Effective Storytelling with Data Visualization

#LitmusLive • @swisswebmiss

Hi, I’m Heidi.

Pronouns are She/Her

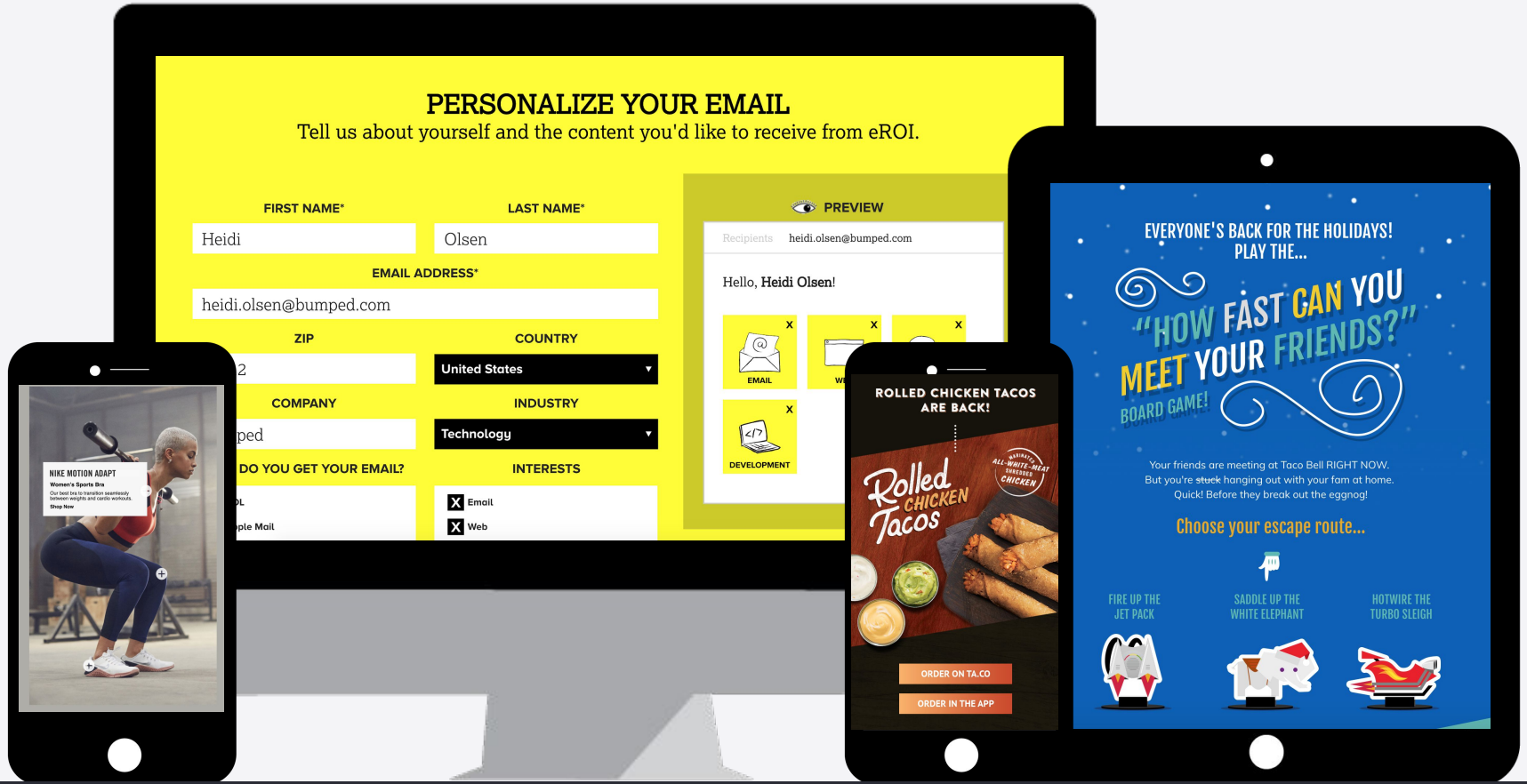
Proud #EmailGeek for 10+ years

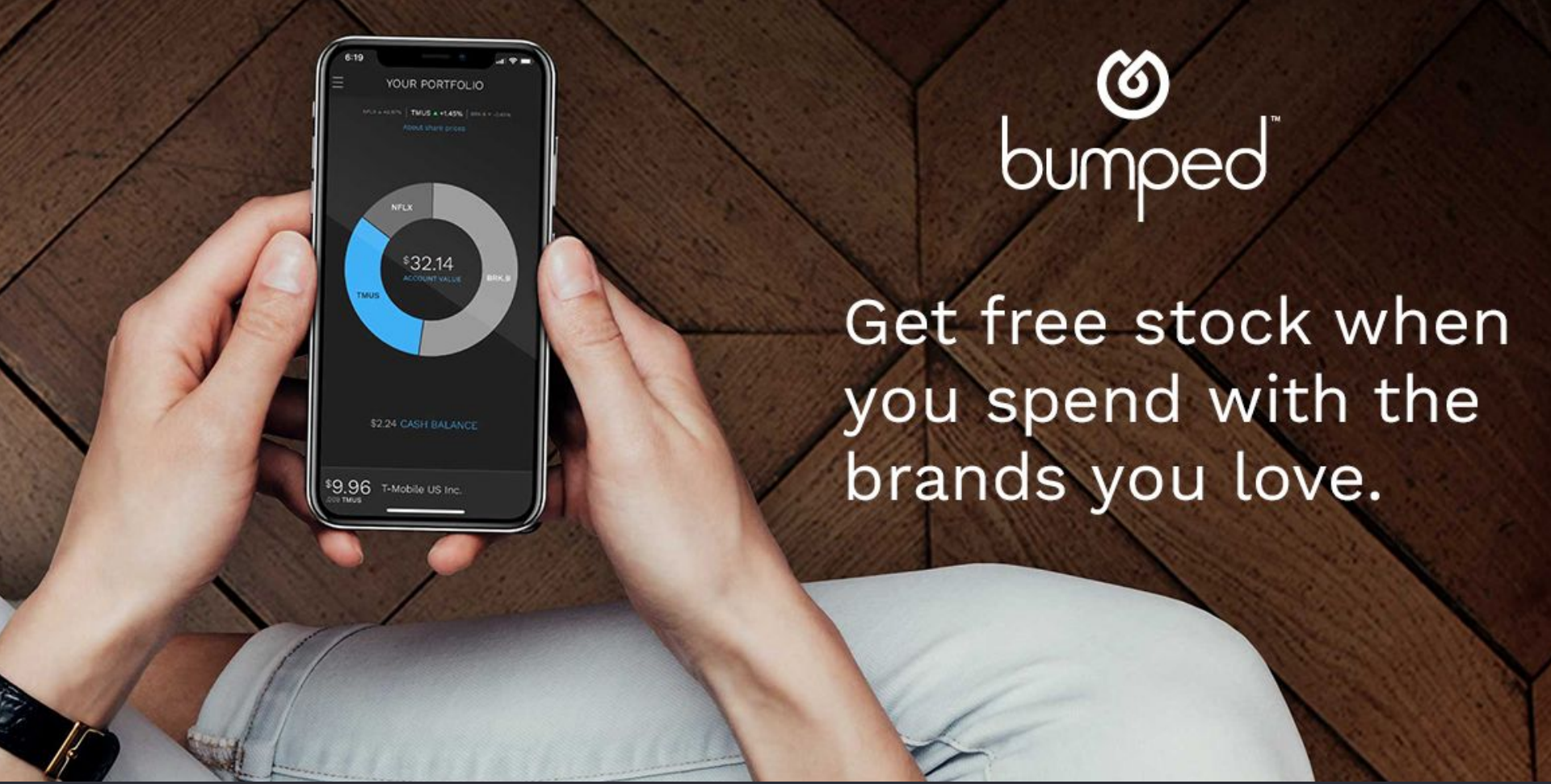
Senior Frontend Engineer @ Bumped

@swisswebmiss

heidiolsen.com/LL19

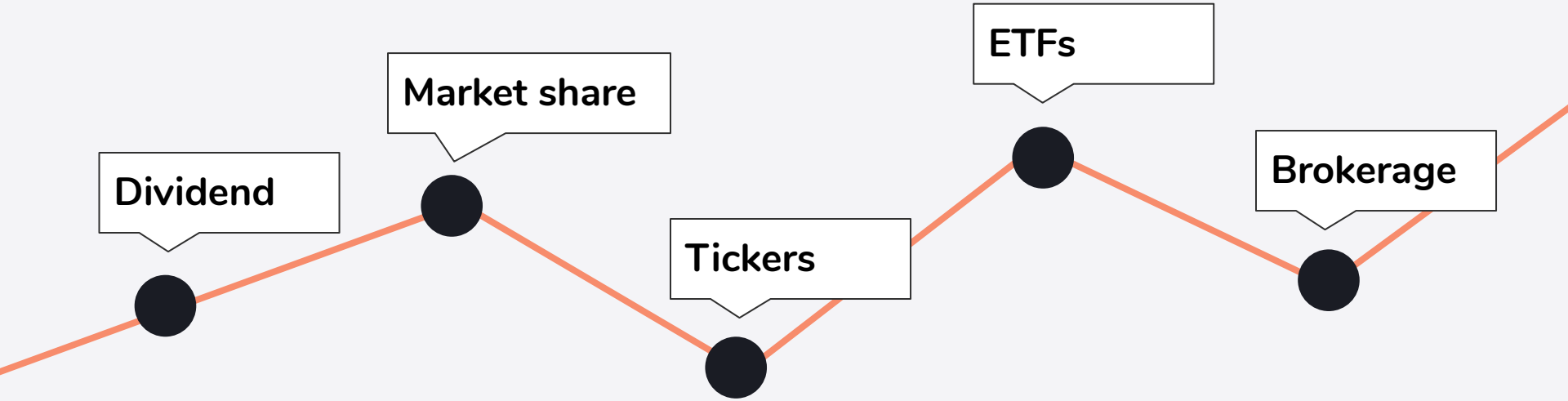
Slides • Code Samples • Links to Resources


PERSONALIZE YOUR EMAIL
Tell us about yourself and the content you'd like to receive from eROI.
FIRST NAME*
Heidi
LAST NAME*
Olsen
EMAIL ADDRESS*
heidi.olsen@bumped.com
ZIP
COUNTRY
United States
COMPANY
INDUSTRY
Technology
INTERESTS
Email
Web
PREVIEW
Recipients
heidi.olsen@bumped.com
Hello, Heidi Olsen!
EMAIL
DEVELOPMENT
NIKE MOTION ADAPT
Women's Sports Bra
Shop Now
ROLLED CHICKEN TACOS ARE BACK!
Rolled Chicken Tacos
ORDER ON TA.CO
ORDER IN THE APP
EVERYONE'S BACK FOR THE HOLIDAYS! PLAY THE...
"HOW FAST CAN YOU MEET YOUR FRIENDS?"
BOARD GAME!
Your friends are meeting at Taco Bell RIGHT NOW.
But you're stuck hanging out with your fam at home.
Quick! Before they break out the eggnog!
Choose your escape route...
FIRE UP THE JET PACK
SADDLE UP THE WHITE ELEPHANT
HOTWIRE THE TURBO SLEIGH


6:19
YOUR PORTFOLIO
TMUS
NFLX
$32.14
ACCOUNT VALUE
TMUS
$2.24 CASH BALANCE
$9.96
T-Mobile US Inc.
bumped™
Get free stock when you spend with the brands you love.

Source: Michael Wharley/Rebecca Pitt, *Financial Times*

New challenges



The Secret Sauce

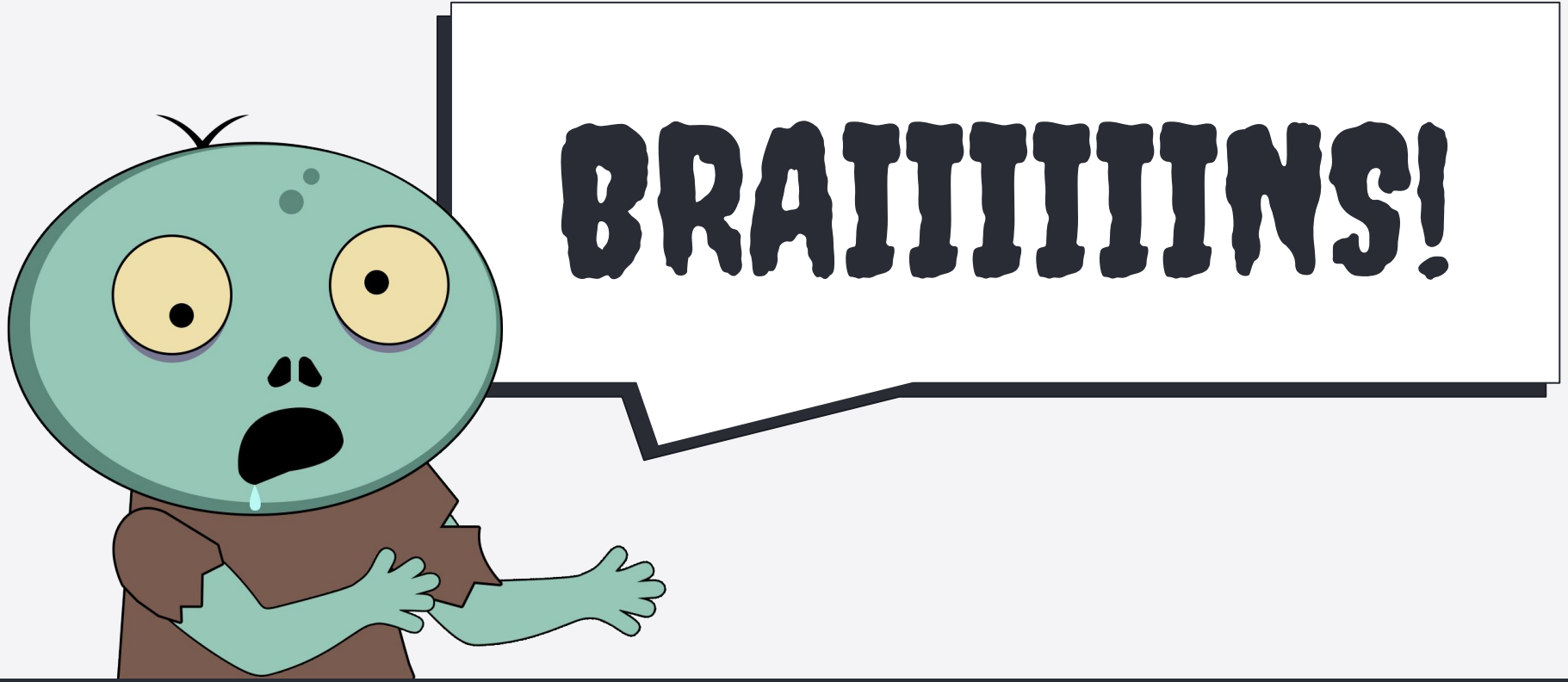
Easy to comprehend

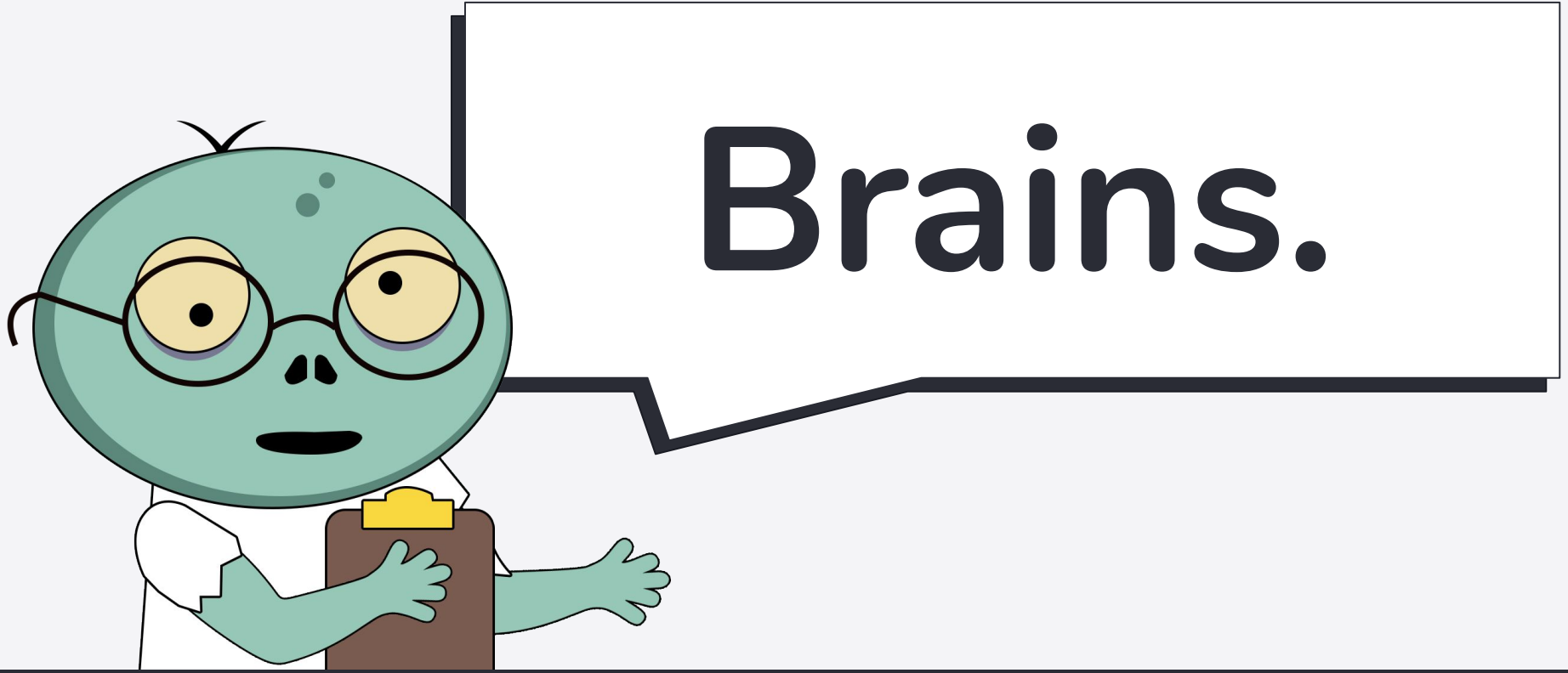
Tells a compelling story

Accessible across various clients

INCREASE UNDERSTANDING

Visual perception + cognitive load


BRAIIIIIINS!


Brains.

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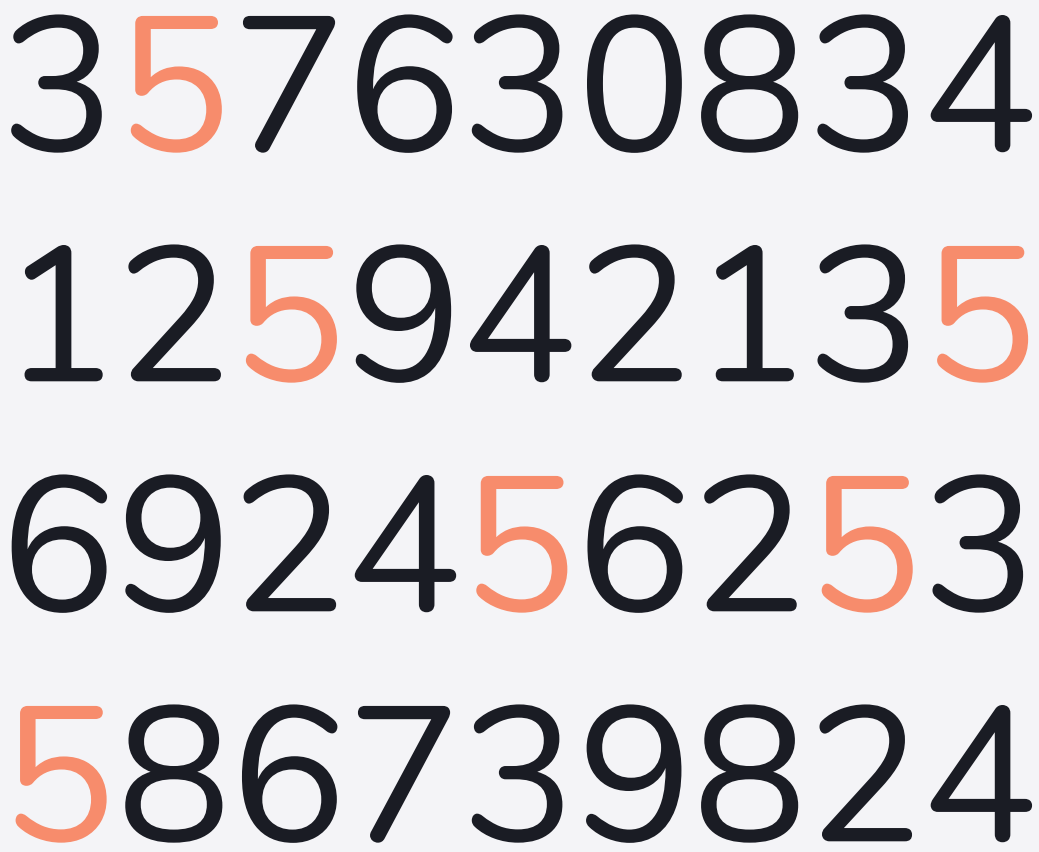
129452135

692462583

586395824


357630834
125942135
692456253
586739824

Working Memory

Long-Term Memory

Cognitive load refers to the total amount of information your working memory can handle.

SENSORY

SENSORY

SHORT-TERM

SENSORY

SHORT-TERM

LONG-TERM

SENSORY

SHORT-TERM

LONG-TERM

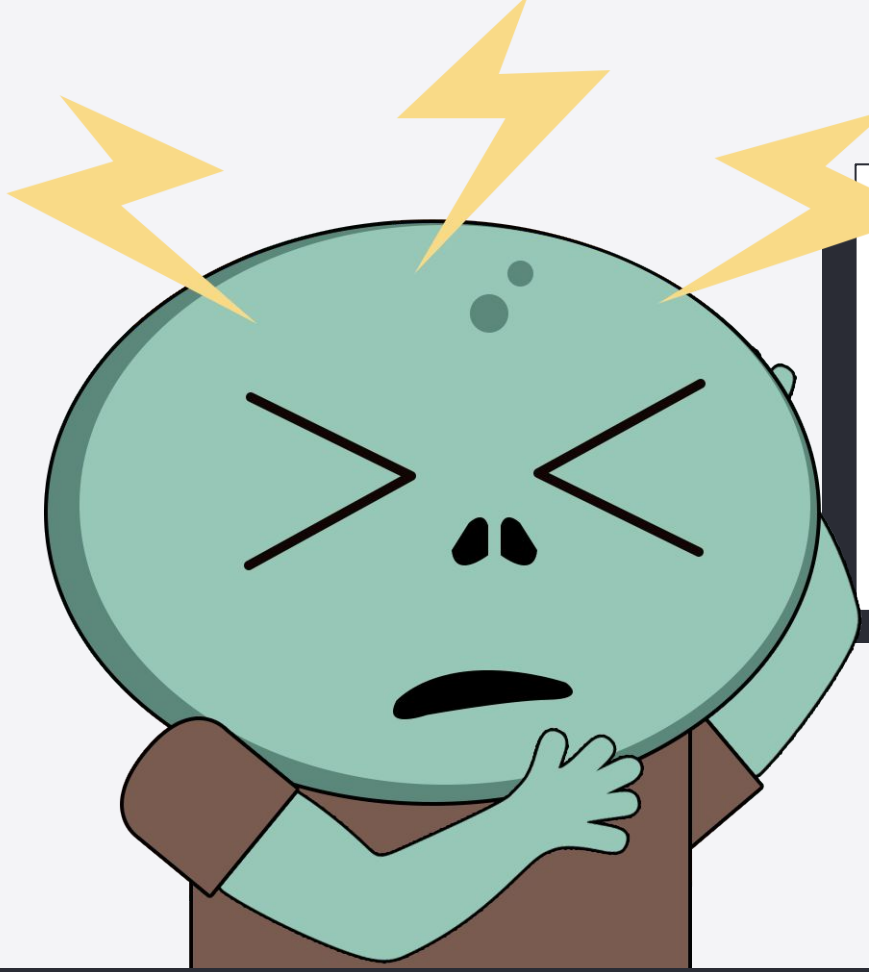
OBLIVION

SENSORY

SHORT-TERM

LONG-TERM

OBLIVION



“UGH” Moment

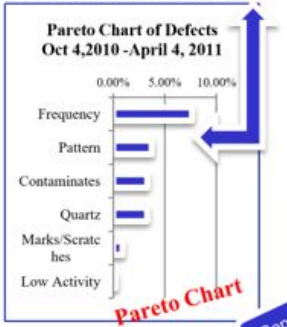
Finding the Skinny on Thin Film Sensor Reject Rates

DEFINE – 5/15/11

1) Problem Statement:
Production reject rate of thin film sensors increases after process change.

Box Plot

2) Work on largest category of defect for MAXIUM IMPACT



Pareto Chart

3) Business Impact:
Reducing/eliminating frequency rejects will prevent reworking of part, extra inventory and labor

MEASURE - 6/1/11

4) Out-of-Control:
Process is highly variable to begin w/ but much worse after change.

Control Chart

5) Change of Focus
The change did cause an increase in variability, but the process is not very good to start w/ a **DPMO of** 19,263! Finding the root cause of the inherent process variability should solve the new issue.

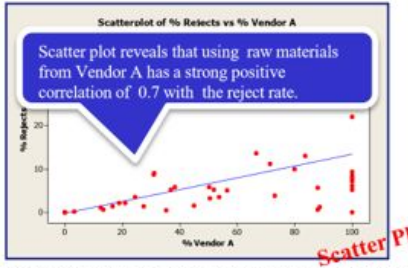
6) Identify Primary Inputs (Y)

Separated wheat from chaff

Cause & Effect Matrix				
Scoring:1=low, 3 = med, 5=high, ...ce to Customer (sensors w/ correct frequency) = 1				
...puts	Effect	Rating	Probability	Score
Vendor frequency sorting quality	Allow accurate calculation of thickness	5	High, makes adjustments when providing thickness data to techs	25

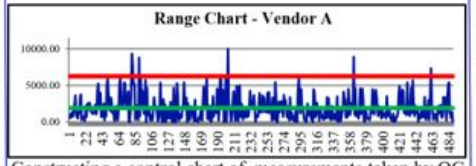
ANALYZE - 7/1/11

7) Probable Cause 1 - Raw Material Supply



Scatter Plot

The r^2 shows that the amount of raw material used from Vendor A explains 46.6 % of the change in reject rate.



Constructing a control chart of measurements taken by QC of frequency illustrates that the vendors process is out of control.

8) Probable Cause 2 – Evaporation Fixture Geometry
The sensors are held in a fixture positioned over a evaporation source that coats them with metal. I performed a test run to measure baseline performance. The data revealed that the metallic coating has too much variation in thickness w/ a mean of 2235 Å, but the range should be 500 Å. This could be caused by the position of the source, size of mask or angle of the holding fixture.

H_o: Test 1 thickness variability ≤ Test 2

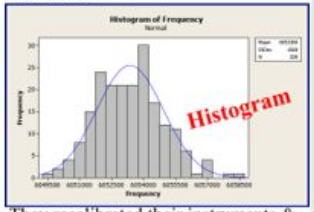
$$Z = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_1}}} = \frac{2235 - 2264}{\sqrt{\frac{333^2}{252} + \frac{242^2}{252}}}$$

Hypothesis Test

IMPROVE - 8/1/11

9) Solution to Probable Cause 1

-Receipt of material from Vendor A was halted. A comparison of their measurements vs. ours found a 7.6 KHz difference!



Histogram

They recalibrated their instruments & next shipment was markedly improved with a mean very close to the center of our specification range of 6.055 as shown on this histogram.

10) Solution to Probable Cause 2
I'm working with engineering to develop a new fixture that will improve the geometry.

Control – 8/8/11

10) Changes to be Made:
✓QC technician does acceptance testing of raw materials w/ zero tolerance.

Source: WTF Visualizations

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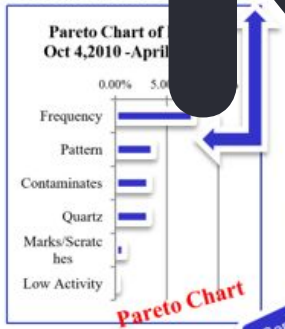

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…ity, but the …
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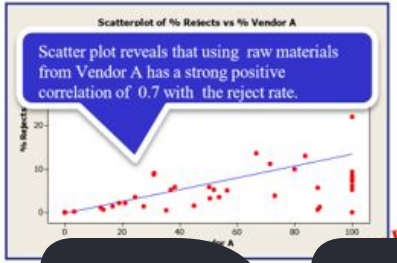
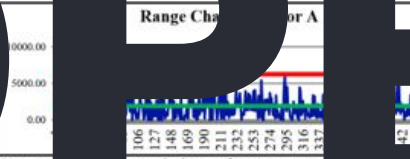


Hypothesis Test Plot

The r^2 s… …mater…
Vendor … …ns 46.6 % … …ge in…e.



Construc… …ontrol chart of measureme…
of frequ… …strates that the vendors pro…
control.

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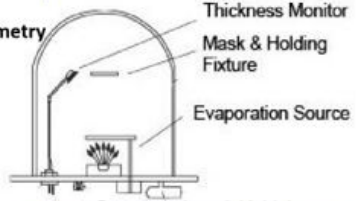

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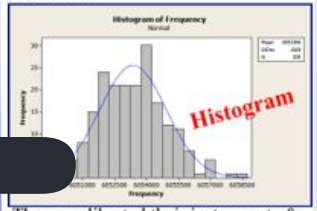

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10) Solution to Probable Cause 2

I'm working with engineering to … a r… fixture that will … th… metry.

Control – 8/8/11

10) Changes to be Made:

✓QC technician does acceptance testing of raw materials w/ zero tolerance.

NOPE.

Source: WTF Visualizations

Tools to reduce cognitive load

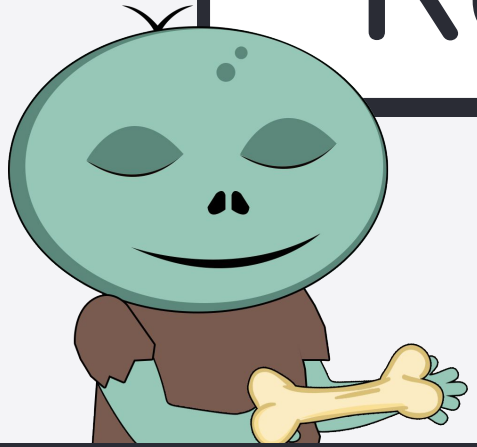
Remove Clutter

Focus Attention

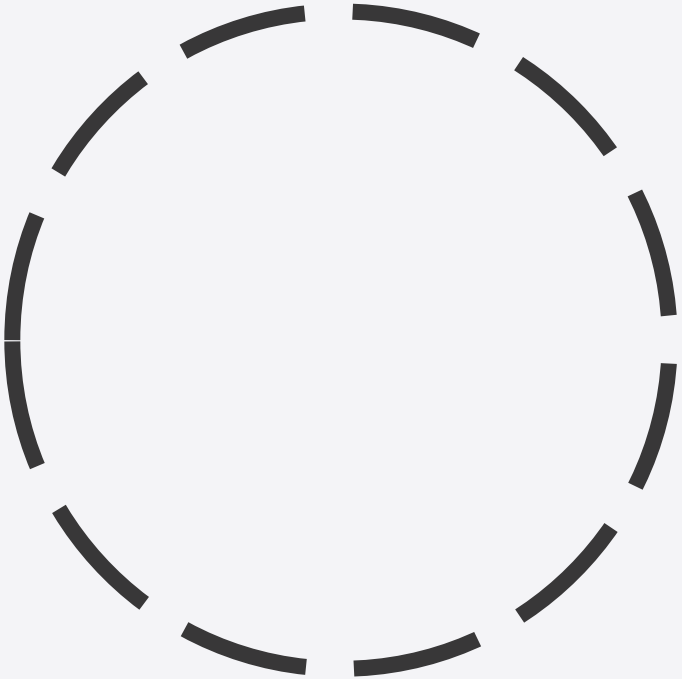
Tell a Story

1

Remove Clutter



Principle of connection



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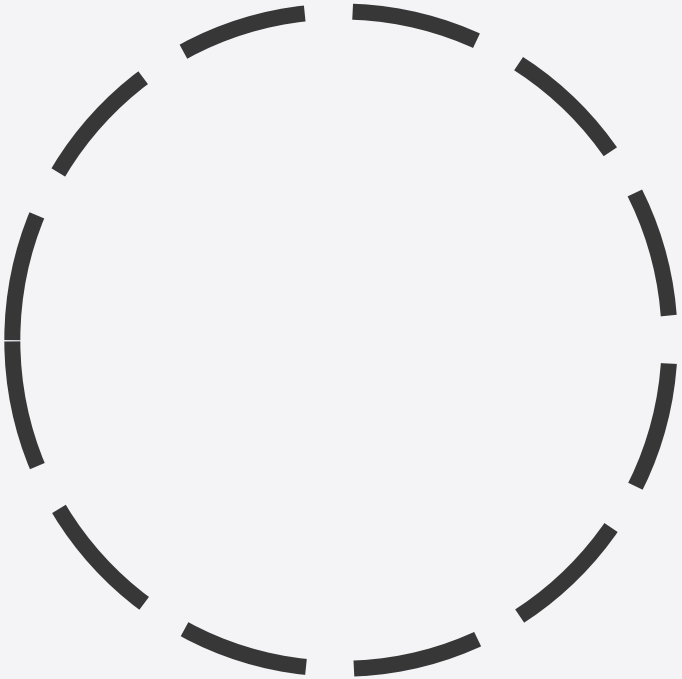


A

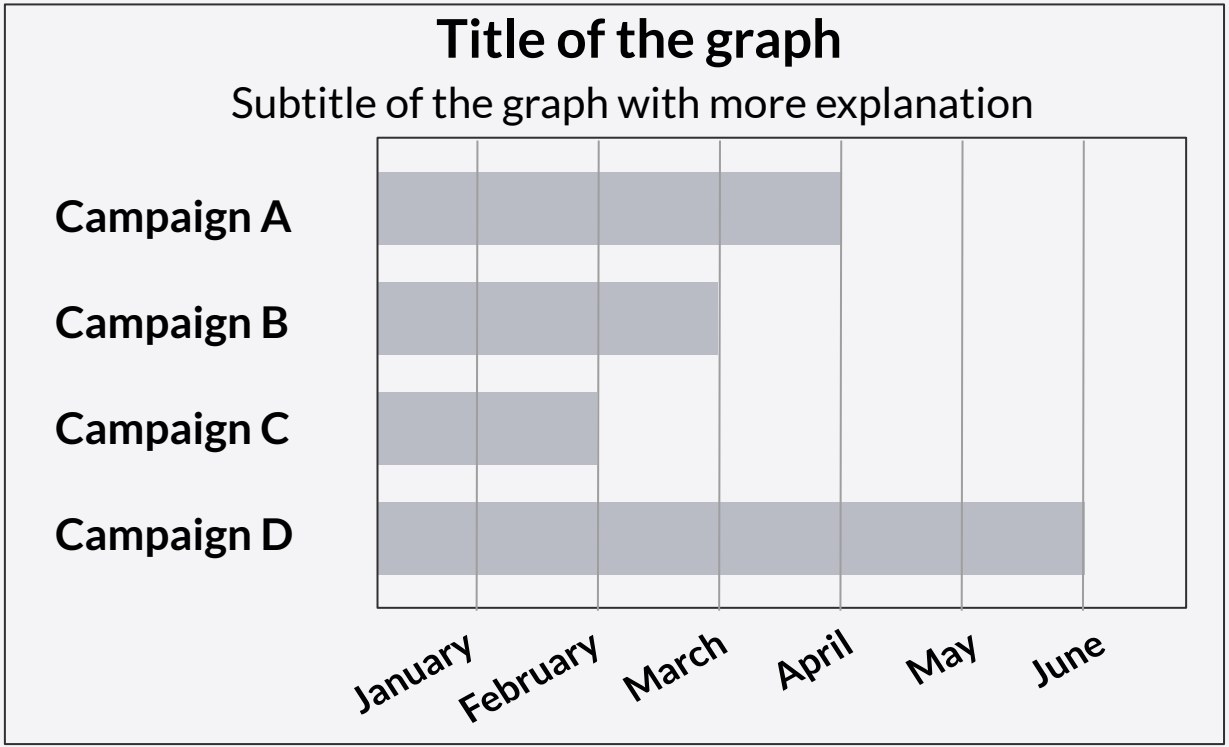
B

C

D

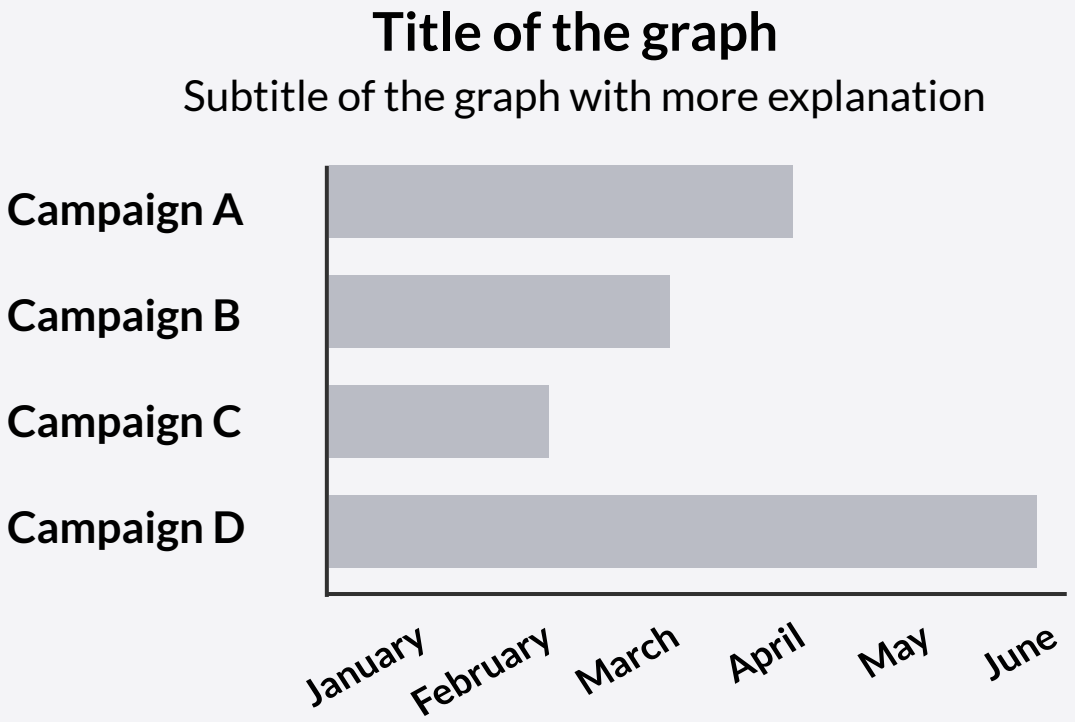
E

Remove clutter



Remove clutter

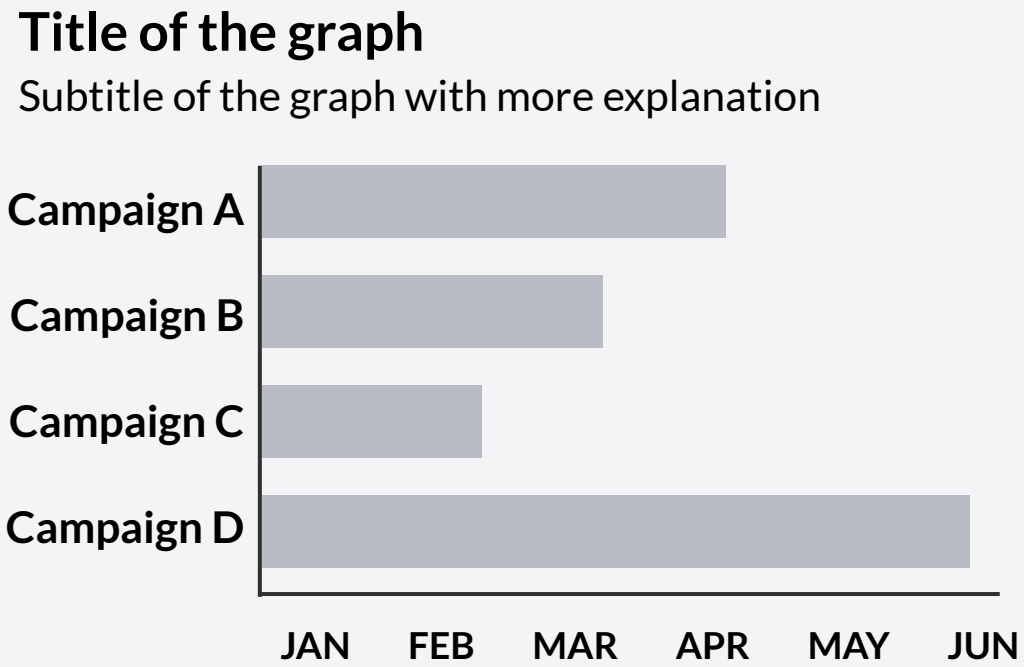
✔️ Reduce visual noise



Remove clutter

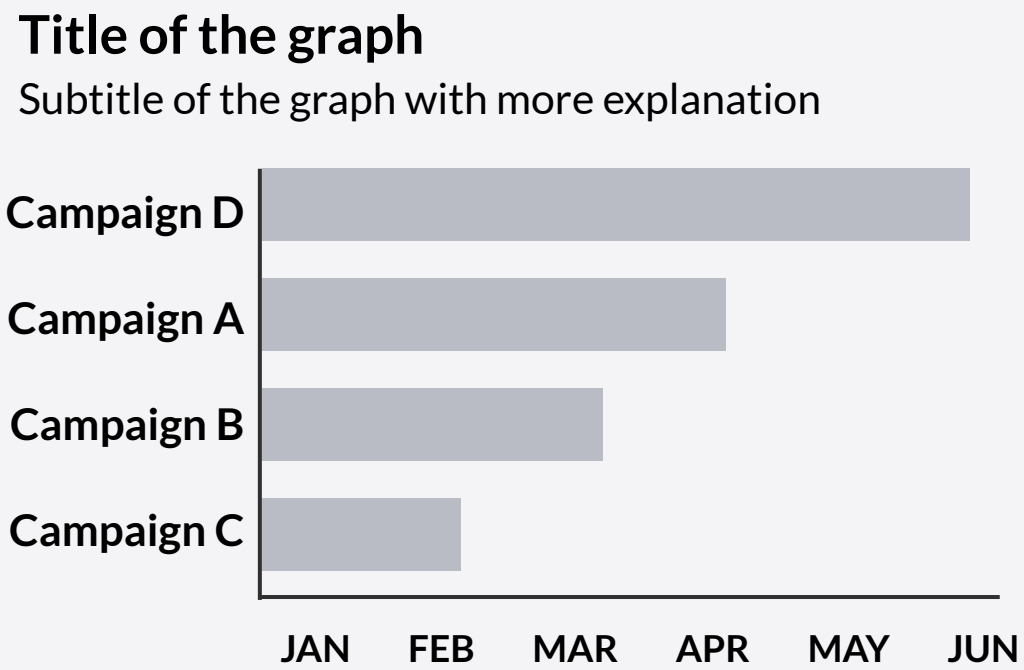
✅ Reduce visual noise

✅ Fix alignment



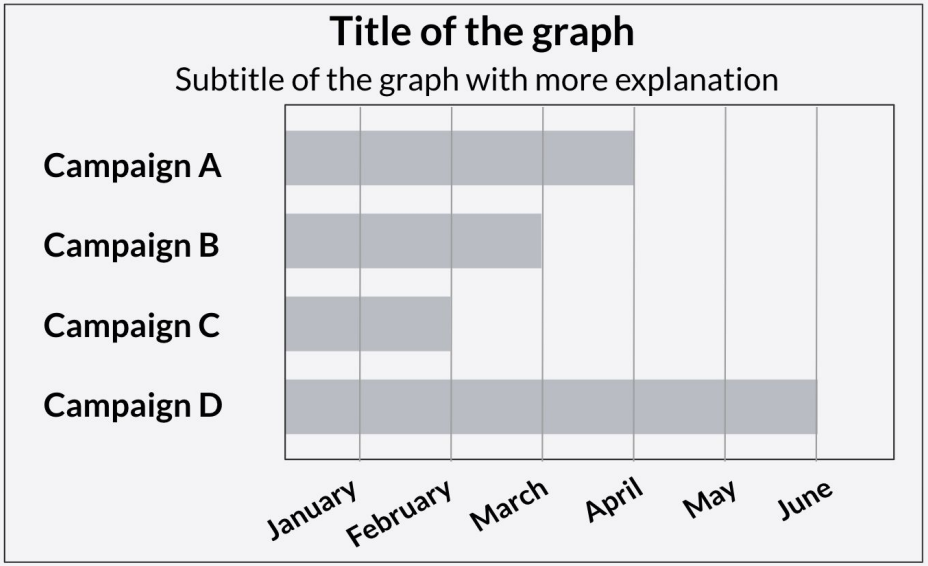
Remove clutter

- ✅ Reduce visual noise
- ✅ Fix alignment
- ✅ Establish hierarchy

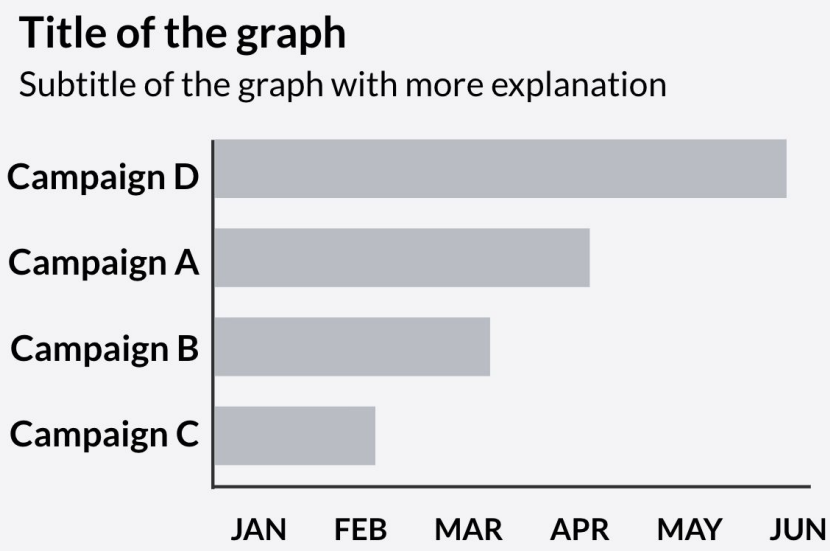


Remove clutter

BEFORE:

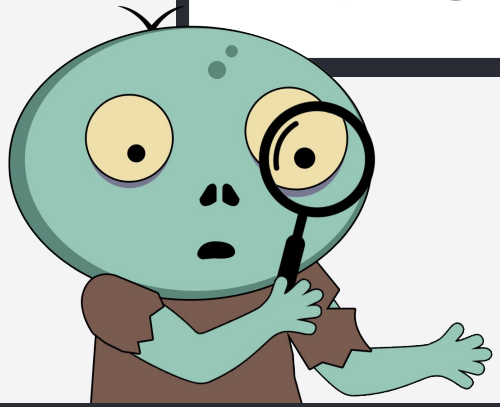


AFTER:

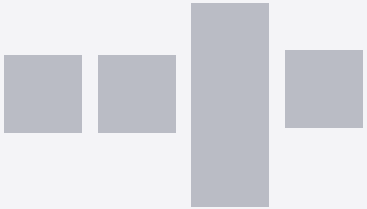


2

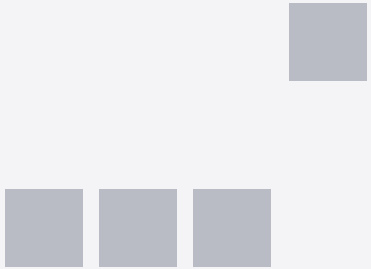
Focus Attention



Leverage visual cues



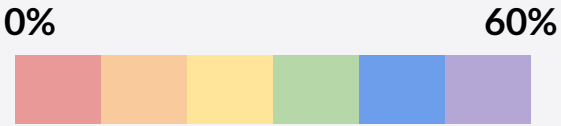
Size



Visual Space

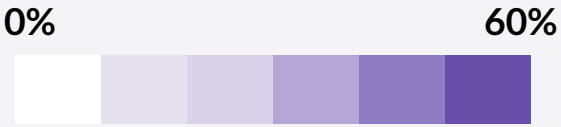
Color

Use color strategically



	A	B	C	D
Category 1	15%	22%	42%	6%
Category 2	43%	36%	20%	13%
Category 3	35%	17%	34%	20%
Category 4	52%	29%	26%	56%

Leverage saturation



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Category 4	52%	29%	26%	56%

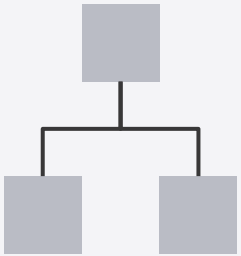
Additional color tips

Leverage brand color

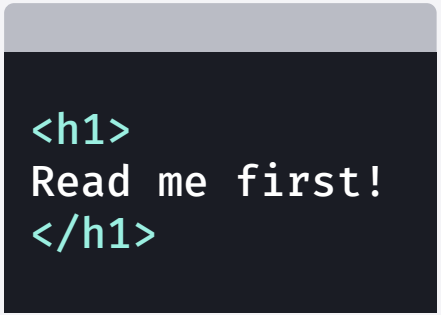
Be mindful of color blindness

Draw attention with **black**

Leverage content cues



Establish hierarchy



Use semantic markup

Consider all interfaces

Accessibility is not a progressive enhancement.

Consider all interfaces

`<caption>`

`<th>` vs `<td>`

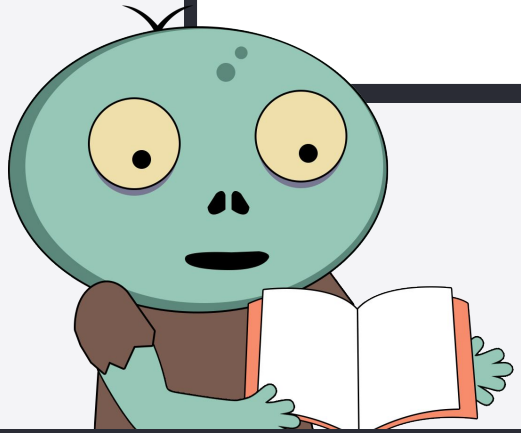
`<th scope="row">`

`<th scope="colgroup">`
with spanned columns

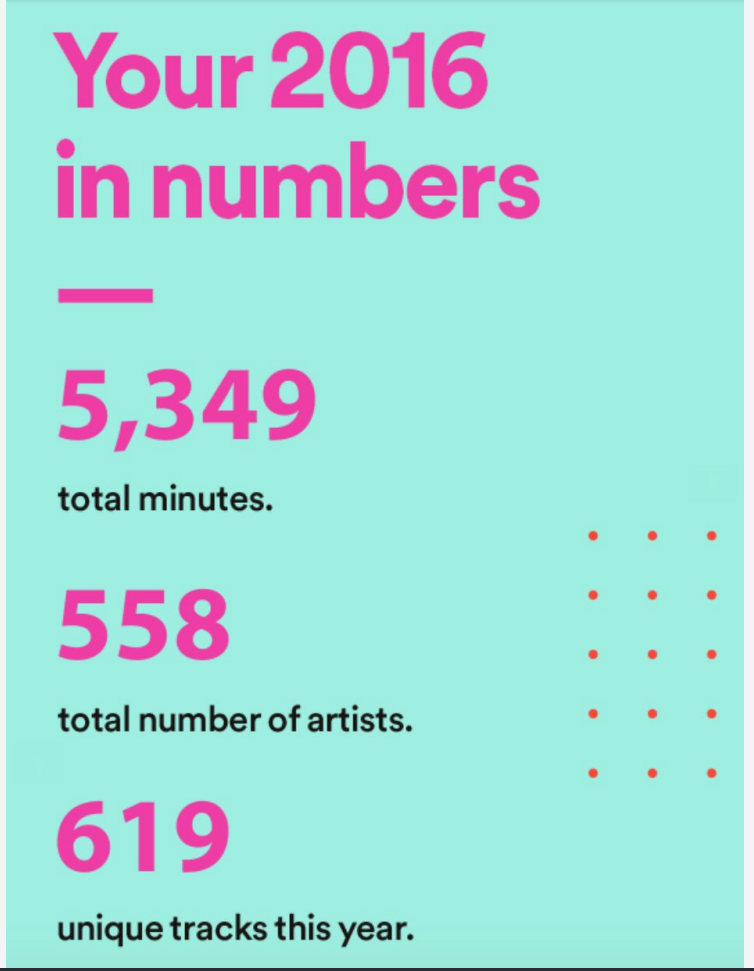
```
<table>
     <caption>Open Rates</caption>
     <tr>
          <td></td>
          <th scope="col">Segment A</th>
          <th scope="col">Segment B</th>
     </tr>
     <tr>
          <th scope="row">Campaign 1</th>
          <td>15%</td>
          <td>22%</td>
     </tr>
     <tr>
          <th scope="row">Campaign 2</th>
          <td>40%</td>
          <td>36%</td>
     </tr>
</table>
```

3

Tell a Story



Some do it well...



Not one size fits all

Your weekend in numbers

34

total hours

6

television series

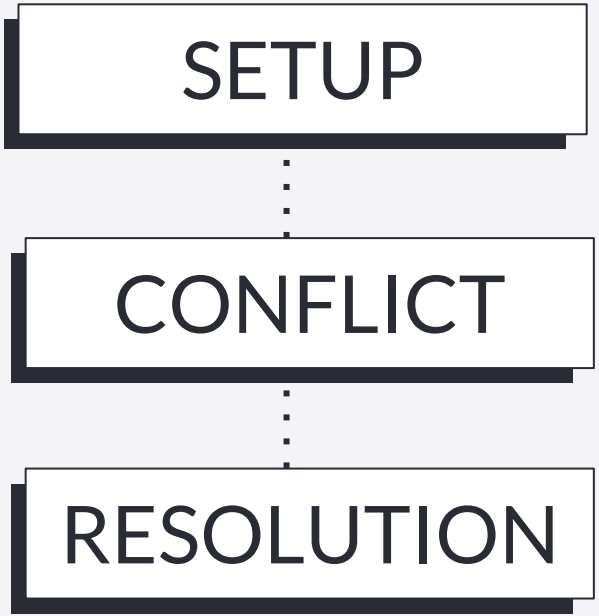
0.5

documentary

Put your audience first

What choices give your subscribers anxiety?

Define the Big Idea



SETUP:

There are two annoying AF tasks that we have to manually do every day.

Storyboarding

Issue:
We want to automate two menial processes

Need to convince our boss

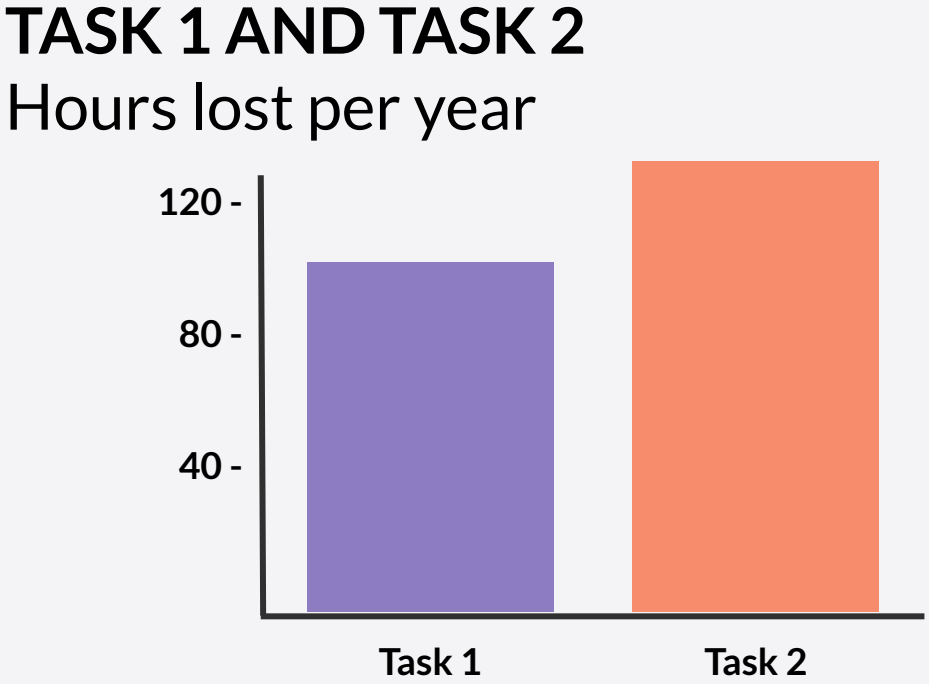
Show how many hours it takes per year to do the task

Describe the manual repetition of the tasks

Ideas for overcoming the issue: Invest in new automation program

Recommendation:
Start vetting automation solutions

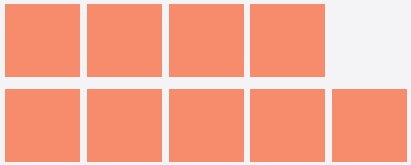
Informative approach



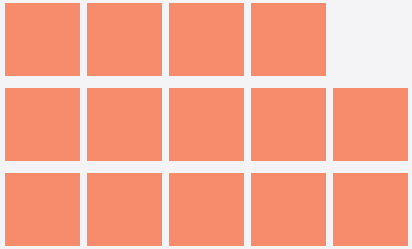
Refine to persuade

DAYS LOST TO TASK 1 AND TASK 2: TIME SINK

Work days lost per year



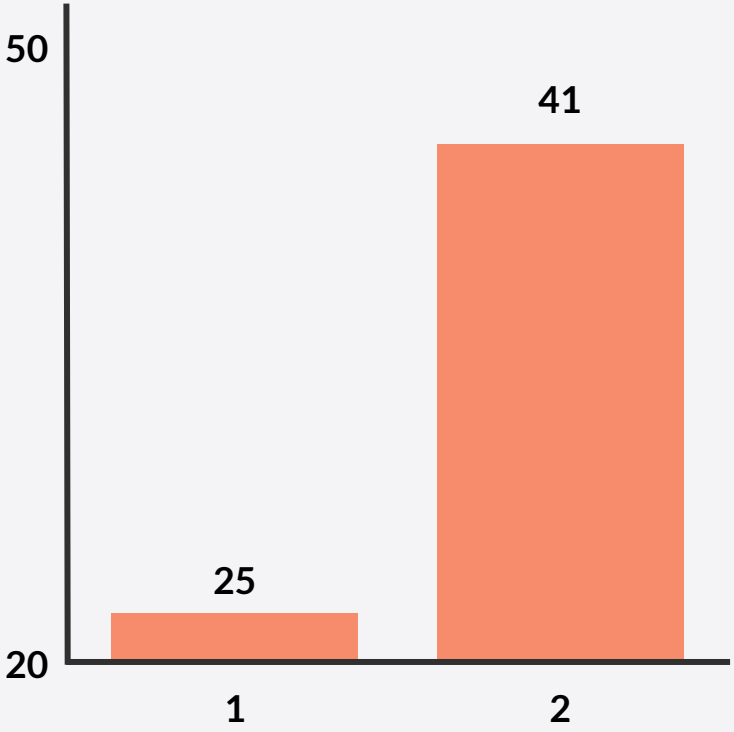
Jerome
9 work days



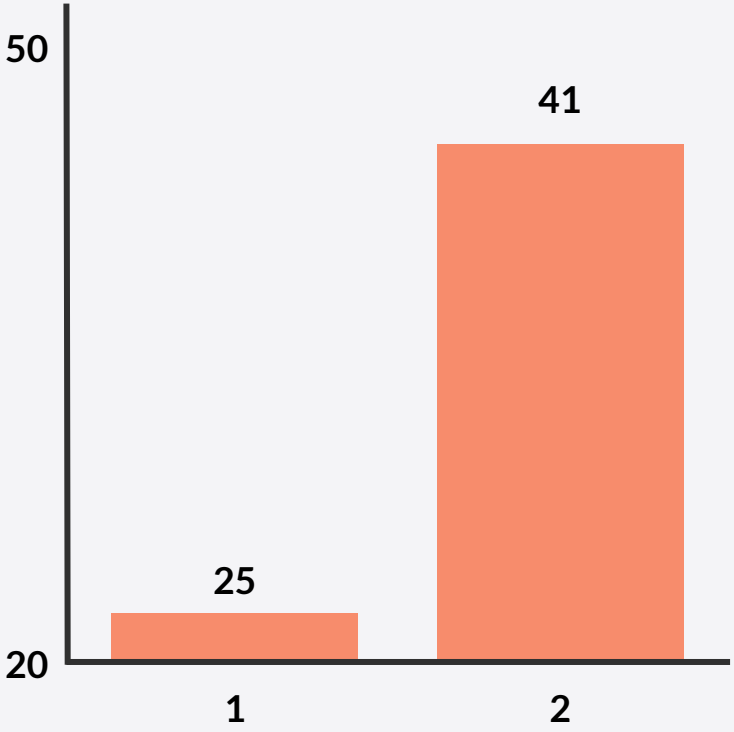
Claire
14 work days

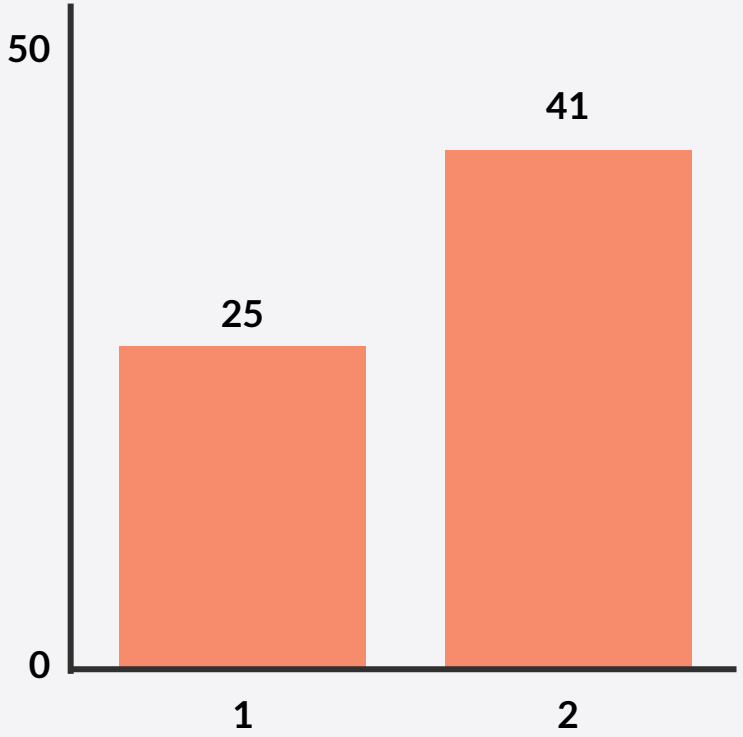
Persuasion or manipulation?

Exaggerating trends

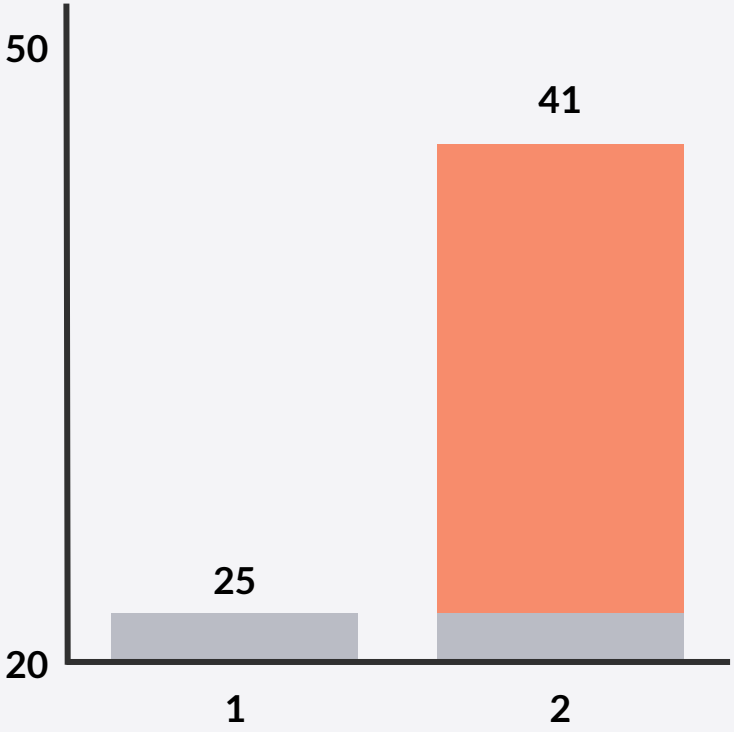


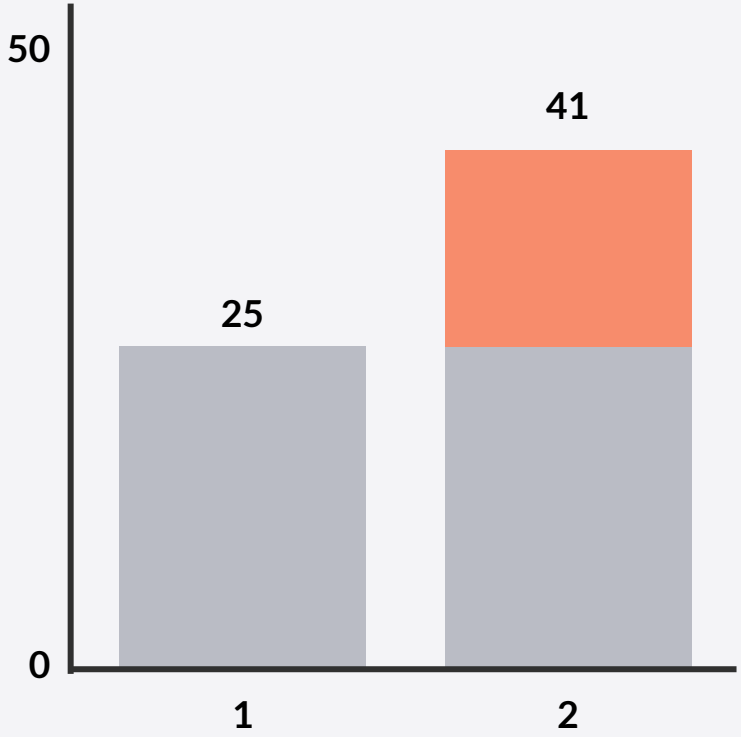
Exaggerating trends



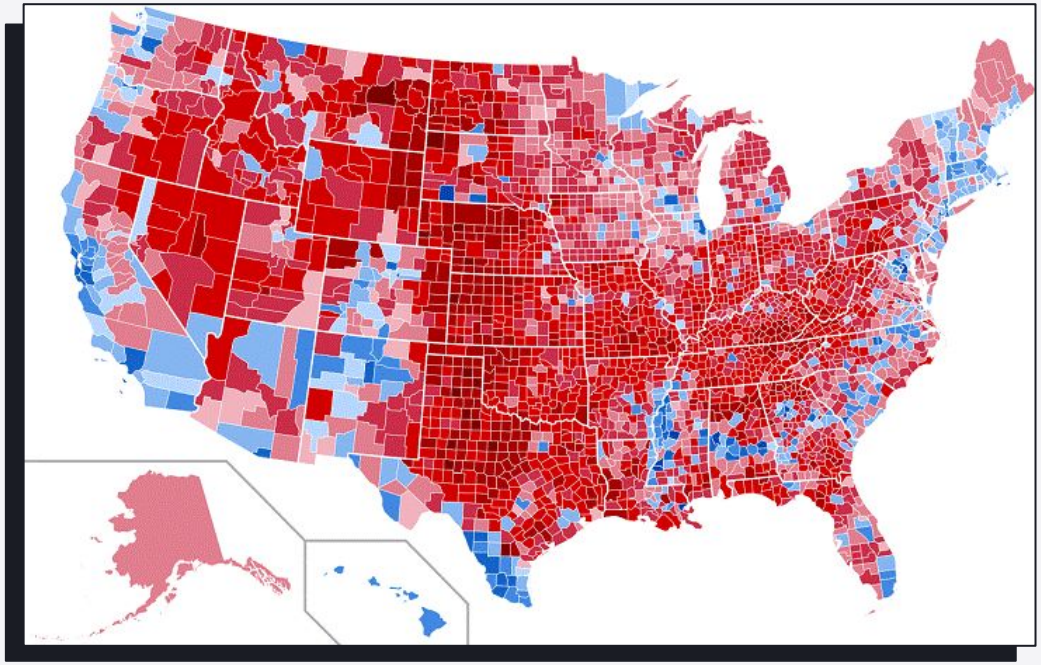


Exaggerating trends





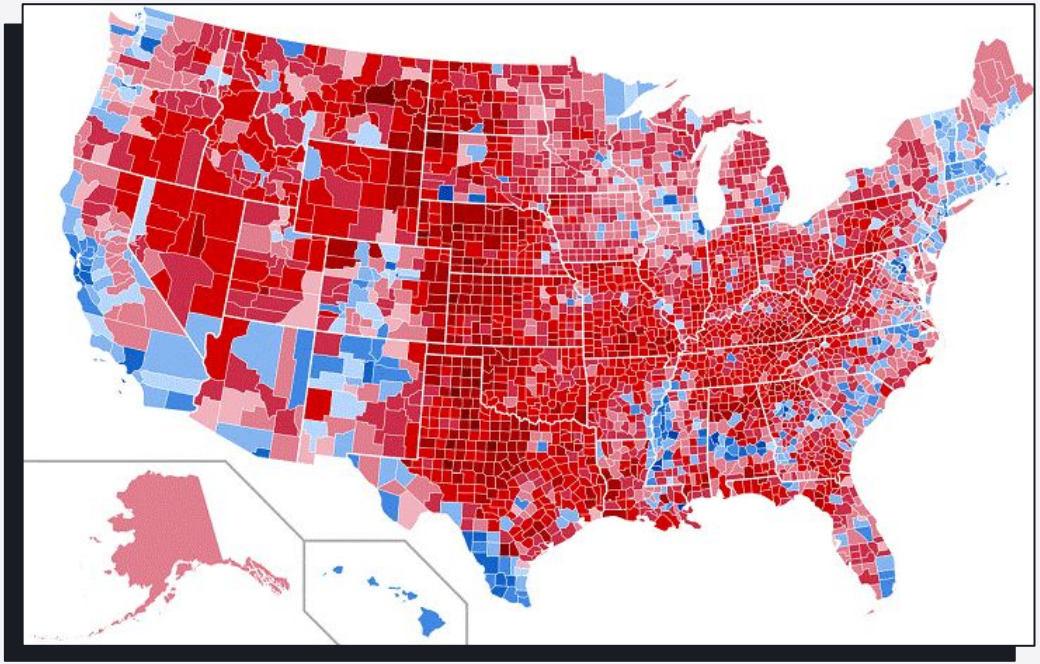
Providing inaccurate context

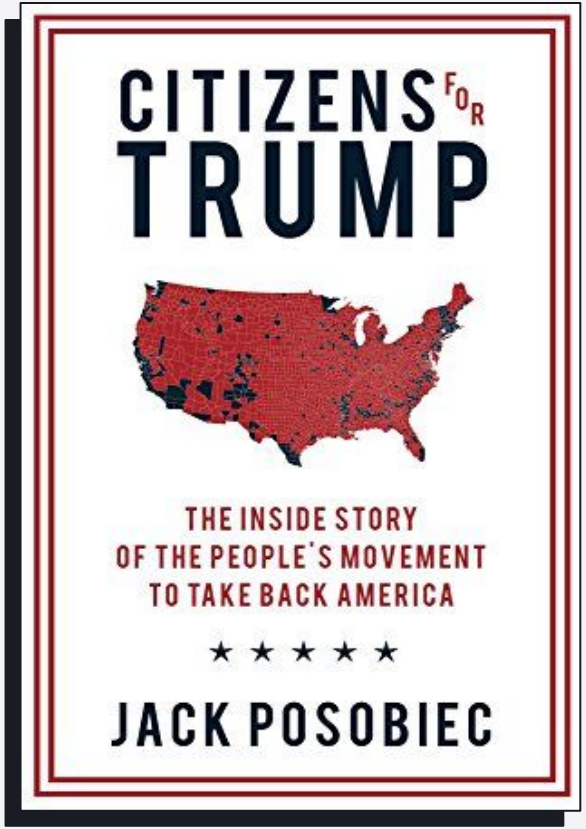


County-by-county results of the 2016 U.S. Presidential election

Democratic **Republican**

Providing inaccurate context



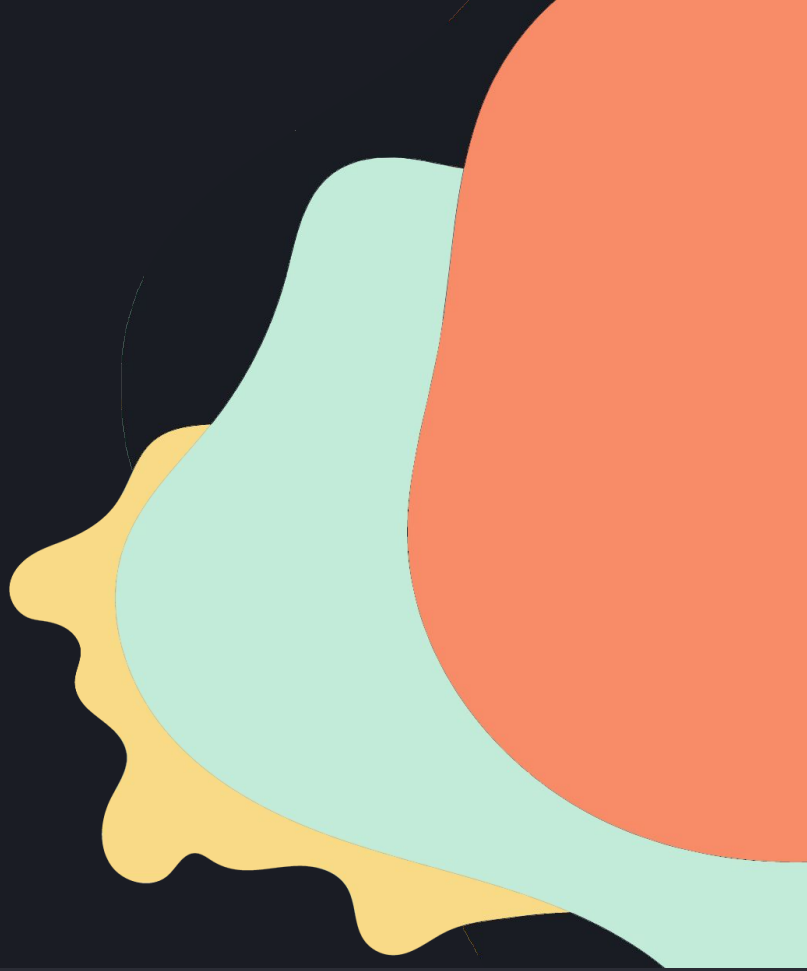


Providing inaccurate context

Share of the popular vote in the 2016 U.S. Presidential election

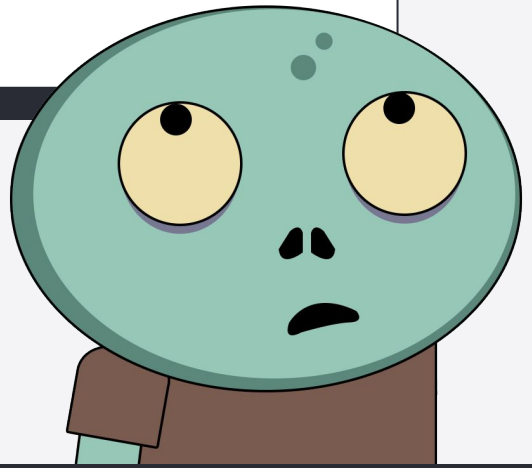
METHOD OF COMMUNICATION

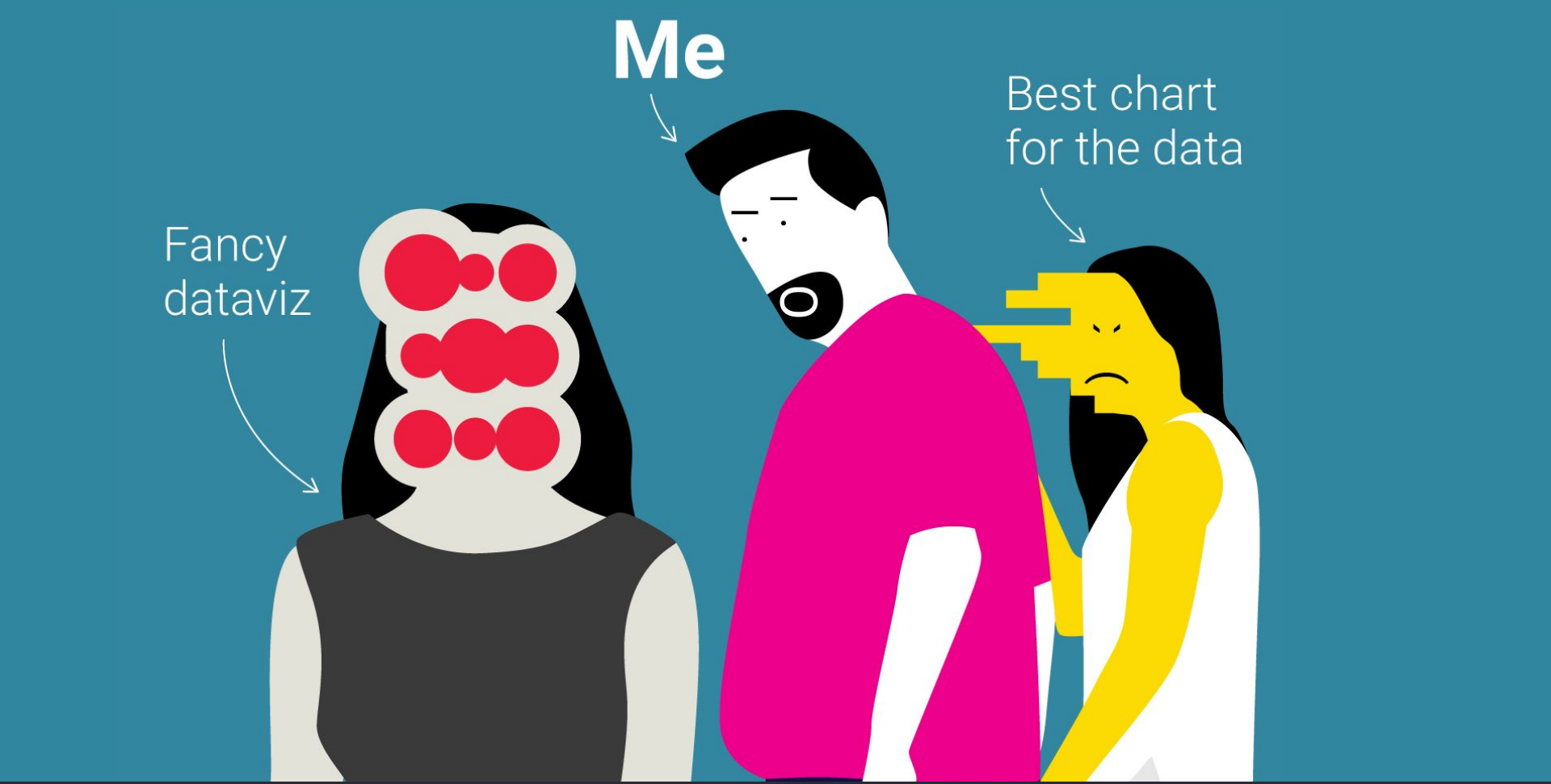
Choosing an effective visual



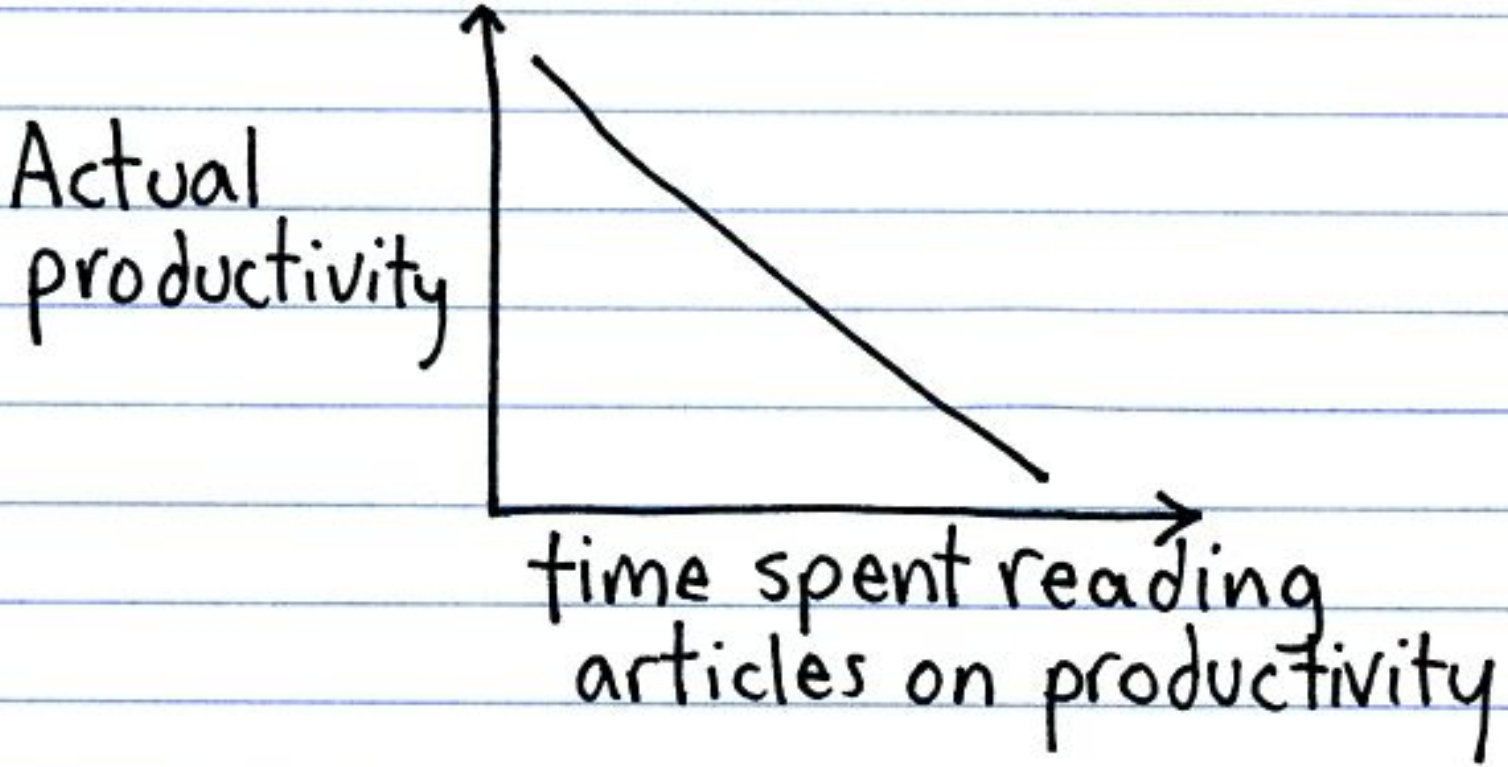
The best solution is the easiest solution.

THe BEsT sOlUtiOn iS tHE eAsIeSt SoLuTiOn.





Source: Xaquín González Veira



Source: This is Indexed

Simple Text

74%

of subscribers opted-in
to additional marketing emails
in 2018, compared to 41% in 2017

More impact,
easier to understand

Can be misleading
without context

Simple Text

74%

of subscribers opted-in
to additional marketing emails
in 2018, compared to 41% in 2017

Use color to highlight and focus

Define a clear content hierarchy using font size and weight

Simple Text

```
@keyframes fadeIn {
  from {
    opacity: 0;
  }
  to {
    opacity: 1;
  }
}

.fadeIn {
  animation-duration: 500ms;
  animation-delay: 1000ms;
  animation-name: fadeIn;
}

@media (prefers-reduced-motion: reduce) {
   .fadeIn { animation: none; }
}
```

Can use custom fonts in certain clients

Animate to focus attention, but respect motion-sensitive subscribers

Tables

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%

Audience with multiple concerns

Hard to follow in live presentations

Tables

	A	B	C
Category 1	15%	22%	42%
Category 2	40%	36%	20%
Category 3	35%	17%	34%
Category 4	30%	29%	26%

Use minimal borders to help legibility

Adjust color saturation to focus attention

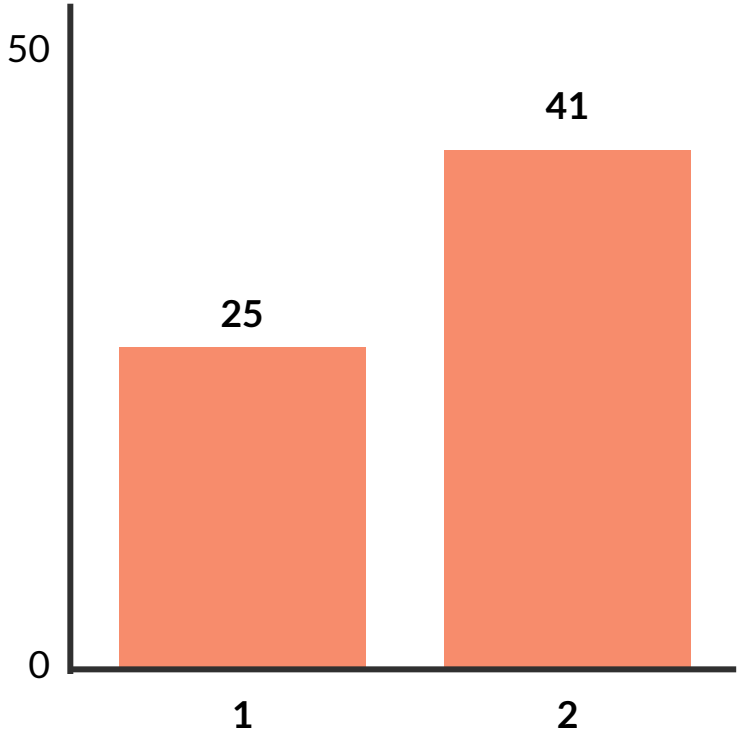
Tables

```
<table>
     <caption>Open Rates</caption>
     <tr>
          <td></td>
          <th scope="col">Segment A</th>
          <th scope="col">Segment B</th>
     </tr>
     <tr>
          <th scope="row">Campaign 1</th>
          <td>15%</td>
          <td>22%</td>
     </tr>
     <tr>
          <th scope="row">Campaign 2</th>
          <td>40%</td>
          <td>36%</td>
     </tr>
</table>
```

We already use tables, hoorah!

But...forget everything you thought you knew about accessibility

Bar Graphs



Basic, but effective

Challenging to label

Bar Graphs

Horizontal graphs easier to read than vertical graphs

Great for showing progress

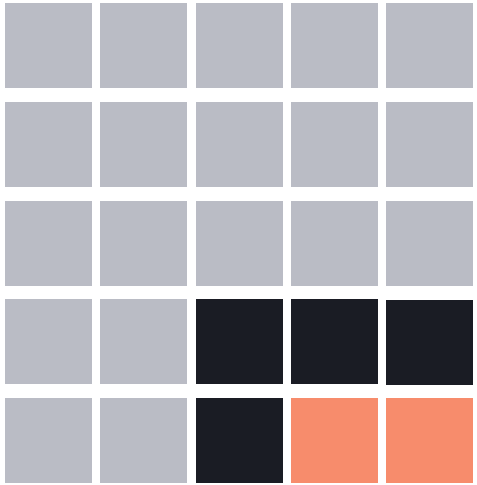
Bar Graphs

```
<table>
    <tr>
        <td width="85%" title="85% to our
        goal" style="background-color:
        #8477e0">
             
        </td>
        <td width="15%" title="15%
        remaining" style="background-color:
        #6C5FC7">
             
        </td>
    </tr>
</table>
```

Can add `<title>` attribute to `<td>` to create tooltip effect

Animating the bars can focus attention

Area Graphs



Out of every **25 emails sent**...

6 users open the email

2 users click-through the email

\+

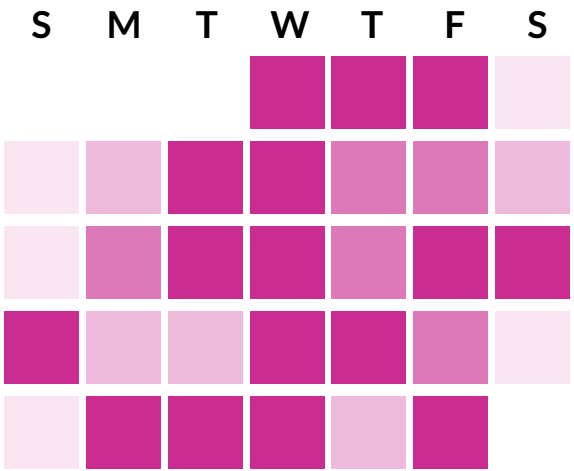
Data of vastly different magnitudes

\-

Harder to read with multiple data points

Area Graphs

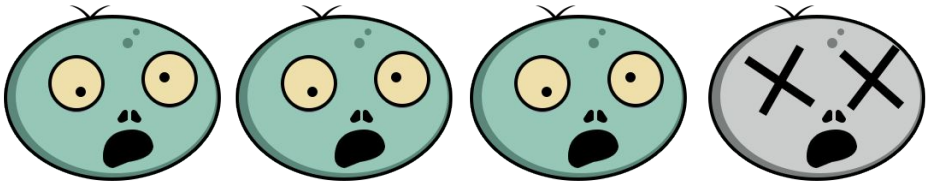
On **Wednesdays** we (mostly) wear pink.



Can visualize time with a calendar

Area Graphs

3 out of 4 zombies depend on brain donations



Can visualize time with a calendar

Can easily sub out shapes for images

Area Graphs

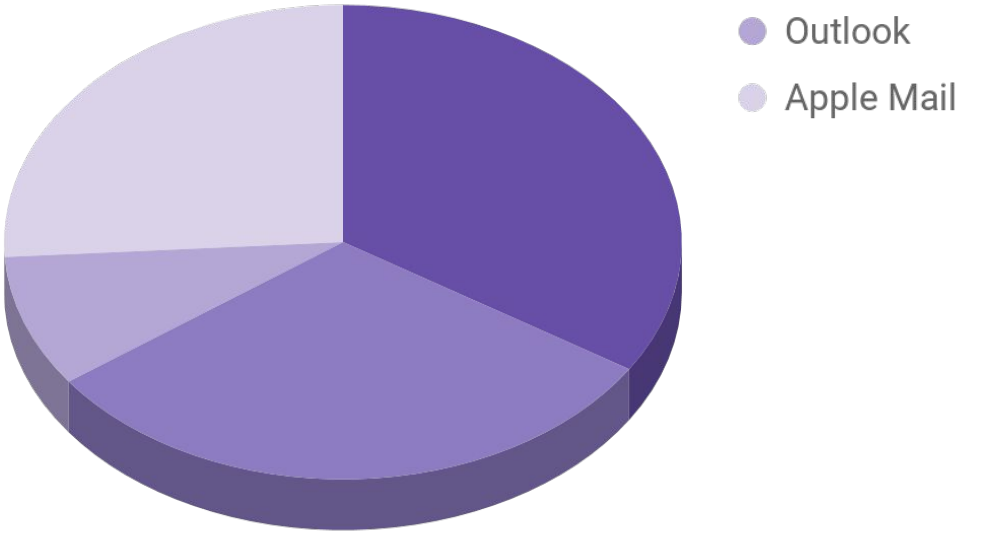
```
<td width="20%" title="Tuesday: 40 outfits"
style="padding: 0 5px 5px 0">
    <span style="width: 100%; background:
    #ff0000;">
         
    </span>
</td>
<td width="20%" title="Wednesday: 60 outfits"
style="padding: 0 5px 5px 0">
    <span style="width: 100%; background:
    #ca2c92;">
         
    </span>
</td>

...
```

Build with additional spacing between cells to show separation

Pies are delicious, but pie charts are garbage.

Pie Charts

Email Market Share

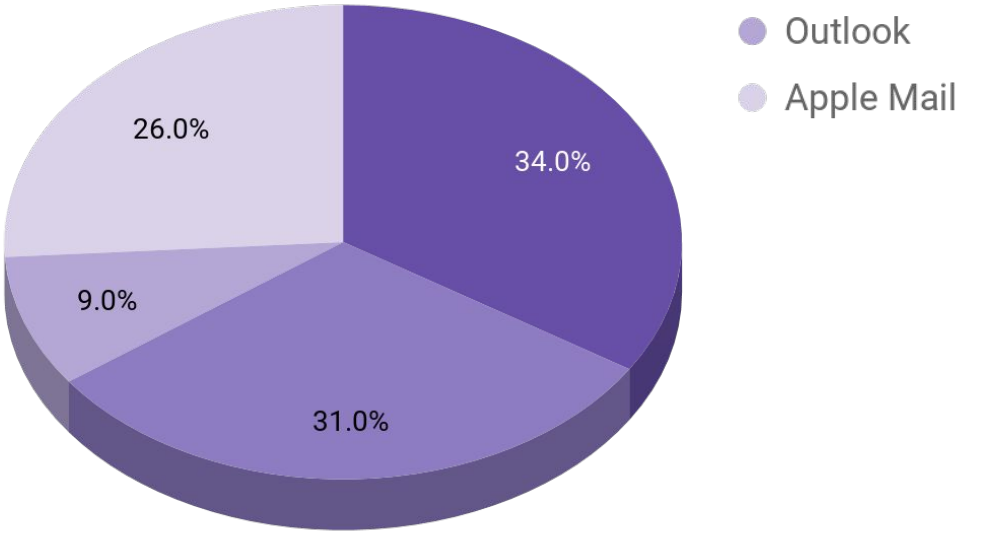


–

Hard to distinguish angles, especially 3D

Pie Charts

Email Market Share

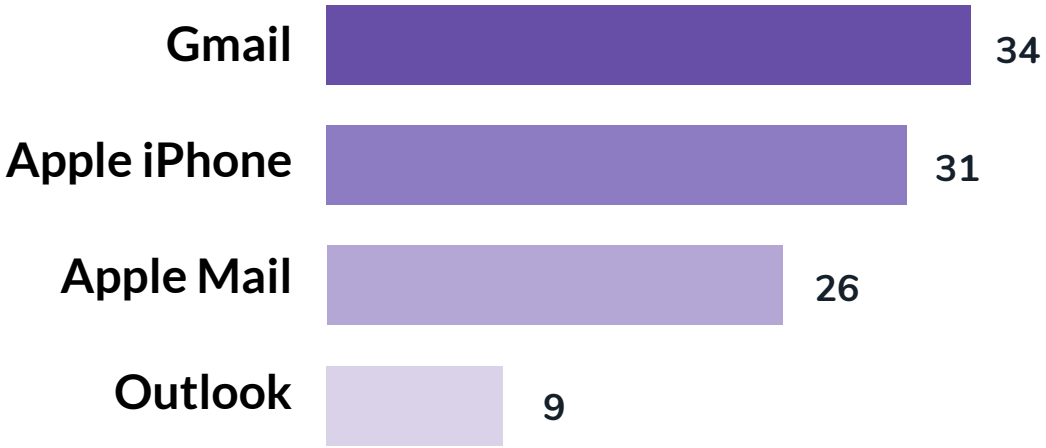


–

Hard to distinguish angles, especially 3D

Pie Charts

Email Market Share



When in doubt, bar chart it out.

REFINEMENT

Building accessible data visualization

Account Dashboard

Big Idea

SETUP

Users receive incremental shares of stock for shopping at the brands they love.

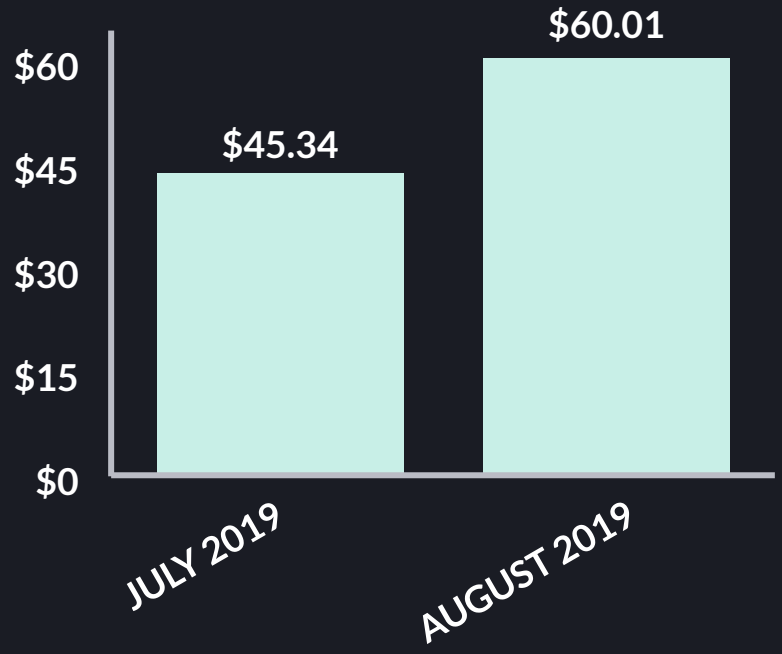
CONFLICT

Stock market is volatile and account value can stagger on a day-to-day basis.

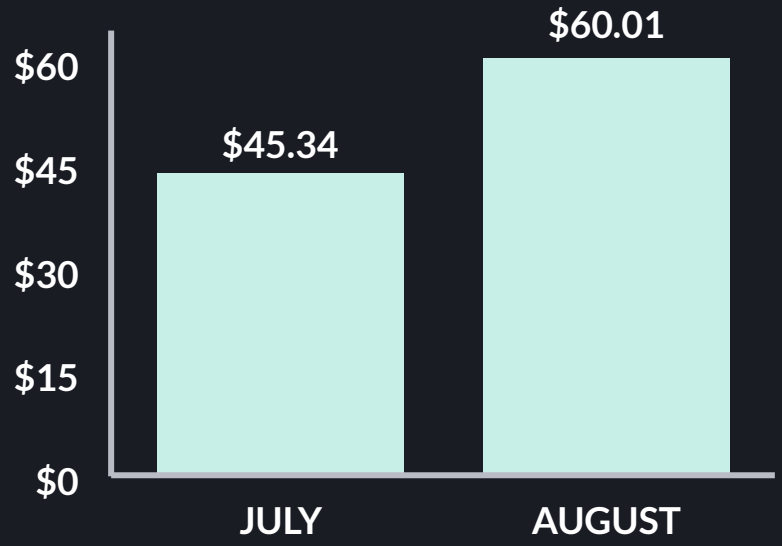
RESOLUTION

Send a monthly email that shows rewards over a period of 30 days vs every day.

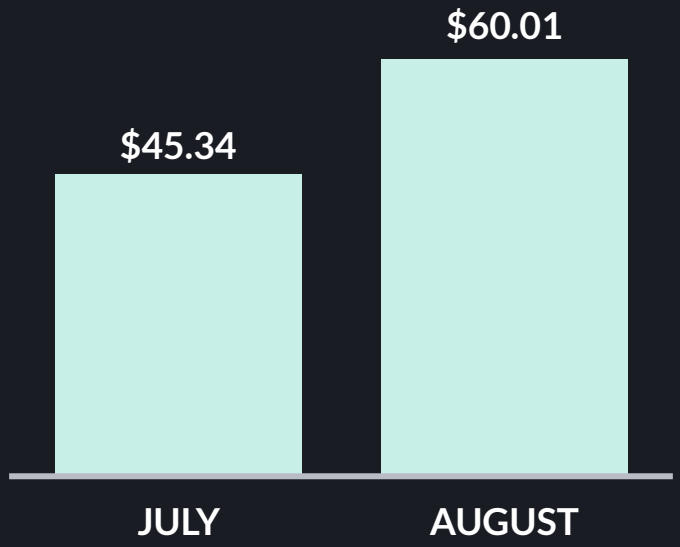
Your account summary in August



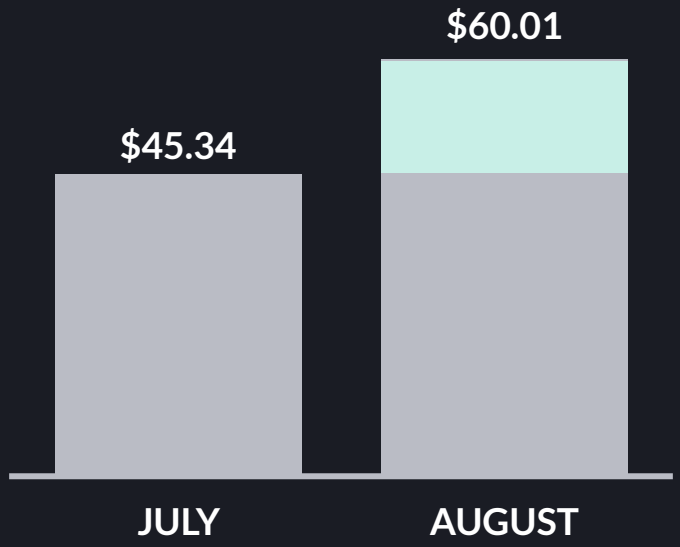
Your account summary in August



Your account summary in August



Your account summary in August



Your account summary
in August

+$14.67

New this month for a
total of $60.01

Your account summary
in August

+$14.67

New this month for a
total of $60.01

Your account summary
in August

+$14.67

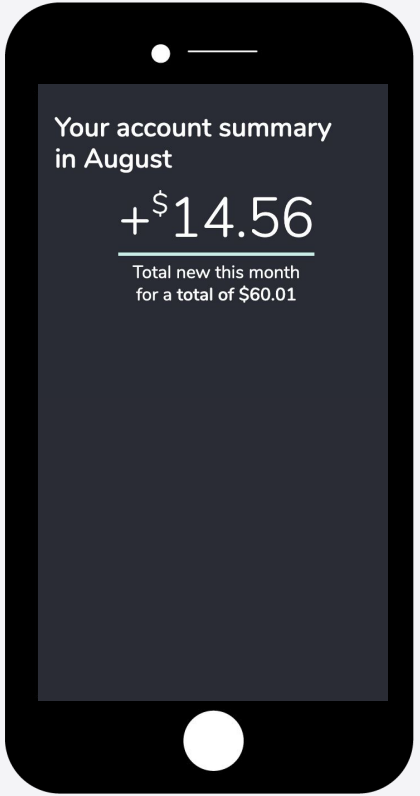
New this month for a
total of $60.01

View Account

Support

A simple text approach will work in all major clients

CSS animations are currently supported in **Apple Mail**, **Outlook for Mac**, **AOL Mail**, **Samsung**, and **Outlook App**.



Product Comparison

Big Idea

SETUP

A new product is being released.

CONFLICT

The new product costs more than the existing product.

RESOLUTION

Compare the features of the new product to the existing product to justify the price difference.

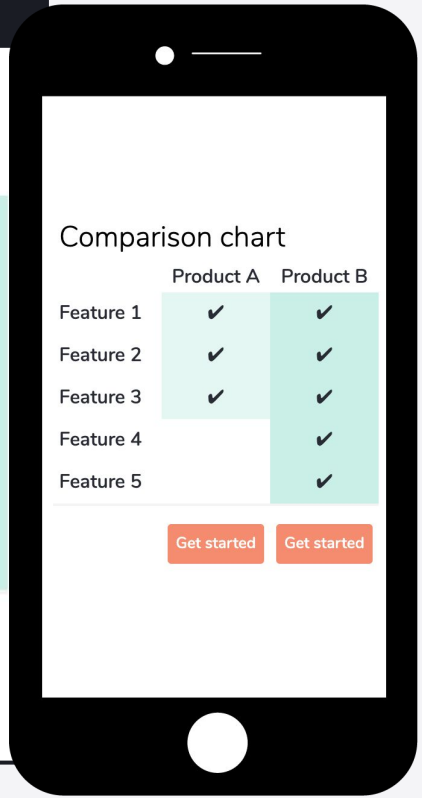
	Product A	Product B
Feature 1	X	X
Feature 2		X
Feature 3	X	X
Feature 4	X	X
Feature 5		X

	Product A	Product B
Feature 1	X	X
Feature 2		X
Feature 3	X	X
Feature 4	X	X
Feature 5		X

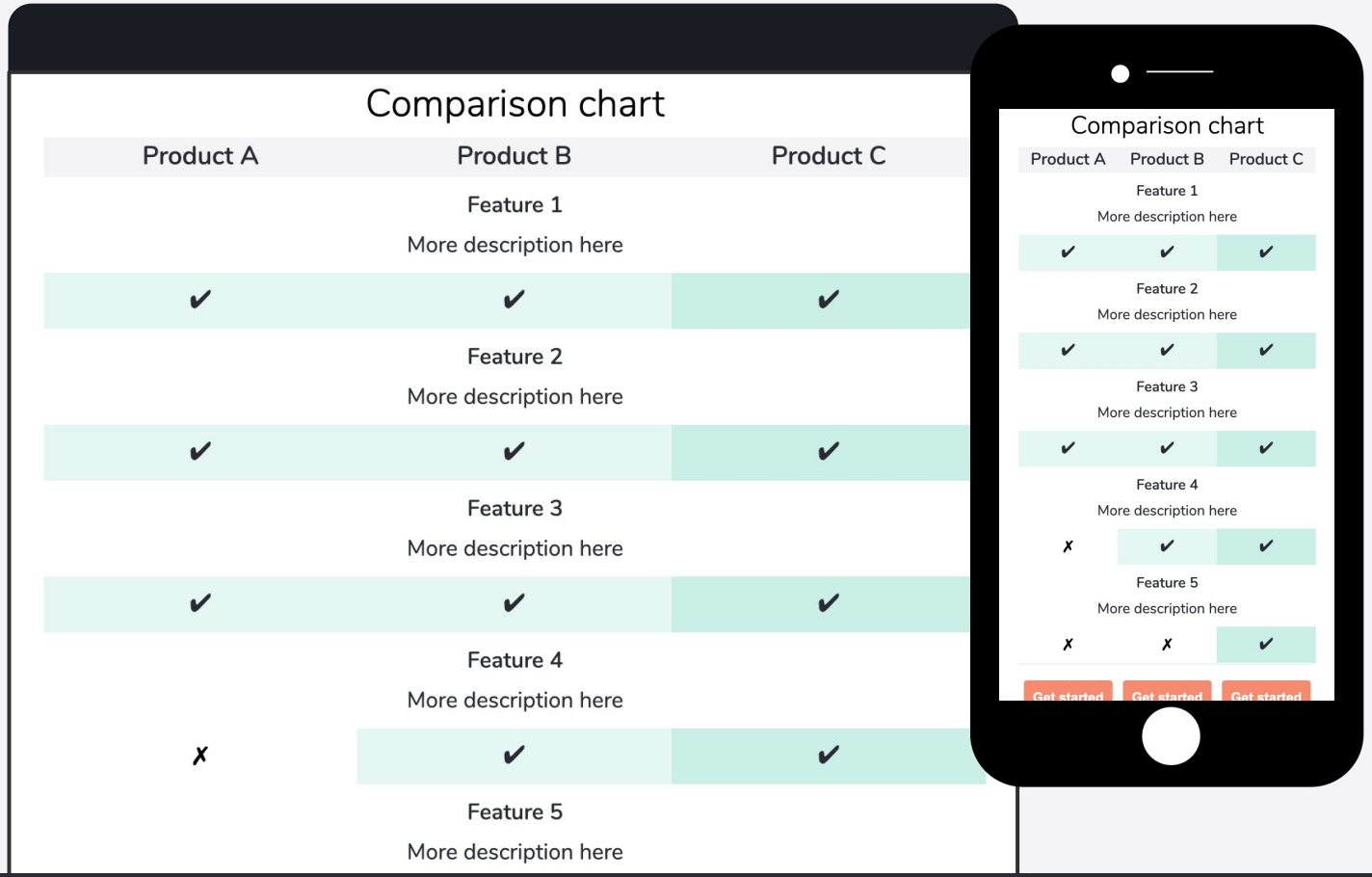
	Product A	Product B
Feature 1	✔	✔
Feature 3	✔	✔
Feature 4	✔	✔
Feature 2		✔
Feature 5		✔

Comparison chart

	Product A	Product B
Feature 1	✔	✔
Feature 2	✔	✔
Feature 3	✔	✔
Feature 4		✔
Feature 5		✔
	Get started	Get started

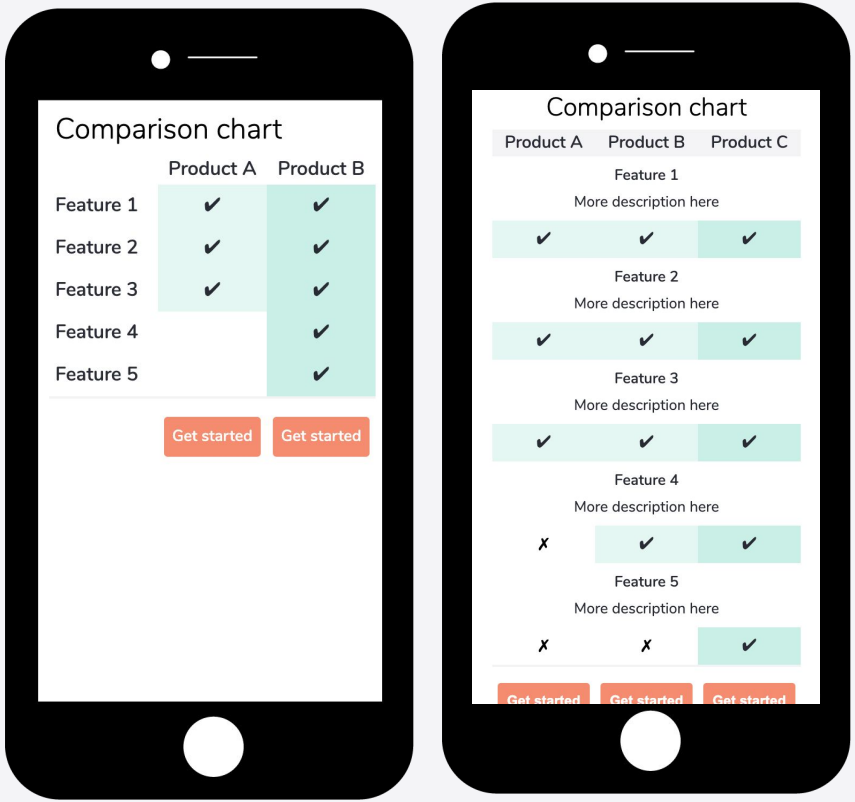


Product A	Product B	Product C
	Feature 1 More description here	
✔	✔	✔
	Feature 2 More description here	
✗	✔	✔


Comparison chart
Product A
Product B
Product C
Feature 1
More description here
✔
✔
✔
Feature 2
More description here
✔
✔
✔
Feature 3
More description here
✔
✔
✔
Feature 4
More description here
✗
✔
✔
Feature 5
More description here
Comparison chart
Product A
Product B
Product C
Feature 1
More description here
✔
✔
✔
Feature 2
More description here
✔
✔
✔
Feature 3
More description here
✔
✔
✔
Feature 4
More description here
✗
✔
✔
Feature 5
More description here
✗
✗
✔
Get started
Get started
Get started

Support

Creating a mobile-first design will ensure that the comparison chart renders correctly in all major clients.



Fundraising Effort

Big Idea

SETUP

A new program is set to launch.

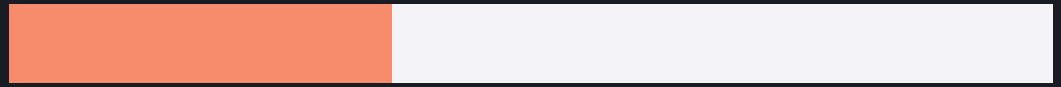
CONFLICT

The program is currently short of their goal and will not be able to fund the necessary supplies.

RESOLUTION

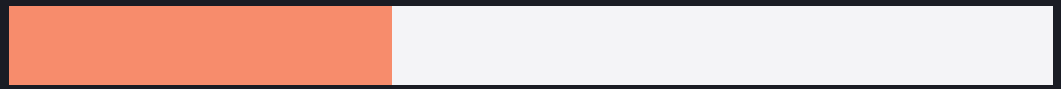
Encourage users to donate more money and show the impact their donations will have.

$10.00



will fund a week of supplies.

$10.00

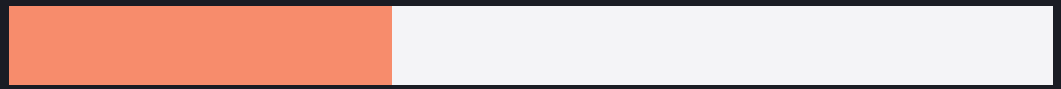


will fund a week of supplies.

$20.00

will fund two and a half weeks of supplies.

$10.00



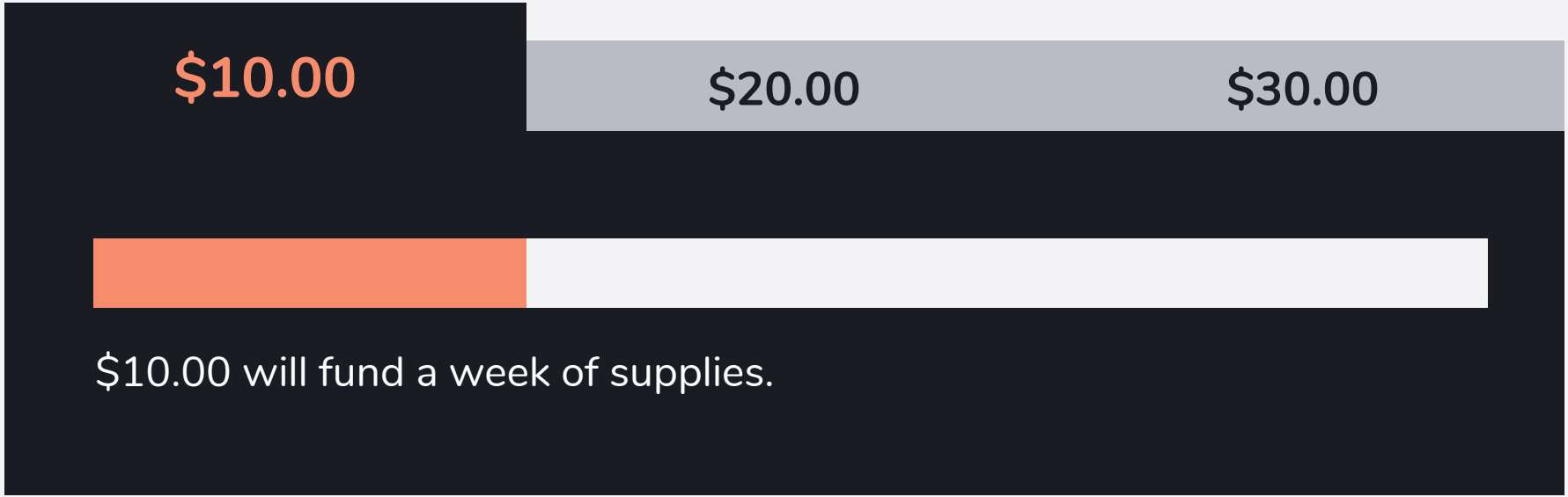
will fund a week of supplies.

$20.00

will fund two and a half weeks of supplies.

$30.00

will fund an entire month of supplies.

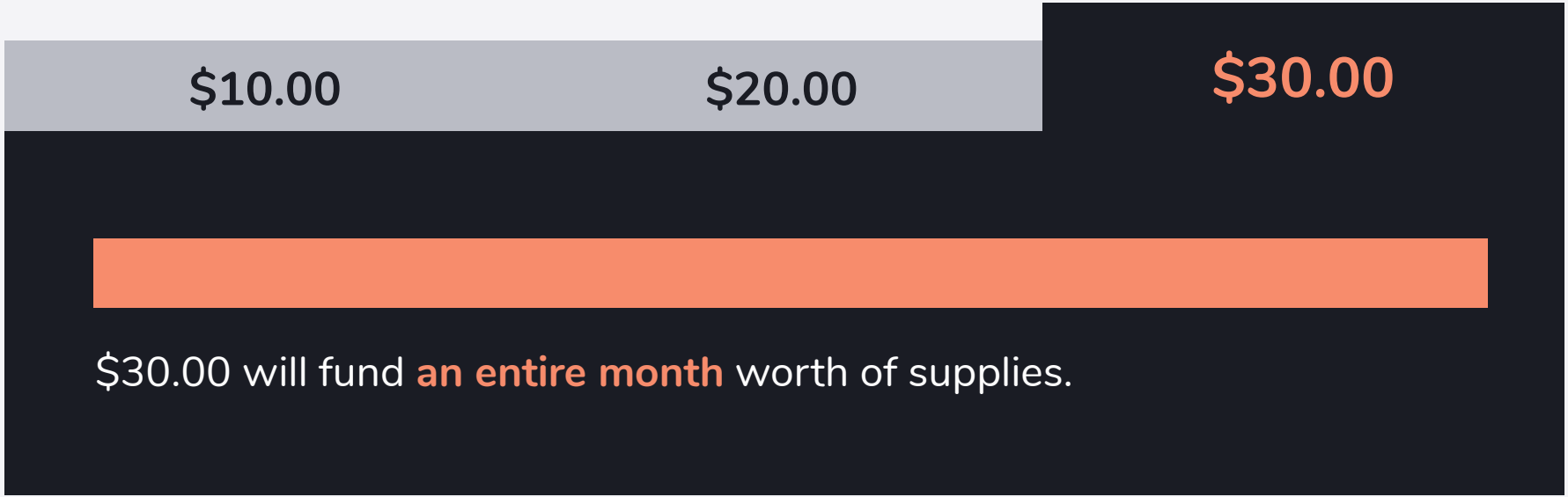

$10.00
$20.00
$30.00
$10.00 will fund a week of supplies.

$10.00

$20.00

$30.00

$20.00 will fund a two and a half weeks of supplies.


$10.00
$20.00
$30.00
$30.00 will fund an entire month worth of supplies.

Your dollars make a difference

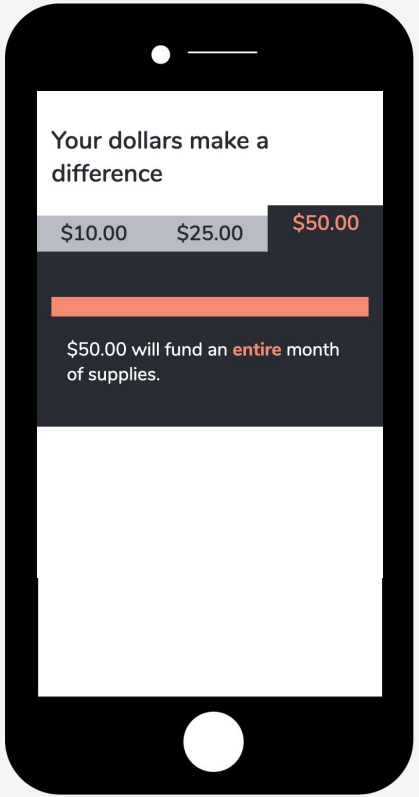
$10.00	$20.00	$30.00

$30.00 will fund **an entire month** worth of supplies.
Donate today »

Support

Bar graphs will work in all major email clients with minimal adjustments for mobile.

Interactive tabs are currently supported in **iOS**, **AOL** and **Yahoo** email clients.
For all other clients, the experience will fallback to three stacked pieces of content.



WRAP UP

Effective storytelling with data visualization

The Secret Sauce

Easy to comprehend

Tells a compelling story

Accessible across various clients

heidiolsen.com/LL19

Slides • Code Samples • Links to Resources