

Data Visualization: How to truly tell a great story!

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What this isn't...



What this isn't...

- Use this chart, don't use that one.
- Use this color, not that one.
- Do this, don't do that.

What this is...

- Give general guides
- Show theory to let YOU decide

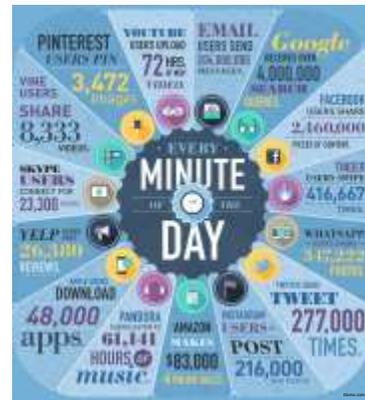
Agenda

- History of Data Visualization
- Consider Your Audience
- Storyboarding
- The types of data and visualizations
- How we see the world
- Datafication
- Pitfalls to avoid
- Where to learn more!

The History of Data Visualization

Every day we create 2.5 quintillion (10^{18}) bytes of data - so much that **90 percent of the world's data today has been created in the last two years alone.**

-IBM CMO Study, 2011



Çatalhöyük – 6200 BC



Most ubiquitous today?



Most ubiquitous today?



Most ubiquitous today?



Consider Your Audience

- Decision maker? What's known?
- Relevant background info?
- Default Biases?
- What data to strengthen our case?
- Is audience familiarity with data?
- Risk? Do we need hedge them upfront?
- What will they use it to do?
- What does success look like?
- One sentence test.

Storyboarding



Source: [Interacting with data: a data visualization guide for business professionals](#) (Wiley 2015)

Different Types

Two main types of data visualization

- Exploration
- Explanation

Exploration

- Discover new areas of interest
- Pose new questions
- Discover new stories

Explanation

- Answer a question
- Support a decision
- Convey information
- Increase efficiency

Two main types of data

- Qualitative
- Quantitative

Qualitative

- Can also be categorical
 - Favorite color = blue
 - Gender, State, etc.
 - Non-Additive facts and some semi-additive

Quantitative

- Expressed in numbers and can be counted and aggregated easily
- Fully additive facts

How we see the world

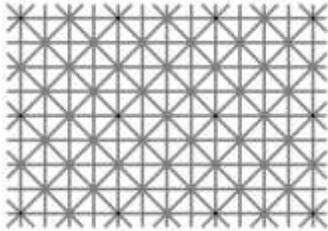
The need to visualize data

"Use a picture. It's worth a thousand words."
-Tess Flanders, 1911

The need to visualize data

- Human brain processes images 60,000x faster than text.
-Persuasion and the Role of Visual Presentation Support: The UVA/IM Study, 1986
- 90 percent of the information transmitted to the brain is visual.
-MIT News, January 16, 2014

How many dots do you see?



Ninio's Extension Illusion

The Gestalt Principles

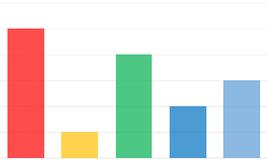
Gestalt

- Introduced by Christian von Ehrenfels
- Psychological term meaning unified whole
 - The whole is different (not greater) than the sum
- Gestalt Effect –
 - Ability of the mind to generate whole images from a collection of parts

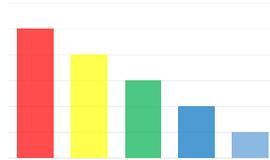
Law of Pragnanz



Law of Pragnanz



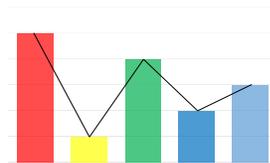
Law of Pragnanz



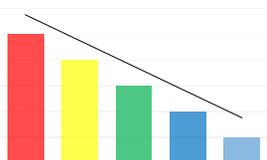
Law of Continuity



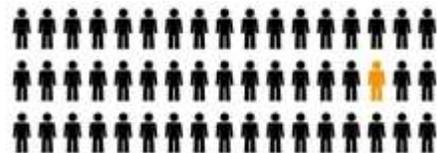
Law of Continuity



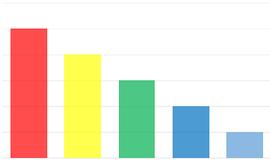
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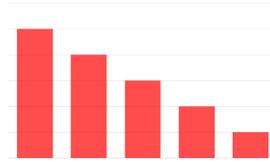
Law of Similarity



Law of Similarity



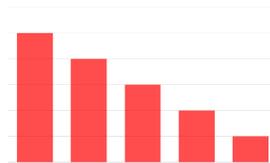
Law of Similarity



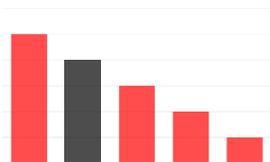
Law of Focal Point



Law of Focal Point



Law of Focal Point



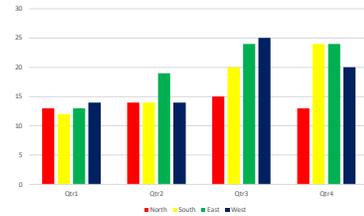
Law of Focal Point

Column1	Column2	Column3	Column4	Column5
10%	20%	30%	40%	50%
15%	25%	35%	45%	55%
20%	30%	40%	50%	60%
25%	35%	45%	55%	65%
30%	40%	50%	60%	70%
35%	45%	55%	65%	75%
40%	50%	60%	70%	80%
45%	55%	65%	75%	85%
50%	60%	70%	80%	90%
55%	65%	75%	85%	95%

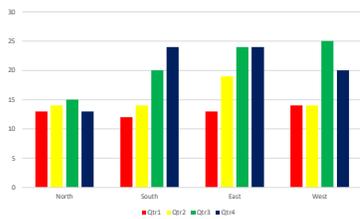
Law of Proximity



Law of Proximity



Law of Proximity



Colors

PSYCHOLOGY OF COLOR

- 84.7% of people prefer blue.
- 93% of people prefer red.
- 6% of people prefer yellow.
- 1% of people prefer green.
- 80% of people prefer purple.
- 52% of people prefer orange.
- 42% more often use the colors in black and white.

PRIMARY COLORS: Red, Yellow, Blue

SECONDARY COLORS: Green, Purple, Orange

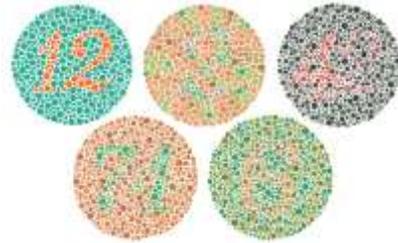
Colors

- We don't see the same thing.
- They have innate meanings and feelings

Color vision deficiency (CVD)

- Affects approximately 1 in 12 men (8%) and 1 in 200 (<1%) women in the world.

Color blindness



Normal Vision



Deuteranopia



Protanopia



Tritanopia



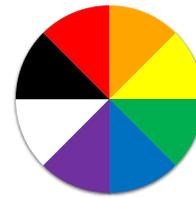
What can we do?

- Be conscious of red and greens together.
- Find a CVD friendly palette when possible.
- Shading and gradients!
- Use help!
 - [The Colorlab](http://colorlab.wickline.org/colorblind/colorlab/) - <http://colorlab.wickline.org/colorblind/colorlab/>
 - [Coblis](http://www.color-blindness.com/coblis-color-blindness-simulator/) - <http://www.color-blindness.com/coblis-color-blindness-simulator/>

Colorlab - Demo

Coblis - Demo

The Psychology Color Wheel



www.empower-yourself-with-color-psychology.com

The Psychology Color Wheel



Combines the energy of red and the happiness of yellow. It is associated with joy, sunshine, and the tropics.

Orange Meanings

Positive Meanings:

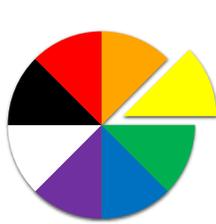
- adventurous, risk-taking, vibrant, flamboyant
- stimulating to the senses
- affordable
- warm, sociable, optimistic, enthusiastic, cheerful
- self-confident, independent, extroverted and uninhibited
- creative flair
- warm-hearted, agreeable and informal

Negative Meanings:

- superficial and insincere
- dependent, over-bearing, self-indulgent
- the exhibitionist, pessimistic
- cheap, unsociable, and overly proud

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel



The color of sunshine. It's associated with joy, happiness, intellect, and energy. Also caution.

Yellow Meanings

Positive Meanings:

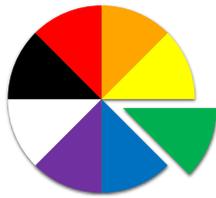
- cheerful, happy, playful, fun
- optimistic, uplifting, illuminating
- logical, mental clarity, aids decision-making
- confidence, originality, creativity
- challenging, academic and analytical
- wisdom and logic
- communication of new ideas

Negative Meanings:

- critical and judgmental, overly analytical
- impatient and impulsive
- egotistical, pessimistic, an inferiority complex
- spiteful, cowardly, deceitful
- non-emotional and lacking compassion

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel



The color of nature. It symbolizes growth, harmony, freshness, and fertility.

Green Meanings

Positive Color Meanings:

- growth and vitality, renewal and restoration
- financial gain
- self-reliance, reliability and dependability
- being tactful, emotionally balanced and calm
- nature lover and family oriented
- practical and down to earth
- sympathetic, compassionate and nurturing
- generous, kind and loyal with a high moral sense
- adaptable and flexible
- encourages 'social joining' of clubs and other groups, a need to belong

Negative Color Meanings:

- possessive and materialistic
- indifferent and over-cautious
- envious, selfish, greedy and miserly
- devious with money
- inconsiderate, a hypochondriac and a do-gooder

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel



The color of the sky and sea. It is often associated with depth and stability. It symbolizes trust, loyalty, wisdom, confidence, intelligence, faith, truth, and heaven.

Blue Meanings

Positive Color Meanings:

- loyalty, trust and integrity
- tactful, caring and concerned
- reliability and responsibility
- conservatism and perseverance
- idealistic and orderly
- authority, devotion and contemplation
- peace and calm

Negative Color Meanings:

- rigid, deceitful and spiteful
- self-righteous, superstitious and emotionally unstable
- too conservative, predictable and weak
- unforgiving and frigid
- manipulation, unfaithfulness and distrust

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel

Combines the stability of blue and the energy of red. Purple is associated with royalty. It symbolizes power, nobility, luxury, and ambition.



Purple Meanings

Positive Color Meanings:

- unusual and individual, creative and inventive
- psychic and intuitive
- humanitarian, selfless and unlimited
- mystery, fantasy and the future

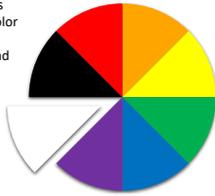
Negative Color Meanings:

- immaturity
- impractical
- cynical and aloof, pompous and arrogant
- fraudulent and corrupt
- delusions of grandeur and the social climber

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel

Associated with light, goodness, innocence, purity, and virginity. It is considered to be the color of perfection. White means safety, purity, and cleanliness.



White Meanings

Positive Color Meanings:

- innocence
- purity, cleanliness
- equality, complete and whole
- simplicity
- immaculate and neat
- self-sufficient, pristine and open
- new beginnings

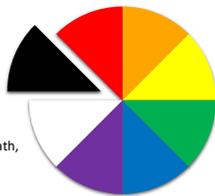
Negative Color Meanings:

- sterile, stark
- fastidious
- empty, isolated
- cautious, critical and boring

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel

Associated with power, elegance, formality, death, evil, and mystery.



Black Meanings

Positive Color Meanings:

- authority, power, control
- protection and comfort
- strong, contained, formal
- sophisticated
- seductive, mysterious
- endings & beginnings

Negative Color Meanings:

- aloof
- depressing and pessimistic
- secretive and withholding
- conservative and serious
- power & control
- sadness and negativity

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

The Psychology Color Wheel

The color of fire and blood, so it is associated with energy, war, danger, strength, power, determination as well as passion, desire, and love.



Red Meanings

Positive Meanings:

- action, power, energy, speed
- passion, desire, lust
- strength, courage
- attention-getting, motivating, stimulating, energizing
- driven and determined
- exciting, warm, spontaneous, assertive and confident

Negative Meanings:

- aggression and anger
- financial loss
- domineering, over-bearing and tiring
- quick-tempered, ruthless, fearful and intolerant
- rebellious and obstinate
- resentful, violent and brutal

<http://www.empower-yourself-with-color-psychology.com/color-meanings-in-business.html>

Datafication

- Benefits
- Dangers

Pitfalls to Avoid

- Not engaging the audience or user first!
- Visual Clutter – Keep it Simple
- Color Abuse
- Poor Design
- Bad Data
- Datafication
- Pie Charts ☹️

Summary

- Know the purpose
- Know the type
- Know the audience
- Avoid pitfalls
- Keep it simple!

QUESTIONS

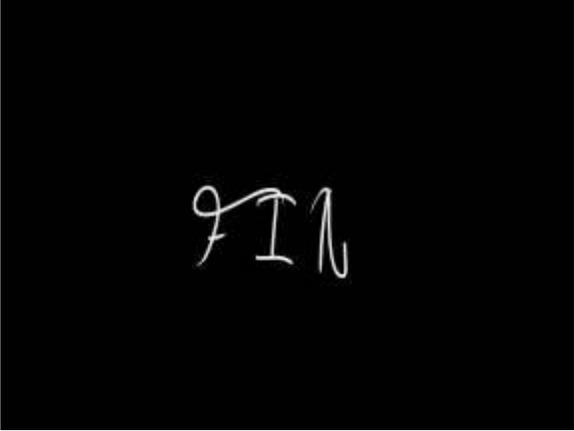


Resources

- Gestalt Psychology – http://en.wikipedia.org/wiki/Gestalt_psychology
- Color Matters – <http://www.colormatters.com>
- CVD Color Lab - <http://colorlab.wickline.org/colorblind/colorlab/>
- Coblis - <http://www.color-blindness.com/coblis-color-blindness-simulator/>



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