Storytelling with data story and visualization (Process)

Introduction to Big Data

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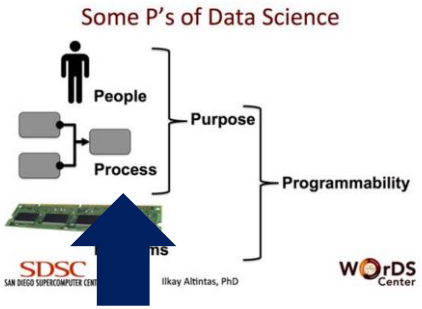
01.- Data project process

5 Ps of Big Data

Process: Remember. Cost, plan, work packages, deliverables,.....

It is a R&D project

Data acquisition/ Pre-Integration → Preparation/Organize • Exploration • Pre-processing → Analysis → Report/ Visualization → Action



01.- Storytelling

"Every dataset, every database, every spreadsheet has a story to tell," says Stuart Frankel, CEO of Narrative Science.

Story is meant to capture the key findings, features, or patterns in data, to convey what caused them where possible, and, looking forward, to spell out the implications and recommendations to the organization

To Stephen Few, "**Data visualization** is the use of visual representations to explore, analyse, and present quantitative data. I view **storytelling** here as an additional interpretative layer, a narrative structure, on top of the data visualization : **Visualization + narrative**

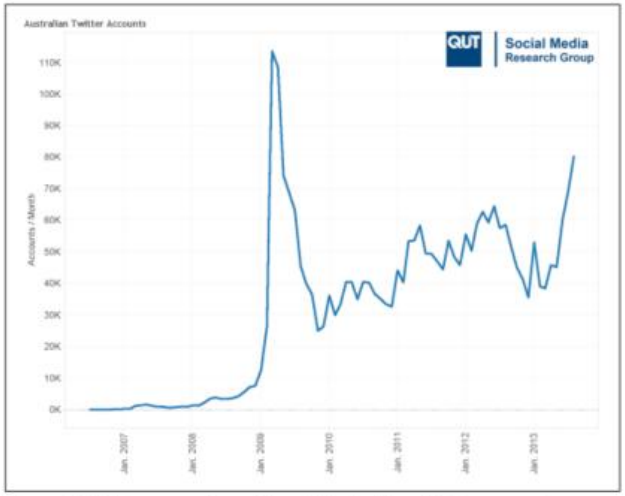


Figure 7-1. New account creation of Australian twitter accounts versus time. From http://bit.ly/aus-twitter.

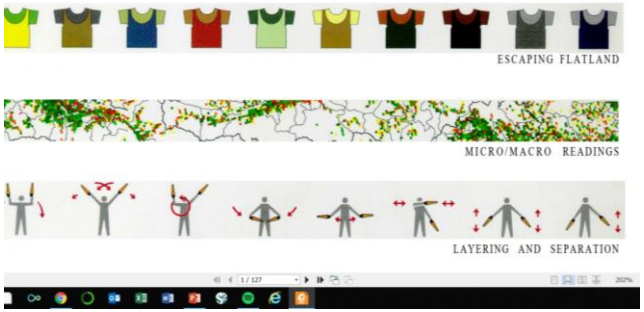
02.- Envisioning Information

Escaping flatland

EVEN though **we navigate daily through a perceptual world of three spatial dimensions and reason occasionally about higher dimensional** arenas with mathematical ease, the world portrayed on our information **displays is caught up in the two-dimensionality of the endless flatlands of paper and video screen**

Edward R. Tufte

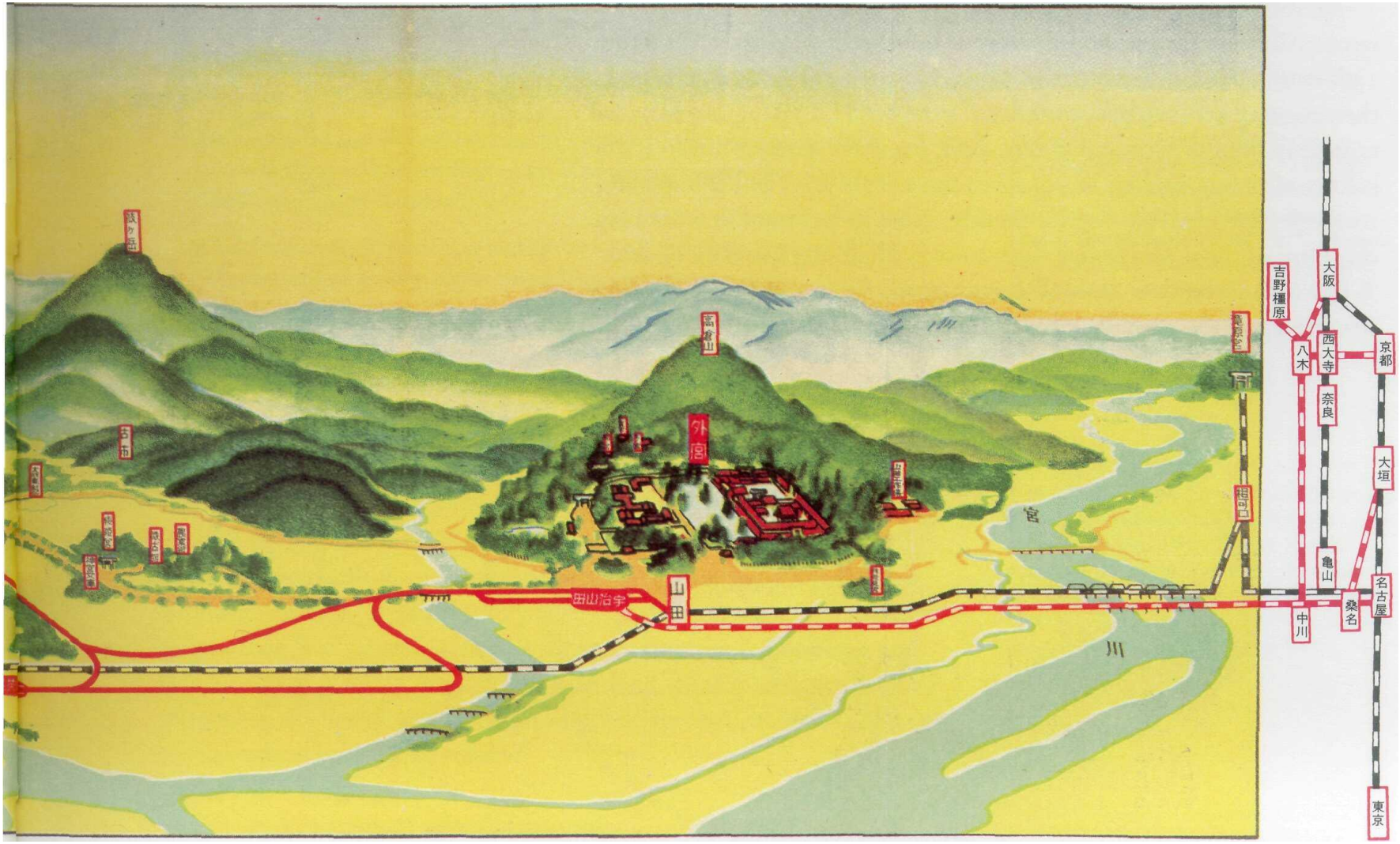
Envisioning Information



- What, then**, are general strategies** for extending the dimensional and informational reach of display flatlands?
- And what **specific techniques effectively** document and envision multivariate worlds?
- **Why are some performances better than others?**

02.- Envisioning Information

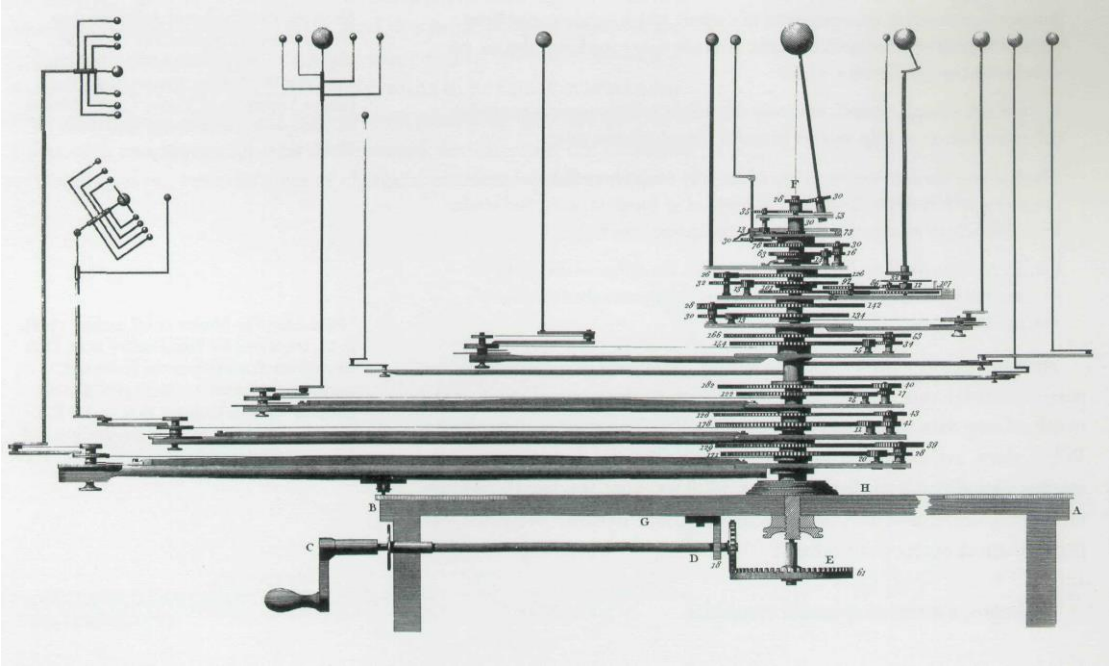
Escaping flatland



04.- Envisioning Information

DIRECT methods for the display of three dimensions include making models

Narratives of the universe were impressively cranked up in orreries, simulations of our solar system (as known in 1800), with planets and their satellites rotating and orbiting



04.- Envisioning Information

DIRECT methods: Particularly intriguing are stereo illustrations, which deliver vivid three-dimensional scenes by means of paired images (one for each eye), which are then fused mentally by viewers Aerial landscapes, molecular structures, and other worldly objects are commonly portrayed

04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- At work here is a critical and effective principle of information design**: Panorama, vista, and prospect deliver to viewers the freedom of choice that derives from an overview, a capacity to compare and sort through detail**.
- And that micro-information, like smaller texture in landscape perception, provides a credible refuge where the pace of visualization is condensed, slowed, and personalized
- Such designs can report immense detail, organizing complexity through multiple and (often) hierarchical layers of contextual reading.

04.- Envisioning Information

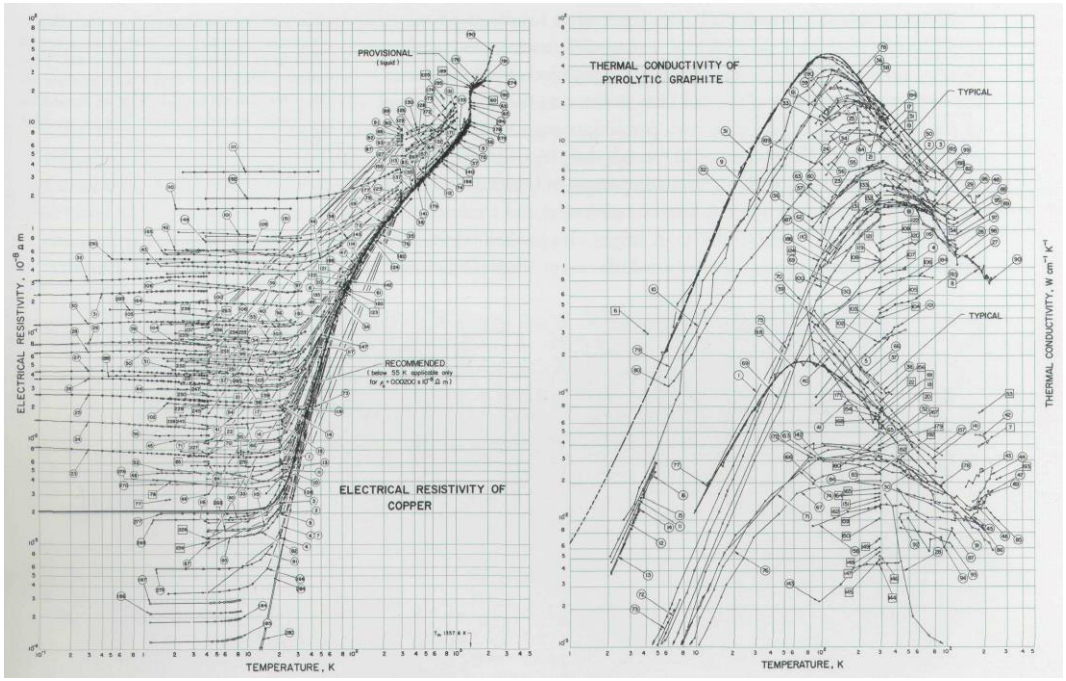
Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- A high-resolution aerial photograph of Senlis, one of the oldest cities in France (construction started on this Notre Dame cathedral in 1153), arrays micro-details mixing into overall pattern

04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- These multi-layered graphs report a clouded relationship between temperature and conductivity for various elements, as measured by many different laboratories.Each set of connected points comes from a single publication, cited by an identification number

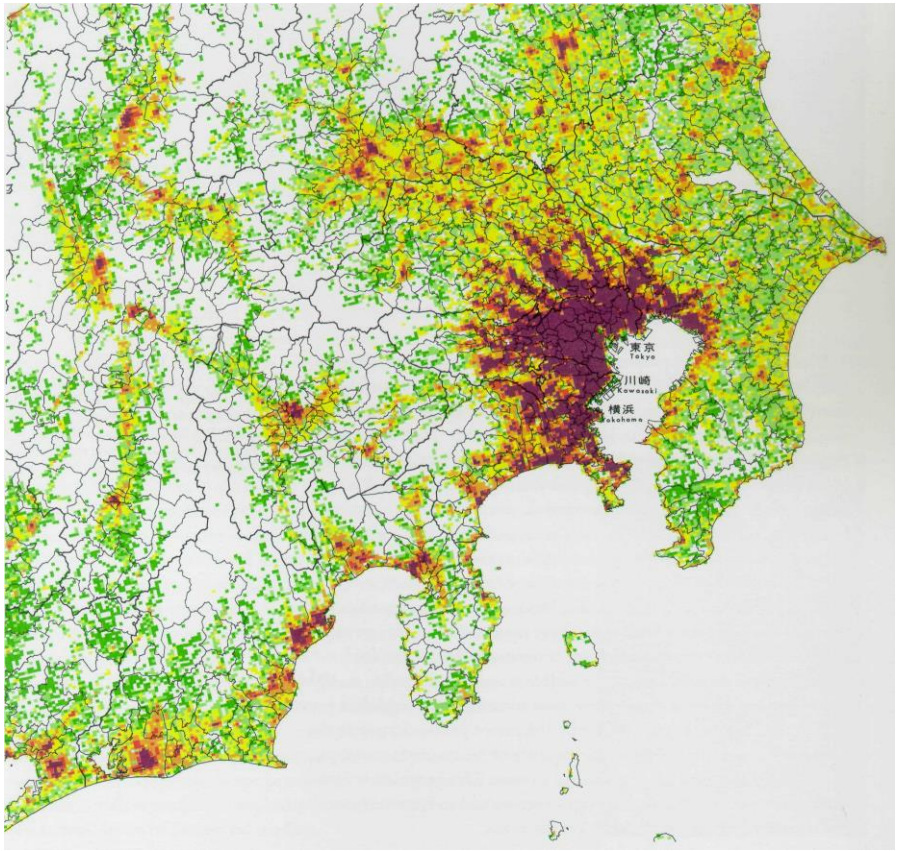


- In this micro/macro arrangement**, 4 layers of data are placed in evidence individual points measured within each study, connected curves formed by those results, and, finally, an overall conglomeration of curves** (which are compared with the standard)

04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- These extraordinary statistical maps report data for thousands of tiny grid squares (1 km on a side). Below, a map of Tokyo shows population density; note smaller concentrations dotting the tracks radiating from the city, as people cluster along rail lines and station stops



04.- Envisioning Information

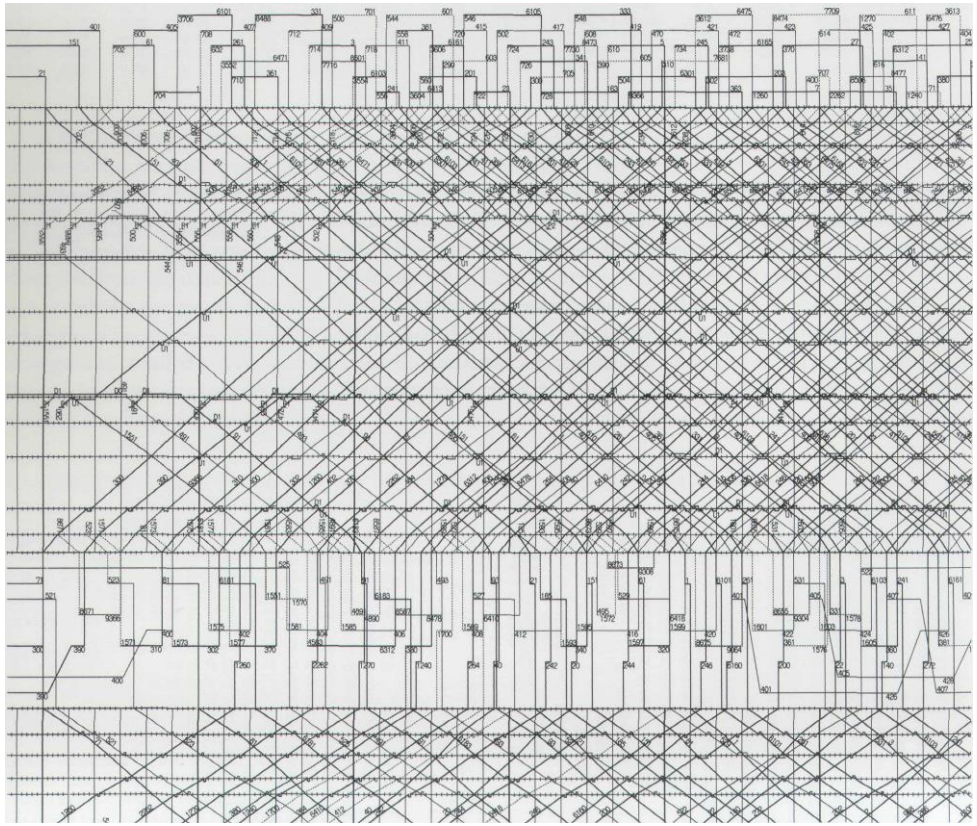
Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- THE Vietnam Veterans Memorial in Washington, D.C. achieves its visual and emotional strength by means of micro/macro design.
- **An additional data dimension comes from the *ordering* of names**. The memorial's designer, Maya Ying Lin, proposed that names be listed by date of death rather than alphabetically

04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- GRAPHICAL timetables also exemplify the multiplicity and wholeness of micro/macro design
- This graphical timetable shown here governs Japanese high-speed trains, or Shinkansen. Station stops are plotted down the side of the grid; time of day runs across the top; diagonal lines show the space-time path of each train



04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- All micro/macro designs mentioned have portrayed large quantities of data at high densities, up to **thousands of bits per square centimetre and 20 million bits per page**

- Such quantities are thoroughly familiar, although hardly noticed:
  - **the human eye registers 150 million bits**
  - **Conventional large-scale topographic maps up to 150 million bits**
  - RGB images are composed of three colour channels. An RGB image with 8 bits per pixel has 256 possible values for each channel, which means more than 16 million possible colour values

- **High-density designs also allow viewers to select, to narrate, to recast and personalize data for their own uses**

04.- Envisioning Information

Micro / Macro Readings :Arrays micro-details mixing into overall pattern

- **What about confusing clutter? Information overload? Doesn't data have to be "boiled down" and "simplified"?**
  - These common questions miss the point, for the quantity of detail is an issue completely separate from the difficulty of reading.

- **Clutter and confusion are failures of design, not attributes of information**. Often the less complex and less subtle the line, the more ambiguous and less interesting is the reading

False equation

Simpleness of data and design = clarity of reading

04.- Envisioning Information

Layering and separation

- Among the most powerful devices for reducing noise and enriching the content of displays is the technique of layering and separation, visually stratifying various aspects of the data

- What matters is the **proper *relationship* among information layers**

- **These visual relationships must be in relevant proportion and in harmony to the substance of the ideas, evidence, and data conveyed**

- **INFORMATION consists of *differences that make a difference***. A fruitful method for the enforcement of such differences is to layer and separate data, much as is done on a high-density map

04.- Envisioning Information

Layering and separation

- Among the most powerful devices for reducing noise and enriching the content of displays is the technique of layering and separation, What matters is the **visually stratifying various aspects of the data**
- proper *relationship* among information layers
- These visual relationships must be in relevant proportion and in harmony to the substance of the ideas, evidence, and data conveyed

Train No.	3701	XM 3301	3801	A 67	3 3803	3 3201	A3 51	.3 3703	3 3807	3 3203	A3 61	3 3809	A3 47	3 3901	3 3811	3 3903	3 3813	3205	3815	3817	3819	3207	3821	3823	3825	3209	3827	3829	3831
New York, N.Y.	A.M. 12.10	A.M. 12.40	A.M. 1.30	A.M. 3.52	A.M. 4.50	A.M. 6.10	A.M. 6.25	A.M. 6.35	A.M. 6.50	A.M. 7.10	A.M. 7.30	A.M. 7.33	A.M. 7.45	A.M. 7.50	A.M. 8.05	A.M. 8.25	A.M. 8.40	A.M. 8.50	A.M. 9.10	A.M. 9.40	A.M. 10.10	A.M. 10.25	A.M. 10.40	A.M. 11.10	A.M. 11.40	A.M. 11.50	P.M. **12.10**	P.M. **12.40**	P.M. **1.10**
Newark, N.J. P	12.24	12.55	1.44	4.07	5.04	6.24	6.38	6.49	7.04	7.24	7.45	7.47	7.59	8.04	8.19	8.39	8.54	9.04	9.24	9.54	10.24	10.39	10.54	11.24	11.54	**12.04**	**12.24**	**12.54**	**1.24**
North Elizabeth	....	....	....	....	....	....	....	....	....	7.30	....	....	....	8.10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Elizabeth	12.31	1.03	1.51	....	5.11	6.31	....	6.56	7.11	7.32	....	7.54	....	8.13	8.26	8.46	9.01	9.11	9.31	10.01	10.31	10.46	11.01	11.31	**12.01**	**12.11**	**12.31**	**1.01**	**1.31**
Linden	12.36	....	1.56	....	5.16	6.36	....	7.01	7.15	7.37	....	7.59	....	8.18	8.31	8.51	9.06	....	9.36	10.06	10.36	....	11.06	11.36	**12.06**	....	**12.36**	**1.06**	**1.36**
North Rahway	....	....	....	....	....	....	....	7.03	....	7.39	....	....	....	8.20	8.33	8.54	....	....	....	....	....	....	....	....	....	....	....	....	....
Rahway	12.40	1.11	2.00	....	5.20	6.40	....	7.06	7.20	7.42	....	8.03	....	8.24	8.36	8.57	9.10	9.18	9.40	10.10	10.40	10.53	11.10	11.40	**12.10**	**12.18**	**12.40**	**1.10**	**1.40**
Metro Park (Iselin)	12.44	....	2.04	4.26	5.24	....	6.56	7.10	7.25	....	8.04	8.07	8.15	....	8.40	....	9.14	....	9.44	10.14	10.44	....	11.14	11.44	**12.14**	....	**12.44**	**1.14**	**1.44**
Metuchen	12.48	....	2.08	....	5.28	....	....	7.14	7.29	....	....	8.11	....	....	8.44	....	9.18	....	9.48	10.18	10.48	....	11.18	11.48	**12.18**	....	**12.48**	**1.18**	**1.48**
Edison	12.51	....	2.11	....	....	....	....	7.17	7.32	....	....	8.14	....	....	8.47	....	9.21	....	....	10.21	....	....	11.21	....	**12.21**	....	....	**1.21**	....
New Brunswick	12.55	....	2.15	....	5.35	....	7.05	7.21	7.35	....	....	8.18	8.25	....	8.50	....	9.25	....	9.54	10.25	10.54	....	11.25	11.54	**12.25**	....	**12.54**	**1.25**	**1.54**
Jersey Avenue	1.02	....	2.18	....	....	....	....	7.28	....	....	....	8.21	....	....	....	....	9.28	....	....	10.28	....	....	11.28	....	**12.28**	....	....	**1.28**	....
Princeton Jct. S	....	....	2.31	....	5.50	....	7.19	....	7.50	....	....	8.34	8.41	....	9.05	....	9.41	....	10.09	10.41	11.09	....	11.41	**12.09**	**12.41**	....	**1.09**	**1.41**	**2.09**
Trenton, N.J.	....	....	2.42	4.58	6.03	....	7.28	....	8.01	....	8.31	8.44	8.52	....	9.16	....	9.52	....	10.19	10.52	11.19	....	11.52	**12.19**	**12.52**	....	**1.22**	**1.52**	**2.20**

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New York, NY	12.10	12.40	1.30	3.52	4.50	6.10	6.25	6.35	6.50	7.10	7.30	7.33	7.45	7.50	8.05	8.25	8.40	8.50	9.10	9.40	10.10	10.25	10.40	11.10	11.40
Newark, NJ P	12.24	12.55	1.44	4.07	5.04	6.24	6.38	6.49	7.04	7.24	7.45	7.47	7.59	8.04	8.19	8.39	8.54	9.04	9.24	9.54	10.24	10.39	10.54	11.24	11.54
North Elizabeth										7.30	. .	. .	. .	8.10	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
Elizabeth	12.31	1.03	1.51	. .	5.11	6.31	. .	6.56	7.11	7.32	. .	7.54	. .	8.13	8.26	8.46	9.01	9.11	9.31	10.01	10.31	10.46	11.01	11.31	12.01
Linden	12.36	. .	1.56	. .	5.16	6.36	. .	7.01	7.15	7.37	. .	7.59	. .	8.18	8.31	8.51	9.06	. .	9.36	10.06	10.36	. .	11.06	11.36	12.06
North Rahway										7.39	. .	. .	. .	8.20	8.33	8.54	. .	. .	. .	. .	. .	. .	. .	. .	. .
Rahway	12.40	1.11	2.00	. .	5.20	6.40	. .	7.06	7.20	7.42	. .	8.03	. .	8.24	8.36	8.57	9.10	9.18	9.40	10.10	10.40	10.53	11.10	11.40	12.10
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Metuchen	12.48		2.08	. .	5.28		. .	7.14	7.29		. .	8.11	. .		8.44		9.18		9.48	10.18	10.48		11.18	11.48	12.18
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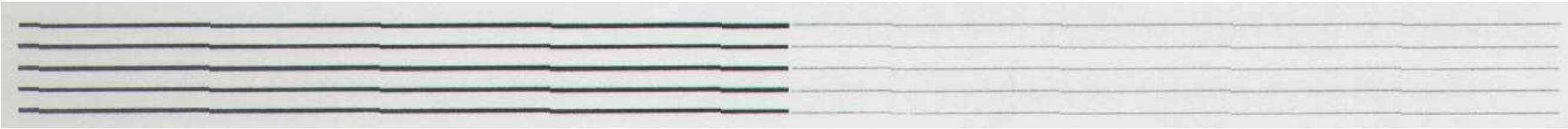
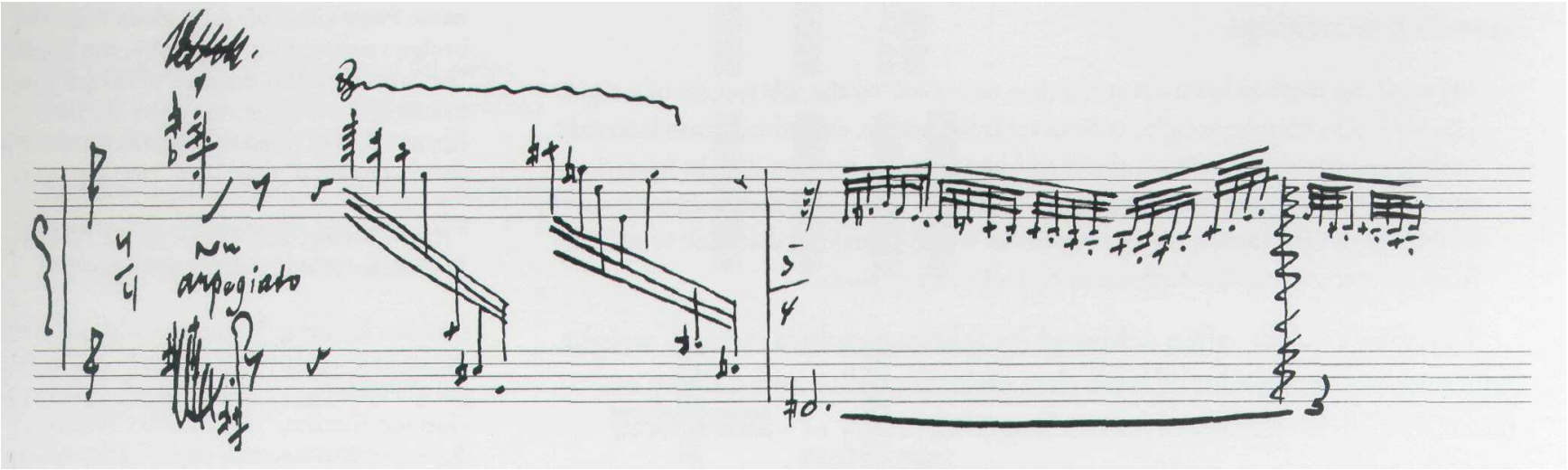
New Brunswick	12.55		2.15	. .	5.35		7.05	7.21	7.35		. .	8.18	8.25		8.50		9.25		9.54	10.25	10.54		11.25	11.54	12.25
Jersey Avenue	1.02		2.18	. .	. .		. .	7.28	. .		. .	8.21	. .		. .		9.28		. .	10.28	. .		11.28	. .	12.28
Princeton Junction S			2.31	. .	5.50		7.19		7.50		. .	8.34	8.41		9.05		9.41		10.09	10.41	11.09		11.41	12.09	12.41
Trenton, NJ			2.42	4.58	6.03		7.28		8.01		8.31	8.44	8.52		9.16		9.52		10.19	10.52	11.19		11.52	12.19	12.52
TRAIN NUMBER	3701	3301	3801	67	3803	3201	51	3703	3807	3203	61	3809	47	3901	3811	3903	3813	3205	3815	3817	3819	3207	3821	3823	3825
NOTES		XM		⟝	3	3	⟝3	3	3	3	⟝3	3	⟝3	3	3	3	3								

04.- Envisioning Information

Layering and separation

- Similarly for music notation, some staff paper is better than others
- **Dark grid lines are “chartjunk”**

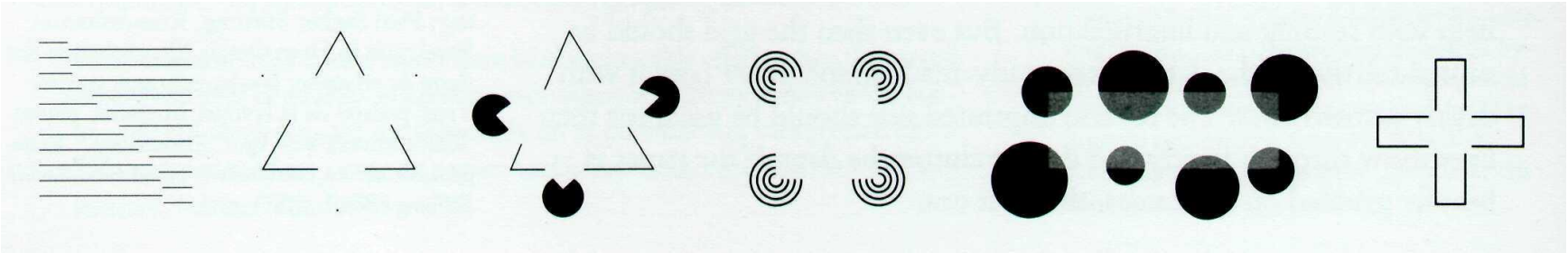




04.- Envisioning Information

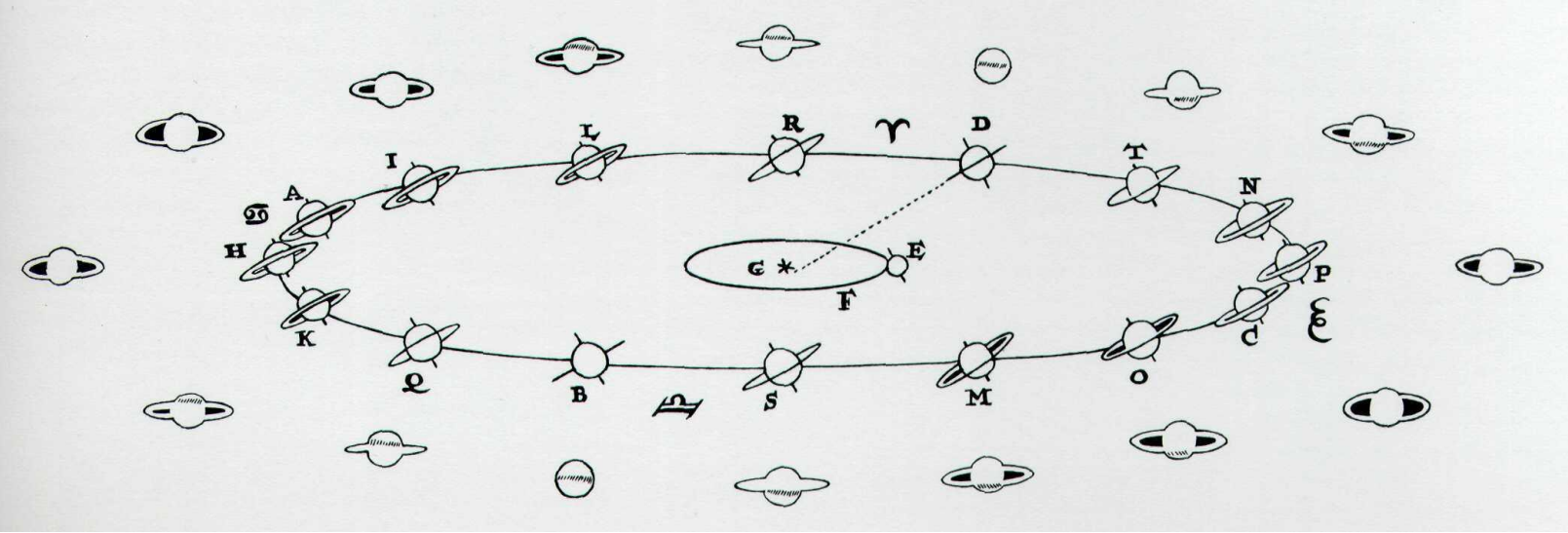
Layering and separation

- Usually this involves creating a hierarchy of visual effects, possibly matching an ordering of information content



Small multiples

- At the heart of quantitative reasoning is a single question**: *Compared to what?*** Small multiple designs, multivariate and data bountiful, answer directly by visually **enforcing comparisons of changes, of the differences among objects, of the scope of alternatives**



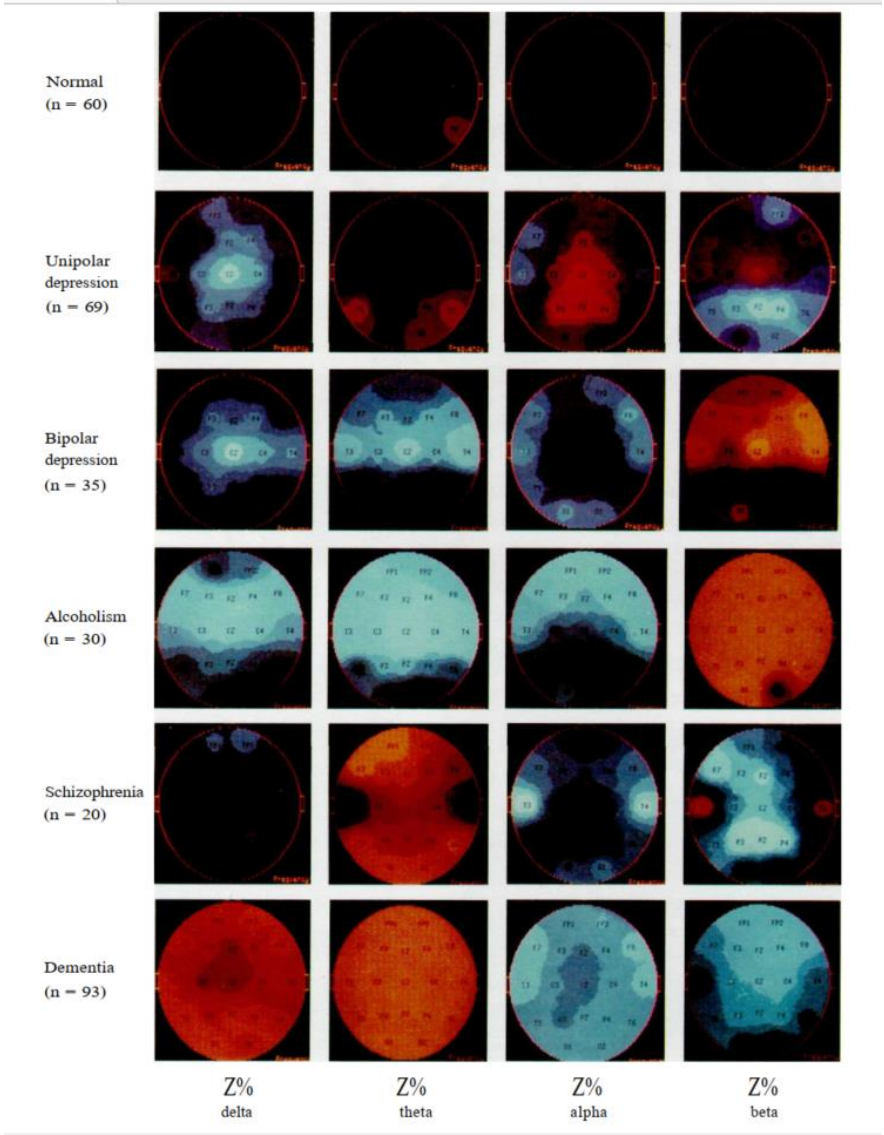
- IN this splendid 1659 drawing by Christiaan Huygens, the inner ellipse traces Earth's yearly journey around the Sun; the larger ellipse shows Saturn's orbit, viewed from the heavens. The outermost images depict Saturn as seen through telescopes located on Earth

04.- Envisioning Information

Small multiples

- Simultaneous two-dimensional indexing of the multiplied image, **flatland within flatland**, significantly deepens displays, with little added complication in reading

- These neurometric maps record distributions of brain electrical activity, arraying data over a matrix of color images —with frequency bands (delta, theta, alpha, and beta) sorting the columns, and individual diagnosis forming the rows



04.- Envisioning Information

Colour and information

- IN representing and communicating information, how are we to benefit from colour's great dominion?

- Human eyes are exquisitely sensitive to colour variations: a trained colourist can distinguish among 1,000,000 colours at least when tested under contrived conditions of pairwise comparison

    - **Some 20,000 colors are accessible to many viewers**

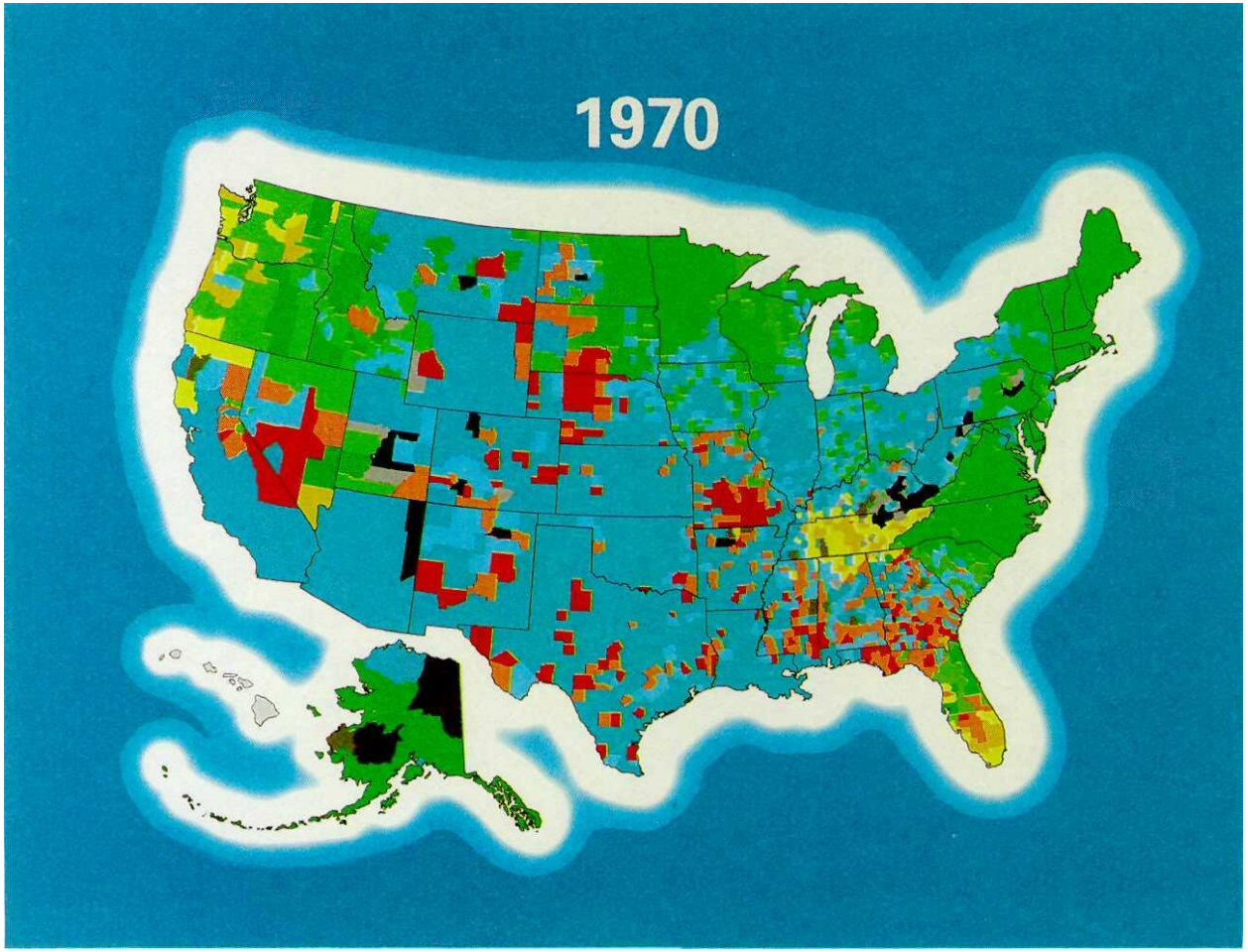
- **For encoding abstract information, however, more than 20 or 30 colors frequently produce not diminishing but negative returns**
    - **First rule: Pure, bright or very strong colours have loud, unbearable effects when they stand unrelieved over large areas adjacent to each other**, but extraordinary effects can be achieved when they are used sparingly on or between dull background tones. "Noise is not music“

    - **Second rule:** The placing of light, **bright colours mixed with white next to each other usually produces unpleasant results**, especially if the colors are used for large area

04.- Envisioning Information

Color and information

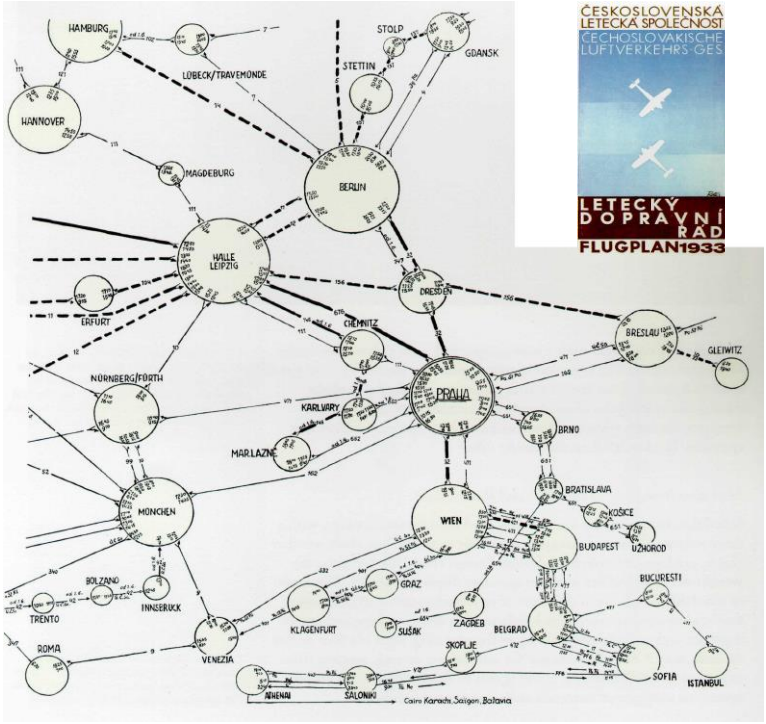
- Bad example



04.- Envisioning Information

Narratives of space and time

- MANY information displays report on the world's workaday reality of three-space and time.
- Painting **four-variable narrations of space-time on to flatland combines two familiar designs, the map and the time-series**



- A comprehensive narrative description of a transport system requires a record of both time and spatial experiences.

03.- Steps

- **What are you trying to achieve?**
  - What is your objective?
  - Why are you putting this presentation or report together?
  - What do you hope to achieve?

- **Who is your audience?**
  - How data literate are they?
  - How technical are they?
  - What expectations do they have?
  - What's their level of interest and motivation? How busy are they?

- **What's your medium?**
  - should you use a written report; a visual presentation, such as PowerPoint; a dashboard; or an infographic ;

04.- Visualization

- To Stephen Few, "**Data visualization** is the use of visual representations to explore, analyse, and present quantitative data. I view **storytelling** here as an additional interpretative layer, a narrative structure, on top of the data visualization : **Visualization + narrative**

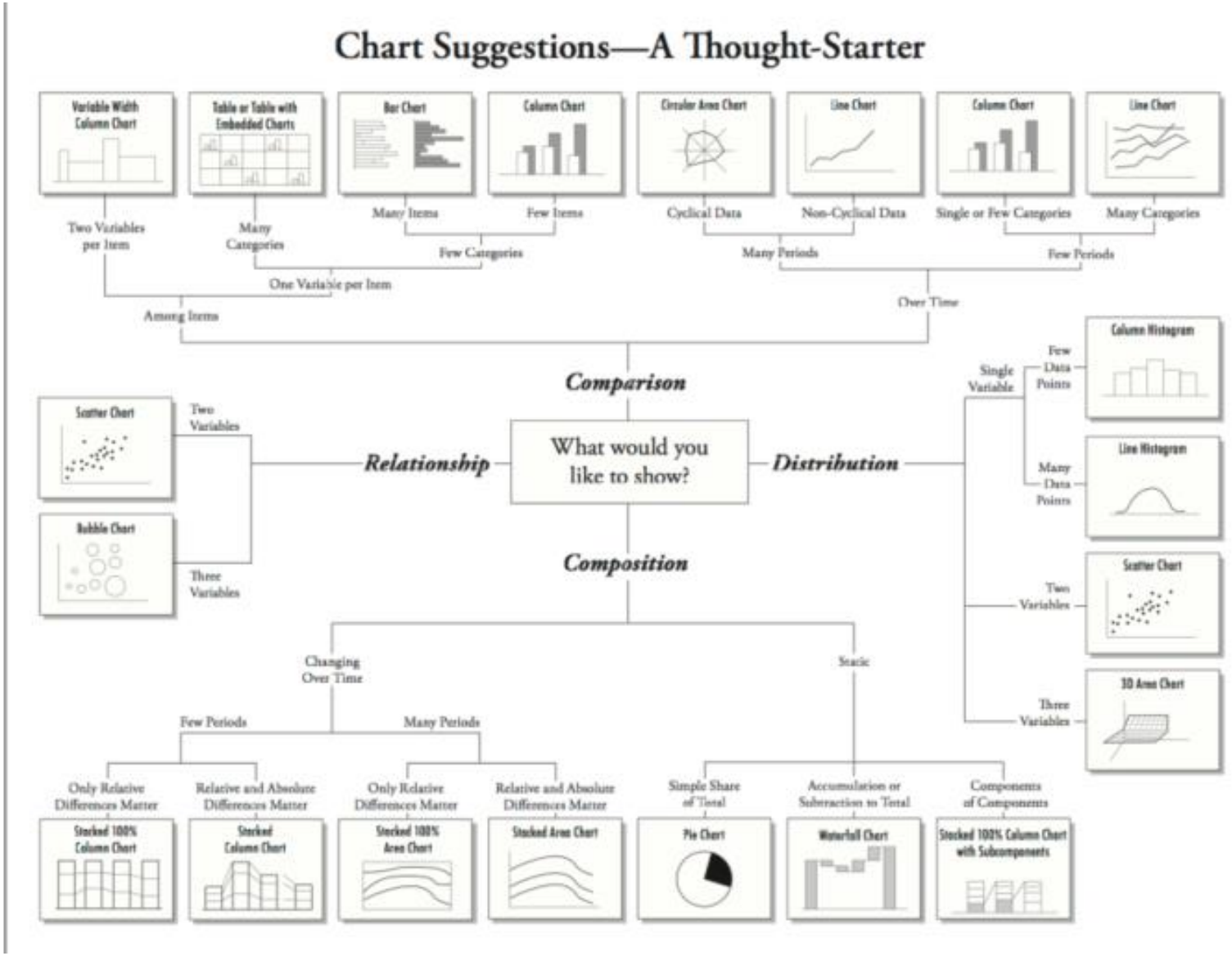
- Assuming that an analyst has chosen appropriate metrics, appropriate dimensions (i.e., how the data has been sliced, say by month or by sales channel) and has found some interesting and significant pattern in those data, he next **needs to select a way to present the data**. **In some cases, that might be a data table, but typically it will involve a chart.**

Choosing a chart

- Selecting a chart type is central in terms of the ability to get the story across to the viewer
- **Four types of reason for that chart**:
  - **Comparisons***:* For example, how cohorts compare, how something changes with time
  - ***Distribution:*** To show the variability of a set of data
  - **Relationships:** To show correlations or associations among variables
  - **Category composition***:* To show how data is divided among two or more categories

02.- Visualization

Choosing a chart



Elements of the chart

Text

- 6-12 word descriptive title
- Subtitle and/or annotations provide additional information.
- Text size is hierarchical and readable.
- Text is horizontal.
- Data are labeled directly.
- Labels are used sparingly.

Arrangement

- Proportions are accurate.
- Data are intentionally ordered.
- Axis intervals are equidistant.
- Graph is two dimensional.
- Display is free from decoration.

Color

- Color scheme is intentional.
- Color is used to highlight key pattern
- Color is legible when printed in black
- Color is legible for people with colorb
- Text su□iently contrasts background

Lines

- Gridlines, if present, are muted.
- Graph does not have border line.
- Axes do not have unnecessary tick m
- Graph has one horizontal and one ve

Overall

- Graph highlights things
- The type of graph is appropriate for d
- Graph has appropriate level of precision
- Contextualized or comparison data
- Individual chart elements work together overarching takeaway message

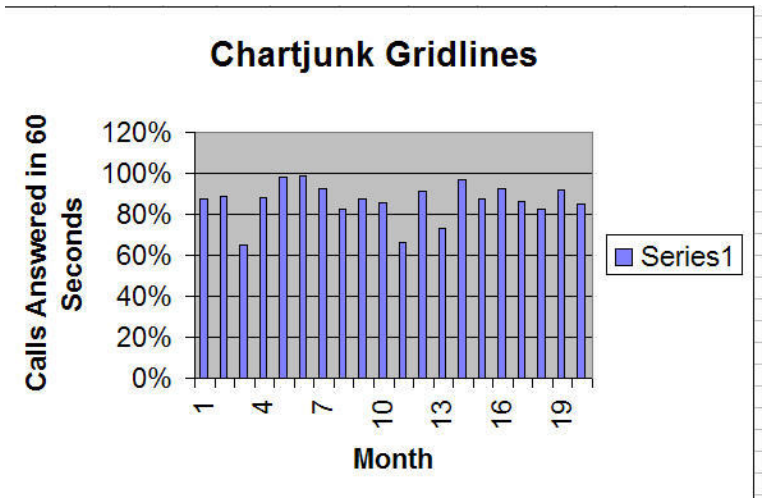
02.- Elements of the chart

Focusing the message

The purpose of creating a visual is to convey a message clearly.

- You have a number of “weapons” in the arsenal, such as fonts, gridlines and orientation. Another is the use of highlight colours. One approach to focus the message and reader is to show only the data of interest

Edward Tufte coined the term chartjunk to cover these visual distractions: “Chartjunk refers to all visual elements in charts and graphs that are not necessary to comprehend the information represented on the graph, or that distract the viewer from this information

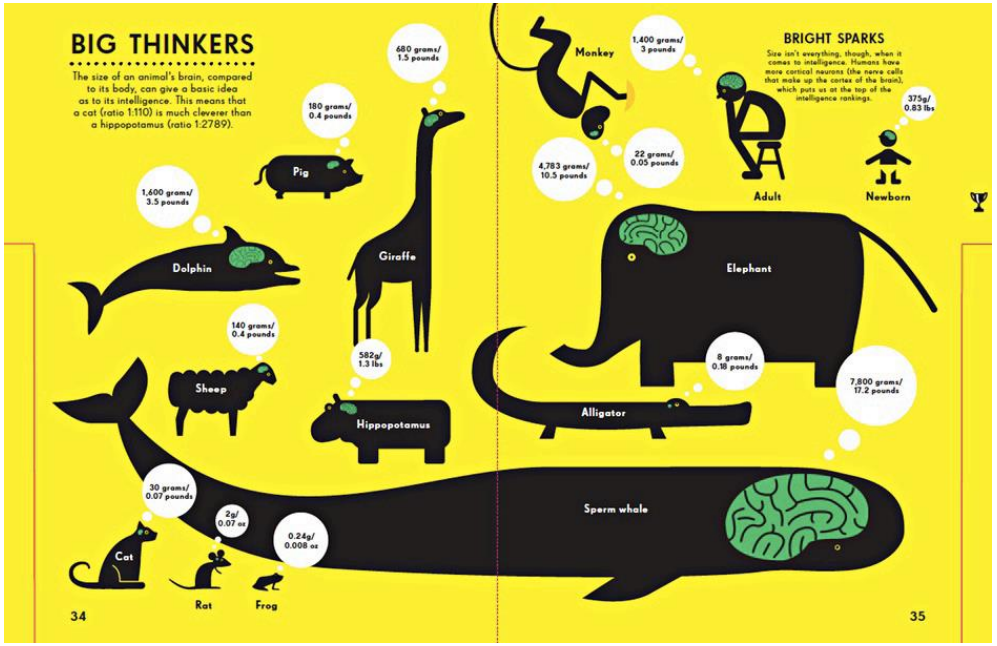


Delivery

Infographics

"In a data-driven business context, I'm not a huge fan of infographics, meant in the modern sense of flashy, colourful visuals peppered with a few facts, typically created by designers rather than analysts"

Thus, the infographic format worked well in that situation, and it can also be useful to communicate externally to the public.



04.- Visualization

Delivery

- **Dashboards**
  Many organizations mistakenly measure their data-drivenness by the number of reports and dashboards they produce.
- Dashboards are very useful and can support a range of activities

We can think of dashboards as falling into **three categories:**

- **Executive or strategic**
- **Analytical**
- **Operational**