How many 5’s can you find?

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<td>431567298459163782431567298</td>
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</table>
Proximity

142 5 367892 5 136478924 5 369178
4193 5 672849 5 1267831493 5 6728
24 5 36917814 5 67289314 5 672938
49 5 1267831493 5 6728423698 5 17
3 5 916478214 5 6729384 5 1672938
46 5 132978423698 5 174 5 9163782
14 5 7629384 5 16729383 5 9164782
431 5 672984 5 9163782431 5 67298
Alignment

555 142367892136478924369178
555 419367284912678314936728
555 243691781467289314672938
555 491267831493672842369817
555 391647821467293841672938
555 461329784236981749163782
555 147629384167293839164782
555 431672984916378243167298
Repetition

123456789 123456789 123456789
123456789 123456789 123456789
123456789 123456789 123456789
123456789 123456789 123456789
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123456789 123456789 123456789
Contrast

142536789251364789245369178
419356728495126783149356728
245369178145672893145672938
495126783149356728423698517
359164782145672938451672938
465132978423698517459163782
145762938451672938359164782
431567298459163782431567298
Contrast

142536789251364789245369178
419356728495126783149356728
245369178145672893145672938
495126783149356728423698517
359164782145672938451672938
465132978423698517459163782
145762938451672938359164782
431567298459163782431567298
Subtraction
Design Principles

Subtraction
Contrast
Repetition
Alignment
Proximity
Enclosure
Approach

**Fundamentals**
Learn from first principles
Know the science
Understand the art

**Experiential**
I hear and I forget
I see and I remember
I do and I understand
I experience and I learn (for life)
Learning the Djembe

Source: The Visitor - Learning the Djembe
da - da - da - da

tak - tak - tak

1 - 2 - 3 - 4

1 - 2 - 3
Linguistic (Verbal)

The Pythagoras' theorem is a relation in Euclidean geometry among the three sides of a right triangle. It states:

“The square of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the other two sides.”
Symbolic (Math-Logic)

For all $\triangle XYZ$, where $\angle XYZ = 90^\circ$
and the length of side $XY = a$, $YZ = b$ and $ZX = c$, there exists a relationship such that:

$$a^2 + b^2 = c^2$$
In a right angled triangle, the square on the hypotenuse is equal to the sum of the squares of the sides.

On , and describe squares, (pr. 46.)

Again, because \(\parallel\) \(\parallel\)

and \(\times\) \(\times\)

In the same manner it may be shown that \(\times\) \(\times\)

hence \(\times\) \(\times\)

\(\therefore\) \(\times\) \(\times\)

\(\therefore\) \(\times\) \(\times\).

Q. E. D.

Book: The First Six Books of The Element of Euclid by Oliver Byrne
Pythagorean theorem

A visual explanation by Victor Powell for Setosa

What follows in an interactive walk through of Euclid’s proof of the Pythagorean Theorem.

\[ a^2 + b^2 = c^2 \]

Let \( \triangle ABC \) be a right-angled triangle having the angle \( \angle BAC \) right.

I say that the square on \( BC \) equals the sum of the squares on \( BA \) and \( AC \).

Describe the square \( BDEC \) on \( BC \), and the squares \( GB \) and \( HC \) on \( BA \) and \( AC \). Draw \( AL \) through \( A \) parallel to either \( BD \) or \( CE \), and join \( AD \) and \( FC \).

Since each of the angles \( \angle BAC \) and \( \angle BAG \) is right, it follows that with a straight line \( BA \), and at the point \( A \) on it, the two straight lines \( AC \) and \( AG \) not lying on the same side make the adjacent angles equal to two right angles, therefore \( CA \) is in a straight line with \( AG \).

For the same reason \( BA \) is also in a straight line with \( AH \).

Source: Setosa.io - Pythagorean
Below is a simplified digital adaptation of the analog state variable filter.

This topology is particularly useful for embedded audio processing, because $F_c$ (cutoff frequency) and $Q$ (resonance) are controlled by independent coefficients, $k_f$ and $k_q$. (With most filters, the coefficients are functions of both parameters, which precludes pre-calculated lookup tables.)

The coefficients and transfer function are:

$$k_f = 2\sin\left(\frac{\pi F_c}{F_s}\right) \quad k_q = \frac{1}{Q}$$

$$H(z) = \frac{k_f^2}{1 - (2 - k_f(k_f + k_q))z^{-1} + (1 - k_fk_q)z^{-2}}$$

Some example frequency responses:

- $F_c = 5.1 \text{ KHz}$
  - $Q = 5.24$

- $F_c = 815 \text{ Hz}$
  - $Q = 1.07$

Source: Explorable Explanation - Bret Victor
“To develop a complete mind, study the science of art, the art of science. Learn how to see. Realize that everything connects to everything else.”

- Leonardo da Vinci
Visual Thinking Spectrum

Hand me the Pen

I can draw but...

I’m not visual
Gesture with Pen

Pointing, Waving, Grabbing, Holding, Reaching out, Dancing

Smiling, Frowning, Disinterest, Concern, Full Attention, Surprise

“Put this there”
Visual Wired Brain

- 50% of the brain used for visual processing
- 70% of the sensory receptors are in the eyes
- 100ms to get a sense of the visual scene
Visual Language

While you are travelling down this road there is a chance that one or more rocks of varying size may fall from the slopes.

You should be aware of this before you travel this way so that you are cautious of this particular type of hazard.
Visualization

ˌvɪʒuələɪˈzeɪʃən (noun)

Derived from the Latin verb videre, "to look, to see"

The act or instance to form a mental image or picture (without an object)

The act or instance to make visible or visual (with an object)
“Why should we be interested in visualization? Because the human visual system is a pattern seeker of enormous power and subtlety.

The eye and the visual cortex of the brain form a massively parallel processor that provides the highest-bandwidth channel into human cognitive centers.

At higher levels of processing, perception and cognition are closely interrelated, which is the reason why the words ‘understanding’ and ‘seeing’ are synonymous.”

– Colin Ware
Pattern Recognition

Driving a Car
Pattern Recognition

Facial & Emotion Recognition
Pattern Recognition

CAPTCHA
Completely Automated Public Turing test to tell Computers and Humans Apart
Pattern Recognition

Chess

Go
Pattern Recognition

Weather Forecasts
Patterns in Random Noise

Choropleth maps of cancer deaths in Texas, where darker colors = more deaths.

Can you spot which of the nine plots is made from a real dataset and not from under the null hypothesis of spatial independence?

Source: Graphical Inference for Infovis
Visualization

“Transformation of the symbolic into the geometric”
- McCormick et al. 1987

“The use of computer-generated, interactive, visual representations of abstract data to amplify cognition.”
- Card, Mackinlay, & Shneiderman 1999
Value of Visualization

Expand memory
Answer questions
Find patterns
See data in context

Make decisions
Persuade | Tell a story
Share | Collaborate

Inspire
Value of Visualization

Exploration
Explanation
Expression
Data Tool for engagement, exploration and discovery
For the popular cricket-playing nations, we took every batsmen that has scored at least 20 runs in their ODI career, and plotted their run rate for every single match. Size = Number of runs. Colour = strike rate 26 50 80 110 140.

<table>
<thead>
<tr>
<th>ODI: IND BATTING</th>
<th>Mahendra S Dhoni</th>
<th>Alaysinhji D Jadeja</th>
<th>Navjot S Sidhu</th>
<th>Gautam Gambhir</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sourav C Ganguly</td>
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<td>Anil Kumble</td>
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<td>Shikhar Dhawan</td>
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</table>

Source: Gramener
Working Capital Profiler

PROCTER & GAMBLE PG compared to the Consumer Goods Industry in North America

Benchmark Comparison
Consumer Goods Industry

Savings at Benchmark Levels
<table>
<thead>
<tr>
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<th>Current</th>
<th>Average</th>
<th>Top Quartile</th>
<th>Target Position</th>
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</thead>
<tbody>
<tr>
<td>Days</td>
<td>27</td>
<td>48</td>
<td>36</td>
<td>27</td>
</tr>
<tr>
<td>Cash Saved ($M)</td>
<td>N/A*</td>
<td>N/A*</td>
<td>50.0</td>
<td></td>
</tr>
</tbody>
</table>

*Already in top quartile

Source: Strategy&
Pincode decoder

Source: Pindecode
Data Stories for telling a specific and (linear) visual narrative
The Joy of Stats

Source: Hans Rosling
Wealth Inequality

Source: Politizane
Drone Attacks

Source: Pitch Interactive
Exhibition | Expression

Data Art for visual expression, delight (and impact, insight)
Wind Map

October 29, 2012
8:59 pm EST
(time of forecast download)

top speed: 45.1 mph
average: 9.4 mph

Source: hint.fm/wind
Flight Patterns

Source: Aaron Koblin
“The ability to take data—to be able to understand it, to process it, to extract value from it, to visualize it, to communicate it—that’s going to be a hugely important skill in the next decades, ... because now we really do have essentially free and ubiquitous data. So the complimentary scarce factor is the ability to understand that data and extract value from it.”

– Hal Varian, Google’s Chief Economist
Design Framework

Approach for Creating Data-Visual-Stories
<table>
<thead>
<tr>
<th>Basic Element</th>
<th>Artist</th>
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<tbody>
<tr>
<td>Word</td>
<td>Writer</td>
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<tr>
<td>Note</td>
<td>Musician</td>
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<tr>
<td>Frame</td>
<td>Film Maker</td>
</tr>
<tr>
<td>Datum</td>
<td>Data Artist</td>
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</table>
Datum

???

???

???

???

Data-Visual-Story
Datum

See the Data

Show the Visual

Tell the Story

Engage the Audience

Data-Stories
See the Data

Pattern

Deviation

Data Abstraction

Trend

Outlier
## Anscombe’s Quartet

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<tr>
<th>x1</th>
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<th>x2</th>
<th>y2</th>
<th>x3</th>
<th>y3</th>
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<th>y4</th>
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<td>4.74</td>
<td>5.0</td>
<td>5.73</td>
<td>8.0</td>
<td>6.89</td>
</tr>
</tbody>
</table>
Anscombe’s Quartet

\[ x(\text{mean}) = 9 \]
\[ y(\text{mean}) = 7.5 \]
\[ x(\text{var}) = 11 \]
\[ y(\text{var}) = 4.12 \]

\[ y = 3.00 + 0.500 \times x \]
Anscombe's Quartet
This is hard work

"80% perspiration, 10% great idea, 10% output."

- Simon Rogers
See the Data

1. Acquire
2. Prepare
3. Refine
4. Explore
See the Data

1. Acquire
2. Prepare
3. Refine
4. Explore

Data Wrangling
Exploratory Data Analysis
"Visualization gives you answers to questions you didn't know you had."

- Ben Schneiderman
Directed Approach

Question ➔ Explore ➔ Insight
Exploratory Approach

Explore → Question → Explore → Insight
Visually Exploring

Active Seeing

Skill Building over Time
Comparison, Deviations

- **Range, Distribution:** high, low, shape
- **Ranking:** big, medium, small
- **Categorical Comparison:** proportion
- **Measurement:** absolutes
- **Context:** target, average, forecast
- **Hierarchical:** category, subcategories

![Questionnaire Results Analysis Summary](image)

- **High values**
  - Q28: Overall, I believe society benefits from linking teaching, research and healthcare provision.  
  - Q31: A high priority should be given to articulating a joint vision between Higher Education and the NHS.  
  - Q30: I think it is achievable to perform with excellence equally across teaching, research and service provision.  
  - Q17: For people with joint appointments, appraisals are always carried out by NHE and University colleagues.  
  - Q29: There is a shared agenda between Higher Education and the NHS.  
  - Q5: This organisation has an effective infrastructure (facilities) to achieve its vision.  
  - Q15: I am routinely informed about how I am performing in my role.  
  - Q26: I receive ongoing training to ensure competence in my role.  
  - Q21: I have received effective mentoring in my role in this organisation.  
  - Q24: I believe this organisation nurtures and develops leaders.  
  - Q18: My organisation creates an optimum environment for talent to thrive.  
  - Q16: The organisation has clear incentives to develop my potential.

- **Range:** 0.6% to 17.4%
- **Unsure:** 6.6%
- **No Response:** 3.4%
Trends

- **Direction**: up, down or flat
- **Optima**: highs, lows
- **Rate of Change**: linear, exponential
- **Fluctuation**: seasonal, rhythm
- **Significance**: signal vs. noise
- **Intersection**: overlap, crossover
Patterns, Relationships

- **Exceptions**: outliers
- **Boundaries**: highs, lows
- **Correlation**: weak, strong
- **Association**: variables, values
- **Clusters**: bunching, gaps
- **Intersection**: overlap, crossover
Show the Visual

Framing

Visual Representation

Transition
Questions:

- How?
- When?
- Why?
- Who & What?
- Where?
- How?
Strip Plot

Frequency Polygon

Histogram

Dot Plot
Small Multiple

Frequency Polygon

Histogram

Box Plot
Strip Plot

Line Chart

Bar Chart

Area Chart

Index Chart
Horizon Chart
Stream Graph
Sparklines
Slopegraph
Show the Visual
Comparison
Comparative
Representation

Position in
Time
Timeline
Relationship, Hierarchy

Position in Space
Map

How many?
When?

Why?

Who & What?

How?

Flowchart

Where?

Portrait
Distribution
Representation

Map

Position in Space

Comparison
Comparative
Representation

How?

Who & What?

When?

How?
Parallel Coordinates

Data: n x quantitative, n x categorical
Encoding: position, connection, color
Bubble Chart

Data: 4 x quantitative, 1 x categorical
Encoding: position, size, color, motion
Flowchart: Relationship, Hierarchy
Timeline: Position in Time
Multi-Variable Plot: Deduction & Prediction
Portrait: Distribution Representation
Comparison: Comparative Representation
Map: Position in Space

Questions:
- Why?
- Who & What?
- How Many?
- When?
- Where?
- How?
Tell the Story

Ordering & Structure

TRF JQL

Messaging (Verbal & Text)

VWX DFR

Point of View

RGT DEF

Relatability

ZEF LXR
Tone of Visualization

Analytical & Pragmatic

Emotive & Abstract
I think people have begun to forget how powerful human stories are, exchanging their sense of empathy for a fetishistic fascination with data, networks, patterns, and total information... Really, the data is just part of the story. The human stuff is the main stuff, and the data should enrich it.

- Jonathan Harris
<table>
<thead>
<tr>
<th>People</th>
<th>tell stories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words</td>
<td>tell stories</td>
</tr>
<tr>
<td>Pictures</td>
<td>tell stories</td>
</tr>
<tr>
<td>Comics</td>
<td>tell stories</td>
</tr>
<tr>
<td>Movies</td>
<td>tell stories</td>
</tr>
</tbody>
</table>
Rhetoric
Persuasion

logos | reason

ethos | credible

pathos | emotional
Body Mass Index (BMI)

\[
\text{BMI} = \frac{\text{mass (kg)}}{[\text{height (m)}]^2}
\]
Living on the edge

- Normal
- Over
- Obese

height (in ft)

mass (in kg)

- Under

[Graph showing body mass index (BMI) categories based on height and mass.]
logic | EMPATHY
Data & Stories

The focus of stories is on individual people rather than averages, on motives rather than movements, on point of view rather than the view from nowhere, context rather than raw data.

Moreover, stories are open-ended and metaphorical rather than determinate and literal.
The Story Mindset

In listening to stories we tend to **suspend disbelief** in order to be entertained, whereas in evaluating statistics we generally have an opposite inclination to **suspend belief** in order not to be beguiled.

- John Allen Paulos
Why Stories?

Stories are emotional
Stories are memorable
Stories are impactful
Dual Coding

Aural

Visual
A narrative (or story) is any account of connected events, presented to a reader or listener in a sequence of written or spoken words, or in a sequence of (moving) pictures.

Derived from the Latin verb narrare, "to tell"
Narrative Structure
Cognitive Flow

Frame it as a Journey

Start

Finish
CHOICE OF MOMENT

Deciding which moments to include in a comics story and which to leave out.

CHOICE OF FRAME

Choosing the right distance and angle to view those moments -- and where to trim them.

CHOICE OF IMAGE

Rendering the characters, objects and environments in those frames clearly.

CHOICE OF WORD

Picking words that add valuable information and work well with the images around them.

CHOICE OF FLOW

Guiding readers through and between panels on a page or screen.

These are the five arenas where your choices can make the difference between clear, convincing storytelling and a confusing mess.

- Choice of Moment
- Choice of Frame
- Choice of Image
- Choice of Word
- Choice of Flow
Don’t just add a chart...

Japanese luxury cars

The limits to Infiniti

Japan’s premium motor brands are still far behind their German rivals. The giant carmakers that own them are missing out on pots of potential profit

Jun 7th 2014 | From the print edition

A MONTH before launching Lexus in America in 1989, Toyota considered running a television advertisement showing German aristocrats at a wild party in a hilltop castle. The voice-over intoned that the Teutons had dominated upmarket, high-performance cars for nearly 60 years but they had only “30 days left to enjoy it.”

A ¥20,000 increase in the price of a BMW or Audi, the showroom said, would make the Japanese brands look “cheap and unrefined.”

That message, and the price disparity between the German and Japanese models, did the trick. Lexus went on to dominate the luxury sport-utility segment in America. In 2000 its volume was in the top two among global luxury carmakers. Infiniti, by contrast, was languishing in seventh place, behind brands such as Saab and holding its own only in China.

At first the Japanese carmakers’ premium marques were aimed mainly at the American market, and got off to a good start. Their mass-market brands had given anything Japanese-made a reputation for reliability. The new, premium models were technically advanced compared with Lincolns and Cadillacs, Detroit’s upmarket offerings, and cheaper than their German rivals. By 2000 Lexus was the best-selling luxury-car brand in America, a position it held for more than a decade.

However, touting up mainstream models with a bit of wood and leather may have impressed American motorsports, who care more about value than styling, but it did not impress image-conscious European buyers. Acura, perhaps sensing the futility of the task, avoided Europe altogether. Since their premium brands had failed to go global, the Japanese carmakers were reluctant to give them the resources to keep up with the competition.

Source: Economist
...or complex visualization

Source: Joshua Gallagher
Think Stories, not Charts
Telling Compelling Stories

Human Development Trends 2005

Interactive presentation of some of the messages in the Human Development Report 2005

1 Income
2 Regions
3 Poverty
4 Health
5 Countries
6 Differences
7 Trends
8 Gaps
9 Deaths

Source: Gapminder
Explanatory (Narrative)

Strong Order
Heavy Messaging
Limited Interactivity
Author Driven

Exploration (Interactive)

Weak Order
Light Messaging
Free Interactivity
Reader Driven
Genres of Story

Source: Narrative Visualization
Think about the structure

Explanatory (Narrative)

Exploration (Interactive)

Source: Narrative Visualization
Choose the Visualization

Bloomberg Billionaires
Today's ranking of the world's richest people

Source: Bloomberg
Make it Simple

The Capabilities Premium in M&A

Source: Capabilities Premium
Iraq's bloody toll

Coalition deaths: 4,802
Civilian deaths: 113,728

The United States officially marked the end of almost nine years of bloody military engagement in Iraq on Thursday. Over 4,800 coalition soldiers and tens of thousands of Iraqis lost their lives in a war that defined a decade.

Source: South China Post
The United States officially marked the end of almost nine years of bloody military engagement in Iraq on Thursday. Over 4,800 coalition soldiers and tens of thousands of Iraqis lost their lives in a war that defined a decade.

**US ground troops in Iraq**

**Coalition deaths**

Total 4,802

United States 4,464

Iraqi security forces 10,125

Others 129

Britain 79

Coalition fatalities by area

Baghdad and the vast desert province of Anbar saw some of the fiercest fighting, the latter being the scene of sectarian tensions and a bloody Sunni insurgency.

0-99

100-499

500+
More Linear, More Story Like

Measured since 1958, atmospheric carbon dioxide (CO2) has been increasing steadily.

One thousand years of temperature history obtained from isotope analysis of ice cores.

One thousand years of CO2 and temperature data -- the curves have similar shape.

650,000 years of CO2 and temperature history, from Antarctic ice cores. Dips record ice ages. CO2 concentration and temperature are related. CO2 has spiked upward in recent years.

If no changes are made, CO2 concentration is predicted to be higher (to 600 ppm) in the future.

Ocean temperatures since 1940. Blue

Source: Inconvenient Truth
Linear Narrative

Out of Sight, Out of Mind.

Source: Pitch Interactive
Story Structure
Story Structure

Beginning

Middle

Epilogue

End
# Focus Attention

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**Genre**

- Data Viz

- Highlight, CloseUp, Zoom, Framing
- Feature Distinct
- Motion, Audio
U.S. GUN KILLINGS IN 2010 - 2013

9,595
PEOPLE KILLED

414,509
STOLEN YEARS

36 | 0.38%
Multiple Victims
Stranger

9,559 | 100%
All Other Victims

This **black boy**, aged 4, was shot in **March** in **Louisiana** by a **stranger**.

3 other people were killed in this incident.

Had he not been killed with a **handgun**, he might have lived to be 62 and died of **respiratory disease**.

Source: [Guns - Periscopic](http://www.guns-periscopic.com)
Single Frame Dominates

Source: Walmart & Target Store Expansion
Establish & Focus

Source: OECD Better Life

Consistent Visual Framework

Japan

Did you know?
- Population: 127.3 mil.
- Visitors per year: 8.6 mil.
- Renewable energy: 3.42%

How’s Life?
Japan performs favourably in several measures of well-being, and ranks close to the average or higher in several topics in the Better Life Index.

Money, while it cannot buy happiness, is an important means to achieving higher living standards. In Japan, the average household net-adjusted disposable income is 24 147 USD a year, more than the OECD average of 23 047 USD a year. But there is a considerable gap.

OECD in Action
Use Staging & Animation

Source: Gapminder
In a right angled triangle the square on the hypotenuse is equal to the sum of the squares of the sides, \( \text{(pr. 46).} \)

On \( \text{and } \) describe squares, \( \text{(pr. 46).} \)

Draw \( \text{|| (pr. 31).} \)

Also draw \( \text{and } \).

\( \therefore \) \( = \) \( \text{and } \) \( = \).

To each add \( \text{and } \) \( = \).

\( \therefore \) \( = \).

Again, because \( \text{|| } \)

\( \text{and } \) \( = \text{twice } \)

\( \therefore \) \( = \text{twice } \)

In the same manner it may be shown that \( \text{and } \) \( = \).

Hence \( = \).

Q.E.D.
Weave Text into Graphics

Source: Napoleons's Campaign
A Century of Meat

American consumption of chicken and beef rose substantially after World War II, aided by the development of intensive farming methods, the proliferation of fast-food restaurant chains and supermarkets and the adoption of reliable home refrigeration.

Beef consumption peaked in 1976 but then declined, in part because of the publication of new dietary guidelines and studies that associated saturated fats and cholesterol with heart disease.

First McDonald’s restaurant opens

1,000th McDonald’s restaurant opens

“Where’s the beef?” ad campaign begins

First U.S. case of mad cow disease

“Where’s the beef?” ad campaign begins

PER CAPITA AVAILABILITY OF BONELESS, TRIMMED MEAT*

90 pounds per year

*Note: per capita availability of boneless meat is a proxy for human consumption, and is lower than retail weight or carcass weight. Bones, offal and game are excluded.

Sources: U.S. Department of Agriculture (data); news and company reports; “Putting Meat on the American Table,” by Roger Horowitz

Source: New York Times
Power of Verbal Messaging

Source: Hans Rosling | Joy of Stats
Answer the why?

We are good at who, what, where, when. Not why?
Provide Relatability
Engage the Audience

Interactivity

Takeaway

Emotion
Attention & Engagement

Acid Reflux
Average yearly health care cost of a 50-year-old with Acid Reflux: $5,456
- Personal Cost: $958
- Insurer Cost: $4,497

Total yearly health care cost for the 987 patients with Acid Reflux: $5,384,667

Source: Cost of Sick
Animation Helps

Source: Multibar Transition
Be Explicit about Actions

Source: Gapminder
Restrict Interactivity

One Report, Diverging Perspectives

Friday’s jobs report is the second-to-last of the presidential campaign. Each party will interpret the numbers in a way to convince voters that its policies will help economic growth.

There have been 31 consecutive months of job growth.

The rate has fallen more than 2 points since its recent peak.

Monthly change in private-sector jobs

Democrats have preferred to focus on recent private-sector job growth.

Unemployment rate

Friday’s crop was larger than expected.

Source: One Report, Many Perspective
Make it look live

Source: 512 Paths to White House
Make it look live

Romney's Shift Wasn't Enough

Most of the nation shifted to the right in Tuesday's vote, but not far enough to secure a win for Mitt Romney.

Source: Obama's Path
Make Interaction Easy

The Wealth & Health of Nations

Source: Health and Wealth of Nation
The Facebook Offering: How It Compares

Facebook
This is the same chart on a logarithmic scale. With this scale, percentage increases and decreases are comparable.

Source: NY Times
Science or Art?

**Science**
- Perceptual Psychology
- Cognitive Science
- Graphic Design
- Data Analysis

**Art**
- Emotional
- Aesthetic sense
- Craft and Skill
- Creativity
Six Thinking Hats

Benefits
Facts
Creativity
Feelings
Caution
Process
Visualization Skill Hats

- Explorer
- Data Scientist
- Visual Designer
- Storyteller
- Programmer
- Manager
Visualization Tools
Tools Landscape

Abstract, Flexible, Difficult
Slow, Code, Expressive

Blackbox, Limited, Simple
Quick, GUI, Efficient
**Tools Landscape**

Abstract, Flexible, Difficult
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Blackbox, Limited, Simple
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**Canvas**

Paint directly on a pixel grid. Design & manage every element of chart

Processing
Nodebox

sketchpad

Raphael.js
Paper.js
Processing.js

**Grammar**

Collection of graphical primitives for composing data driven graphics

R-ggplot2
SPSS

raw
d3.js
Vega
Bokeh

**Visual**

Visual analysis languages allowing flexibility to design many variants

Tableau
Gephi

plot.ly
...

**Charting**

Collection of fixed charts that require data to be shaped in a particular way

Excel
Mondrian

Many Eyes

Google Charts
HighCharts
Fusion Charts
Amit Kapoor
@amitkaps
Partner, narrativeVIZ Consulting
amit@narrativeviz.com

Find this presentation and more at http://narrativeviz.com/playbook