SPEAKING WITH DATA

Jake Kaupp

5 years of visualization & data science work at Queen's

Visualization & Educational Consultant

Tools: R, Javascript, Affinity Designer, Tableau, Excel

Promoting visualization and data use for improvement in Higher Education

Encouraging adoption of analytics & data science to inform instructional design/educational development

I <3 Open Source, Open Data & Open Science!

out·come

/ˈoutˌkəm/

noun

plural noun: **outcomes**

the way a thing turns out; a consequence.

"it is the outcome of the vote that counts"

synonyms: result, end result, consequence, net result, upshot, aftereffect, aftermath, conclusion, issue, end, end product

"the future of the industry could hinge on the outcome of next month's election"

Translations, word origin, and more definitions

1. **Describe** why visualization is important

2. **Recall** principles & themes of effective visualization

3. **identify** design/perceptual elements used in visualization

4. **Apply** a user-focused workflow, alongside principles & themes to develop visualizations

Why Visualization?

Dataset	Mean(x)	Mean(y)	SD(x)	SD(y)	Cor(x,y)
1	54.2656953	47.8350992	16.71300144	26.84776634	-0.064128352
2	54.2656953	47.8350992	16.71300144	26.84776634	-0.068586394
3	54.2656953	47.8350992	16.71300144	26.84776634	-0.068343356
4	54.2656953	47.8350992	16.71300144	26.84776634	-0.064471853
5	54.2656953	47.8350992	16.71300144	26.84776634	-0.060341442
6	54.2656953	47.8350992	16.71300144	26.84776634	-0.061714838
7	54.2656953	47.8350992	16.71300144	26.84776634	-0.068504221
8	54.2656953	47.8350992	16.71300144	26.84776634	-0.068979735
9	54.2656953	47.8350992	16.71300144	26.84776634	-0.068609206
10	54.2656953	47.8350992	16.71300144	26.84776634	-0.0629611
11	54.2656953	47.8350992	16.71300144	26.84776634	-0.06944557
12	54.2656953	47.8350992	16.71300144	26.84776634	-0.06657523
13	54.2656953	47.8350992	16.71300144	26.84776634	-0.065583337

1

2

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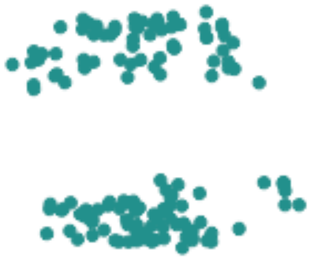

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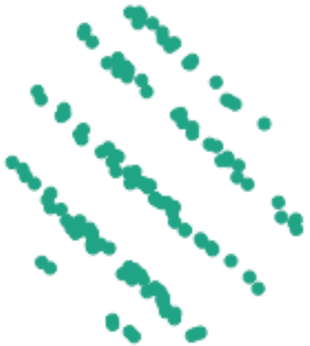


13

DA·TA VIS·U·AL·I·ZA·TION

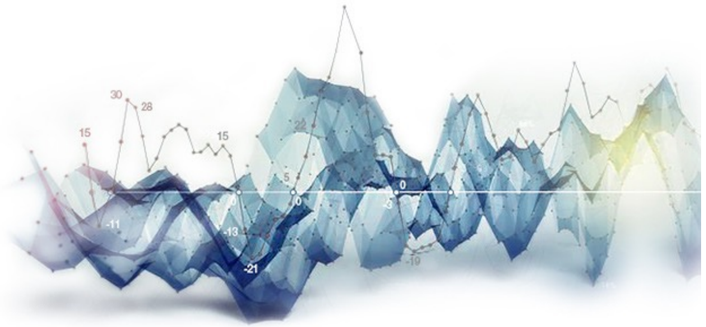
'dadə viZH(o͞o)ələ'zāSH(ə)n,

"A display of data designed to **enable analysis, exploration and discovery**. These are not intended to convey predefined messages from designers, but are conceived as tools to let people **extract their own conclusions** from the data"

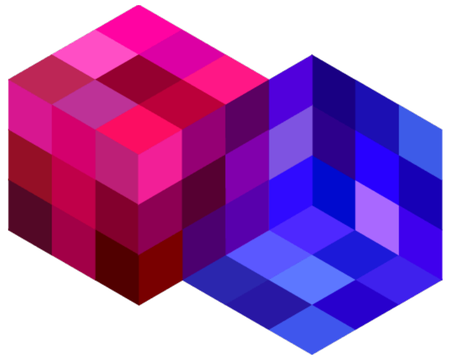
- Alberto Cairo

Information

Abstraction



Patterns



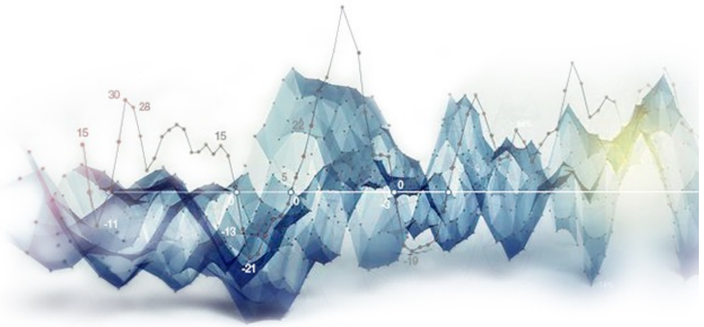
Meaning

Use & Apply

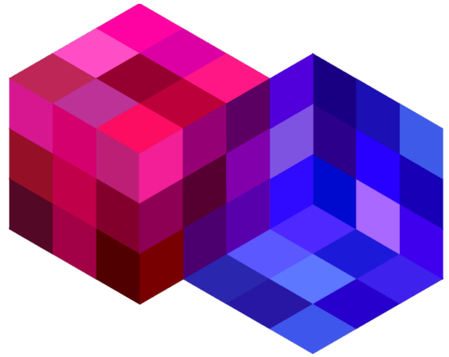
Discern & Enhance

Information

Abstraction



Patterns



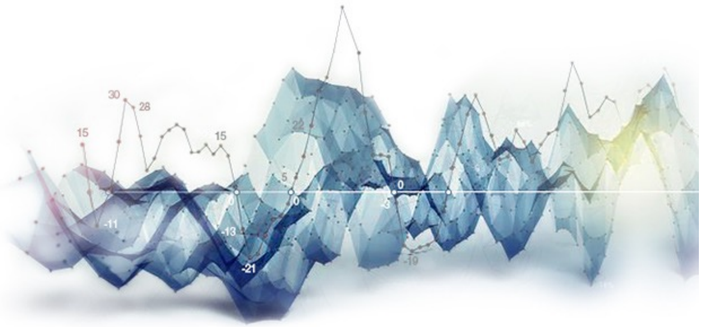
Meaning

Data

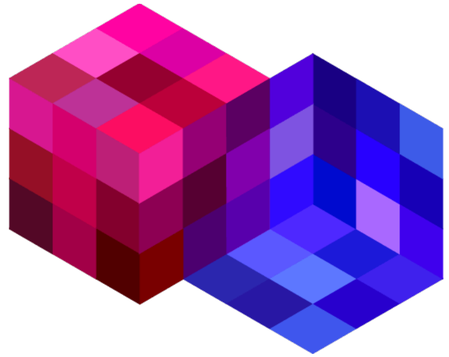
PRICE OF DIAMONDS VS. CARATS

Information

Abstraction



Patterns

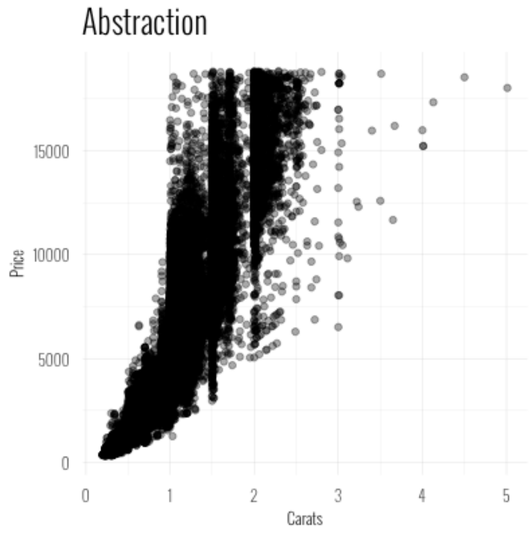


Meaning

Data

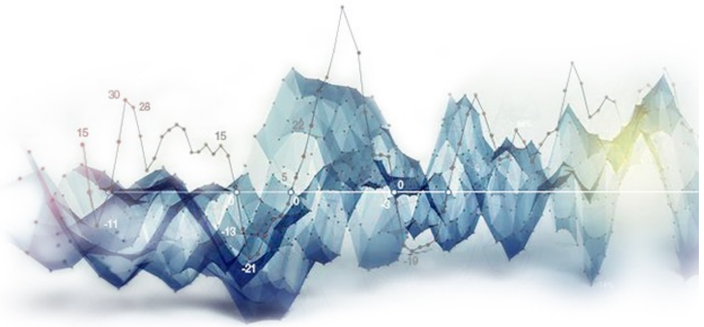
PRICE OF DIAMONDS VS. CARATS

Visualization

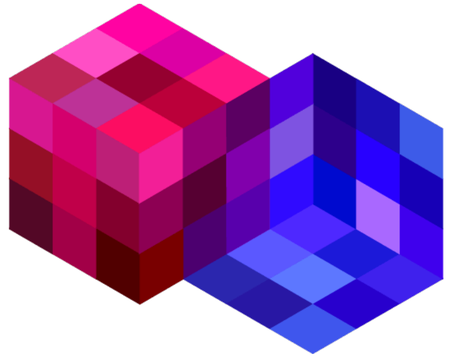


Information

Abstraction



Patterns



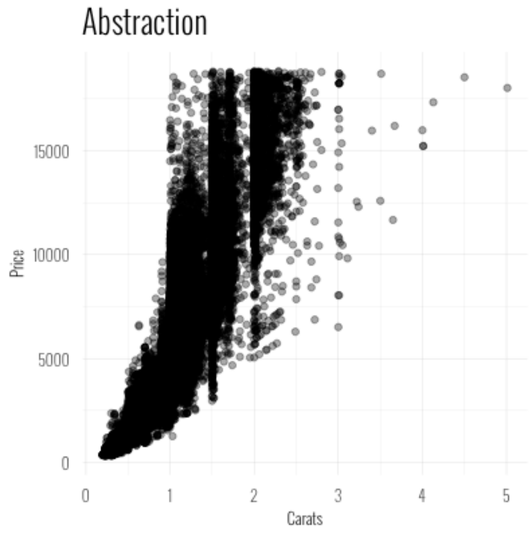
Meaning

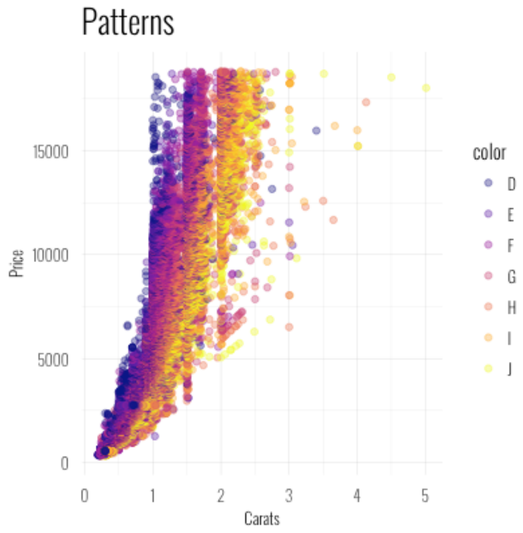
Data

Visualization

Perception

PRICE OF DIAMONDS VS. CARATS



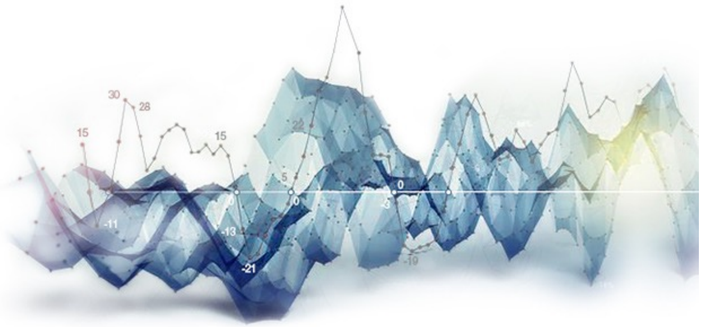


Information

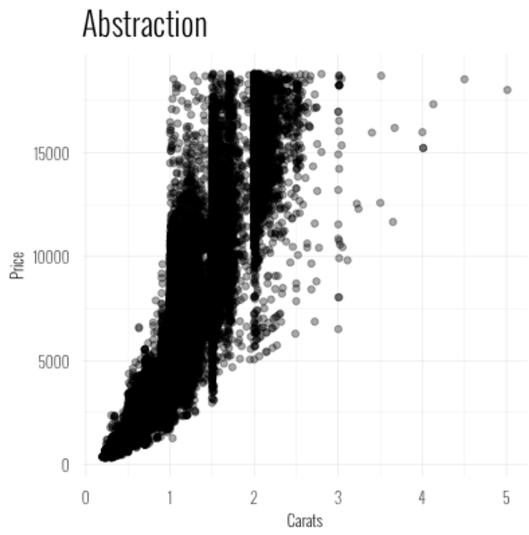
Data

PRICE OF DIAMONDS VS. CARATS

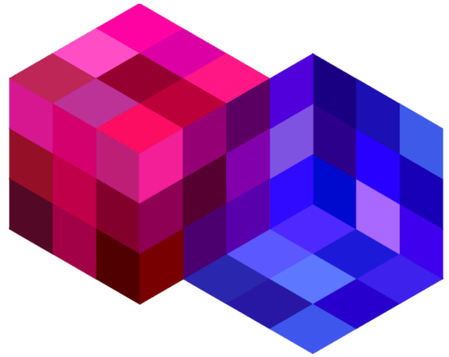
Abstraction



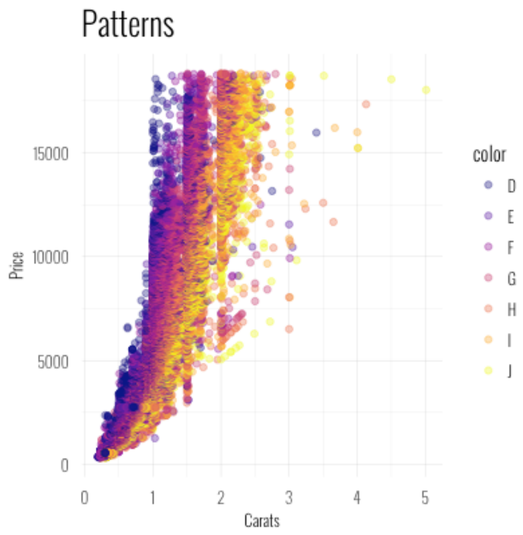
Visualization



Patterns



Perception



Meaning

Cognition

KEEP IT UNDER A CARAT FOR BETTER VALUE

"Visualization is surprisingly difficult."

- William Cleveland

The 3 little errors

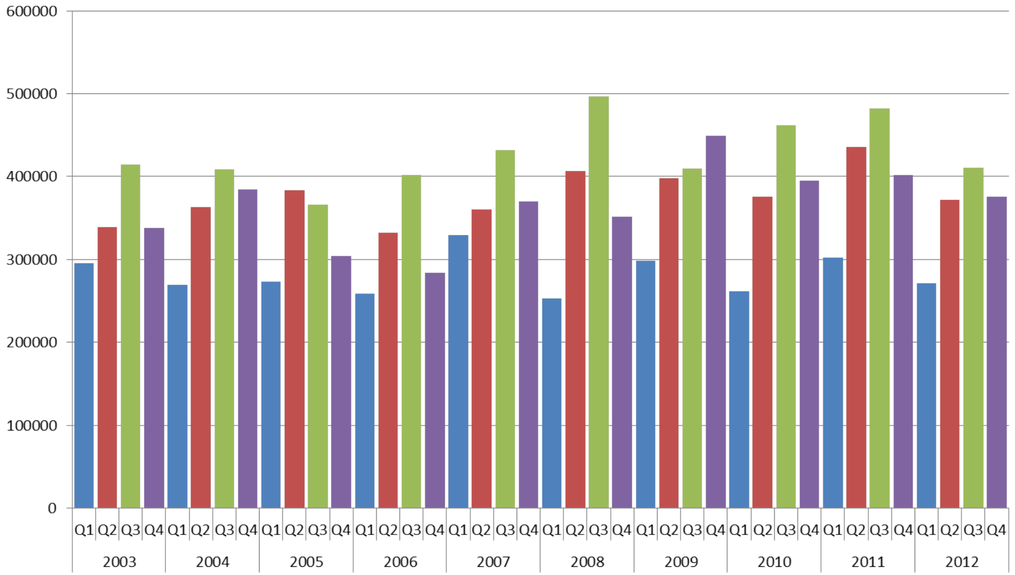
Data

Decoding

Encoding &
Abstraction

"Application defaults are a balm for users, because they save time, avoid the anxiety of multiple choices, and give the illusion of skills that do not exist"

- Jorge Camoes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500000
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200000
100000
0
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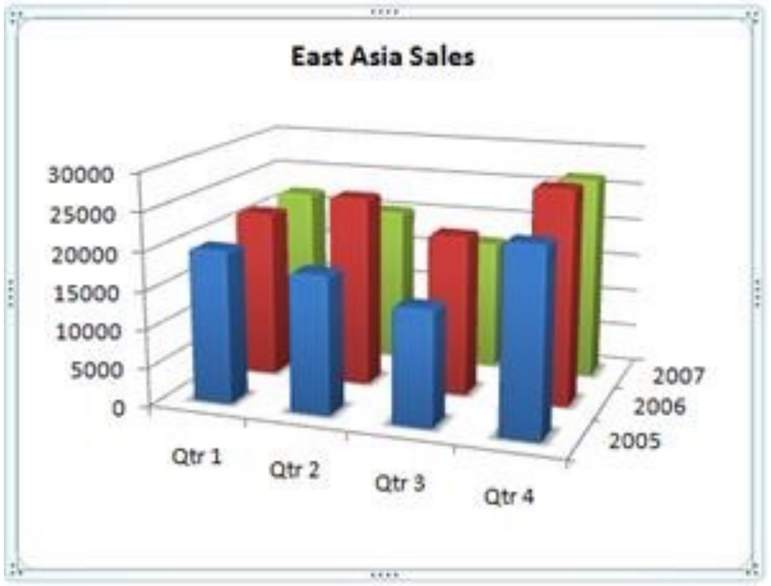
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


East Asia Sales
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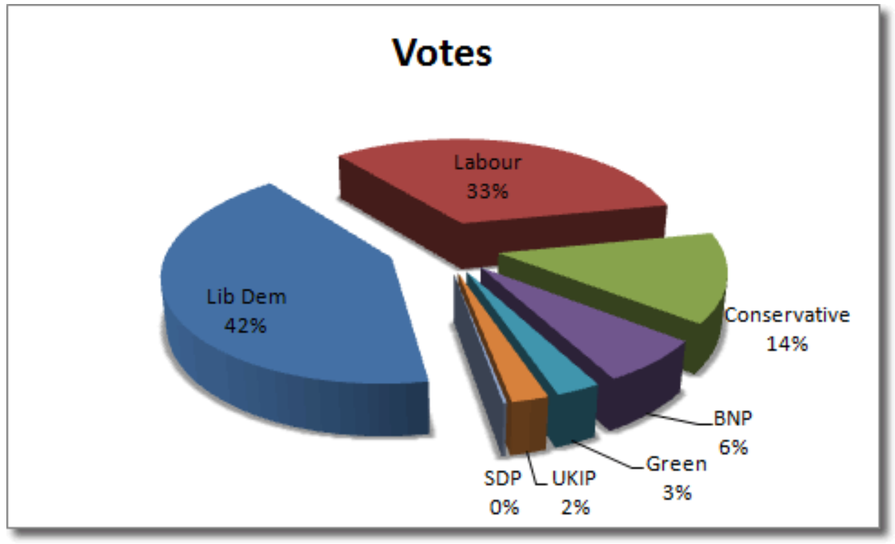
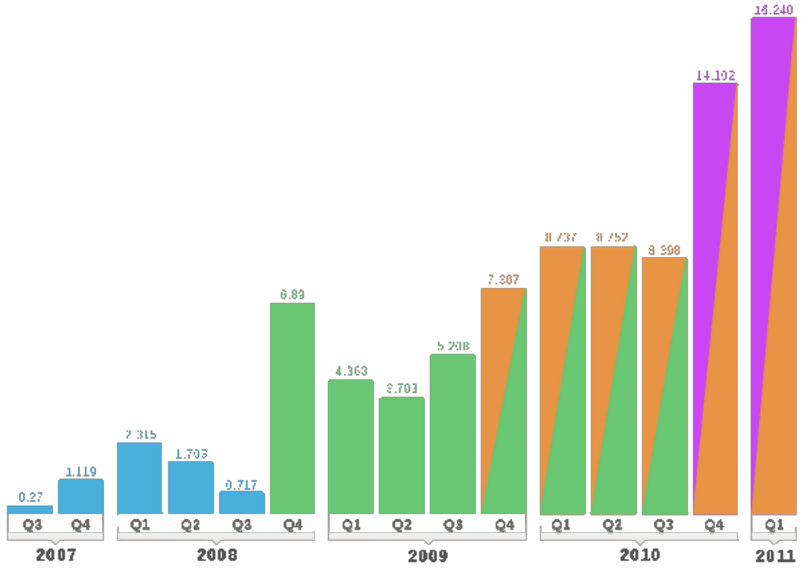
25000
20000
15000
10000
5000
0
Qtr 1
Qtr 2
Qtr 3
Qtr 4
2007
2006
2005


Votes
Labour
33%
Lib Dem
42%
Conservative
14%
BNP
6%
Green
3%
UKIP
2%
SDP
0%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7.307
8.737
8.752
8.398
14.192
14.240
Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1
2007
2008
2009
2010
2011

EFFECTIVE VISUALIZATION

EFFECTIVE VISUALIZATION

Graphical Excellence

Complex ideas communicated with **clarity**, **precision and efficiency**.

Edward Tufte

EFFECTIVE VISUALIZATION

Graphical Excellence

Complex ideas communicated with **clarity**, **precision and efficiency**.

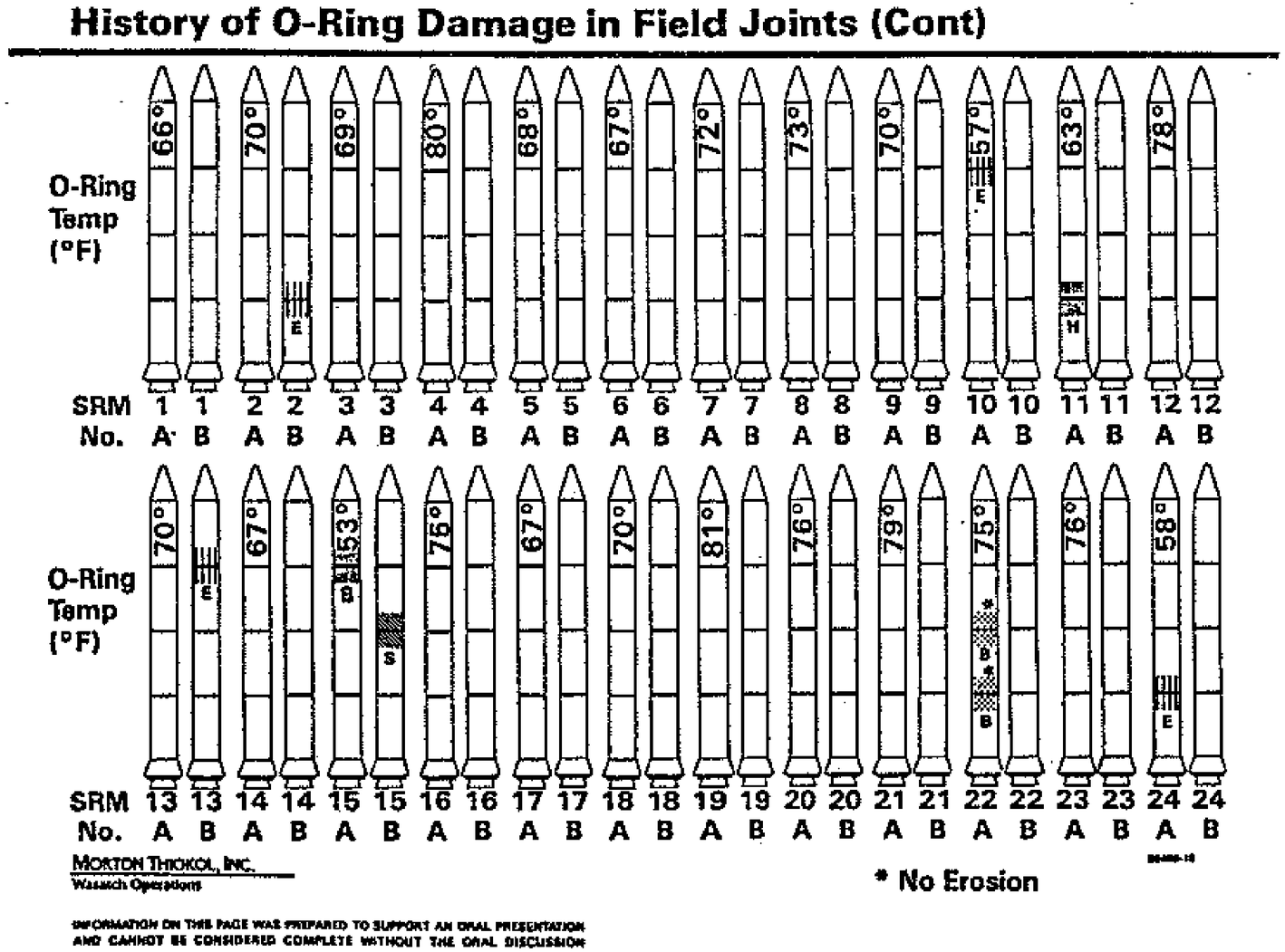
EDWARD TUFTE

Graphical Perception

Accuracy and **efficiency** in **visually decoding** the presented information.

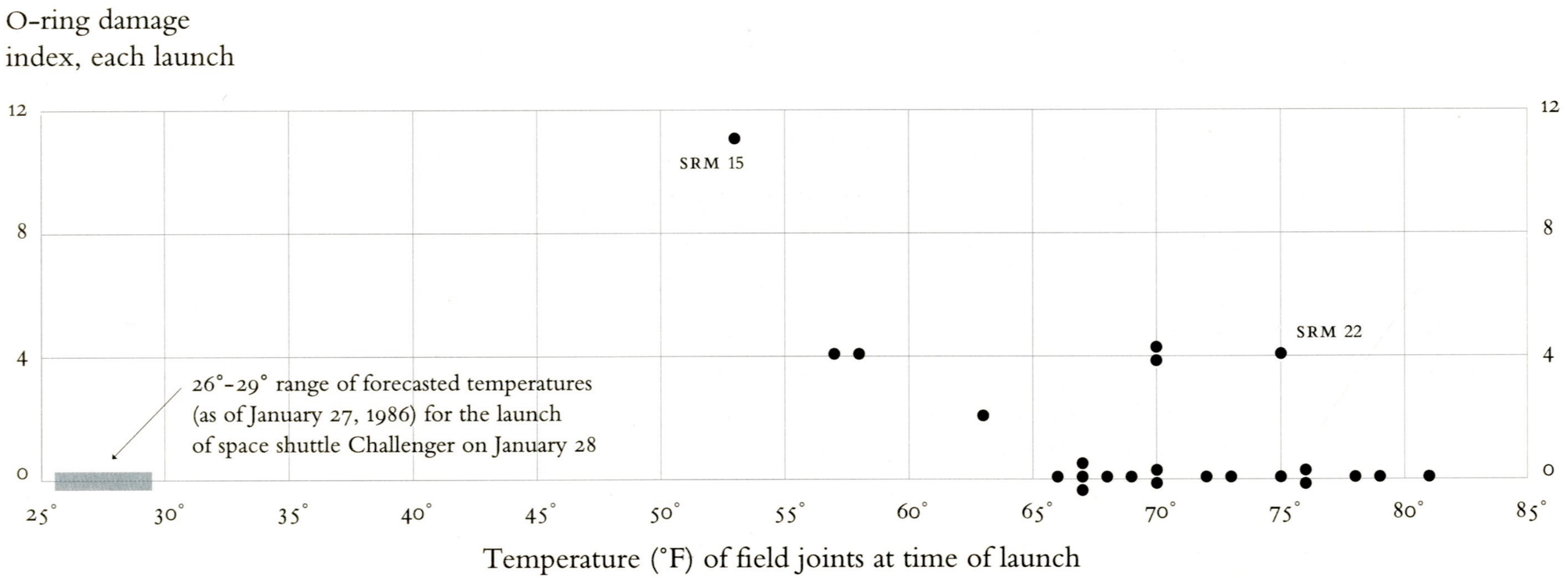
WILLIAM CLEVELAND

Graphical Excellence



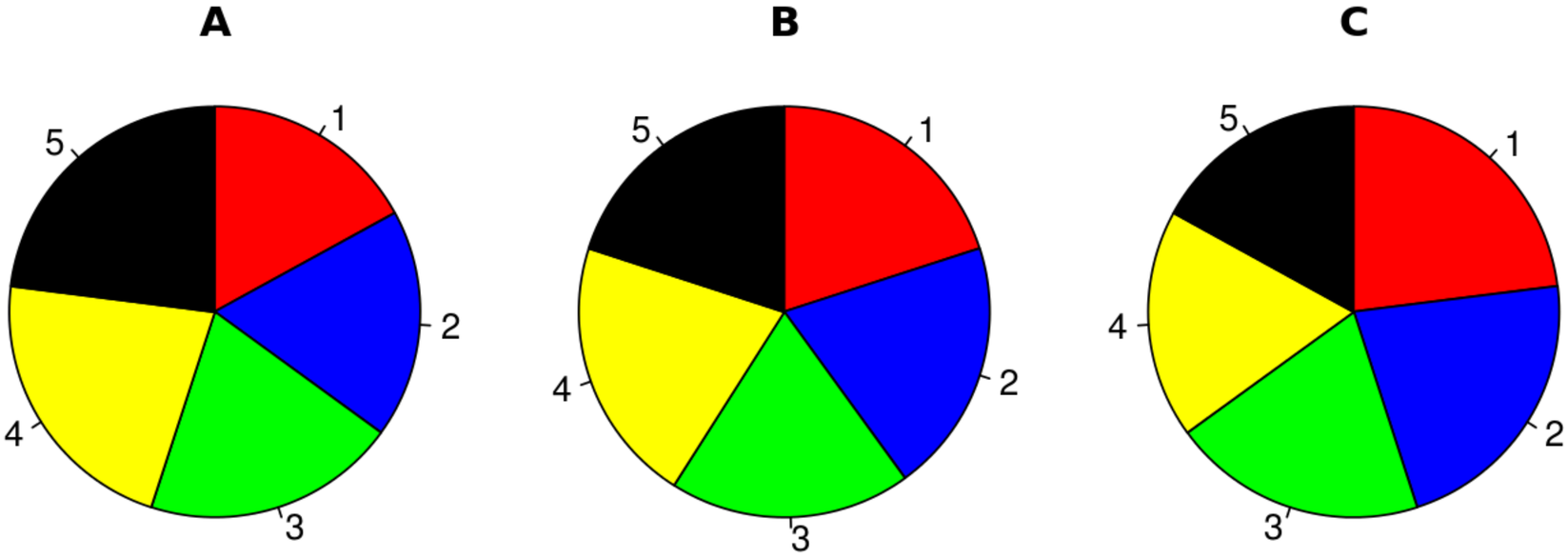
Tufte, Edward R. Visual and statistical thinking: Displays of evidence for making decisions. Vol. 13. Cheshire, CT: Graphics Press, 1997.

Graphical Excellence

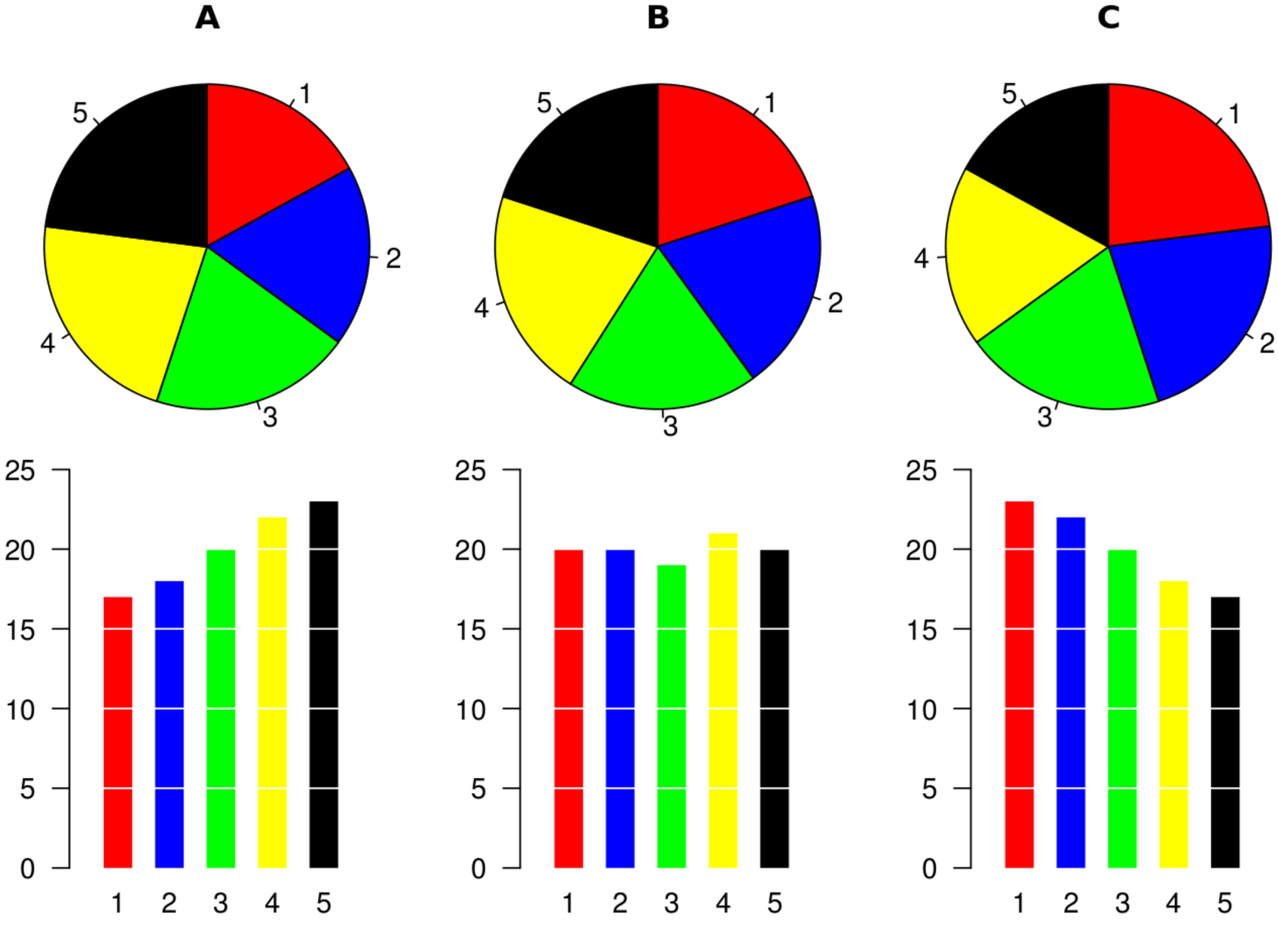


Tufte, Edward R. Visual and statistical thinking: Displays of evidence for making decisions. Vol. 13. Cheshire, CT: Graphics Press, 1997.

Graphical Perception



Graphical Perception



VISUAL ENGAGEMENT

"The role of data visualization is to communicate meaning through stories"

- Scott Murray

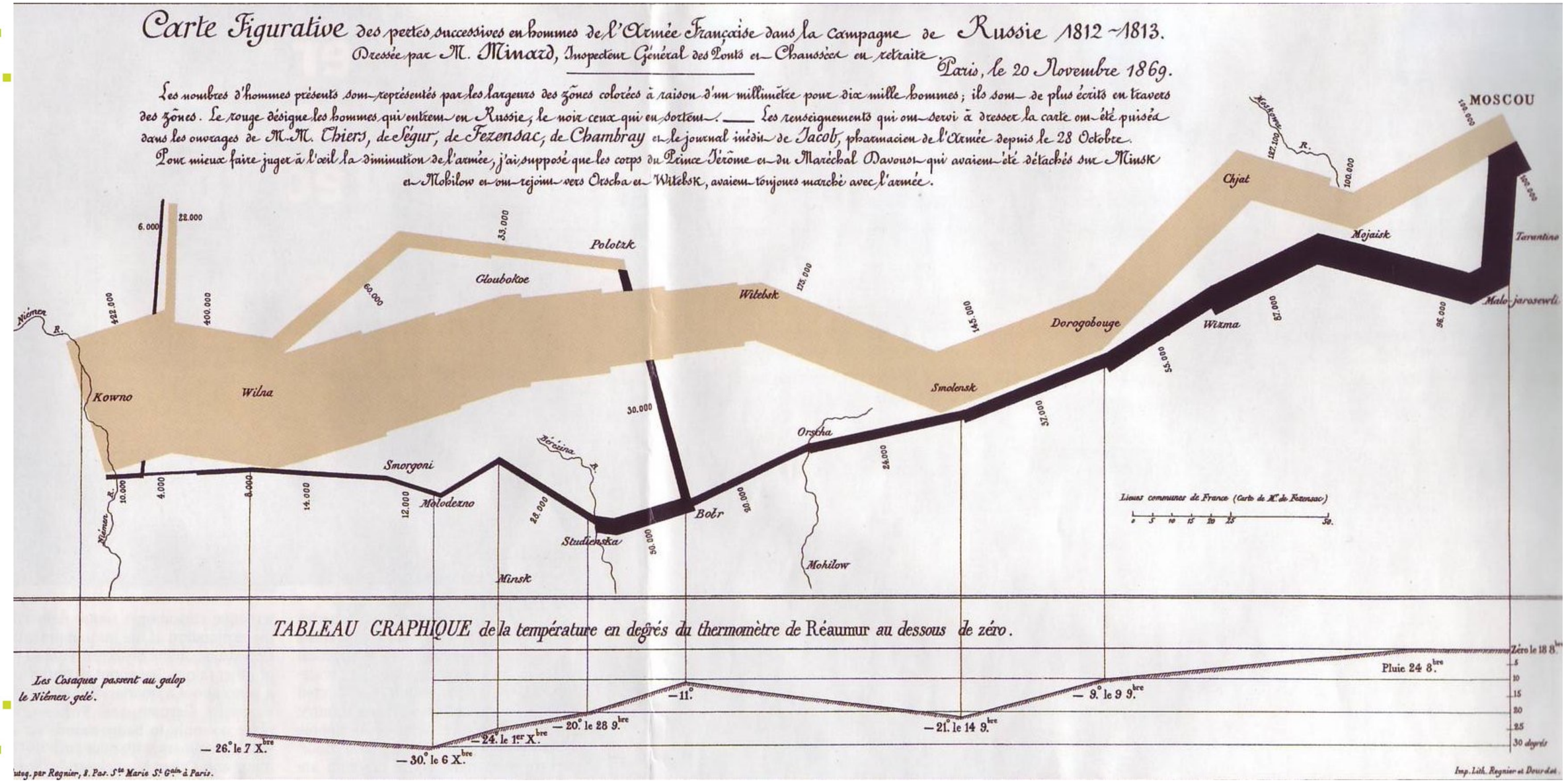
Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite.

Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Thiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.



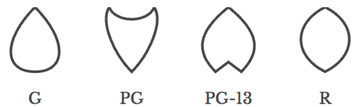
Lith. par Regnier, 8. Pas. Ste Marie St Gain à Paris.

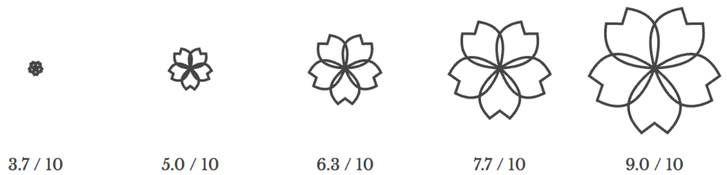
Imp. Lith. Regnier et Dourdet.

film flowers

top summer blockbusters
reimagined as flowers

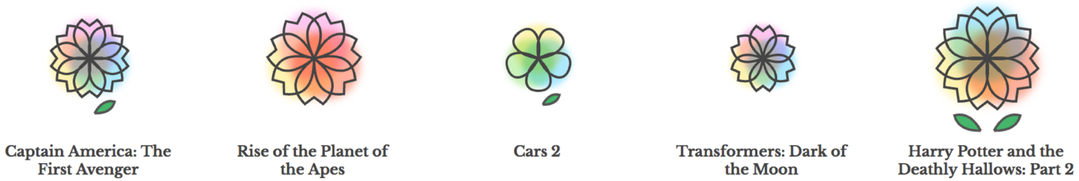
(shirley wu)





2012

2011



2010

http://bl.ocks.org/sxywu/raw/d612c6c653fb8b4d7ff3d422be164a5d/

EFFECTIVE VISUALIZATION

Graphical Excellence	CLEARLY PRESENT COMPLEX IDEAS, AND RICH DATA
Graphical Perception	EMPLOY METHODS TO ACCURATELY REPRESENT KEY FEATURES
Visual Engagement	CONSTRUCT A NARRATIVE FOR USERS TO EXPLORE

Design Guidelines for

EFFECTIVE VISUALIZATION

Golden Rule

What's your point 

—OR—

What's the story you want to tell 

— Design Themes —

Have a Clear Vision

FOCUS ON storytelling

use **COLOUR** appropriately

TYPOGRAPHY **MATTERS**

Don't Lie

Data Themes

SHOW THE DATA

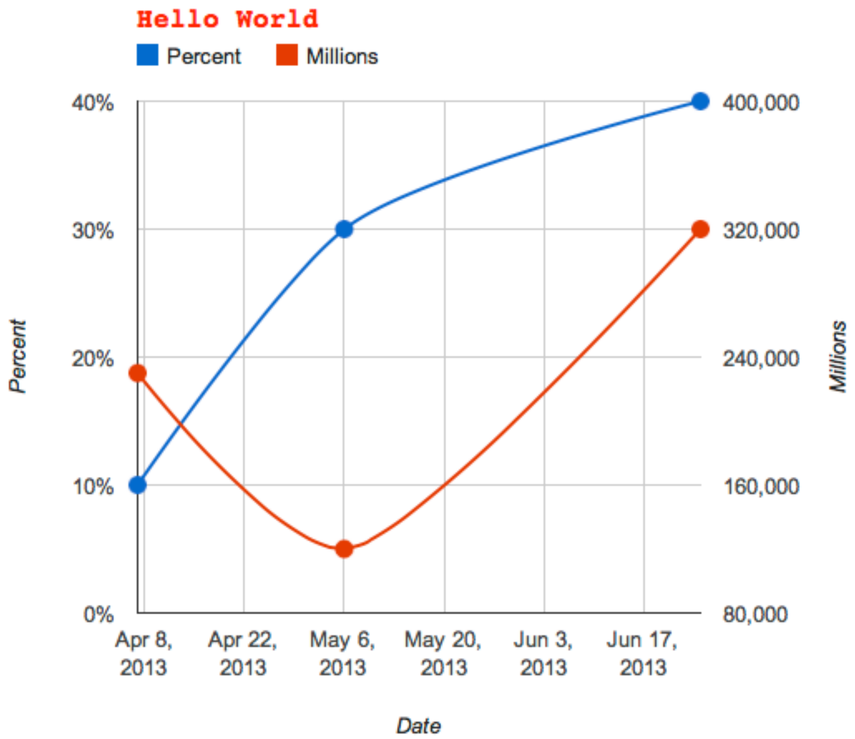
Facilitate comparison

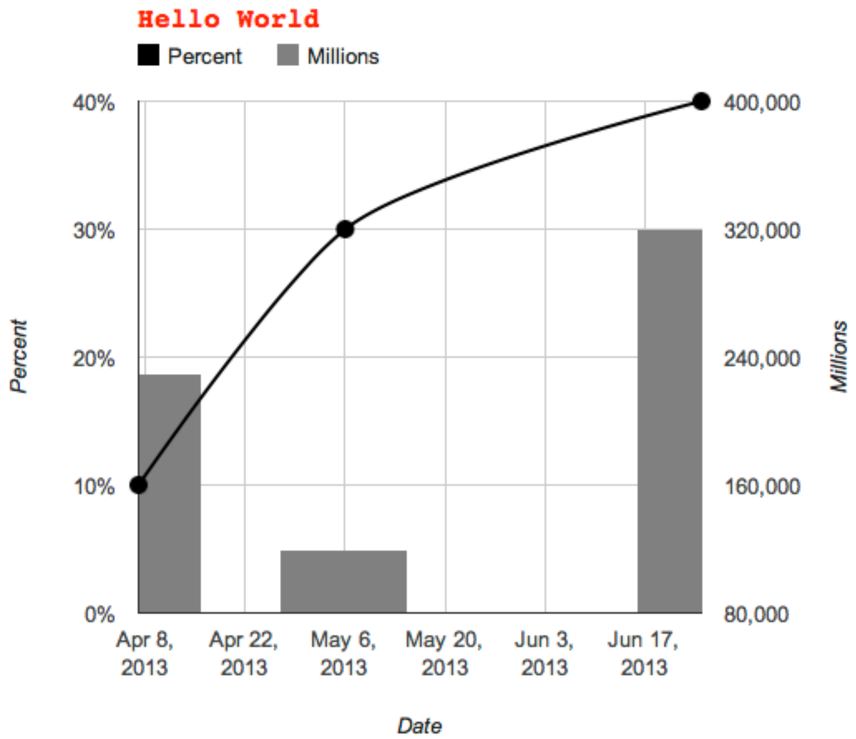
Avoid unnecessary ~~or superfluous~~ elements

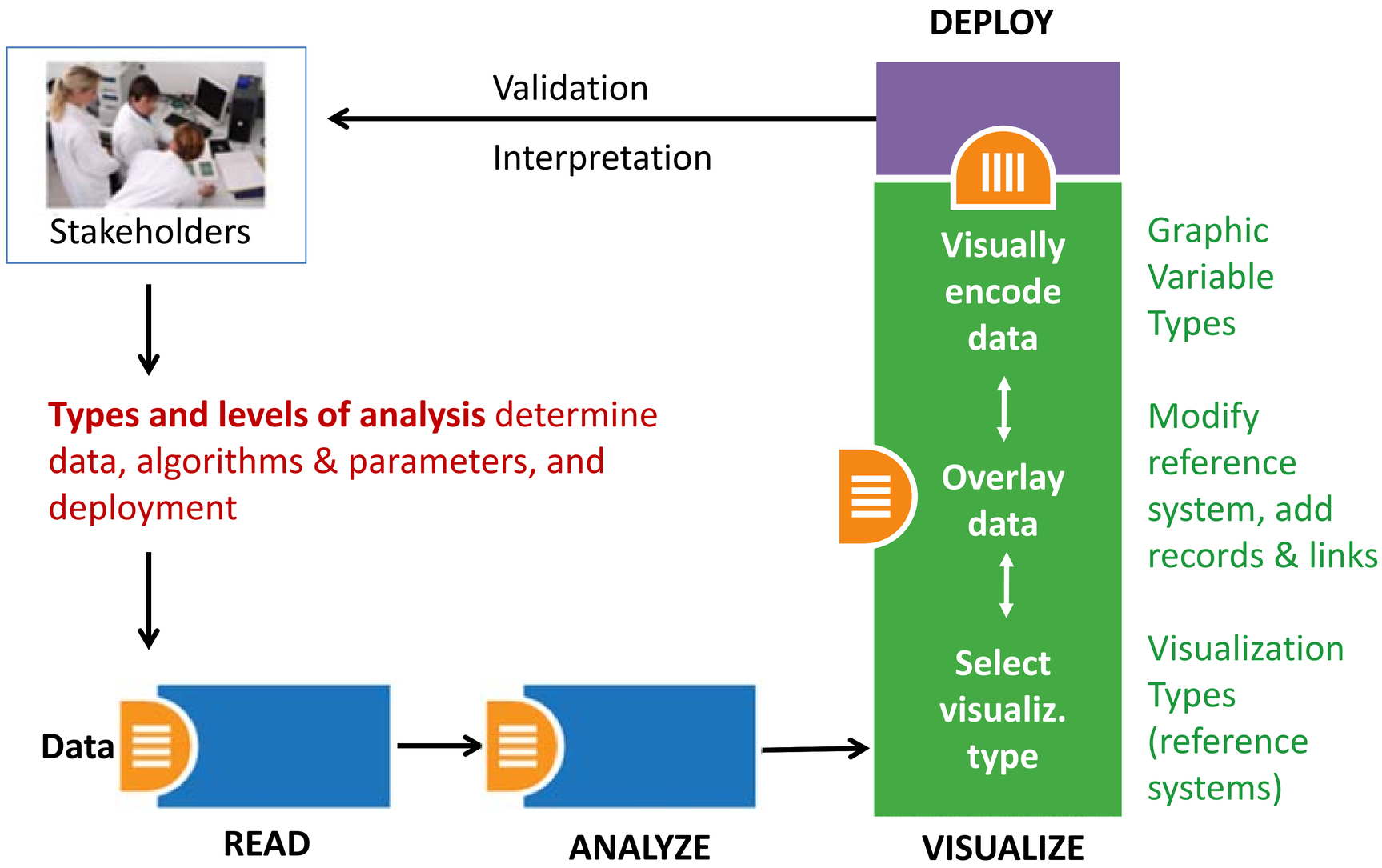
Include Emotion

Provide Context

Practice Time





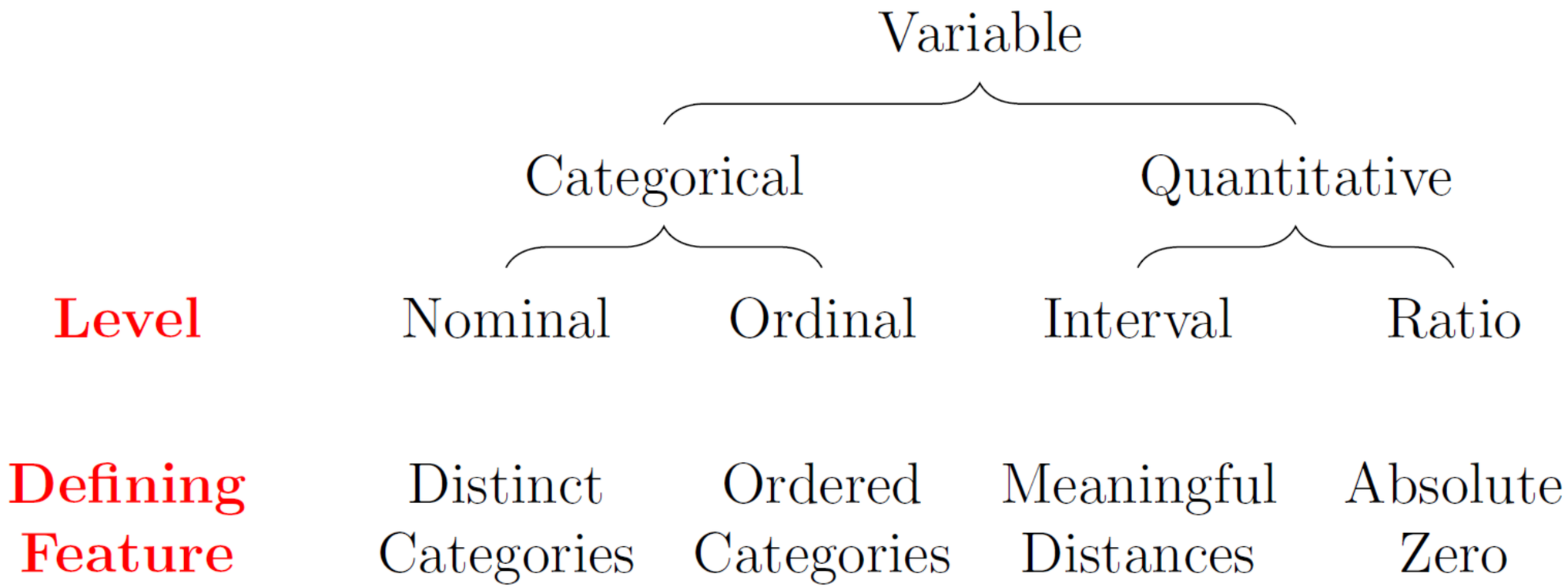


Börner, Katy, and David E. Polley. Visual insights: A practical guide to making sense of data. MIT Press, 2014.

Design Elements of

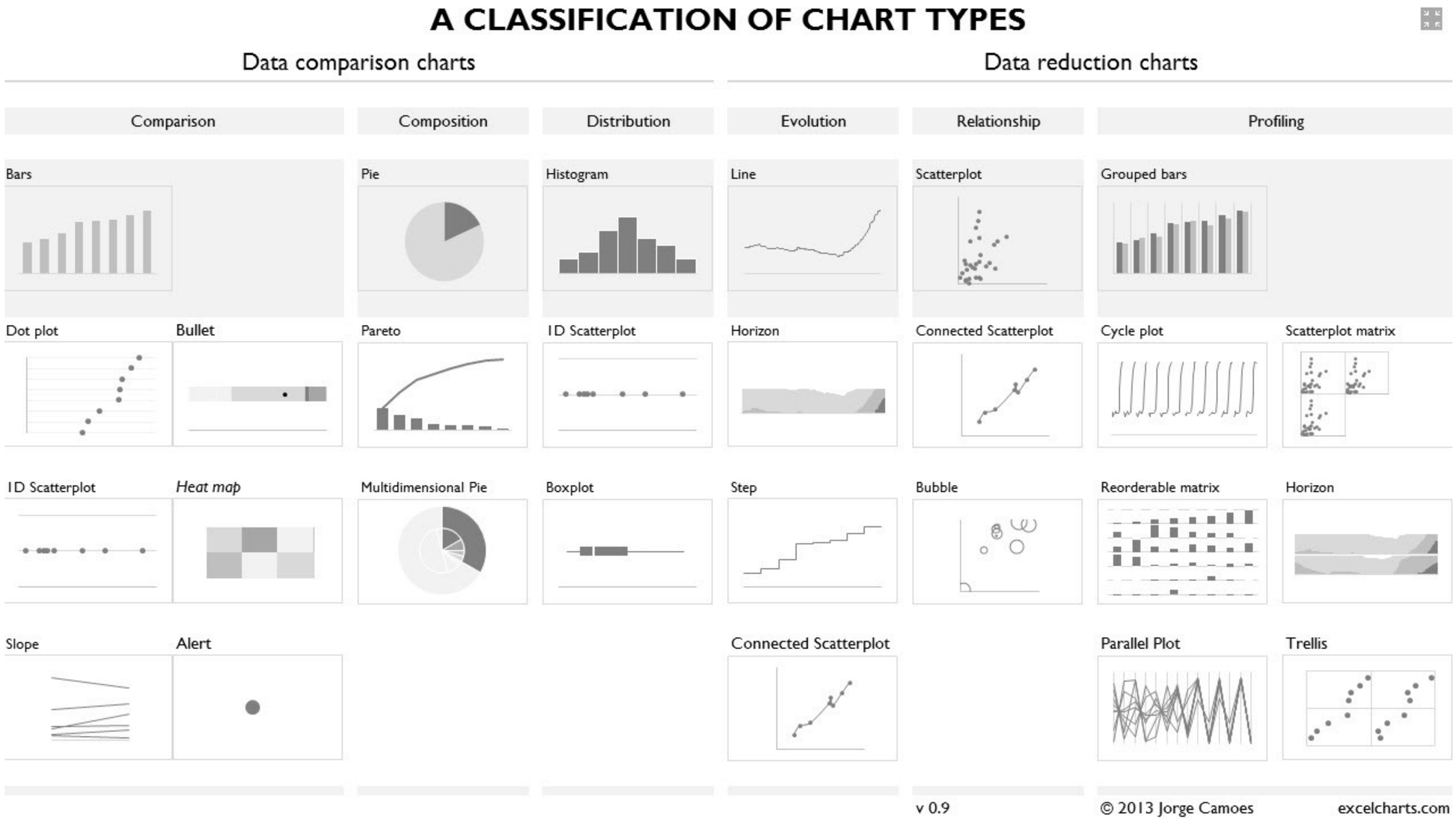
EFFECTIVE VISUALIZATION

Data Types

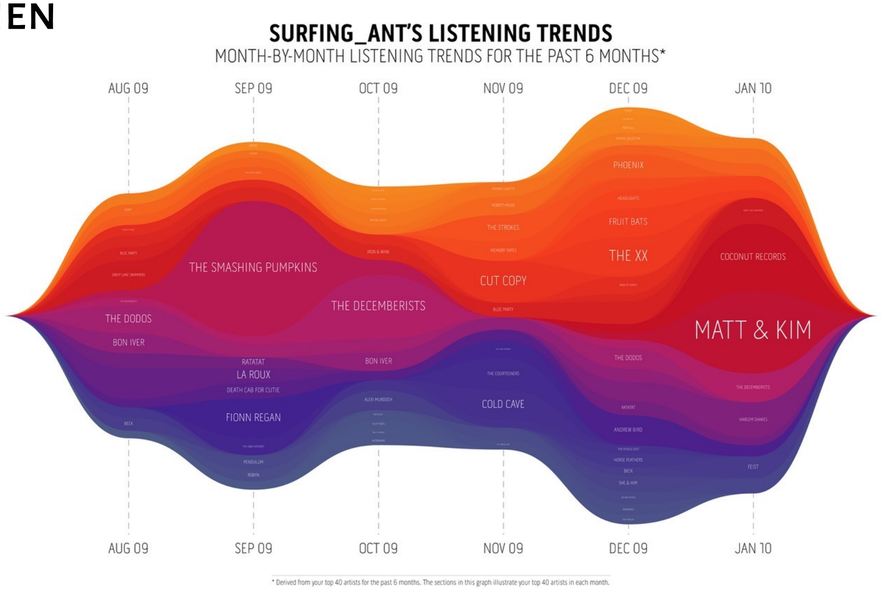


Stevens, Stanley Smith. "On the theory of scales of measurement." (1946): 677-680.

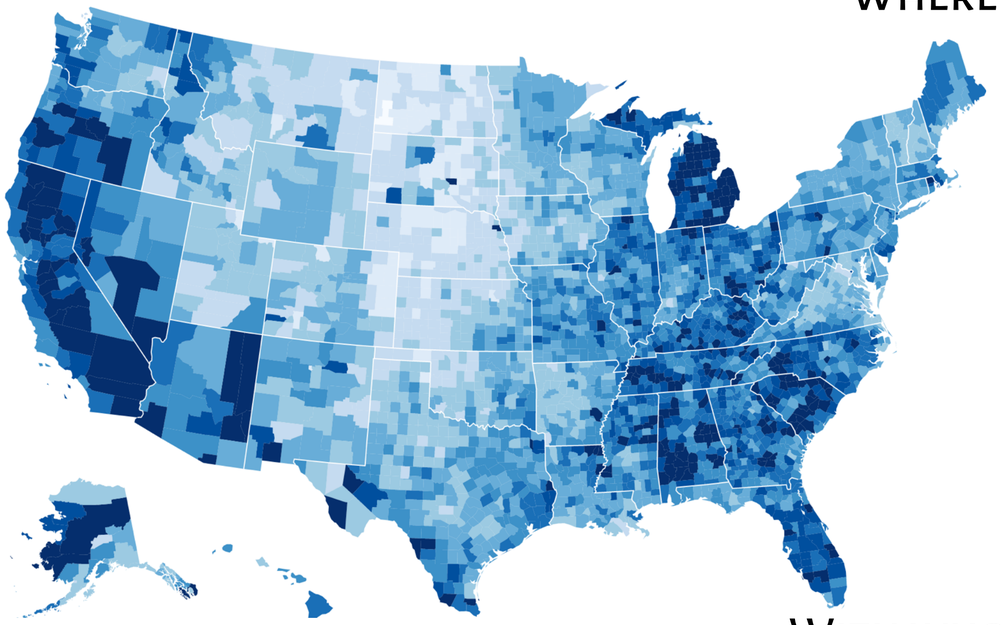
Visualization Types



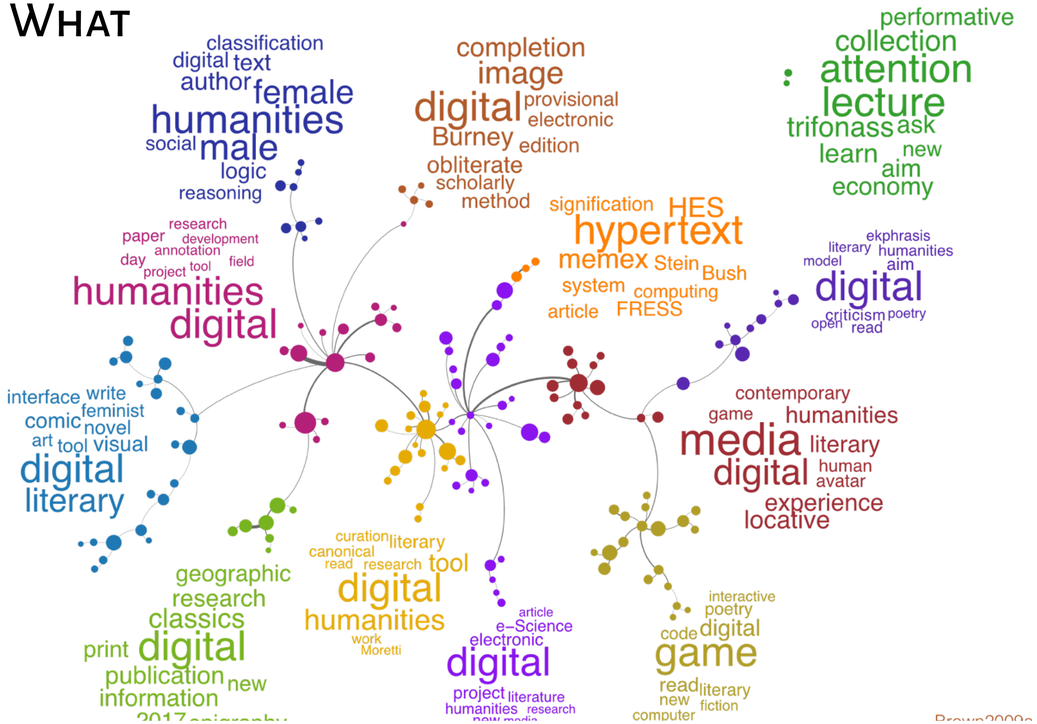
When



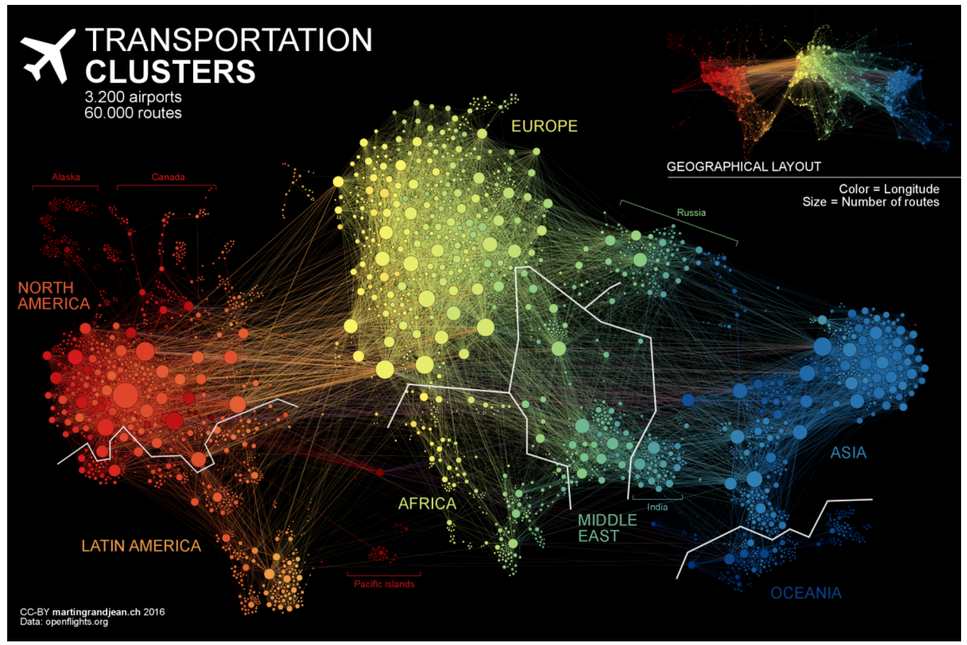
Where

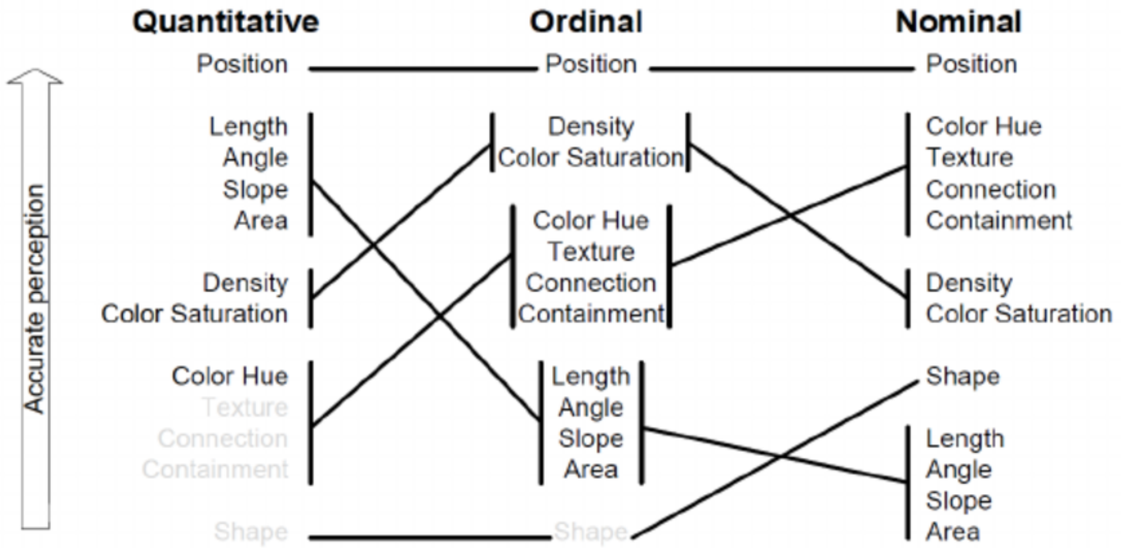


What



With whom?





variable

Perception Accuracy

encoding methods

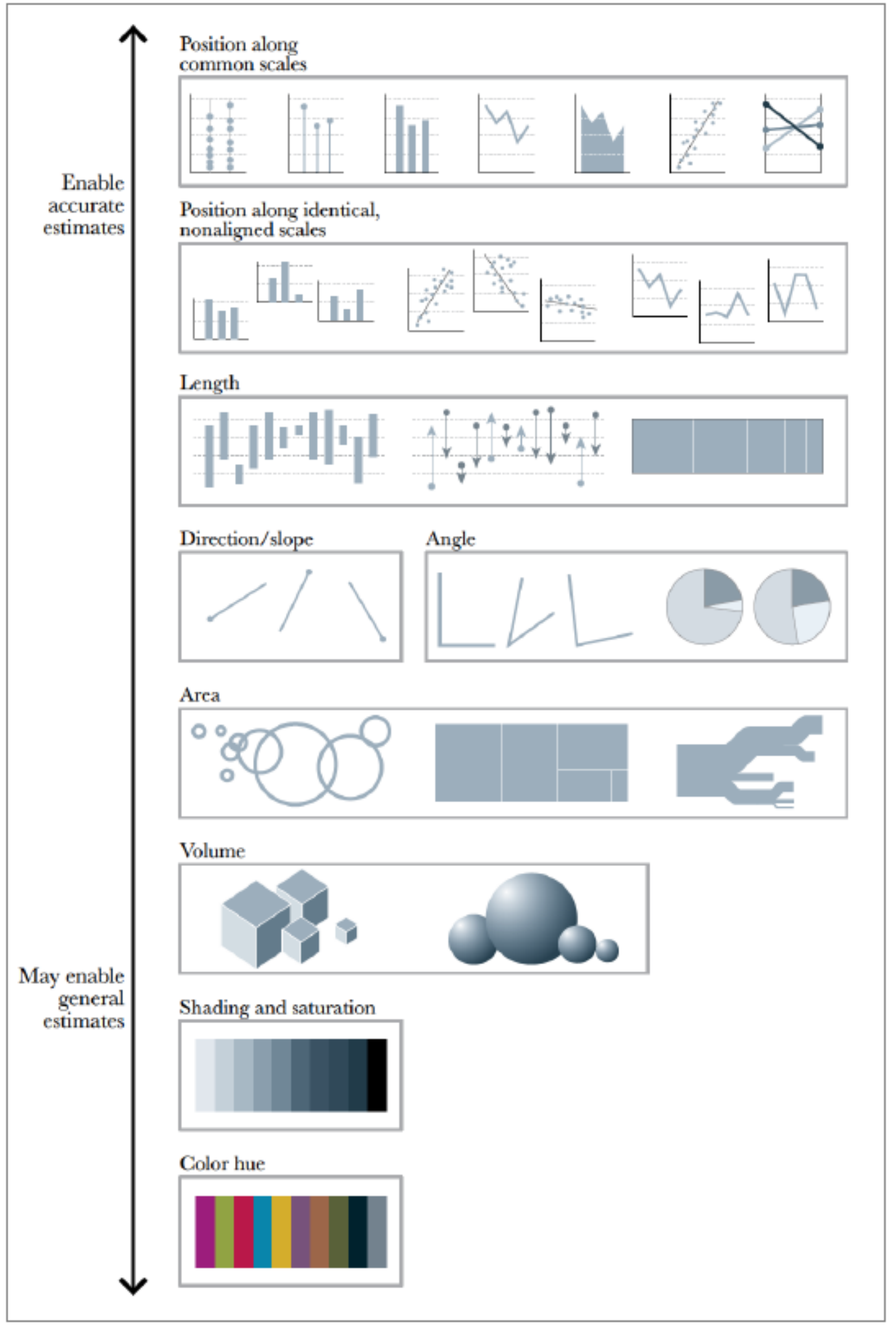
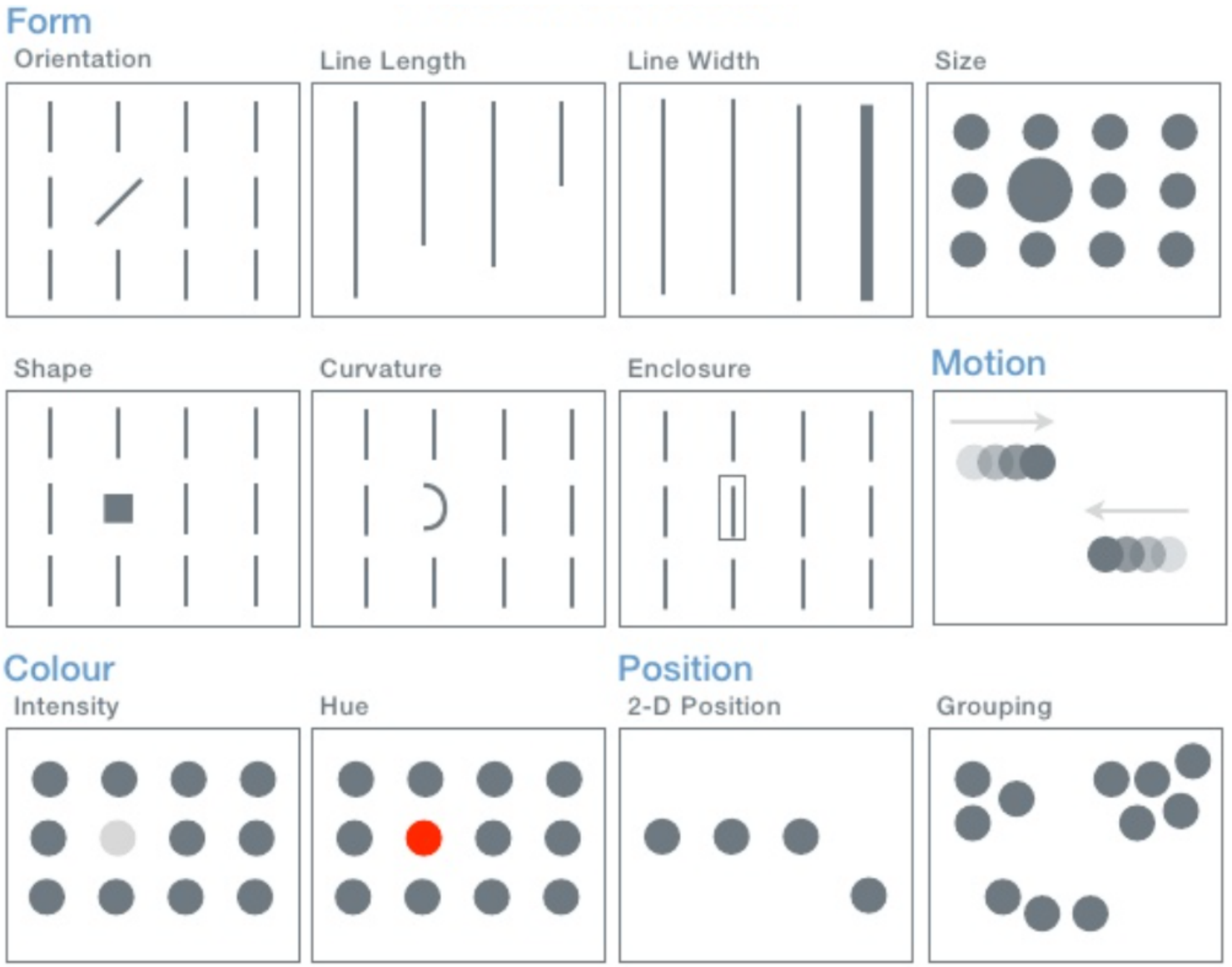
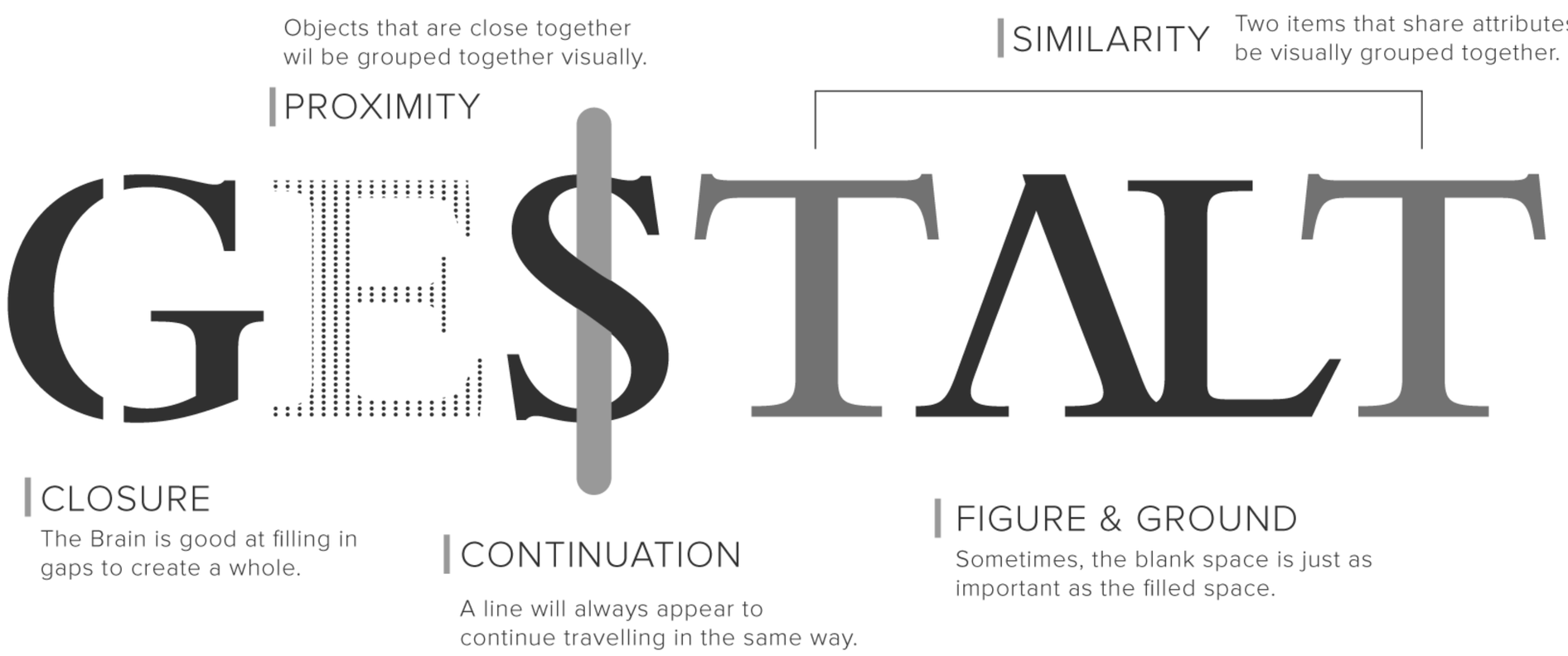


Figure 5.5 Scale of elementary perceptual tasks, inspired by William Cleveland and Robert McGill.

PRE ATTENTIVE FEATURES



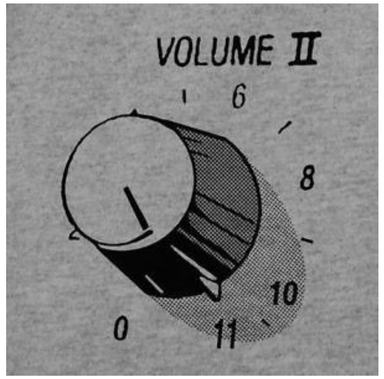


PRINCIPALS OF VISUAL PERCEPTION

HTTPS://EMEEKS.GITHUB.IO/GESTALTDATAVIZ/SECTION1.HTML

SOURCE: HTTP://BOBBIJOPMH.COM/ADMIN/WP-CONTENT/UPLOADS/2014/09/GESTALT-PRINCIPLES.PNG

Cognitive Load



CEEA 2017

DATA VISUALIZATION CHALLENGE

THE DATA

bit.ly/SWD-Data

assessment data of a pilot research project

43 observations

Quantitative (Interval)

cleaned

THE RUBRIC

bit.ly/SWD-Rubric

Rubric used for Grades and Outcomes

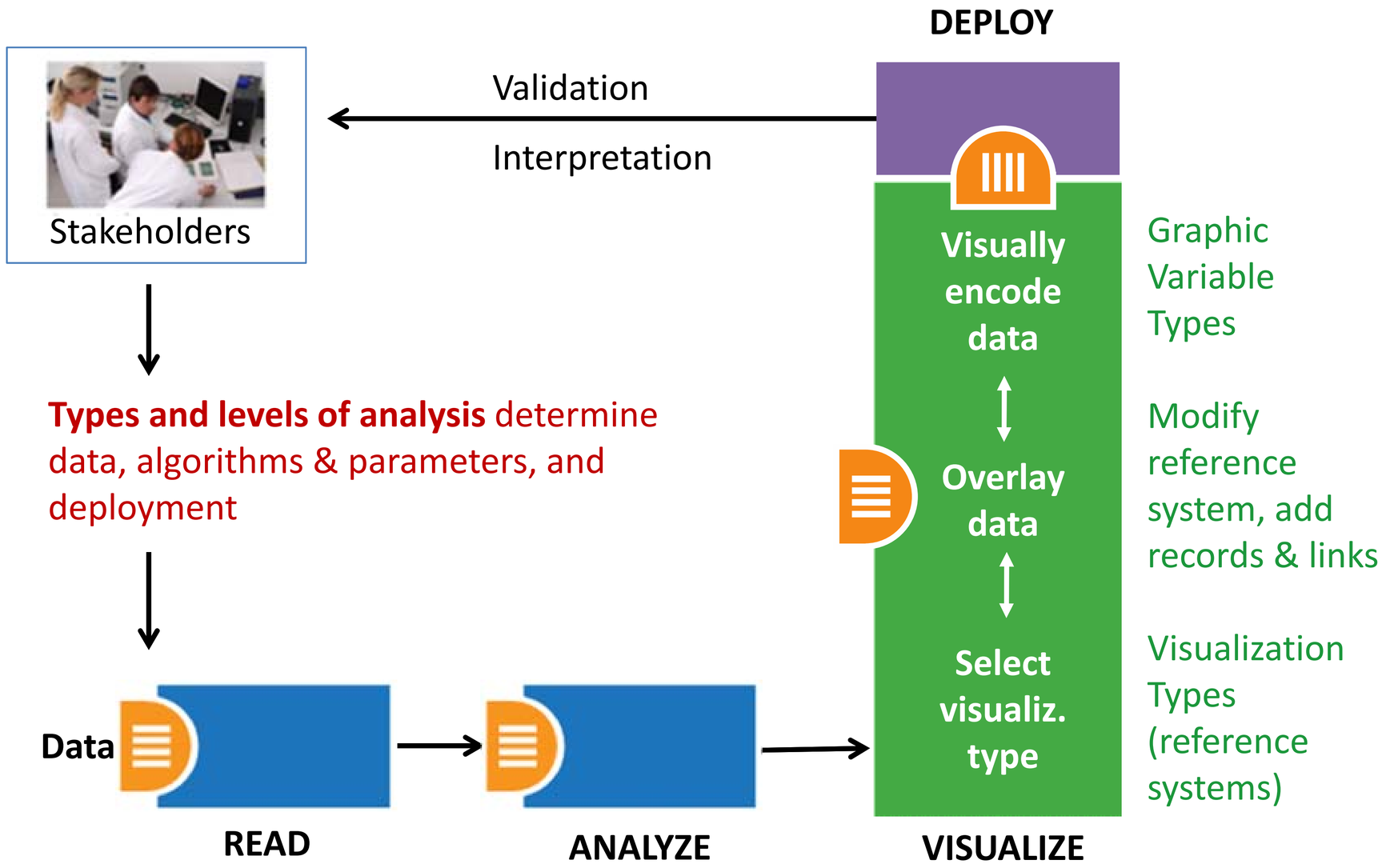
10 Criteria, 5 levels

Outcome achievement based on levels

Grades based on numeric score

The **CHALLENGE**

Design a visualization that can be shown to **STUDENTS** for **FORMATIVE DEVELOPMENT** and provide useful **INSIGHT** for **INSTRUCTORS**



Börner, Katy, and David E. Polley. Visual insights: A practical guide to making sense of data. MIT Press, 2014.

Step **ONE**

Look at the data.

Discuss your golden rule.

What's the narrative?

Who, What, When, Where, Why

Step **Two**

CRAZY EIGHTS

Fold a piece of blank paper in half
4 times. Unfold it. You should
have 8 panels

8 minutes for 8 rough design sketches,
annotate to show ideas, themes, etc.

Step **THREE**

Critical Hits

Each person in the group narrow
their ideas down to their top choice

Step **Four**

#1 WITH A BULLET

As a group, using the top choices, decide which idea your group will refine.

Step **Five**

Refine, Refine

Refine the common idea, and create a larger sketch, detailing use of themes/principles etc where applicable

Step **Six**

HIGHLY TECHNICAL VOTING

Place a sticker on your favourite idea.

Conclusion

Post-moterm

Let's talk about the winner