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The Art and Science of Data

Nikki Dowlman, 10th October 2011

Agenda

- The Value of Information
- The Characteristics of a Good Metric
- Consolidated Metrics
- The Value of Visual Displays of Information
 - Spotting patterns
 - How much is too much?
 - Preattentive processing – your new best friend
- Visual Display in Dashboards

The Value of Information



Information Ensures Focus

“For me, goals and daily metrics are the key to keeping me focused. If I don’t have access to the right stats, every day, it is so easy for me to move on mentally to the next thing. But if I have quick access to key metrics every day, my creativity stays within certain bounds—my ideas all center on how to achieve our goals.”

A Good Metric?

- Simple
- Small
- Actionable
- USED

Four types of metrics



Understanding User Needs - What is a good metric?

Question I need to answer	Answers that can be displayed as a metric
How many sites do I have active?	Total number of sites that are active
How many should I have active?	Total number of sites that should be active based on planned activation date, irrespective of their current status
How big is the discrepancy?	What is my current activation rate? Is that greater or less than my planned activation rate Is the discrepancy getting bigger or smaller compared to historic information
How do I get back on target?	Provide 'model' activation rate to get back on target Is this target rate more or less that it was in the month previous
If I don't get back on target when will I finish?	Based on current rate of activation the predicted completion date for the activation process Is this predicted date getting closer or further away?
Where is it going right/wrong?	There are a number of trends that could be analyzed, examples are given here. Display activation through time e.g. line chart to determine if there are any trends that can be observed e.g. does a national vacation slow activation more than expected. Look at activation rates by e.g. country manager or monitor; is one performing better than another? Is there best practice that can be shared?

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Consolidated Metrics

Consolidating Metrics

- Data marts
- Data Warehouses
- Integrations
- Consolidations
- Enterprise Service Bus
- Middleware
- ETL

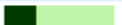
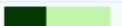
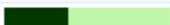
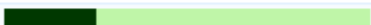
It's the synergy created that counts – the added value of the data and the information it tells us

Examples of Consolidated Metrics

- Expected CRFs
- Expected Images

Study DLD055



Country	CRF Entry Status	Completed CRFs State
< No Country >		
England		
France		
Germany		
Switzerland		
USA		

 Completed
  Partial
  Published Due*
  Locked
  Frozen
  Not Frozen / Locked

**Published Due are available Casebook forms that are entry started or blank but are overdue.*

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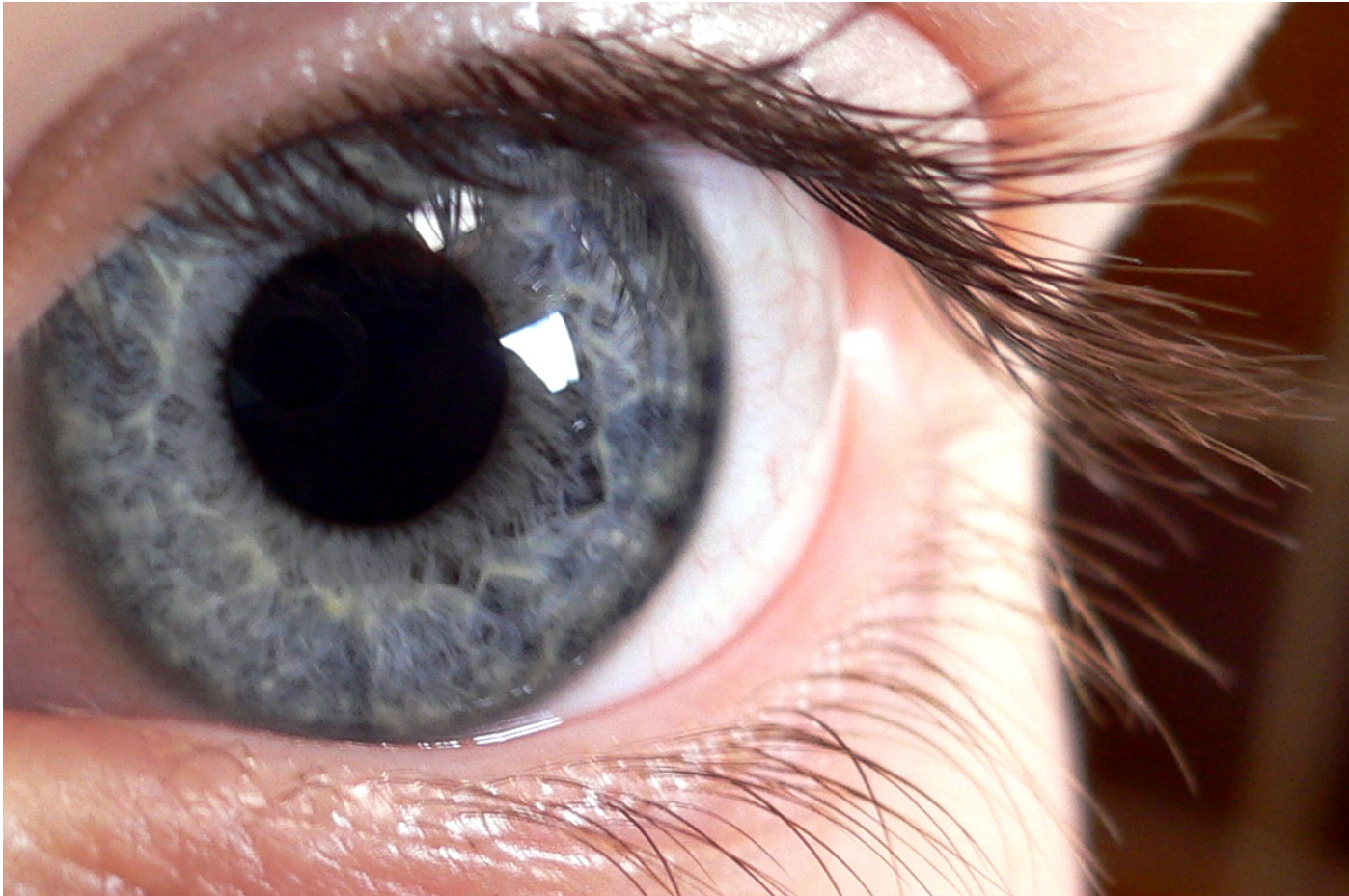
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Why Present Data Visually?

Visualisation of Data



Spotting Patterns



Trivia for the day

- And just so you know.... Nephelococcygia – The act of seeking and finding shapes in clouds.

Missing Number

Can you discover the missing number in this series?

37, 10, 82

29, 11, 47

96, 15, 87

42, ?, 15

Answer

The missing number is 6.

can you spot the pattern now?

$$3+7 = 10, 8+2 = 10$$

And so on.....

Which does not belong?

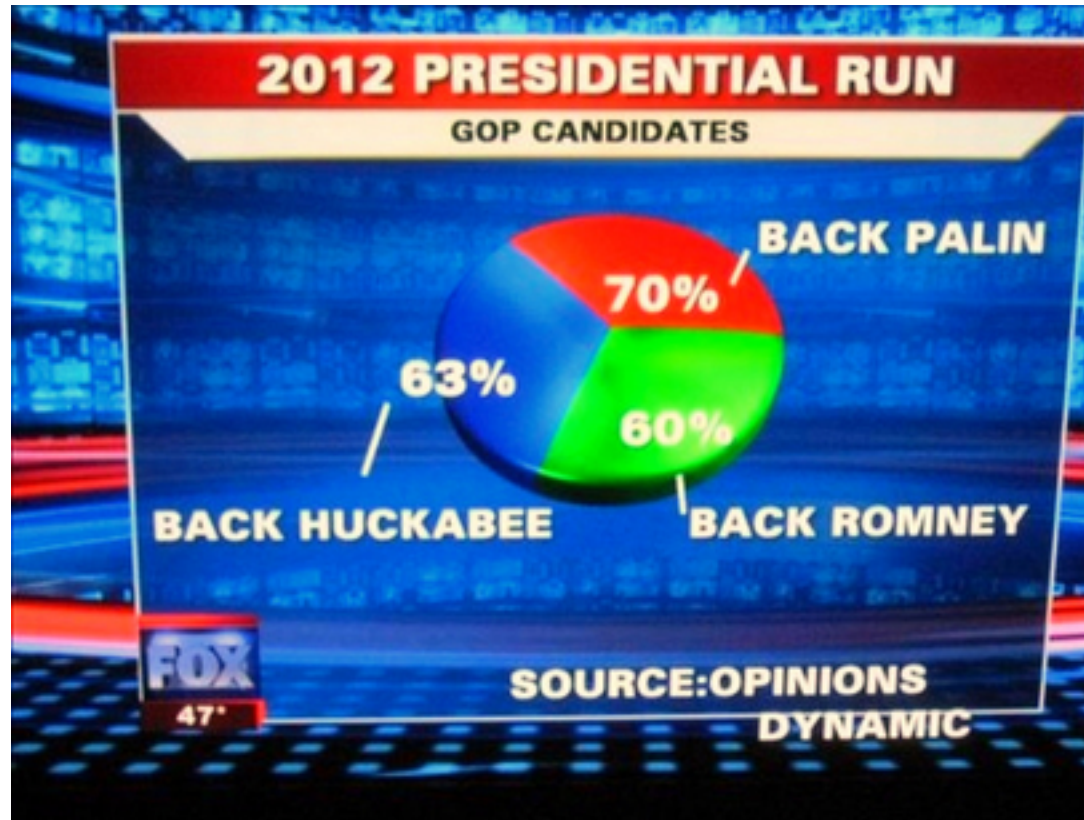
Binoculars
Eyeglasses
Goggles
Handlebars
Jeans
Pliers
Scissors
Shoes
Tweezers

Why is this important?

“There are three kinds of lies: lies, damned lies and statistics”

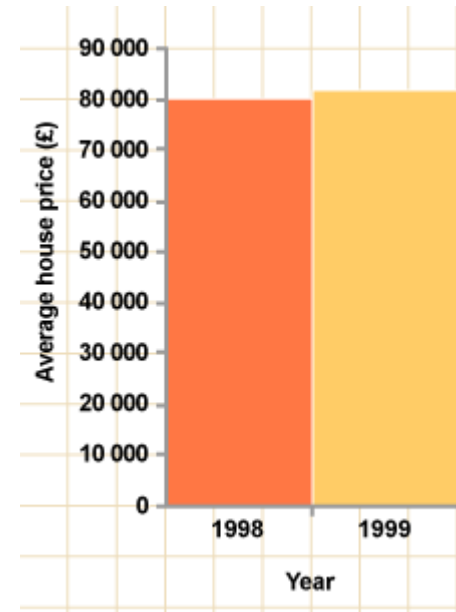
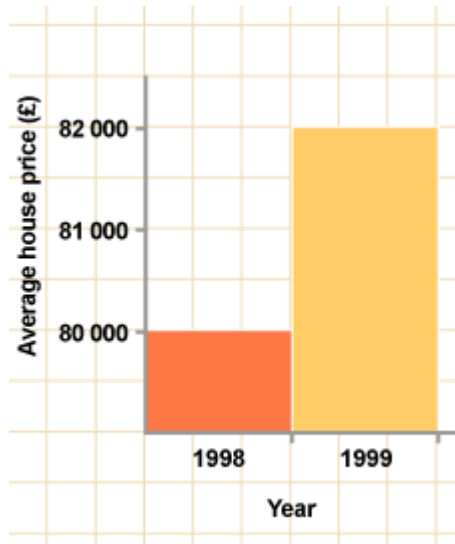
Mark Twain – Chapters from My Autobiography, 1906

Does this tell you anything?

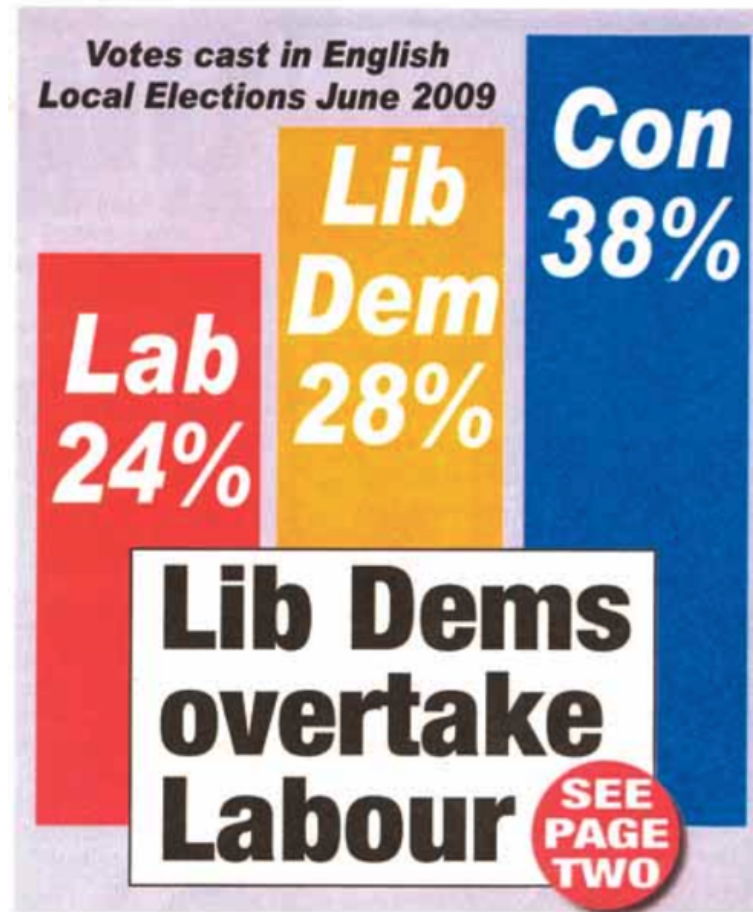


<http://www.turningleft.net/2009/11/fox-news-chicago-surveys-193-of-republicans-for-2012-presidential-race/>

Poor chart use can mislead



Poor chart use can mislead



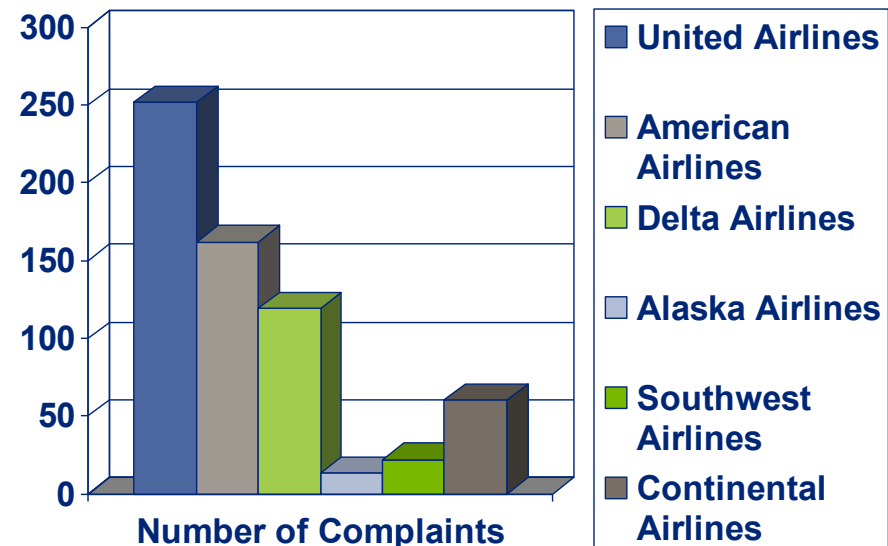
<http://conservativehome.blogs.com/goldlist/2009/07/another-classic-misleading-liberal-democrat-bar-chart.html>

Patterns can mislead

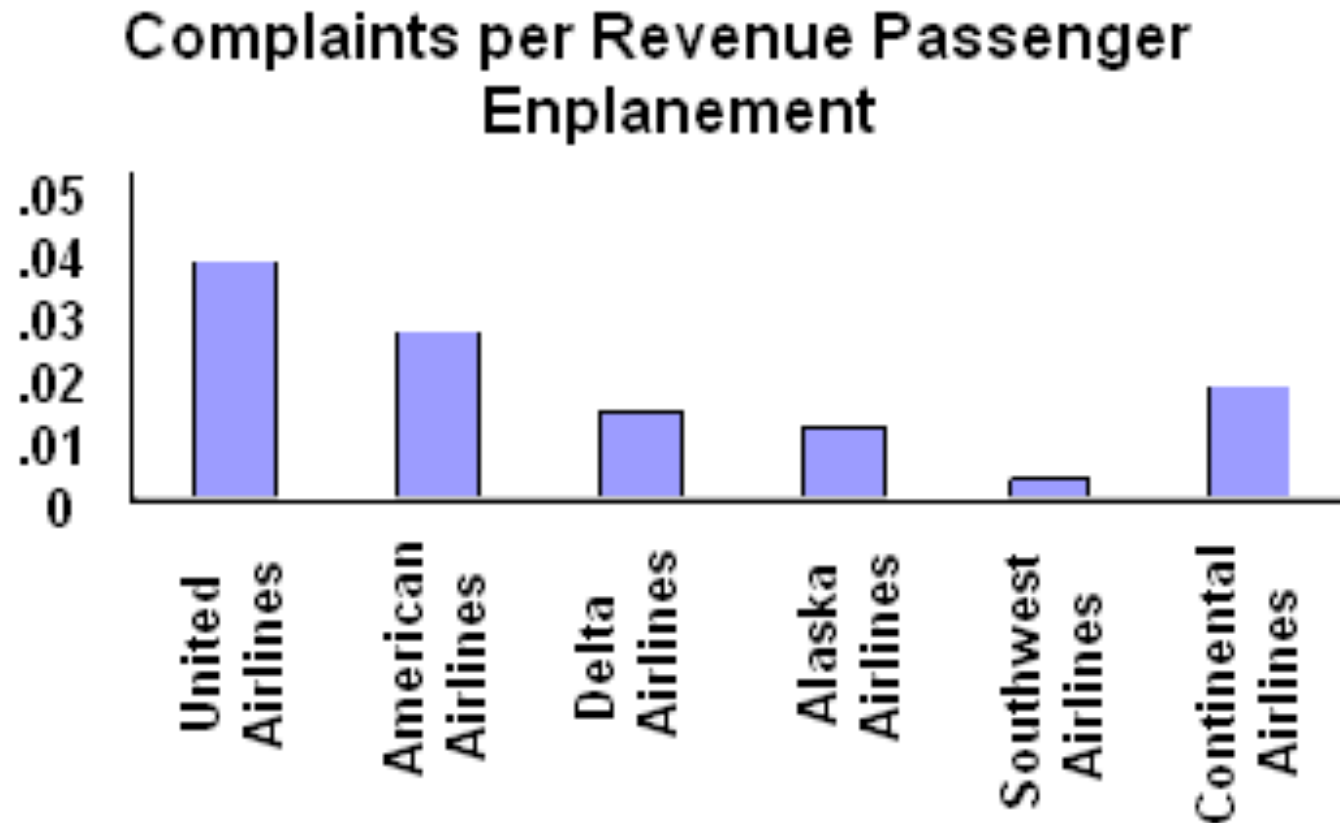
Why is the overall information to draw that conclusion?

Why is the overall information to draw that conclusion?

Airline	Number of Complaints, Nov, 2000
United Airlines	252
American Airlines	162
Delta Airlines	119
Alaska Airlines	13
Southwest Airlines	22
Continental Airlines	60



Patterns can mislead



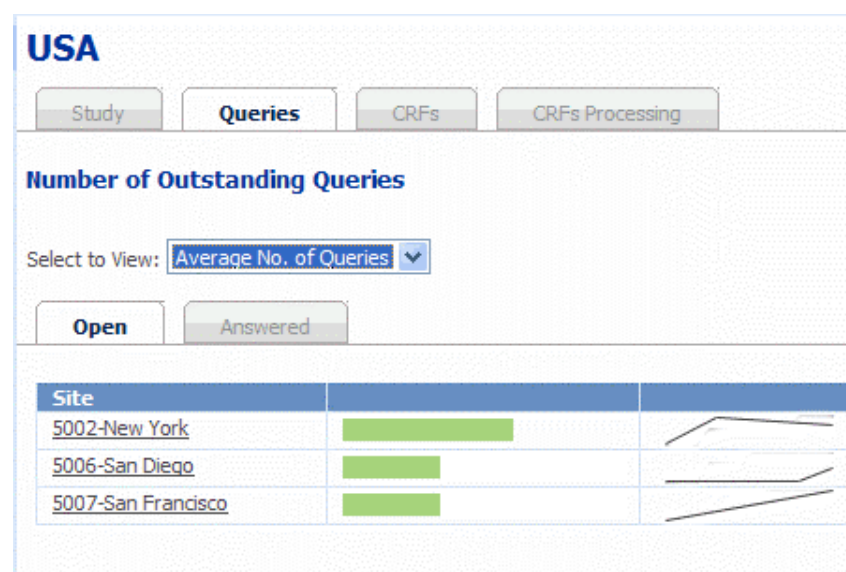
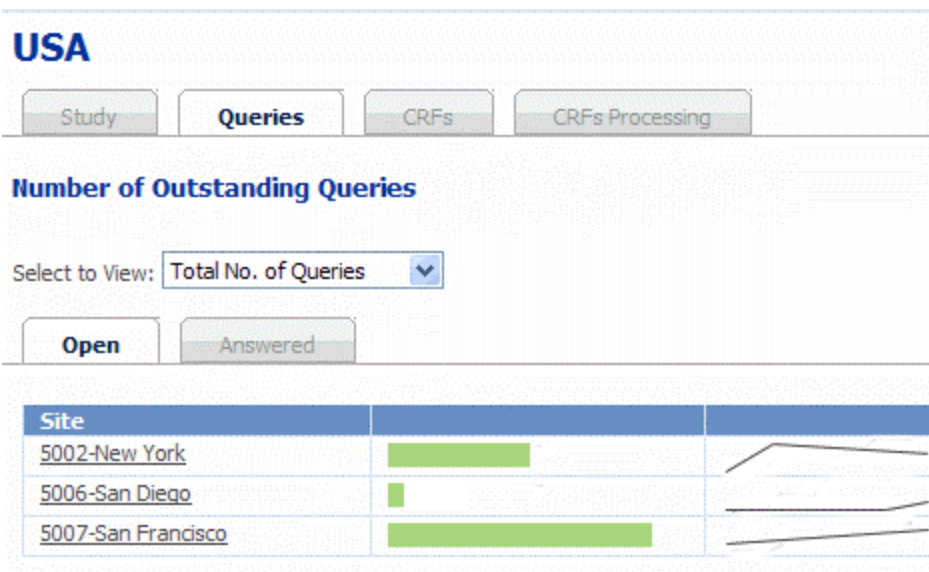
<http://www.econoclass.com/misleadingstats.html>

**“I wouldn't have seen it
if I hadn't believed it.”**

Marshall McLuhan

Example

■ EDC Query Metrics



Summary

Poor Chart Selection or Design

- Can mask information
- May suggest information that is incorrect
- Fails to highlight important data
- Can fail to reveal a relationship that exists
- Can suggest a relationship that doesn't exist

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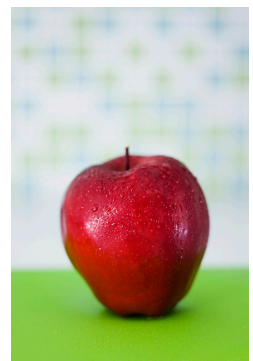
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How much information is too much?

Memory game



Memory game



How much information can the mind hold?

"The Magical Number Seven, Plus or Minus Two"

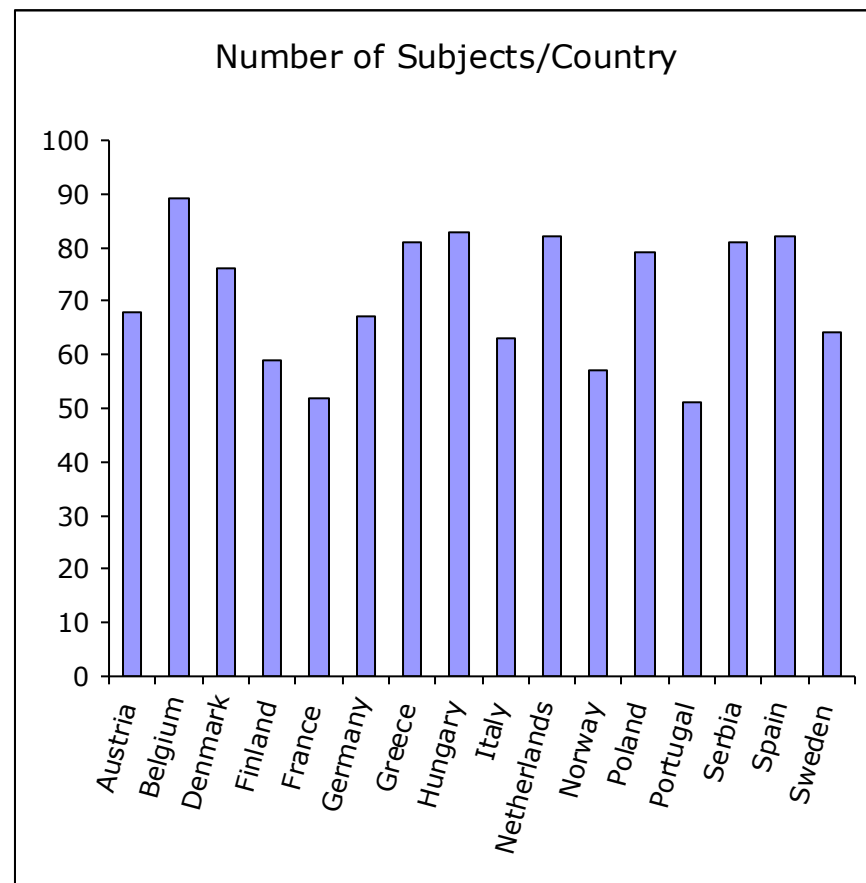
published in 1956 in *Psychological Review*

Encoding Information Graphically



A Picture is Worth a Thousand Words

Country	Number of Subjects
Austria	68
Belgium	89
Denmark	76
Finland	59
France	52
Germany	67
Greece	81
Hungary	83
Italy	63
Netherlands	82
Norway	57
Poland	79
Portugal	51
Serbia	81
Spain	82
Sweden	64



Summary

- An individual can hold assimilate a small amount of information in short term memory
- Presenting information in wordy format can make it harder for the user to immediately interpret
- Graphics can be used to encode information reducing the number of chunks

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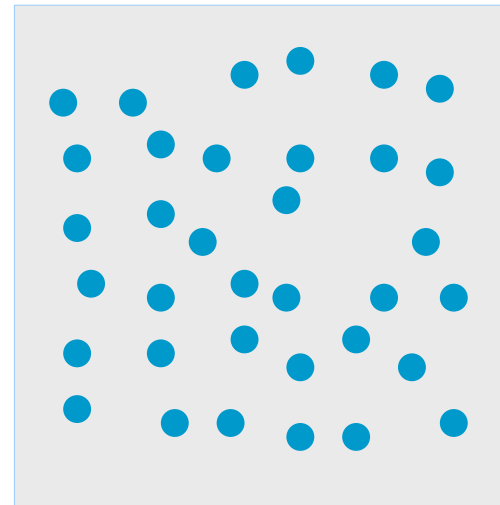
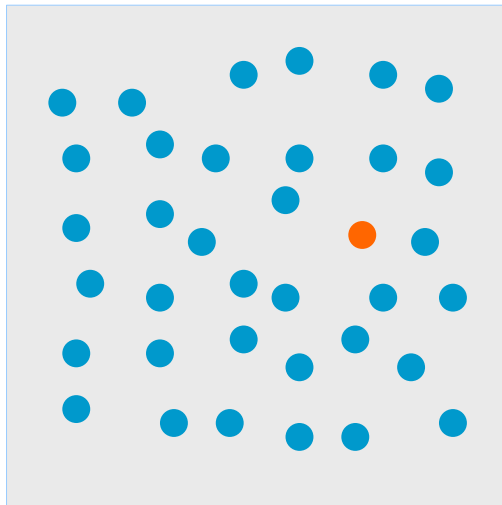
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Pre-attentive Process

Or how to attract attention

Pre-attentive Processing



Which does not belong?

Binoculars
Eyeglasses
Goggles
Handlebars
Jeans
Pliers
Scissors
Shoes
Tweezers

Pre-attentive attributes

Colour	Hue				
	Intensity				
Position	2D location				
Appearance	Orientation				
	Line Length				
	Line Width				
	Size				
	Shape				
	Added Mark				
	Enclosure				
	Flicker				

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**How does this relate to a
dashboard**

What is a Dashboard?

“Visual Display
of

The most important information needed to achieve
one or more objectives

which

Fits entirely on a single computer screen

so it can be

Monitored at a glance”

Stephen Few

Principles

Easy to Understand

- Use of graphics
- Limited amount of data
- Use of pre-attentive processing to highlight what is important

Actionable

- Need to be able to act on a problems revealed

Timeliness

- Needs to be a reflection of reality now
- Needs to be able to demonstrate the result of any actions

Customised

- Content relevant to the particular user



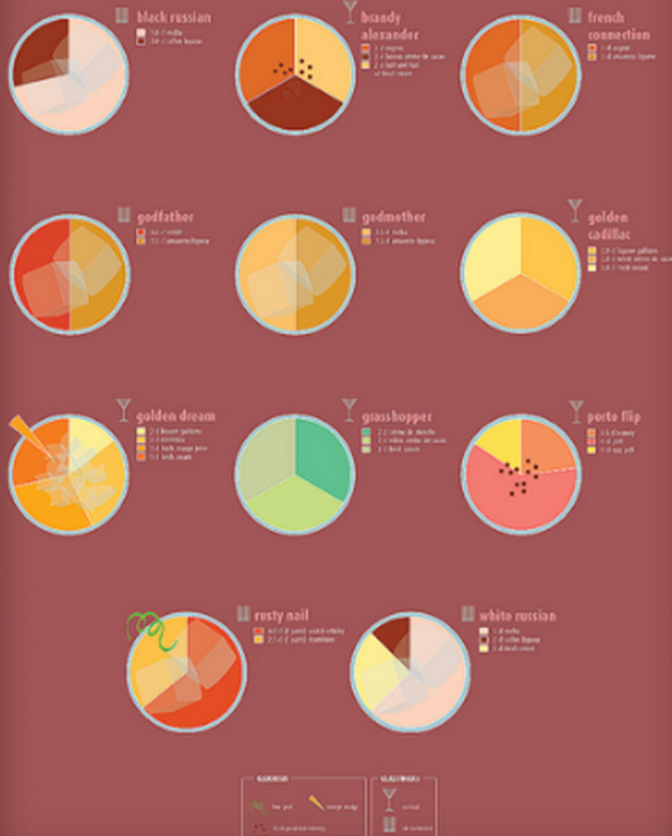
Further Reading

- Dave Zuckerman, *Pharmaceutical Metrics: Measuring and Improving R&D Performance*, (Gower Press, 1996).
- G. A. Miller, "The Magical Number Seven, Plus or Minus Two," *Psychological Review*, 63 81-97 (1956).
- Stephen Few, *Information Dashboard Design: The Effective Visual Communication of Data*, (O'Reilly, 2006).
- Stephen Few, "Data Visualization for Human Perception," (2010),
http://www.interaction-design.org/encyclopedia/data_visualization_for_human_perception.html.
- Perceptual Edge,
<http://www.perceptualedge.com/examples.php/>.
- N Dowlman: Translating eClinical Data, ACT May 2011

Pre-attentive Processing references

Feature	Author
line (blob) orientation	Julész & Bergen [1983]; Wolfe [1992]
length	Triesman & Gormican [1988]
width	Julész [1985]
size	Triesman & Gelade [1980]
curvature	Triesman & Gormican [1988]
number	Julész [1985]; Trick & Pylyshyn [1994]
terminators	Julész & Bergen [1983]
intersection	Julész & Bergen [1983]
closure	Enns [1986]; Triesman & Souther [1985]
colour [hue]	Triesman & Gormican [1988]; Nagy & Sanchez [1990]; D'Zmura [1991]
intensity	Beck et al. [1983]; Triesman & Gormican [1988]
flicker	Julész [1971]
direction of motion	Nakayama & Silverman [1986]; Driver & McLeod [1992]
binocular lustre	Wolfe & Franzel [1988]
stereoscopic depth	Nakayama & Silverman [1986]
3-D depth cues	Enns [1990]
lighting direction	Enns [1990]

AFTER-DINNER COCKTAILS



Thank You