, but always an interpretation of reality. I see data visualization as sort of a new photojournalism – a highly editorial activity.”

Moritz Stefaner

**Defining editorial perspectives: Angle, Framing & Focus**

**Example: Defining your editorial perspectives**

**Angle:** Which view(s) is most relevant?

**Bar chart:**

- The 10 actors with the most Oscar nominations but no wins (2015)

**Photos from:** http://neilleifer.com/portfolio/
Example: Defining your editorial perspectives

Why Peyton Manning’s Record Will Be Hard to Beat
BY BRIAN ROSE AND JAY ROBB
SEP 19, 2013

The future quarterback of the all-time NFL touchdown passing record—and is still going strong.

Example: How many different views of your data are required?

Angle: How many different views of your data are required?

“What is the pattern of success or failure in the movie careers of a range of notable actors?”

Angle of analysis 1...
Angle of analysis 2...
Angle of analysis 3...
Angle of analysis 4...
Angle of analysis 5...
Angle of analysis 6...

Framing: What’s to be included? Is it representative?

Images taken from http://www.theguardian.com/football/blog/2014/jul/05/diego-maradona-belgium-famous-photo
“For me, the picture does not show six terrified defenders: it shows our players working perfectly in harmony... It is symbolic of how we took on the world champions – and won. Because that’s the thing people forget. We won 1-0.”

Frank Vercauteren

**Framing:** What’s to be included? Is it sufficient?

**Example:** Defining your editorial perspectives

- **Image from** [http://i.imgur.com/OTfytjA.jpg](http://i.imgur.com/OTfytjA.jpg)

**Framing:** Parameters for time (1930 to 19th October 2014) and minimum qualifying quantitative threshold (30 TD passes)

**Focus:** Emphasis and contrast

**Focus:** What supports the point you are making?

- **Image from** [http://vashivisuals.com/splitting-focus-de-palmas-blow/](http://vashivisuals.com/splitting-focus-de-palmas-blow/)

- **Image from** [https://www.ft.com/content/b2eced58-a6cc-11e6-8898-79a99e2a4de6](https://www.ft.com/content/b2eced58-a6cc-11e6-8898-79a99e2a4de6)
Focus: What supports the point you are making?

Visualisation by FiveThirtyEight http://fivethirtyeight.com/features/mizzous-racial-gap-is-typical-on-college-campuses/

Example: Defining your editorial perspectives

Why Peyton Manning’s Record Will Be Hard to Beat

The Broncos quarterback has set the all-time NFL touchdown passing record — and is still going strong.


Focus: Emphasis on record holder, highlights for other current players and previous record holders/notable players

Defining editorial perspectives: What do you want to say?

Who are your audience? What do you want to tell them? What do you know they need to know? If you were them what would you find relevant?


Defining editorial perspectives: What do you really want to say?

How are my taxes spent?

In 2014, the IRS allocated how their income tax and excise tax collections were divided.

Defining editorial perspectives: What do you **really** want to say?

15 'Department' categories:

2 series of % values (totaling 100%) for 'Actual' and 'Perceived'.
Exercise 5

Visualising the Olympics (2): Editorial thinking

Your challenge now is to compile a cohesive list of potentially interesting angles of analysis about this subject. Where possible, define the framing and (optionally) the focus you would apply to each. For example:

**Angle:** How many medals have been won over time broken down by country?
**Framing:** Gold medals for the men’s 100 metres since the second world war
**Focus:** Emphasising GBR vs. USA

Try stay within the boundaries of what you have BUT if you have interesting ideas that would require more data, that is allowed.

STAGE 4

Developing your design solution
The representation and presentation of data to facilitate understanding

STAGE 4

Developing your design solution:
PRINCIPLES OF GOOD DESIGN

Design principles: Supporting our decision-making

- Bad visualisation design is MISLEADING
- Bad visualisation design is CONFUSING
- Bad visualisation design is UGLY

Design principles: Supporting our decision-making

- Good visualisation design is TRUSTWORTHY
- Good visualisation design is ACCESSIBLE
- Good visualisation design is ELEGANT
Good visualisation design is TRUSTWORTHY

**Trustworthiness: Distortions**

Don't create 3D out of 2D data


**Trustworthiness: ‘Truncated’ and ‘Embellished’ axes**

Most of Trump’s charts skew the data. And not always in his favor.

Images from https://www.washingtonpost.com/graphics/politics/2016-election/trump-charts/

**Trustworthiness: ‘Embellished’ axes**

Images from http://visual.ly/top-10-most-read-books-world
Trustworthiness: ‘Embellished’ bar lengths

Trustworthiness: In the eye of the reader…

Trust is hard to earn and easy to lose.

Image from https://twitter.com/YouGov/status/838720989991223297

Other items not depicted include: onions (6%), chicken (6%), beef (6%), chilies (5%), anchovies (3%), pork (3%), tuna (3%), and mushrooms (1%). 3% of people say they only like Margherita pizzas.
Good visualisation design is **ACCESSIBLE**

The efforts required to read a visualisation should be exceeded by the rewards of understanding it leads to.

...in other words, reduce *unnecessary* brainwork.

**Accessible: Some subjects are complex, use complex methods**

**Accessible: Some subjects are simple, use simple methods**
Accessible: Some subjects are more familiar to some

Lionel Messi: Games and Goals for FC Barcelona

Accessible: Some subjects are less familiar to some

Total Sightings of Winglets and Spungles

Good visualisation design is ELEGANT

Elegance: Elusive notion, difficult balance...
Elegance: What is it? How do you find it?
Is it ‘easy on the eye’? Cluttered, shouty, busy, noisy display?

Elegance: (1) Visual harmony
‘Easy on the eye’ = Harmonious, calm, attractive, balanced colour and layout.
**STAGE 4.1**

**Developing your design solution:**

**DATA REPRESENTATION**

**Exercise 6**

**How to ‘show’ two numbers?**
Ways of showing two numbers (the ‘Santiago Ortiz’ challenge)?

How many different ways can you think of to represent this simple table of two records:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>10</td>
</tr>
</tbody>
</table>

Sketch out on flipchart paper as many ideas as you can think of in FIVE minutes.

Open your mind, be creative! There are no limits, maybe think about non-standard/non-visual representations…

**Data encoding**

**MARKS** = Placeholders to display data items

<table>
<thead>
<tr>
<th>Characters</th>
<th>Points</th>
<th>Lines</th>
<th>Shapes</th>
<th>Forms</th>
</tr>
</thead>
<tbody>
<tr>
<td>abc</td>
<td>○</td>
<td>I</td>
<td>⊙</td>
<td>●</td>
</tr>
</tbody>
</table>
ATTRIBUTES = Visual property variations to display data values

- **Position**
- **Size (length)**
- **Size (area)**
- **Size (volume)**
- **Angle/slope**
- **Quantity**
- **Pattern**

Influenced by Bertin (1983) and Card et al. (1999)

**Encoding data using CHARACTERS**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Team</th>
<th>X-Position</th>
<th>Y-Position</th>
<th>Diff.</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Real Madrid</td>
<td>2.24</td>
<td>0.17</td>
<td>+3.87</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Barcelona</td>
<td>3.13</td>
<td>0.10</td>
<td>+1.94</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bayern Munich</td>
<td>2.92</td>
<td>0.13</td>
<td>+0.56</td>
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<td>0.10</td>
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<td>Spain</td>
<td>2.73</td>
<td>0.12</td>
<td>+0.71</td>
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<td>8</td>
<td>Manchester City</td>
<td>2.79</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Paris Saint-Germain</td>
<td>2.66</td>
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<td>10</td>
<td>Atlético Madrid</td>
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<tr>
<td>11</td>
<td>France</td>
<td>2.50</td>
<td>0.17</td>
<td>+0.32</td>
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<tr>
<td>12</td>
<td>Chelsea</td>
<td>2.65</td>
<td>0.14</td>
<td>+1.93</td>
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<td>13</td>
<td>England</td>
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<td>0.11</td>
<td>+0.87</td>
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<td>14</td>
<td>Liverpool</td>
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<tr>
<td>20</td>
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<td>2.26</td>
<td>0.13</td>
<td>+0.84</td>
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</tr>
</tbody>
</table>

Influenced by Bertin (1983) and Card et al. (1999)

**Encoding data using POINTS**

- **Symbol/icon**
- **Colour (Hue)**
- **Colour (Saturation)**
- **Colour (Lightness)**
- **Connection**
- **Direction**
- **Containment/Enclosure**

Influenced by Bertin (1983) and Card et al. (1999)
Encoding data using LINES

THE COUNTRIES WITH THE MOST LAND NEIGHBOURS

- People's Republic of China
- Russia
- Belarus
- Democratic Republic of the Congo
- Germany
- France
- Italy
- Belgium
- Spain
- Japan
- Australia
- Brazil
- India
- Mexico
- Colombia
- South Africa
- Singapore
- Taiwan
- Norway
- Pakistan

Source: Data from the CIA World Factbook, 2016.

Encoding data using SHAPES

Four Ways to Slice Obama’s 2013 Budget Proposal

Explore every task and category of President Obama’s Federal budget proposal.

- How $3.7 Trillion is Spent
- The Overall Budget: President Obama’s proposed budget includes a $3.7 trillion spending plan and reduces a $1.4 trillion deficit.

Implementation of the proposal will require:

- An increase of federal spending
- An increase in taxes
- A decrease in existing entitlement programs

Gallery of chart types

- 3,302 cubic miles
- 1,460 cubic miles
- 737 cubic miles
- 1,000 cubic miles

1985 to 2006 average Arctic sea ice volume

2015 to 2030

2045 to 2060

Volume of the Grand Canyon
Five classifying families: CHTS

<table>
<thead>
<tr>
<th>CATEGORICAL</th>
<th>HIERARCHICAL</th>
<th>RELATIONAL</th>
<th>TEMPORAL</th>
<th>SPATIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparing categories and distributions of quantitative values.</td>
<td>Charting part-to-whole relationships and hierarchies.</td>
<td>Graphing relationships to explore correlations and connections.</td>
<td>Showing trends and activities over time.</td>
<td>Mapping spatial patterns through overlays and distortions.</td>
</tr>
</tbody>
</table>

### CATEGORICAL
Comparing categories and distributions of quantitative values

#### Bar chart

The 10 actors with the most Oscar nominations but no wins

#### Connected dot plot

[Source: https://en.wikipedia.org/wiki/List_of_actors_with_two_or_more_Academy_Award_nominations_in_acting_categories (as at August 2017)]

Pictogram

**Razors Are for the Regular Season**

Based on recent photographs, here is how the four remaining teams in the NHL playoffs compare in terms of facial hair. Players are divided into three categories: full beard, average beard, and clean shaven.

<table>
<thead>
<tr>
<th>Team</th>
<th>Full Beard</th>
<th>Average Beard</th>
<th>Clean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rangers</td>
<td>15</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Blackhawks</td>
<td>8</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Ducks</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Lightning</td>
<td>10</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: Results reflect a count of 25 forwards, 12 defensemen and any players with no playing time.


Bubble chart

**10.2 Old age**

- £118.2bn

- £128.9bn

HIERARCHICAL

Charting part-to-whole relationships and hierarchies

Histogram

**A Career in Numbers: Movies Starring Michael Caine**
Summary of electorate voting during the UK General Election 2017

- Voted Conservatives: 29%
- Voted for other parties: 36%
- Did not vote: 35%

March 2003: Microsoft's Internet Explorer (61.9%) achieves peak dominance in browser usage

September 2008: Desktop usage for Firefox (14.9%) vs Chrome (3.1%) is launched by Google

May 2015: As Chrome (64.9%) achieves peak usage share, IE (9.7%) falls further away

LITERACY PROFICIENCY: Percentage of adults (16-65 years) scoring at each proficiency level

- Japan
- Finland
- Netherlands
- Australia
- Estonia
- Italy

Tree map

[Tree map image: Color-coded rectangles representing different categories with percentages.]
RELATIONAL

Graphing relationships to explore correlations and connections.
TEMPORAL

Showing trends and activities over time
SPATIAL

Mapping spatial patterns through overlays and distortions
Influencing factors
Context: What tools make which charts (and vice-versa)?

Context: Free tools? 'Think outside the box'

http://rawgraphs.io/

Microsoft PowerPoint [Priced]
Data: How many ‘things’
Too many categories?

John Peel’s most played artists in his Festive 50s

Data: What’s it about?
Finding ways to engage through creative – but relevant – aesthetics

Editorial: Which ‘angle’ of analysis are you showing?

Exercise 7
Visualising the Olympics (3):
Developing your chart vocabulary
Visualising the Olympics (2): Developing your chart vocabulary

Building on your work examining the Olympics data and developing your editorial ideas, your challenge is now to identify (but not build) 5 different charts that could be used to portray interesting angles about this subject.

Mandatory constraint (1): Challenge yourself to select only one chart from each of the five classifying families (CHRTS)

Optional constraint (2): Challenge yourself to not select the standard bar, pie or line charts!

Optional constraint (3): Restrict yourself to basing your ideas only upon the data you have been provided with.

In the final presentation, be prepared to describe what each chart would show and how you would map the data on to the marks/attributes offered by each chart.

Visualising the Olympics (3): Developing your chart vocabulary

Break

15 minutes
STAGE 4.2

Developing your design solution: INTERACTIVITY

Data adjustments: Controlling what data is displayed
Presentation adjustments: Controlling how data is displayed

Features of interactivity: Judging the right user experience

Data adjustments

Framing: Categorical menus
Framing: Parameter handles

Visualisation by Stamen

Framing: Navigating through 'pan' and 'zoom'

Visualisation by Dustin Cable
http://demographics.coopercenter.org/DotMap/index.html

Framing: 'Drill-down' navigation

Visualisation by Jeff Clark
http://neoformix.com/Projects/ObesitySlope/

Animating: Controlled time lapse

https://www.shipmap.org/
**Animating: Controlled time lapse**

**The Guantanamo Docket**

A History of the Detainee Population

<table>
<thead>
<tr>
<th>Detainees Held</th>
<th>Detainees Transferred</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sequencing: 'Angle' navigation (menus)**

Four Ways to Slice Obama's 2013 Budget Proposal

**Contributing: ‘Plot’ your comments**

The Death of a Terrorist: A Turning Point?

**Contributing: Selection slider**

How well do you know your area?

Outsiders for the Week of 23rd May 2012

For many 100 people, how many are aged 60 or over?

You can contribute your comments at http://projects.nytimes.com/guantanamo/


Visualisation by ONS http://www.neighbourhood.statistics.gov.uk/HTMLDocs/dvc147/
Presentation adjustments
Focusing: Selection filters

Annotating: Reader guides

Annotating: Selectable tooltips

Influencing factors
Context: What tools do you have?

D3.js

Four Ways to Slice Obama's 2013 Budget Proposal

Explore every major item of President Obama's Fiscal Year 2013 budget proposal. Each map visualizes a different aspect of the comprehensive proposal, including tax reform, Medicare and Medicaid, and discretionary spending. The visualizations are designed to help you see how the proposal affects different sectors and communities across the United States.

Video from http://www.ibtimes.co.uk/videos/uk-election-timelapse-how-2017-general-election-unfolded-26336

Context: What tools do you have?

D3.js

**Context:** What tools do you have? Processing & P5.js

Multimodal Symphony
- Multimodal interaction
- Audio & visuals
- Spatial & Temporal

**Context:** What tools do you have? Tableau Desktop [License]

**Context:** What tools do you have? Tableau Desktop [Free]

**Context:** What setting, how much time?

With interactives, it is hard to know how long it will take to ‘reach the end’. It is much easier to estimate/quantify the reading proposition of statics.
Vision: Your judgement of ‘Experience’ & ‘Tone’

Data representation: What chart type?
Some charts are inherently visually complicated and need interactivity

Resort to interactivity only when you have exhausted the possibility of an appropriate and effective static solution.

“Make it the least interactive thing that works”

Design principles: Preserve accessibility, beware feature creep!

Data adjustments
Framing: Parameter handles to modify data filtering
Navigating: Pan and zoom around a map, drill-down hierarchically
Animating: Automatic or controlled time-lapse portrayals
Sequencing: Use of ‘steppers’ or ‘scrollers’ to navigate through content
Contributing: Means for adding user data to customise the experience

Presentation adjustments
Focusing: Various means of filtering to emphasise/de-emphasise values
Annotating: Revealing details through tooltips
Orientating: Visual guides to help make sense of location within display
Customising: Modifying composition settings to suit needs

INTERACTIVITY: Summary
Exercise 8

Forensic design assessments

After covering each layer of design consider the effectiveness or otherwise of the choices you see in the following visualisations/infographics.

If the choices are effective, why do you think that?
If the choices are ineffective, what would you do differently?

(When looking at interactivity, most pieces are NOT interactive so simply consider what interactive features could improve on the existing static format to enhance the experience.)

1. Leading Men Age, But Their Love Interests Don’t

2. Vanishing Elephants
### Visualising the Olympics (3): Developing your chart vocabulary

<table>
<thead>
<tr>
<th></th>
<th>Visualisation 1</th>
<th>Visualisation 2</th>
<th>Visualisation 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data representation</strong></td>
<td>What works well and why?</td>
<td>What doesn’t. How improve it?</td>
<td></td>
</tr>
<tr>
<td><strong>Interactivity</strong></td>
<td>What works well and why?</td>
<td>What doesn’t. How improve it?</td>
<td></td>
</tr>
<tr>
<td><strong>Annotation</strong></td>
<td>What works well and why?</td>
<td>What doesn’t. How improve it?</td>
<td></td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>What works well and why?</td>
<td>What doesn’t. How improve it?</td>
<td></td>
</tr>
<tr>
<td><strong>Composition</strong></td>
<td>What works well and why?</td>
<td>What doesn’t. How improve it?</td>
<td></td>
</tr>
</tbody>
</table>

---

**Exercise 8.1**

Forensic design assessments: **DATA REPRESENTATION & INTERACTIVITY**

---

**STAGE 4.3**

Developing your design solution: **ANNOTATION**
**Project annotation**: Helping viewers understand what the project is about and how to use it

**Chart annotation**: Helping viewers perceive the charts and optimise their understanding of the potential interpretations

---

**Headings (titles/sub-titles): Statements, Questions, Descriptions**

- **Presidential Approval, like to Obama**
  - Why Peyton Manning’s Record Will Be Hard to Beat
  - How Y’all, Youse and You Guys Talk

- **Song Structure**
  - Which companies caused global warming?
  - Lunge Feeding

- **SPOTLIGHT ON PROFITABILITY**
  - What Would It Take To Turn The States Red?

- **THE COUNTRIES WITH THE MOST LAND NEIGHBOURS**
  - Arteries of the city

- **Global Ph.D. Gender Gap (2010)**
  - Razors Are for the Regular Season

  - Comparing Critics Scores (Rotten Tomatoes) for major movie franchise (Dec 2014)

  - ‘Avengers’ characters’ appearances over time

---

**Headings (titles/sub-titles): Statement title & descriptive sub-title**

- **Sweeping up the Remain-voting seats will be a tall order for the Lib Dems**
  - The Lib Dems are running a campaign with a positive message in a party that has been in power too long to fall into their trap.
Reader guides: Explaining sophisticated charts

Chart apparatus: Axis labels, scales, value labels

Chart apparatus: Axis labels, scales, value labels

Chart apparatus: Axis labels, scales, value labels
Legends: Colour, size, shape, texture meaning

Data overlays: Lines, marks and bandings

Visualisation by Financial Times https://www.ft.com/content/70728758-1298-3c77-b186-5093439152d2

Legends: Attribute meaning incorporated into introduction

Data overlays: Lines, marks and bandings


Visualisation by BBC http://www.bbc.co.uk/news/uk-politics-38762034

Visualisation by National Geographic http://www.nationalgeographic.com/astrobiology/goldilocks-worlds/
Data overlays: Lines, marks and bandings

Captions: Narrative, observations, summaries

Context:
Circumstances and requirements
What is your audience’s domain knowledge, sophistication?

Influencing factors
**Context:** Circumstances and requirements

What is your audience’s knowledge of terminology, acronyms, abbreviations?

**Purpose map:** Defining ‘Experience’

Through what experience will understanding be facilitated?

- Designer tells
- Viewer receives
  - Explanatory
- Designer displays
- Viewer discovers
  - Exhibitory
- Designer enables
- Viewer discovers
  - Exploratory

**Editorial:** What values to focus on?

**Principles:** Visual obstructions reduce accessibility & elegance
Exercise 8.2
Forensic design assessments:
ANNOTATION

STAGE 4.4
Developing your design solution:
COLOUR

Project annotation
Headings: Titles (headline/message), subtitles (descriptive)
Introductions: Report description, main summary findings
User guides: Help with using functional features
Footnotes: Data sources, credits, links, dates, versions

Chart annotation
Reader guides: Help with charts, guidance about the subject, calculations
Chart apparatus: Axis labels, scales, value labels, degree of precision?
Legends: To explain the meaning of any visual attribute
Data overlays: Additional marks to indicate key insights (avg., forecasts)
Captions: Provide some in-chart narrative to explain interesting insights

The value of effective colouring
One of the most confusing optical illusions I've seen. The green and blue are actually the same color. psy.tutu.me/oo/jp/~akitaoka/rot.png...
The value of effective colouring

Features of colours: Imparting the right meaning

**Data legibility:** Applying colour choices to represent quantitative scale classifications or categorical associations

**Editorial focus:** Helping viewers quickly perceive the most important features of a data display

**Functional harmony:** Helping establish balance and unity through the colour choices of every other visual property

---

Showing quantities: Magnitude & order (?)

---

Data legibility
Showing quantities: Magnitude & order

How rational polls varied in the final week of past campaigns

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CANDIDATE/POLITICAL PARTY</th>
<th>LEADING POLLS</th>
<th>LAGGING POLLS</th>
<th>PROBABILITY</th>
<th>CONFIDENCE INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>Jimmy Carter</td>
<td>+4</td>
<td>-1</td>
<td>+3</td>
<td>± 0.5</td>
</tr>
<tr>
<td>1980</td>
<td>Ronald Reagan</td>
<td>-6</td>
<td>+1</td>
<td>-5</td>
<td>± 0.2</td>
</tr>
<tr>
<td>1984</td>
<td>Ronald Reagan</td>
<td>-20</td>
<td>+10</td>
<td>-12</td>
<td>± 0.7</td>
</tr>
<tr>
<td>1988</td>
<td>George HW Bush</td>
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<td>+4</td>
<td>-11</td>
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<tr>
<td>1992</td>
<td>Bill Clinton</td>
<td>+8</td>
<td>-4</td>
<td>+3</td>
<td>± 0.7</td>
</tr>
<tr>
<td>1996</td>
<td>Bill Clinton</td>
<td>-9</td>
<td>+1</td>
<td>-8</td>
<td>± 0.3</td>
</tr>
<tr>
<td>2000</td>
<td>George W Bush</td>
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<td>-12</td>
<td>+10</td>
<td>± 0.6</td>
</tr>
<tr>
<td>2004</td>
<td>George W Bush</td>
<td>+6</td>
<td>-2</td>
<td>+5</td>
<td>± 0.2</td>
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<tr>
<td>2008</td>
<td>Barack Obama</td>
<td>+12</td>
<td>-6</td>
<td>+12</td>
<td>± 0.8</td>
</tr>
<tr>
<td>2012</td>
<td>Barack Obama</td>
<td>+6</td>
<td>-1</td>
<td>+7</td>
<td>± 0.3</td>
</tr>
<tr>
<td>2016</td>
<td>Hillary Clinton</td>
<td>+4</td>
<td>-1</td>
<td>+3</td>
<td>± 0.2</td>
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</table>

© 2017 Visualising Data Ltd
<table>
<thead>
<tr>
<th>Category</th>
<th>Image Source</th>
</tr>
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**UN Global Pulse Survey**

"Given the global financial crisis, I feel positive about the future prospects in my country"

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

**Procurement Report**

<table>
<thead>
<tr>
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<th>Raw Data</th>
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</tr>
<tr>
<td>noun</td>
<td>FY2015: $1,000,000</td>
</tr>
<tr>
<td>Rejected as a result of process</td>
<td>FY2016: $1,464,000</td>
</tr>
<tr>
<td>noun</td>
<td>FY2015: $1,000,000</td>
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<td>noun</td>
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</tr>
<tr>
<td>noun</td>
<td>FY2015: $1,000,000</td>
</tr>
</tbody>
</table>

© 2017 Visualising Data Ltd
Data legibility: Colour resources

Data legibility: Colour resources

Emphasis & contrast: What supports the point you are making?

Guys Named John, and Gender Inequality
Share of C.E.O.s of S&P 500 companies by C.E.O. name

<table>
<thead>
<tr>
<th>Name</th>
<th>Share of C.E.O.s</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>23%</td>
</tr>
<tr>
<td>David</td>
<td>12%</td>
</tr>
<tr>
<td>Jill</td>
<td>6%</td>
</tr>
<tr>
<td>Robert</td>
<td>4%</td>
</tr>
<tr>
<td>James</td>
<td>5%</td>
</tr>
<tr>
<td>Michael</td>
<td>13%</td>
</tr>
<tr>
<td>William</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: DataBar

Editorial focus
Emphasis & contrast: What supports the point you are making?

Two-thirds of the time, the 'girl' is a woman
Share of most popular books on Goodreads with "girl" or "girls" in the title by whether the title character is an adult or a child

<table>
<thead>
<tr>
<th></th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woman</td>
<td>65%</td>
</tr>
<tr>
<td>Girl</td>
<td>28%</td>
</tr>
<tr>
<td>Indeterminate</td>
<td>7%</td>
</tr>
</tbody>
</table>

This data set is the 860 most popular "girl" books on Goodreads that aren't cookbooks, aren't for children or young adults and have more than 250 ratings.

Functional harmony
Functional harmony: The colouring of every non-data feature!


Functional harmony: The colouring of every non-data feature!


Functional harmony: Using colour to organise content hierarchy

Image from http://www.flickr.com/photos/walkingsf/6276642489/sizes/l/in/photostream/

Functional harmony: Using colour to organise content hierarchy

Visualisation by Bloomberg http://www.bloomberg.com/billionaires/
**Functional harmony: Using colour to organise content hierarchy**

<table>
<thead>
<tr>
<th>MATCH OUTCOME</th>
<th>TOTAL</th>
<th>WINNING</th>
<th>DRAWN</th>
<th>LOSING</th>
<th>TOTAL MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL MATCHES</td>
<td>43</td>
<td>27</td>
<td>21</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>SCORED FIRST</td>
<td>35</td>
<td>22</td>
<td>11</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CONCEDED FIRST</td>
<td>23</td>
<td>5</td>
<td>5</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>GOALS SCORED</td>
<td>98</td>
<td>68</td>
<td>22</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>GOALS CONCEDED</td>
<td>71</td>
<td>37</td>
<td>22</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MATCH STATUS</th>
<th>TOTAL</th>
<th>WINNING</th>
<th>DRAWN</th>
<th>LOSING</th>
<th>TOTAL MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL MATCHES</td>
<td>387</td>
<td>1,239</td>
<td>3,364</td>
<td>1,487</td>
<td></td>
</tr>
<tr>
<td>SCORED FIRST</td>
<td>35</td>
<td>22</td>
<td>11</td>
<td>2</td>
<td></td>
</tr>
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</tr>
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<td>GOALS CONCEDED</td>
<td>71</td>
<td>37</td>
<td>22</td>
<td>13</td>
<td></td>
</tr>
</tbody>
</table>

**Influencing factors**

**Context:** Circumstances and requirements
The science of colour perception: Colour blindness (~5% people)

1. **Colour blindness simulator**
   - [http://colororacle.org/](http://colororacle.org/)

2. **Alternative approaches to replace default green and red**
   - '#7b3294' for 'GREEN = GOOD'
   - '#d01c8b' for 'RED(ish) = BAD'
   - '#008837' for 'RED = 'HELL' = 'BAD''
   - '#4dac26' for 'BLUE = 'HEAVEN' = 'GOOD''
   - '#d7191c' for 'BLUE = 'HEAVEN' = 'GOOD''

---

**Context:** Circumstances and requirements
Alternative approaches to replace default green and red

**Election results**

<table>
<thead>
<tr>
<th>Election results</th>
<th>Seats won</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colours</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
<td>36</td>
</tr>
<tr>
<td>Green</td>
<td>35</td>
</tr>
<tr>
<td>Red (dark)</td>
<td>12</td>
</tr>
<tr>
<td>Blue (light)</td>
<td>23</td>
</tr>
</tbody>
</table>

---

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**Context:** Circumstances and requirements

Accommodating colour branding requirements

---

**Context:** Circumstances and requirements

Colour output constraints

---

**Data:** How many categories?

---

**Principles:** Accessible design

Exploiting/avoiding colour connotations

---

**'How Do You Like Your Steak Prepared?'**

From a survey of 432 steak-eating Americans

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well</td>
<td>84%</td>
</tr>
<tr>
<td>Medium-well</td>
<td>17%</td>
</tr>
<tr>
<td>Medium</td>
<td>31%</td>
</tr>
<tr>
<td>Medium-rare</td>
<td>38%</td>
</tr>
<tr>
<td>Rare</td>
<td>5%</td>
</tr>
</tbody>
</table>
**Principles: Accessible design**
Commit a colour once in the same view. Consistency more important than metaphor.

**COLOUR: Summary**

**Data legibility**
How to colour quantitative scales? (Magnitude/order)
How to colour categorical (nominal) associations? (Distinct, learnable)
How to colour categorical (ordinal) scales? (Magnitude/order or distinct)

**Editorial focus**
How to direct the eye towards any features of your data you think are most interesting? (indicative of ‘explanatory’ visualisation types)

**Functional harmony**
Using colour to organise content?
How to colour all other features? (background, text, apparatus, labels)?

---

**Exercise 8.3**
Forensic design assessments:
COLOUR

**STAGE 4.5**
Developing your design solution:
COMPOSITION
Project composition: Defining the layout and hierarchy of the entire visualisation project

Chart composition: Defining all shape, size and layout decisions within your charts

Position: Organising content through sequence

Position: Organising content through sequence and grouping

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**Sizing:** Creating a visual hierarchy through relative sizing

**Orientation:** Consistency with ‘meaning’

**Chart composition**
Positioning: Where and how to locate chart annotations?

Chart sizing: Don’t be afraid to go small!
Chart sizing: Axis scales

The glass ceiling persists

In 2013, women accounted for 25% of CEOs in Fortune 500 companies.

Source: Catalyst

Chart sizing: Axis space

South Texas river levels, feet above sea level

Sorting (LATCH): Location

Sorting (LATCH): Alphabetical

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Sorting (LATCH): Temporal

- March 2003: Microsoft's Internet Explorer becomes the top browser.
- September 2008: Distinctive features for Microsoft's IE 8.0.28 as Chrome 3.11 is launched by Google.
- May 2015: As Chrome 41.0 breaks past IE 8.0.28, IE 11.0 editor further away.

Sorting (LATCH): Categorical

- LITERACY PROFICIENCY: Percentage of adults (16-65 years) scoring at or above proficiency level.
- Countries include: Japan, Finland, Netherlands, Australia, Estonia, Korea.

Sorting (LATCH): Hierarchical


Table composition: Position (Alignment) and size (height/width)

- Columns: Numbers, Right Align.
- Headers: Consistent with row values.
- Rows: Middle Align.
- Words: Left Align.
- Optimize height to suit row count.
- Optimize width to suit value lengths.

Table from FiveThirtyEight: Election Update - The Polls: Agree and That's OK.
Influencing factors

Context: Circumstances and requirements
What is your output format? Print vs. digital layouts

Data: How many things? What range of sizes?

<table>
<thead>
<tr>
<th>HEADING</th>
<th>SUMMARY STATS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>63 matches = 8 x 8 grid</td>
</tr>
</tbody>
</table>

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**Data representation:** What chart type?
Some charts are bigger than others, they occupy a certain shape.

**COMPOSITION:** Summary

**Project composition**
Positioning: Absolute and relative locations of charts/annotation features
Positioning: Organising content through position, annotation, colour
Orientation: Consistency with meaning and available space?
Sizing: Using variation in size to establish a visual hierarchy
Sizing: Variation in typeface/font to establish hierarchy/suit legibility

**Chart composition**
Positioning: Where and how to locate all your chart annotations
Chart sizing: Don’t be afraid to go small (‘small multiples’), axis scales
Sorting: Optimise the readability of your display through astute sorting
Table composition: Alignment and size of rows and columns

---

**Exercise 8.4**

Forensic design assessments: COMPOSITION

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**Leading Men Age, But Their Love Interests Don’t**

http://www.vulture.com/2013/04/leading-men-age-but-their-love-interests-dont.html
Wrap-up

References for ongoing development & workshop review

Developing the craft: Addressing shortcomings?

- Some require fresh thinking
- Some require new attitudes/better discipline
- Some require more knowledge
- Some require more skills
- Some require latent talent (technical, creative)
- Some can be compromised on
- Some can be gained by collaborating
- Most requires further experience/practice
Developing the craft: Addressing shortcomings?

- Some require fresh thinking
- Some require new attitudes/better discipline
- Some require more knowledge
- Some require more skills
- Some require latent talent (technical, creative)
- Some can be compromised on
- Some can be gained by collaborating
- Most requires further experience/practice

Developing the craft: Acquiring knowledge

- Online content – immerse yourself in the community
- Books – many invaluable references and inspirations
- Academia – papers, journals
- Conferences – within the field and around it
- Training/education – continue looking for opportunities
- Look beyond just visualisation – writing, video games, graphic design, architecture, cartoons etc.

Developing the craft: Experience/practice

- How many incidents? Where?
- Victim profiles?
- Trend over time for context?
- Age profile of previous Wimbledon/Grand Slam finalists?
- Comparison of fire response speeds and types across London?
- Profile of what’s happened since the coup (arrests, sackings, protests, political changes)?
- Who has held this status in the past? Spread across the country?
- Profile of the routes and quantities of migrant boats over time?
- Map displaying the new/old routes?
- Quantifying the decline in population and range on a map?
- Breakdown of average/median incomes by age group and trends?
- Timeline of US-Cuba policies and changes?
Supportive and open – friendly, constructive, welcoming
Compact and visible – social media (esp. Twitter) very active
Undersupply of professionals – especially those with all 7 hats
US & Europe dominance – maturing and expanding elsewhere
Gender balance – not perfect but improving
Will it ever NOT be needed? – robots can’t do everything!

Useful visualisation websites
www.visualisingdata.com
www.flowingdata.com
www.eagereyes.org
www.thefunctionalart.com
www.perceptualedge.com

My book’s companion website: Reading, Exercises, Case Study

Monthly ‘Best of...’ collections
A monthly digest of the best of data visualisation

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6-Monthly ‘Most significant...’ collections

ALL THE ‘10 SIGNIFICANT VISUALISATION DEVELOPMENTS’ POSTS IN ONE PLACE


131 further book recommendations

http://www.visualisingdata.com/references

Data visualisation podcasts


Objectives: The art & science of data visualisation design

Challenge your existing thinking about how you most effectively and efficiently create data visualisations and infographics

Enlighten you with an appreciation of the many different capabilities and creative techniques in use today, increasing your design sophistication

Equip you with an understanding of the critical thinking that will help you to make the most effective design decisions in the most efficient way

Inspire you to think creatively and empathetically about how you can embrace this subject through exposure to examples and useful resources