

Tricks for Report Builders: Best Practices and Visualization Skills for Designing Impactful Reports

Teri Patsilaras & Nicole Ball



Tricks for Report Builders: Best Practices and Visualization Skills for Designing Impactful Reports

Teri Patsilaras, SAS

Nicole Ball, SAS

Teri Patsilaras is a Senior Manager in the Education Division within SAS. Teri works to enable SAS technologists and customers on the latest data visualization techniques and how to leverage SAS Visual Analytics to meet business needs. She has extensive knowledge of report design methodologies and how to efficiently and effectively apply data visualization methods. She has a B.A. in Applied Mathematics and B.A. in Computer Science from North Carolina State University.

Nicole Ball, a Principal Technical Training Consultant at SAS, teaches courses on SAS Visual Analytics, SAS Data Quality, and the SAS programming language. Nicole is also a course developer for SAS Visual Analytics, which includes writing and updating courses and preparing customized training. Before coming to SAS, Nicole was an Economic Analyst at the Federal Reserve where she learned more about SAS code and how to apply it to real-world problems. She has a M.S. in Economics from the University of Texas at Dallas and a B.A. in Economics from Trinity University in San Antonio, TX.







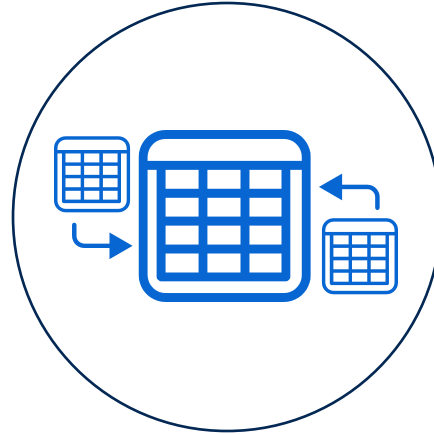
Draft a Plan

Select your data



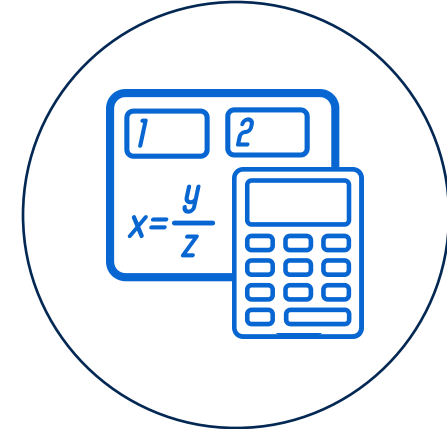
Any format

- SAS data sets
- Microsoft Excel files
- Database tables
- Text files



Multiple tables

- Combine tables
- Multiple data sources



Create data items

- One-click calculations
- Hierarchies
- Geography data items
- Parameters
- Statistical data items



Prepare your data before using it in SAS Visual Analytics



Draft a Plan

Know your audience



What to present?



How to present?

What level of detail?

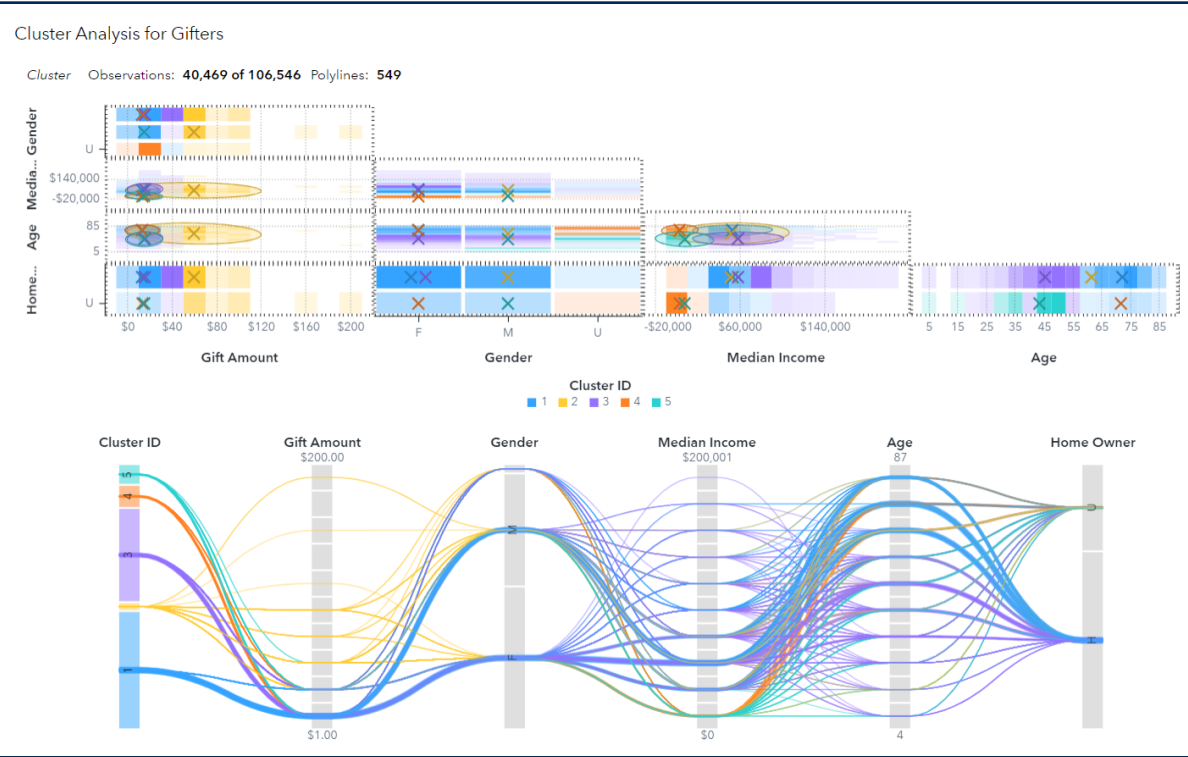




Draft a Plan

Know your audience

Statisticians



General audience



Provide context for graph content



Draft a Plan

Know your audience

Simple edits

- Sort >
- Explain data >
- Grouping style >
- Labels >
 - ✓ Data labels
 - Segment labels
- Hide legend
- Maximize view
- Export >
- Copy link...

Comprehensive edits

- Sort >
- Explain data >
- Grouping style >
- Labels >
- Hide legend
- Maximize view
- Export >
- Copy link...
- Change Bar chart to >
 - Butterfly chart
 - Crosstab
 - Dot plot
 - Dual axis bar chart
 - Dual axis bar-line chart
 - Dual axis line chart
 - Gauge
 - Key value
 - Line chart
 - List table
 - Needle plot
 - Numeric series plot
 - Pie chart
 - Scatter plot
 - Step plot
 - Targeted bar chart
 - Treemap
 - Waterfall chart
 - Word cloud

Data edits

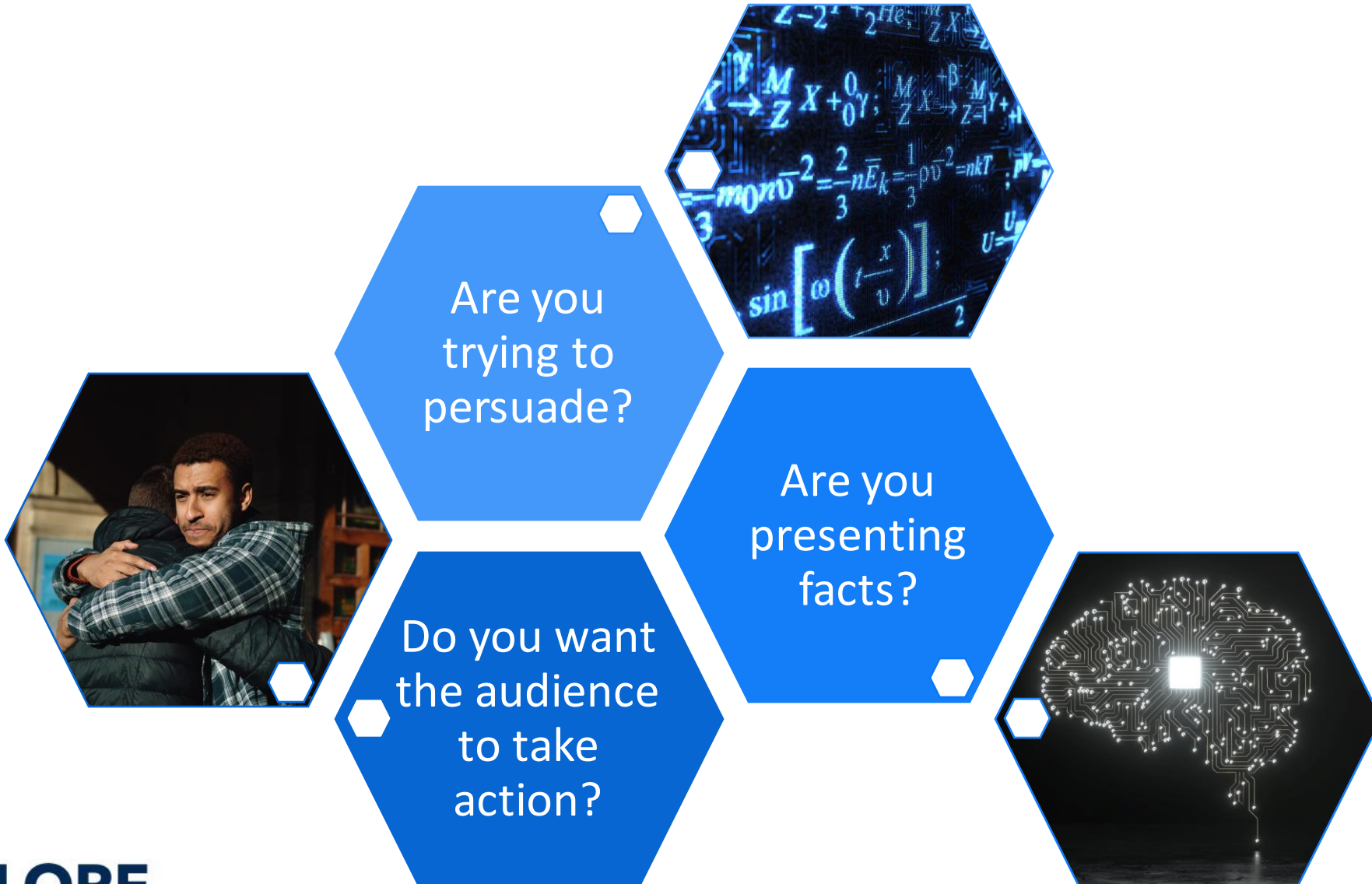
- Sort >
- Replace data >
 - Product Line
 - Number of Orders
- Remove data >
- Explain data >
- New filter from selection >
- Grouping style >
- Labels >
- Hide legend
- Maximize view
- Export >
- Copy link...
- Change Bar chart to >

Viewer Customization Level



Draft a Plan

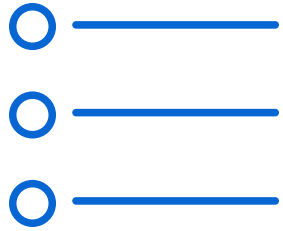
Craft your story





Draft a Plan

Sketch design



Outline



Draft

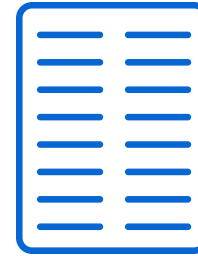
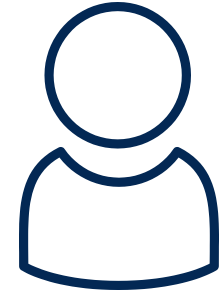


Table of contents

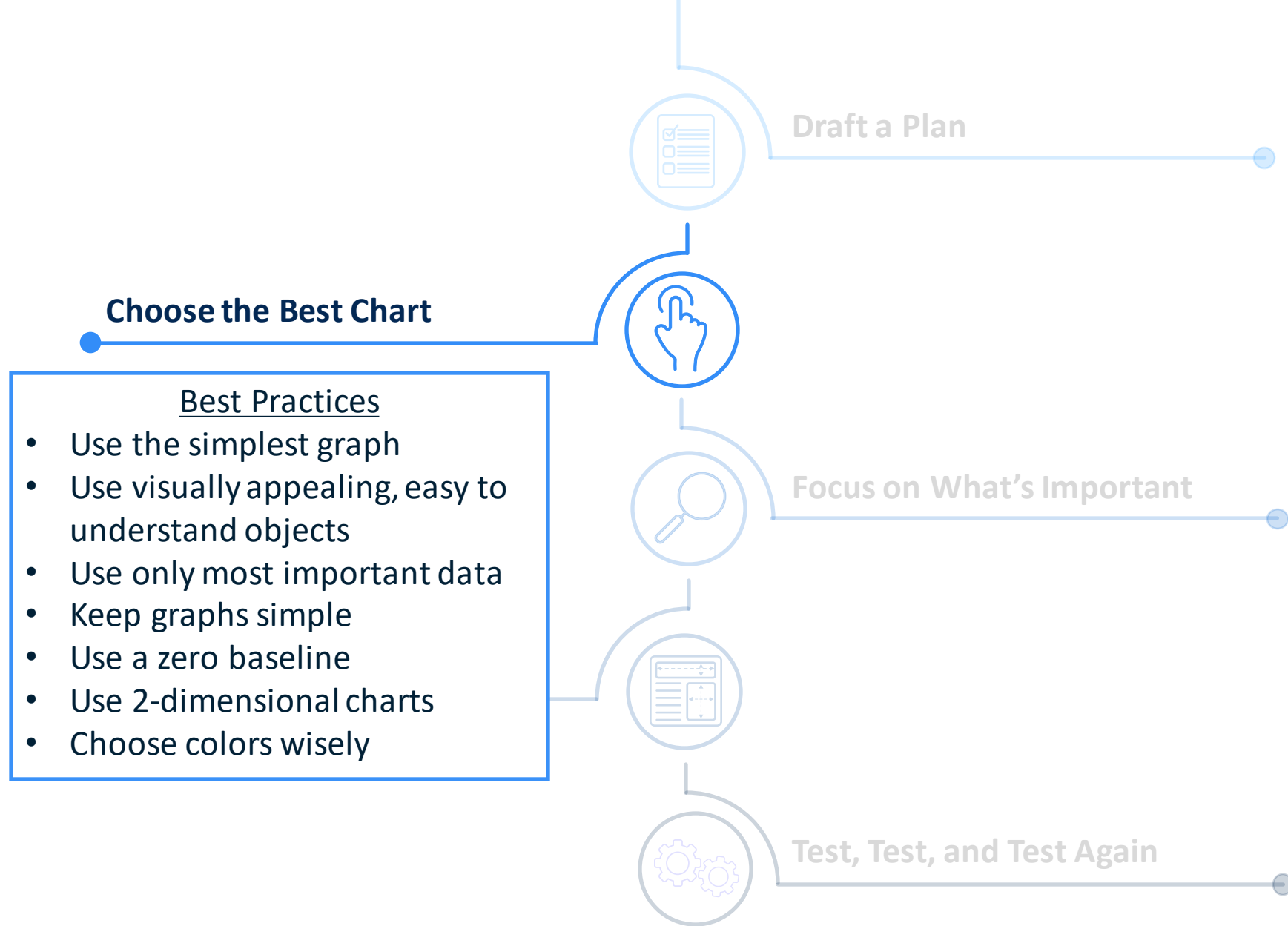


Plan for accessibility



Keep the story in
mind







Choose the Best Chart (Best Practices)



Who is the audience?

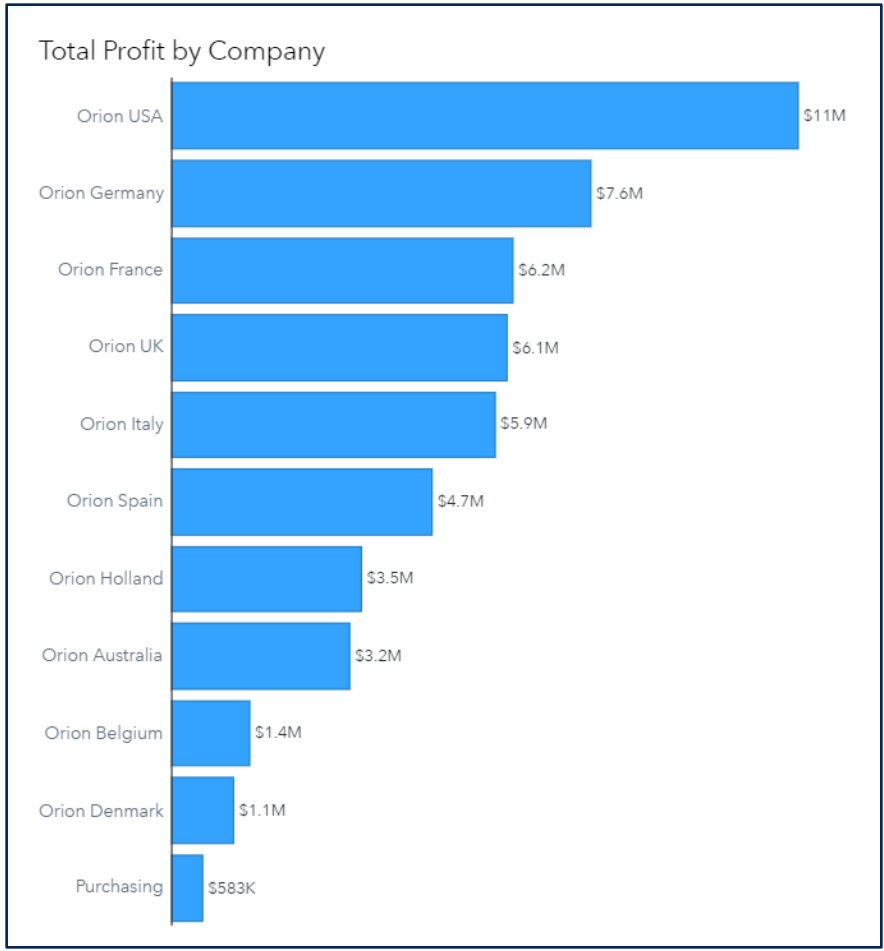
What data do you want to display?





Choose the Best Chart (Best Practices)

Use the simplest graph



- Muddled message
- Less accessible



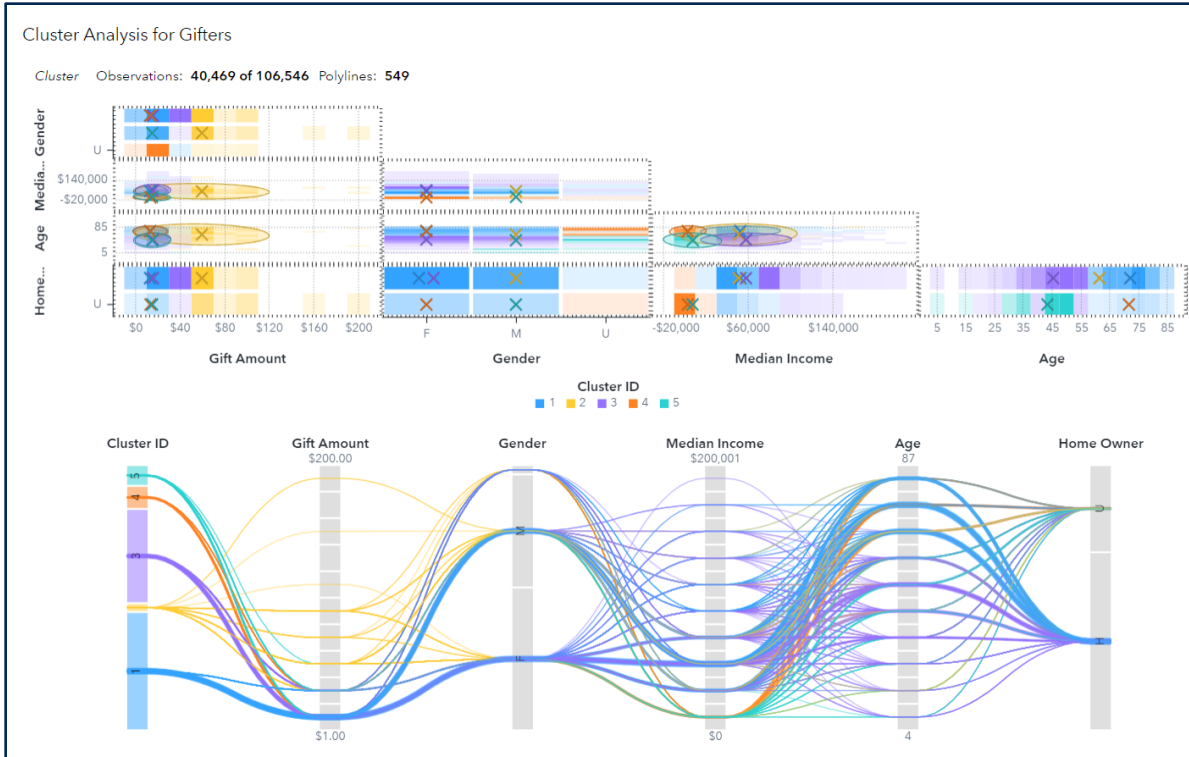
Create object templates to speed up development



Choose the Best Chart (Best Practices)

Use visually appealing, easy to understand objects

Statisticians



General audience

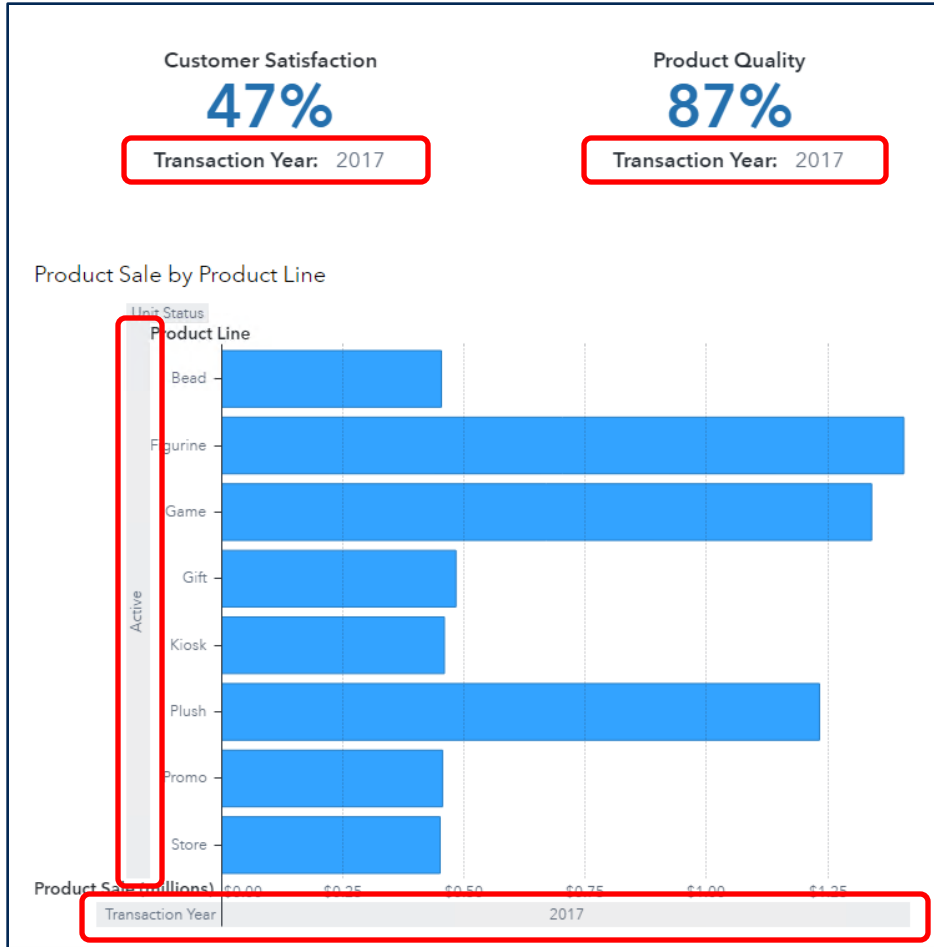


Consider the audience



Choose the Best Chart (Best Practices)

Use only the most important data



Notify users if lattice columns or lattice rows are used



Choose the Best Chart (Best Practices)

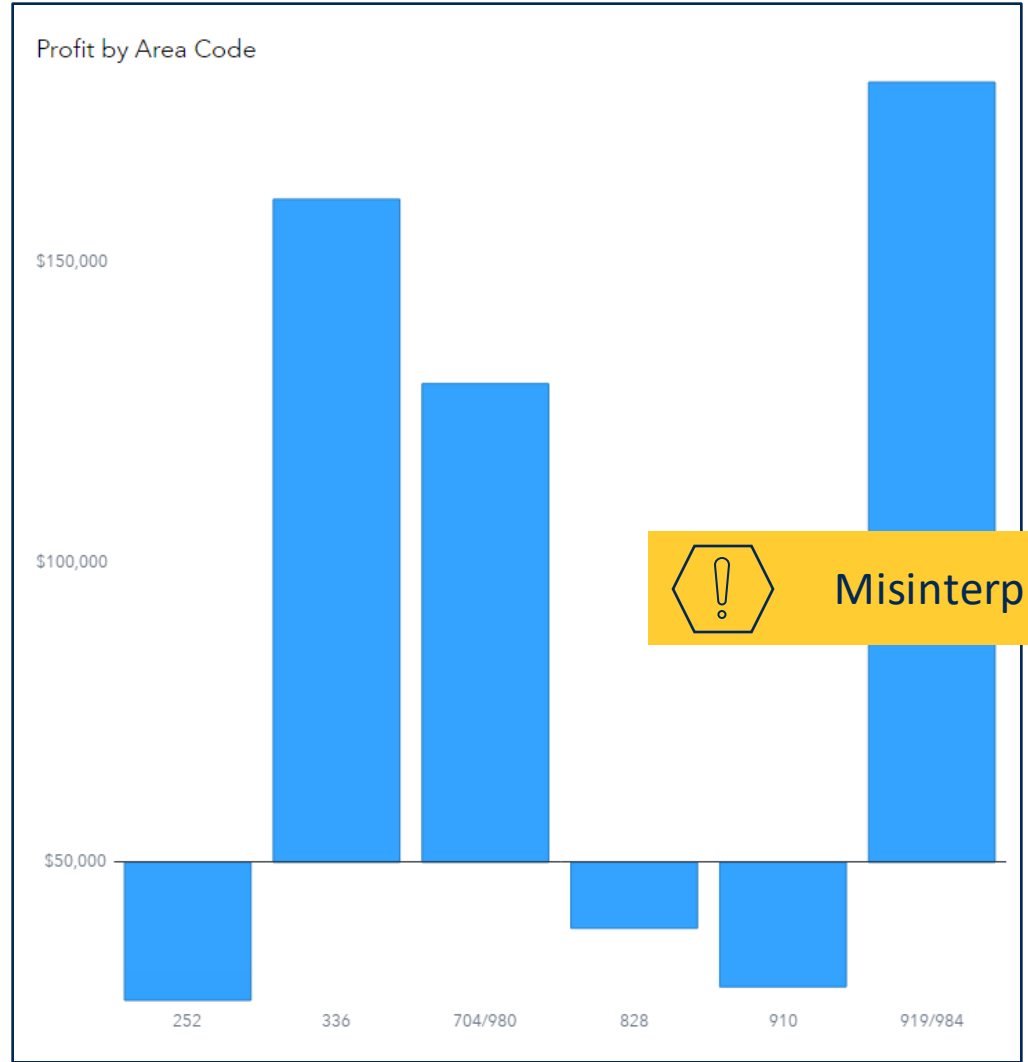
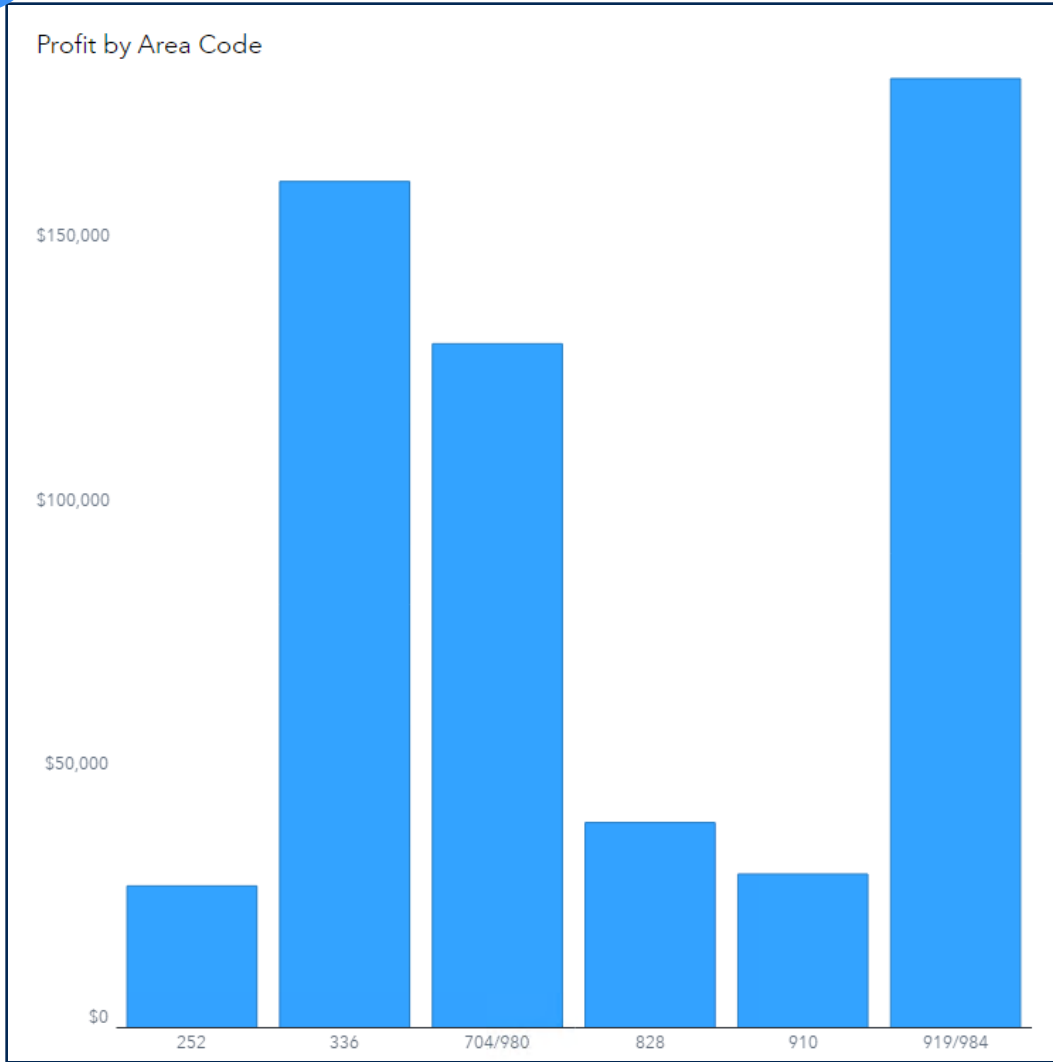
Keep graphs simple





Choose the Best Chart (Best Practices)

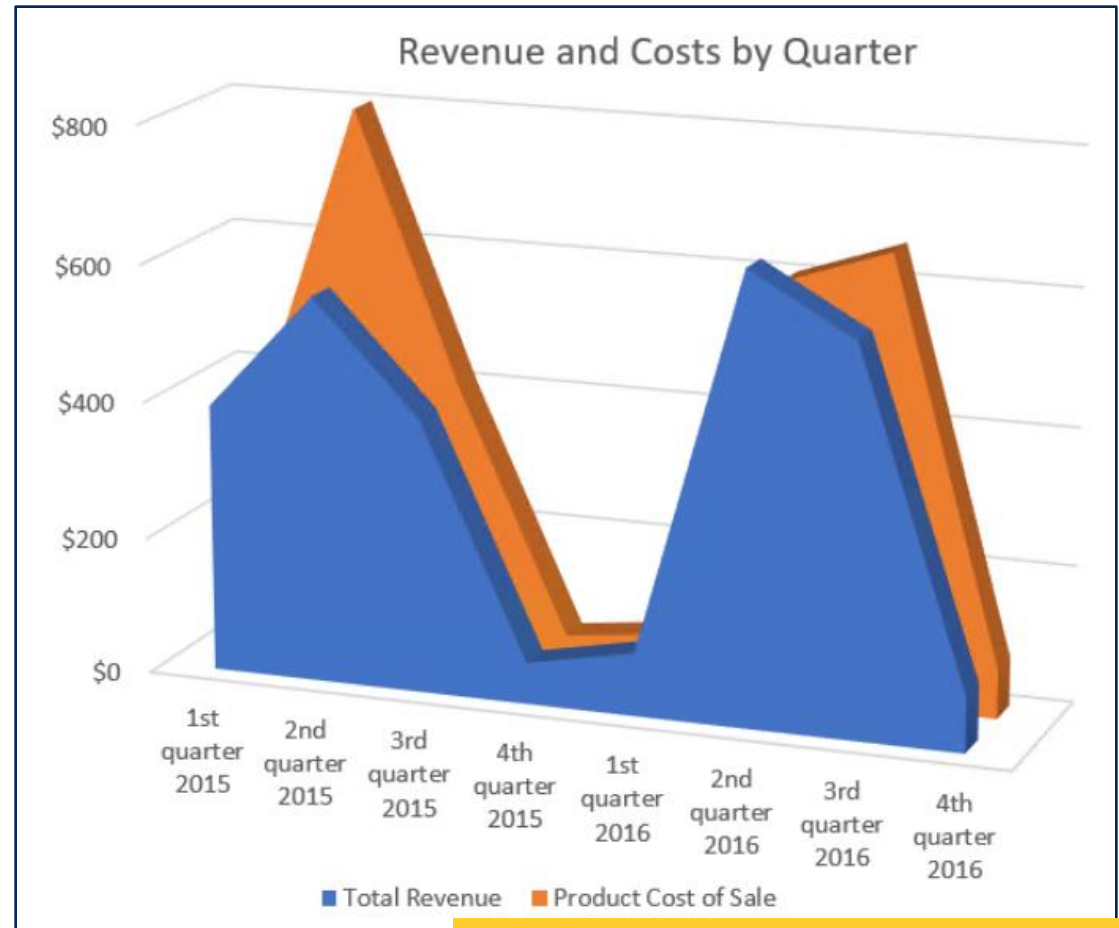
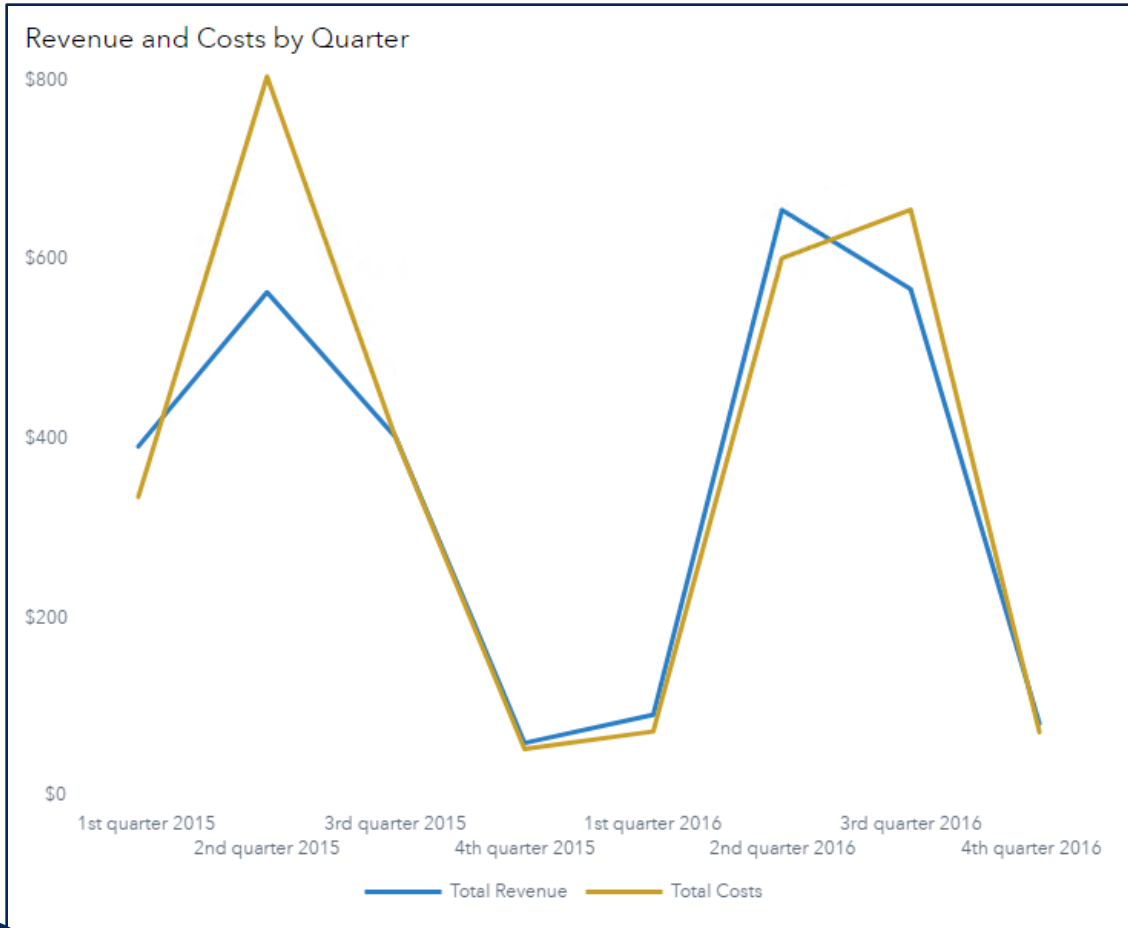
Use a zero baseline





Choose the Best Chart (Best Practices)

Use two-dimensional charts



For multi-line charts, rotate attributes for data element styles

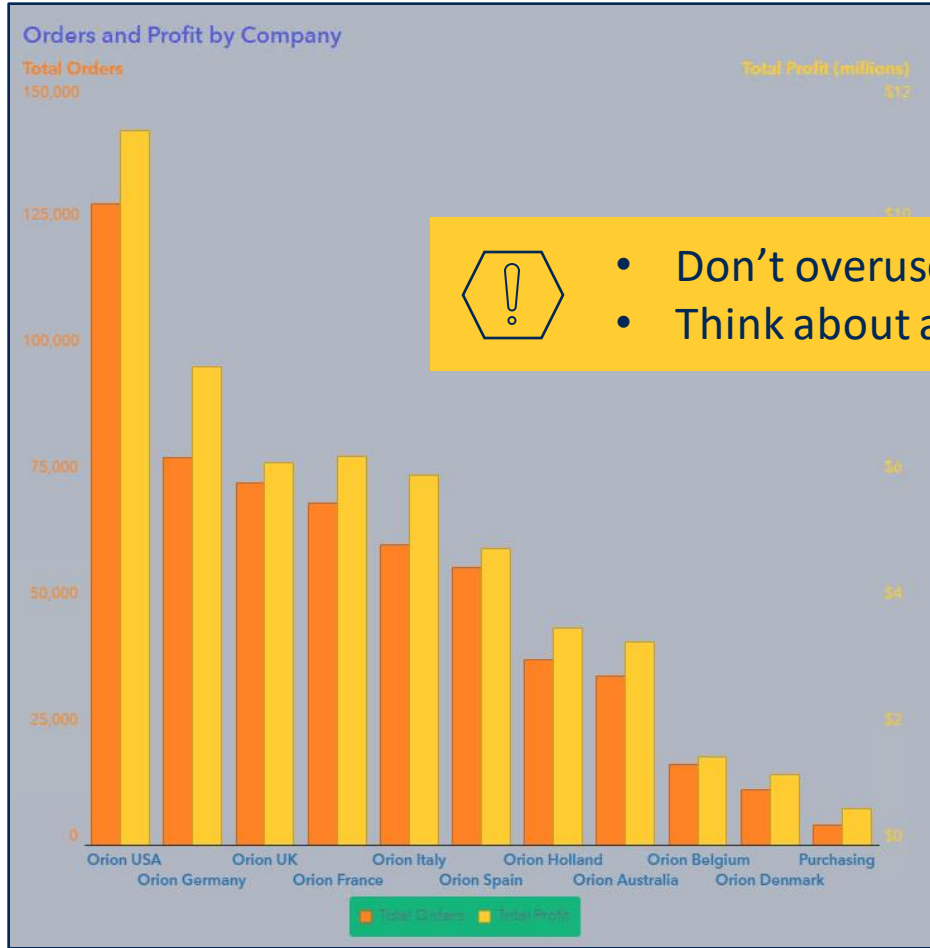
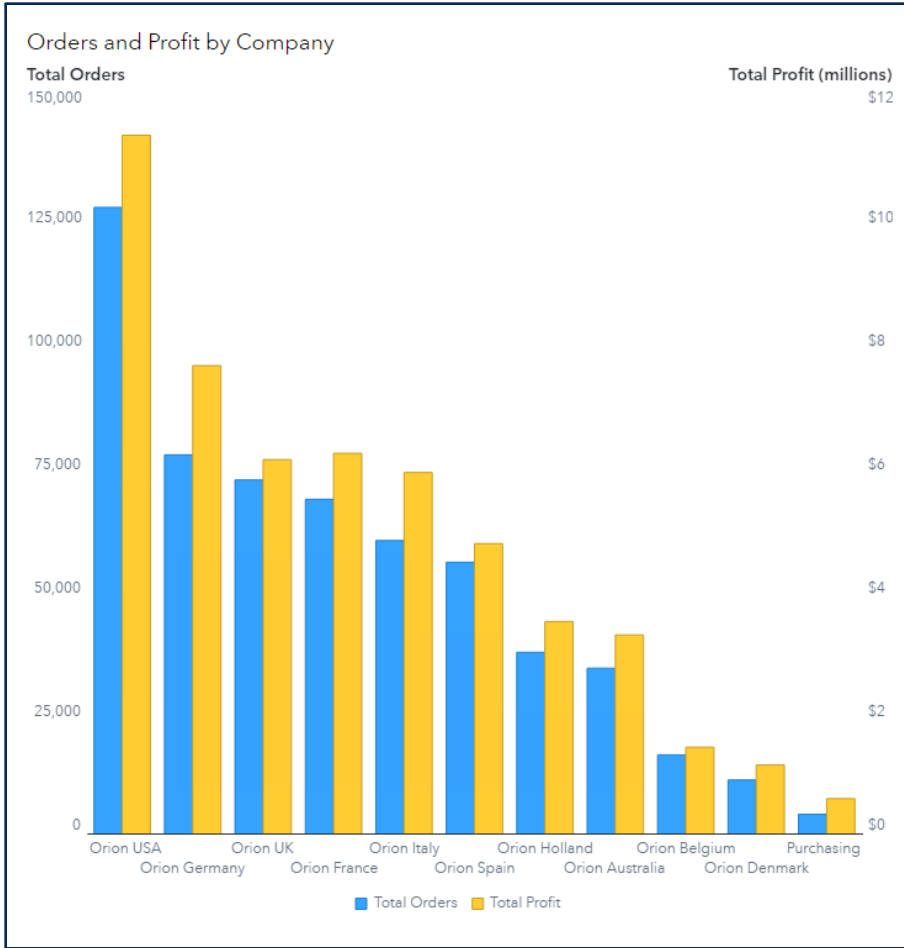


- Miss vital information
- Distorts data



Choose the Best Chart (Best Practices)

Choose colors wisely

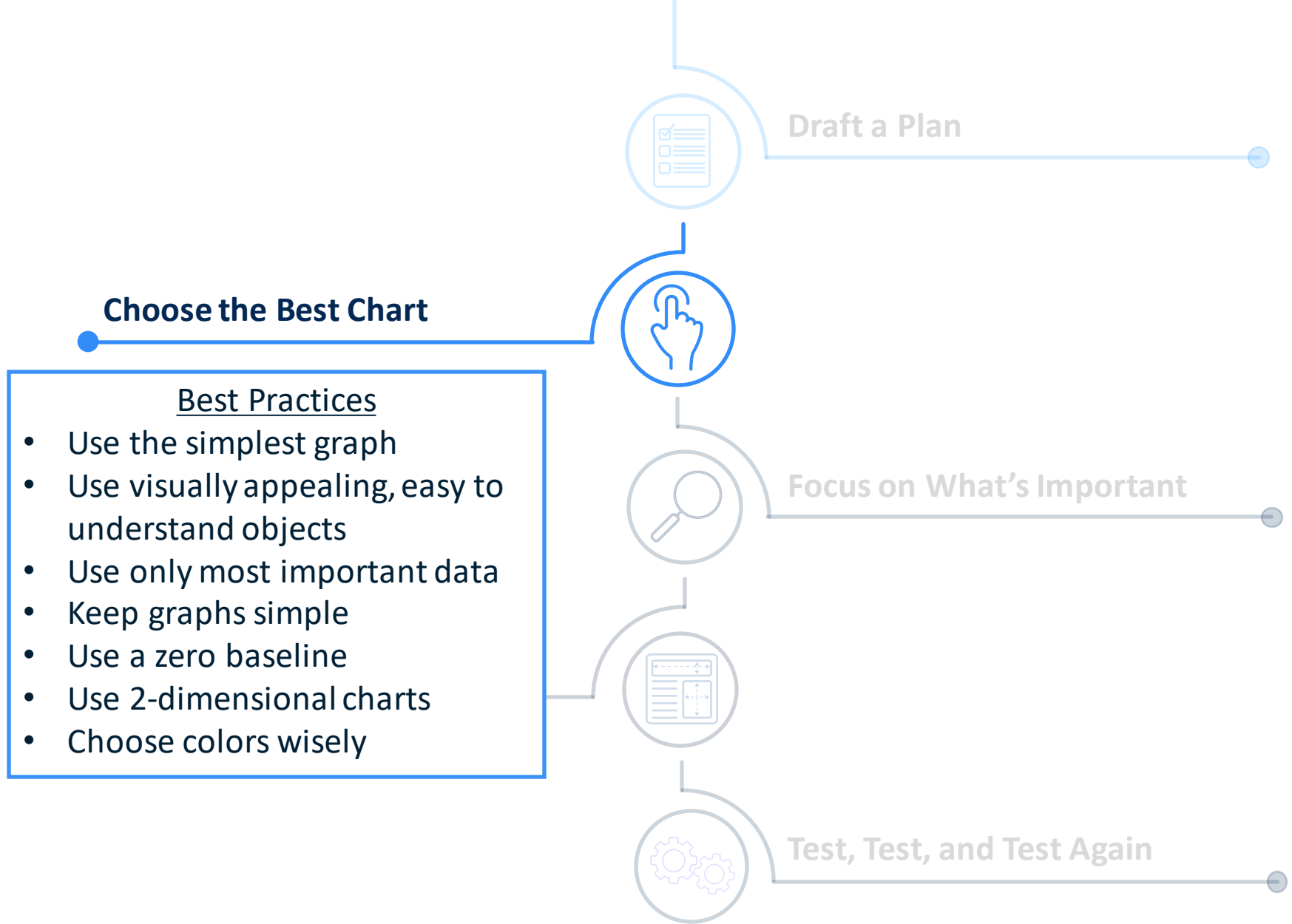


Create custom themes to customize the color palette

Above all else, show the data.

Edward Tufte

- Godfather of data visualization





Draft a Plan



Choose the Best Chart

Presentation

- Highlighting one important fact
- Comparing two or more things
 - General
 - Over time
 - Against benchmark
- Showing survey or questionnaire results
- Describing how parts relate to the whole
- Showing relationship between data items
- Is a graph required?



Focus on What's Important

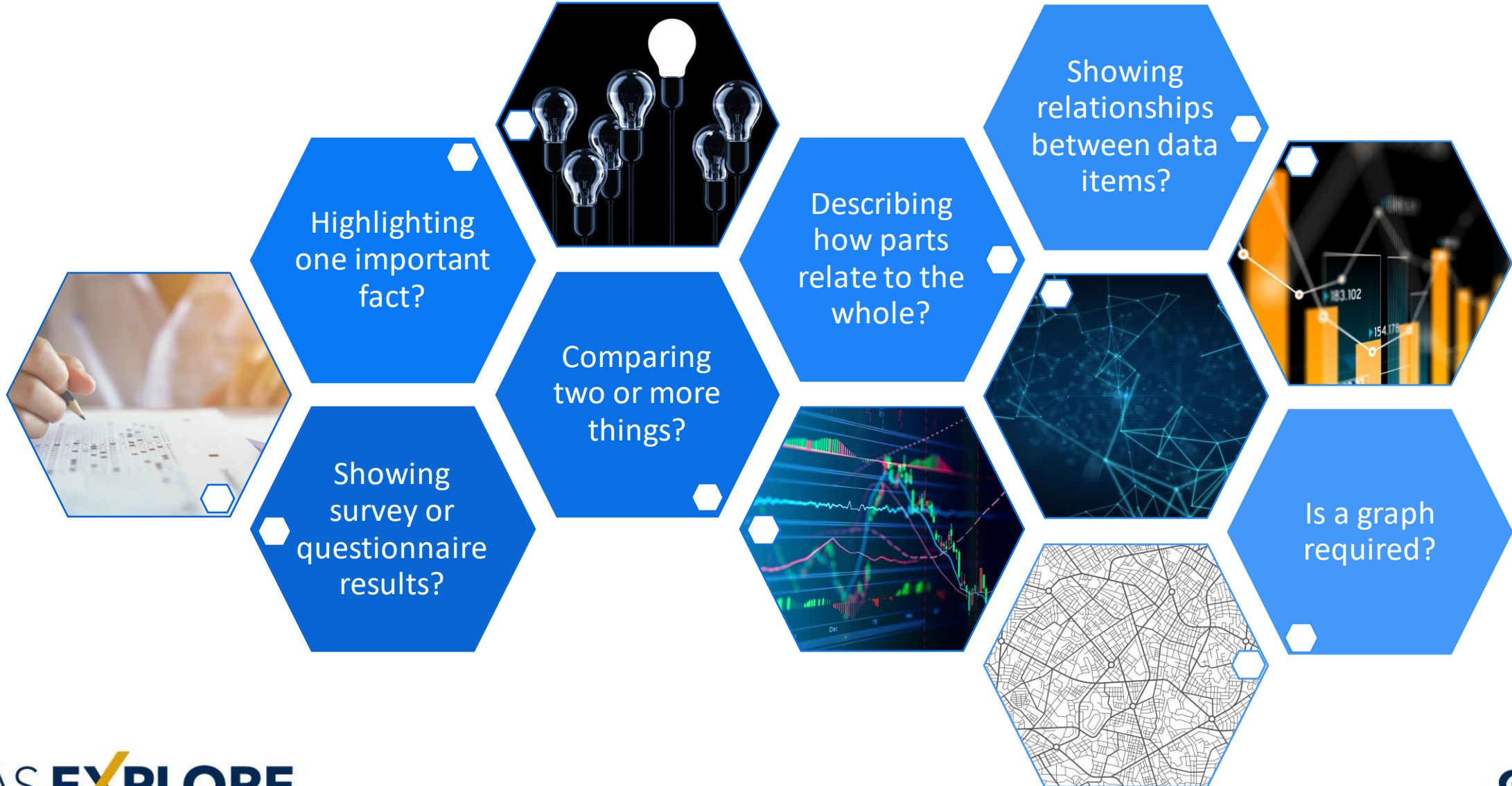


Test, Test, and Test Again



Choose the Best Chart (Presentation)

Which chart do I choose?





Choose the Best Chart (Presentation)

Highlight one important fact

Key value object

Customer Satisfaction

47%

Donut chart

Quantity Ordered by Order Type

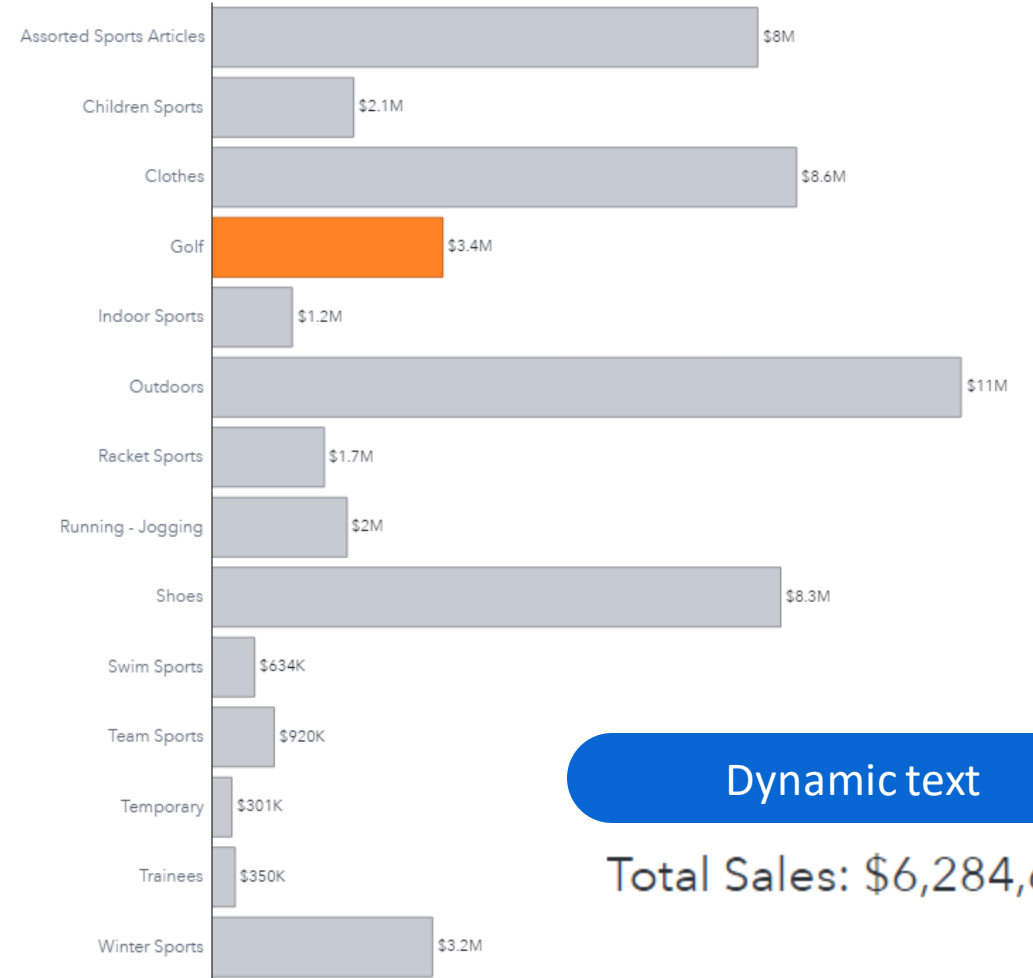


Order Type

- Retail Sale
- Catalog Sale
- Internet Sale

Faded bar chart

Total Profit by Group



Dynamic text

Total Sales: \$6,284,652



Use display rules to highlight important values

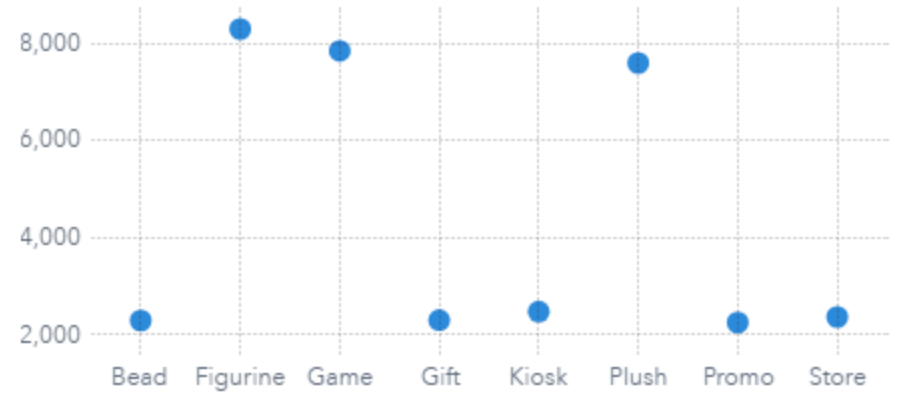


Choose the Best Chart (Presentation)

Compare two or more things (General)

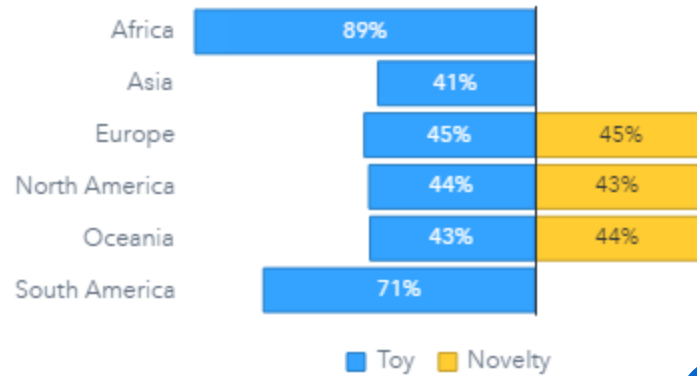
Dot plot

Number of Orders by Product Line

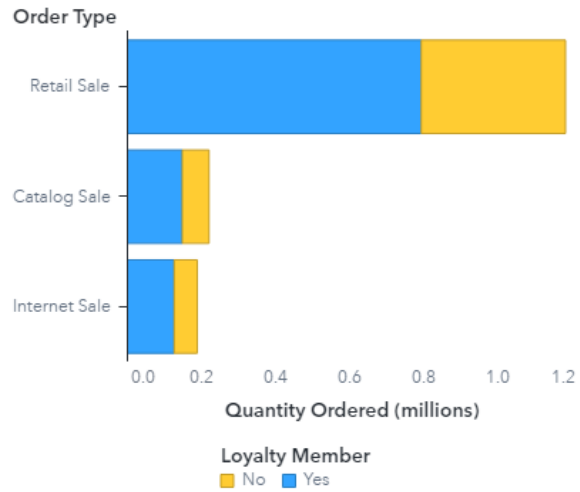


Butterfly chart

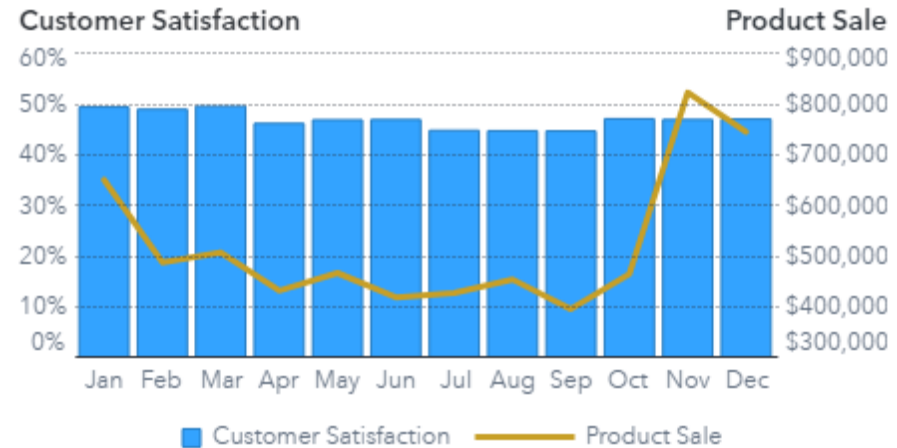
Customer Satisfaction by Continent



Bar chart



Dual axis chart



Cautiously consider fixed axis ranges

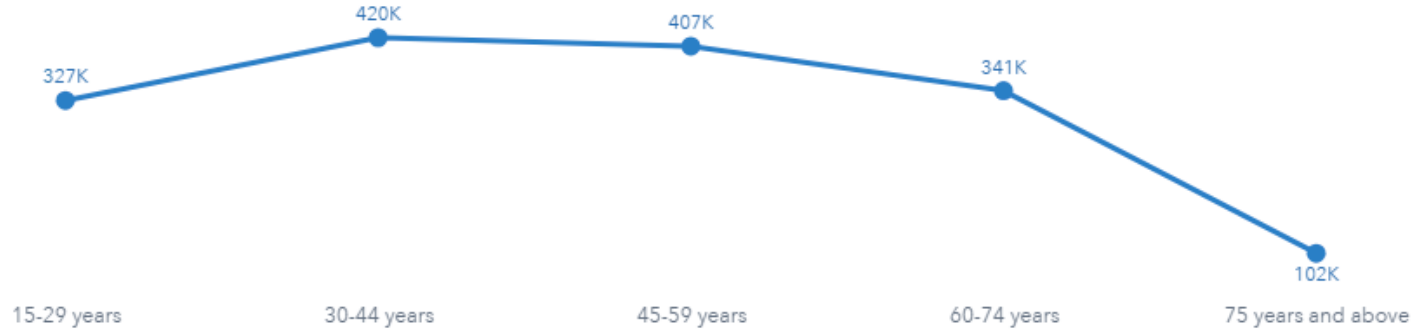


Choose the Best Chart (Presentation)

Compare two or more things
(Over time)

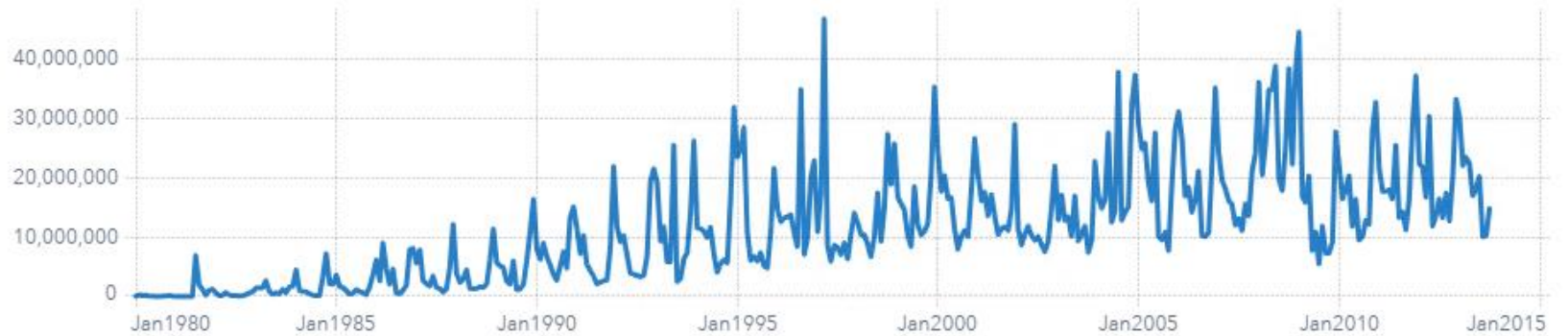
Line chart

Quantity Ordered by Customer Age Group



Time series plot

Total Sales Over Time



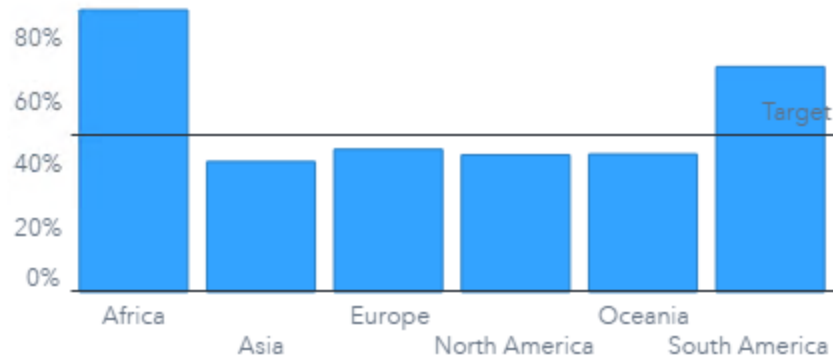
Avoid using an overview axis, use animation with caution



Choose the Best Chart (Presentation)

Reference lines

Customer Satisfaction by Facility Continent



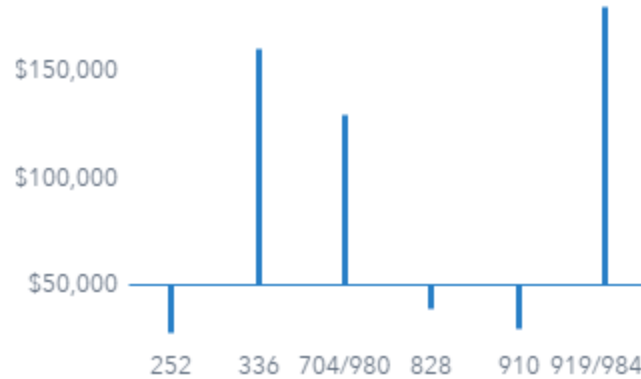
Avoid three-color gradients

SAS EXPLORE

Compare two or more things (Benchmark)

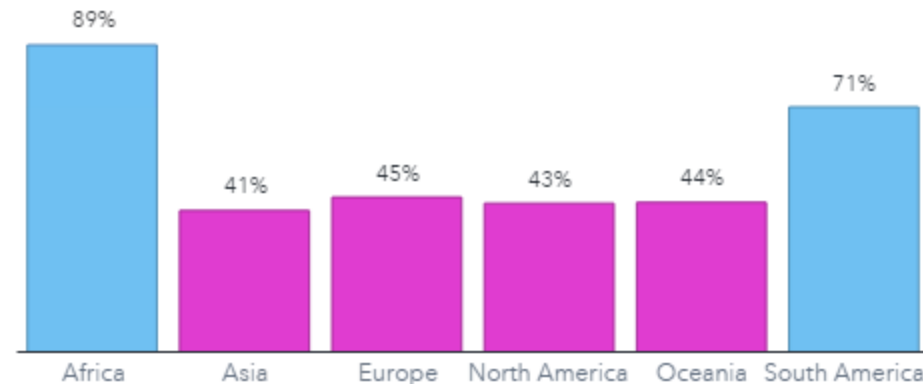
Needle plot

Profit by Area Code



Display rules

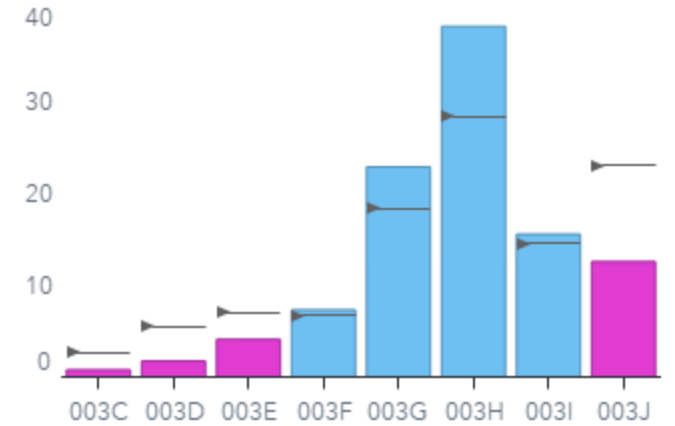
Customer Satisfaction by Facility Continent



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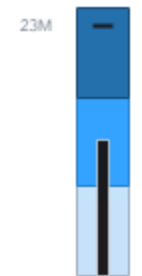
Targeted bar chart

Total Sales (millions)



Bullet gauge

Sales Goal



13M



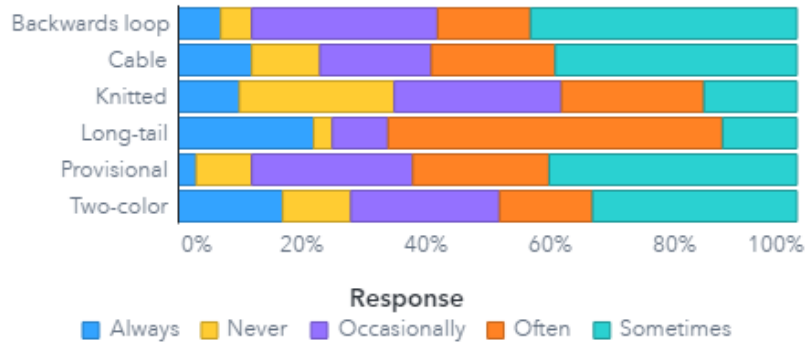


Choose the Best Chart (Presentation)

Show survey or questionnaire results

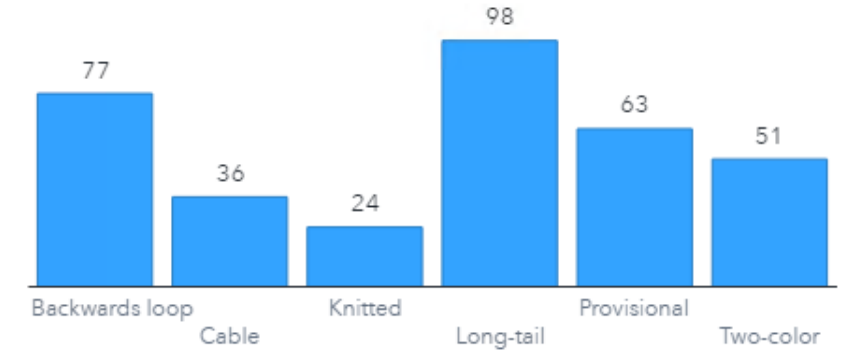
Stacked bar chart

How often do you use these cast on methods?



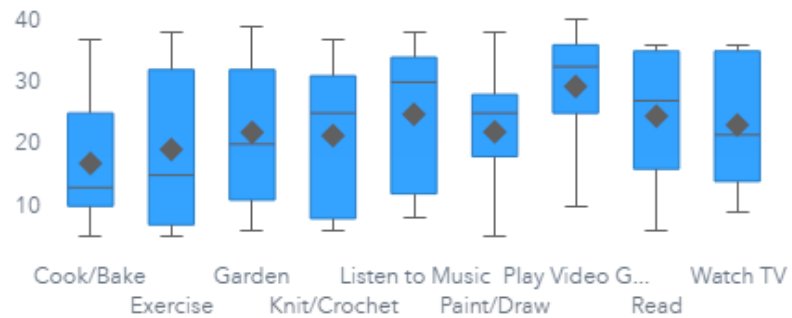
Vertical bar chart

Which cast on methods do you use regularly?



Box plots

How many hours a week do you ...?



Crosstab

Average hours spent per week

Question	Answer
Cook/Bake	16.9
Exercise	19.1
Garden	21.9
Knit/Crochet	21.4
Listen to Music	24.8
Paint/Draw	22
Play Video Games	29.3
Read	24.5
Watch TV	23.1

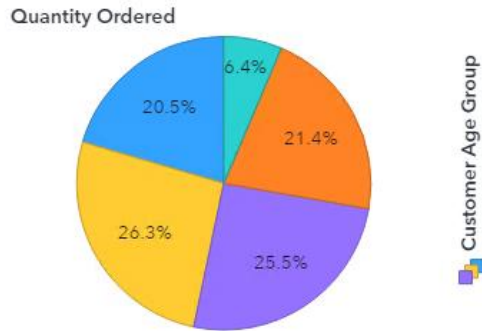


Choose the Best Chart (Presentation)

Donut chart



Pie chart

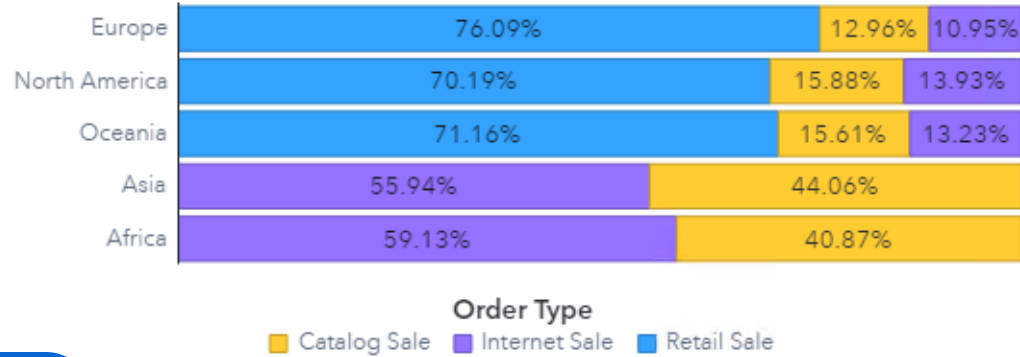


Use pie charts sparingly

Describe how parts relate to the whole

Stacked bar chart

Quantity Ordered by Continent and Order Type



Geo map

Customer Locations

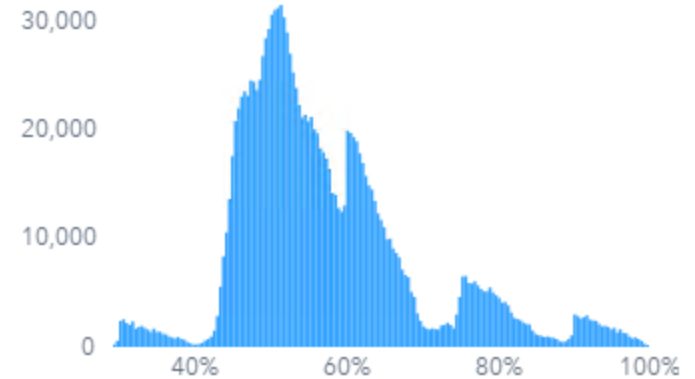


Treemap



Histogram

Distribution of Vendor Satisfaction





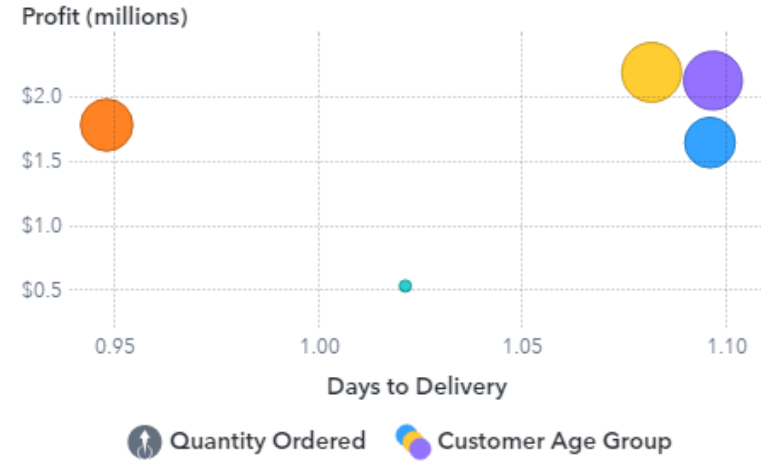
Choose the Best Chart (Presentation)

Show relationships between data items

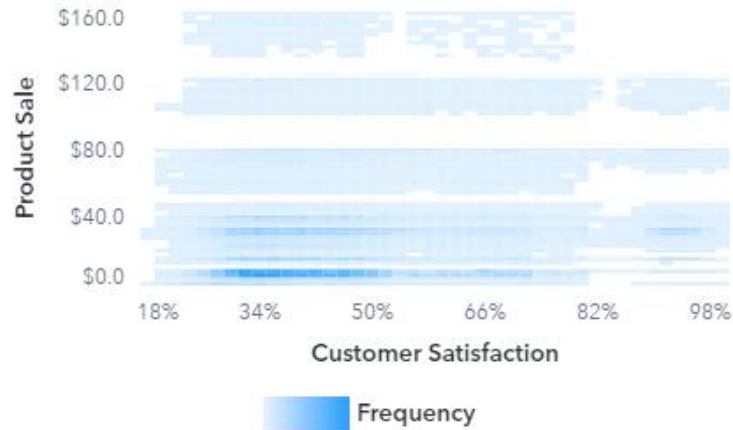
Scatterplot



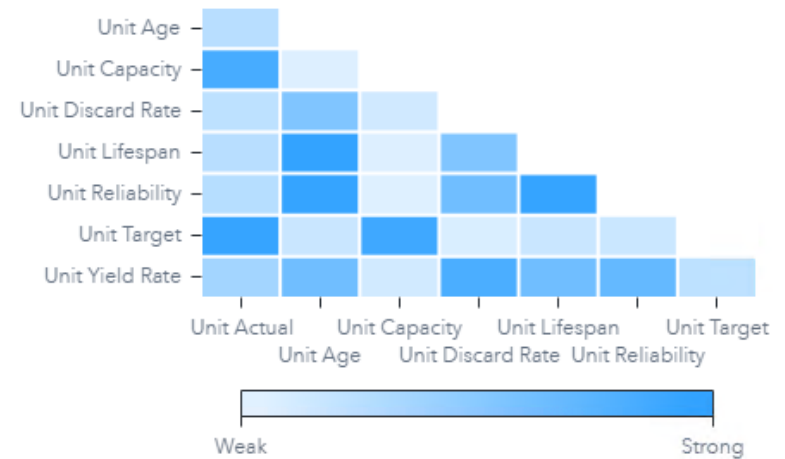
Bubble plot



Heat map



Correlation matrix



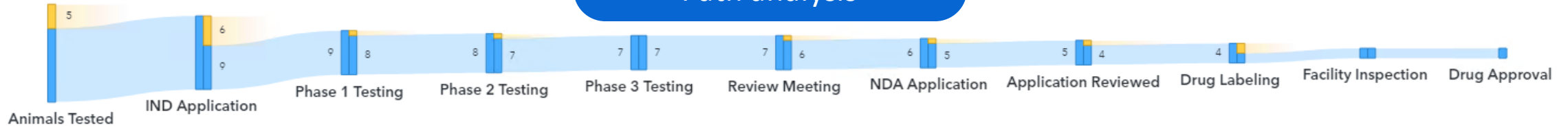
Limit digits after decimal points



Choose the Best Chart (Presentation)

Show relationships between data items

Path analysis



Text object

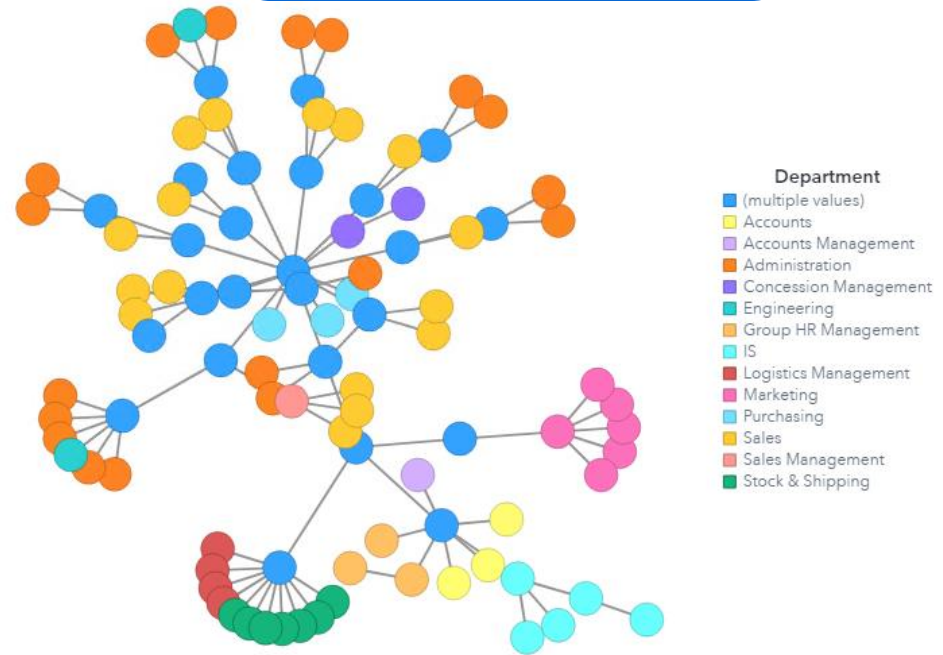
Moving To-Do List

- Schedule movers
- Obtain packing supplies
- Cancel existing utilities
- Start new utilities
- Pack
- Change address
- New driver's license
- Register car
- Register to vote
- Find new providers

Path Frequency by Link

Drop Off

Network diagram



Ensure legends can be displayed on all screen sizes



Choose the Best Chart (Presentation)

Is a graph required?

Word cloud



Images

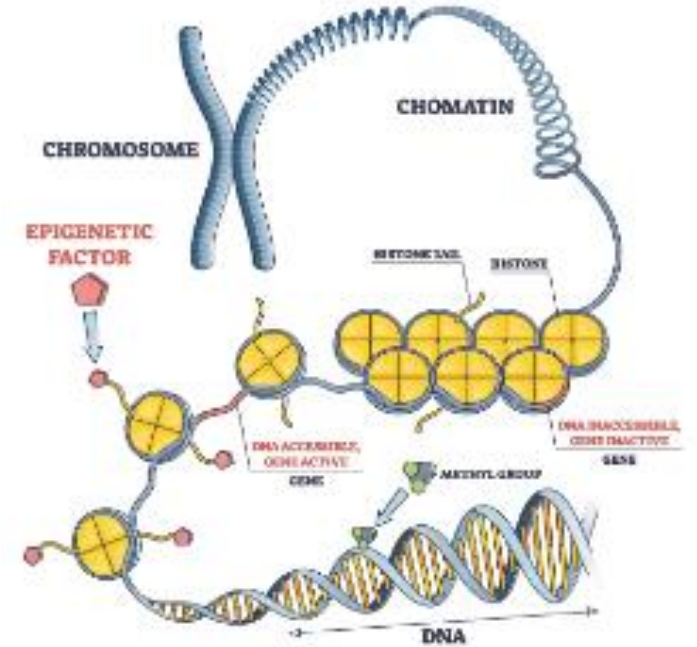


Text object

Average customer satisfaction is higher in South America, but average product quality is the same. Perhaps the additional product lines in Europe (Kiosk, Bead, Store, Promo, and Gift) account for the lower satisfaction scores.

Illustrations

EPIGENETIC MECHANISMS



Limit sensitivity characteristics (size, shape, position)

“...the only thing worse than a pie chart is several of them.” – Edward Tufte

“Save the pies for dessert.” – Stephen Few



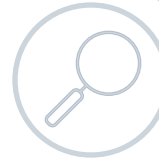
Draft a Plan



Choose the Best Chart

Presentation

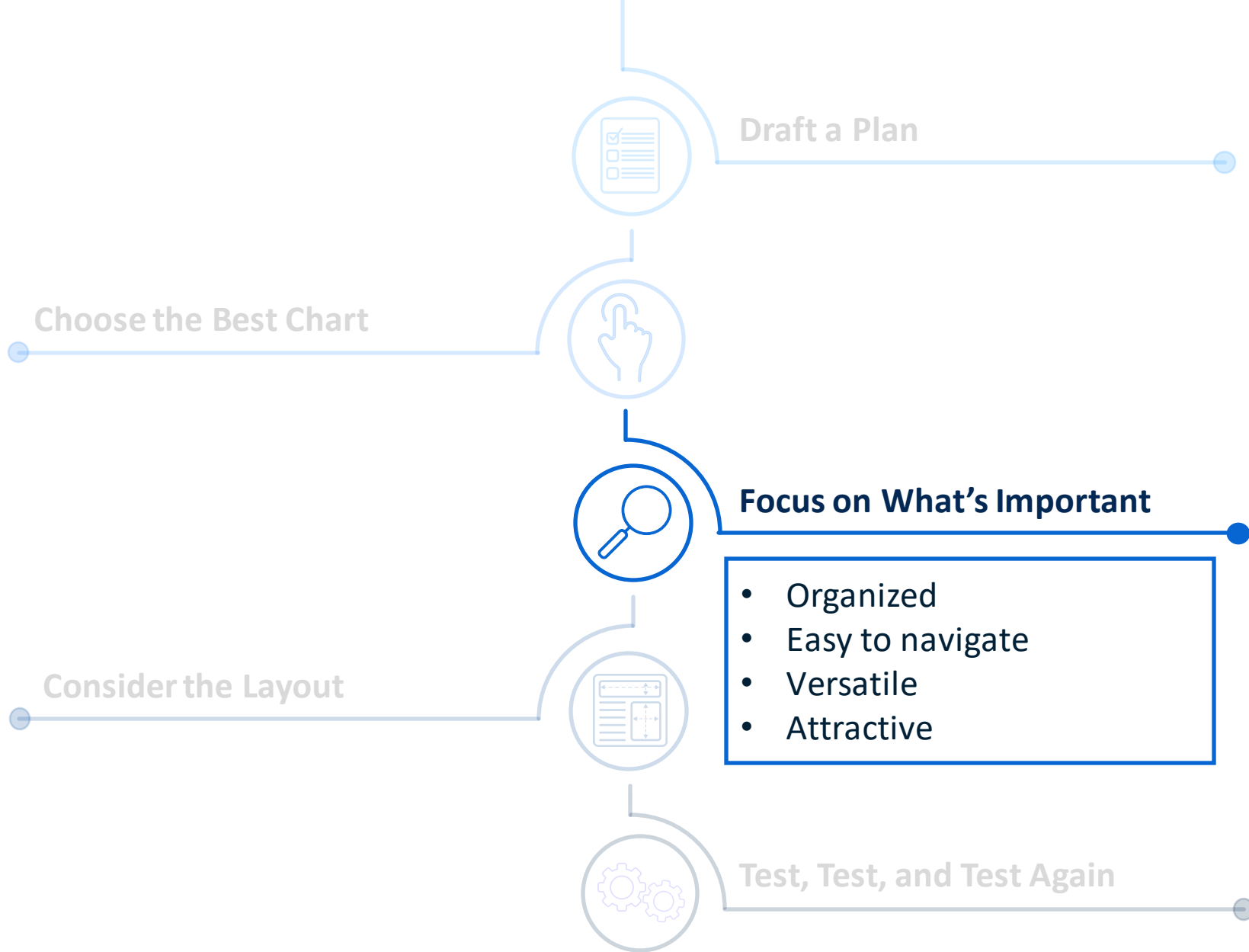
- Highlighting one important fact
- Comparing two or more things
 - General
 - Over time
 - Against benchmark
- Showing survey or questionnaire results
- Describing how parts relate to the whole
- Showing relationship between data items
- Is a graph required?



Focus on What's Important



Test, Test, and Test Again

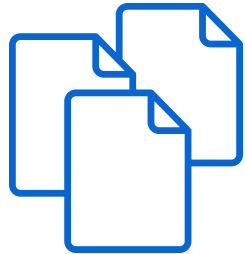




Focus on What's Important

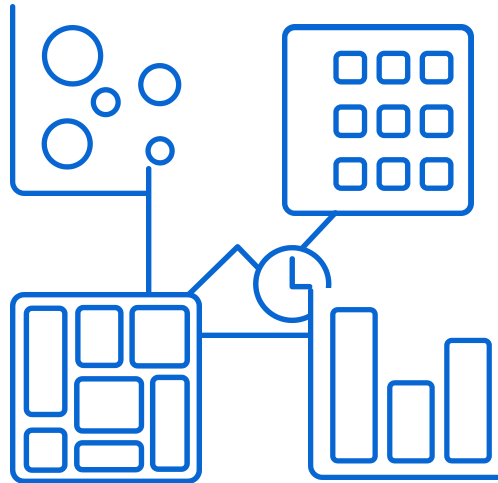
Organized

Focus on a single idea



Multiple pages

Limit the number of objects



Use hidden and pop-up pages to provide details



Stand on its own



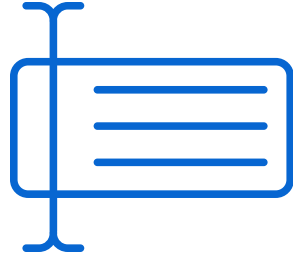
Limit the number of pages





Focus on What's Important

Easy to navigate



ADD DESCRIPTIONS

- Use clear, detailed titles
- Add additional details and numbers, when needed



ADD INSTRUCTIONS

- Table of contents
- Introductory page
- Instructions for each page
- Explain report actions

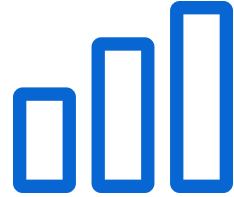


Use consistent fonts, provide details for keyboard shortcuts



Focus on What's Important

Versatile



Ranks

- Focus on important values
- Identify leaders or laggards



Actions

- Add interactivity
- Aid in self discovery



Viewer customization

- Modify options
- Change chart types
- Select the data



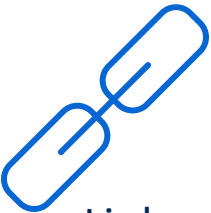
Animation

- View changes over time
- Focus on differences



Prompts

- Focus on specific areas
- Filter report or page



Links

- Provide additional information



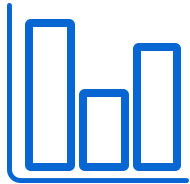
Use automatic actions to speed up development



Focus on What's Important



Styles



Display rules



Specify labels for display rules, choose WCAG-compliant colors

Attractive

Excitement
Energy
Passion
Love
Danger
Revolution

Happiness
Optimism
Warmth
Joy
Cowardice
Caution

Nature
Freshness
Wealth
Youth
Depression
Jealously

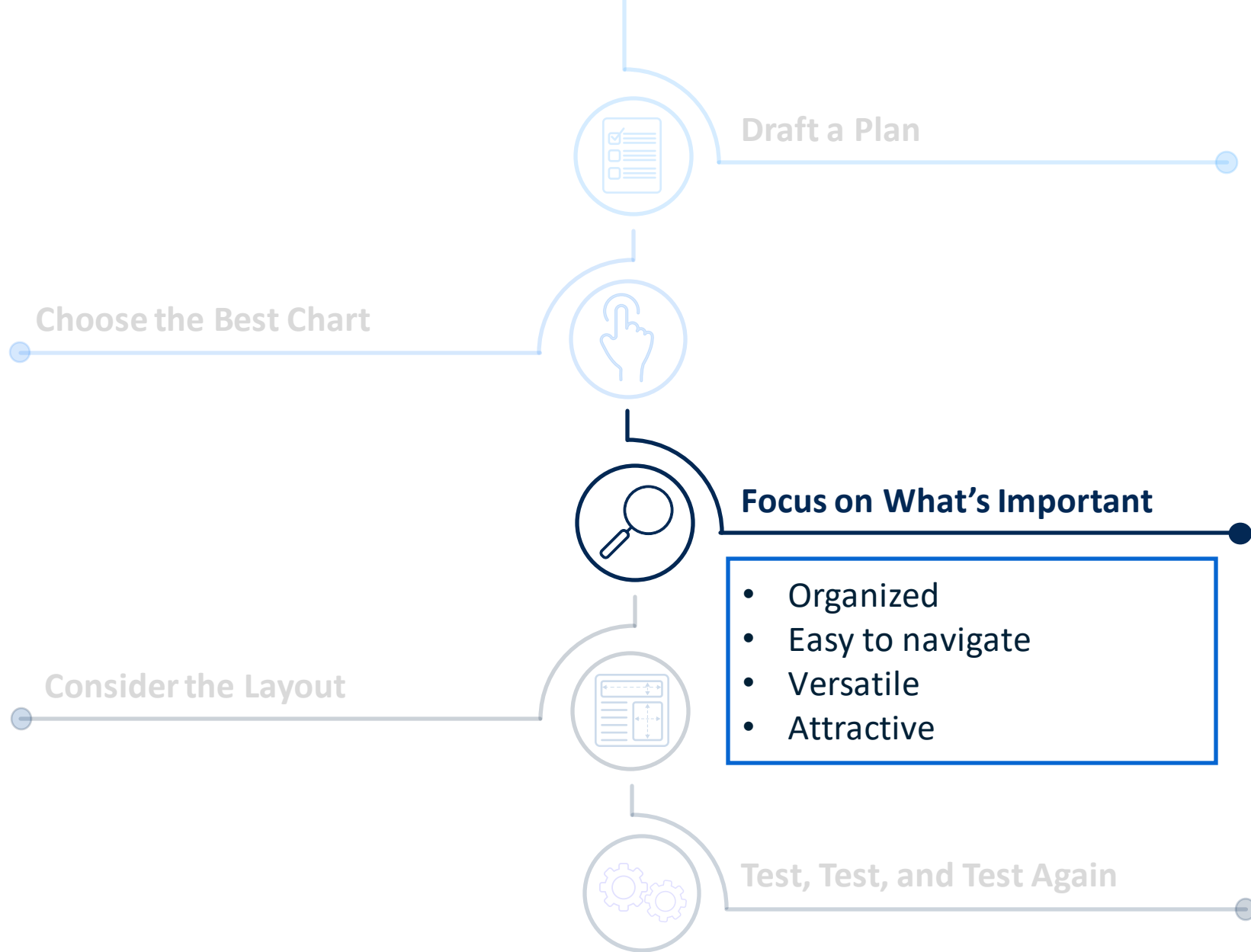
Warmth
Autumn
Visibility
Harvest

Royalty
Wealth
Nobility
Honor

Immortality
Peace
Trust
Security
Sadness

Purity
Elegance
Peace
Cleanliness

Sophistication
Mystery
Formality
Death
Mourning
Illness





Draft a Plan



Focus on What's Important



Test, Test, and Test Again



- Limit the number of pages
- Limit the number of objects
 - Make more important objects larger
 - Consider placement of objects
 - Arrange objects with actions in a logical order
 - Use negative space
 - Use the default grid layout or containers

Consider the Layout



Consider the Layout

Limit the number of pages

Table of Contents

:

Draft a Plan

Choose the Best Chart

Focus on What's Important

Consider the Layout

Test, Test, and Test Again

Arrange the pages to advance your data story

Limit the number of pages (less than 6)

Add a table of contents or introductory page

Use page links to control navigation

Use pop-up pages to provide additional details

SAS EXPLORE
Level Up Your Skills in AI and Analytics

Tricks for Report Builders:
Best Practices and Visualization Skills for Designing
Impactful Reports

PAGES

Select a link to navigate to the page in the report and then follow the instructions on the page.

- [Draft a Plan](#)
- [Choose the Best Chart](#)
- [Focus on What's Important](#)
- [Consider the Layout](#)
- [Test, Test, and Test Again](#)

This report uses the data from these sources. Please contact the report designer with any questions.

Vilano Surf Co. 2017 Annual Report

OVERVIEW

Lorem Ipsum has been the industry's standard dummy text ever since the 1500s, when an unknown printer took a galley of type and scrambled it to make a type specimen book.

[Breakdown of Report Interactions](#)

UPDATE SCHEDULE

The date sourced in this report will be updated once a week following the initial release.

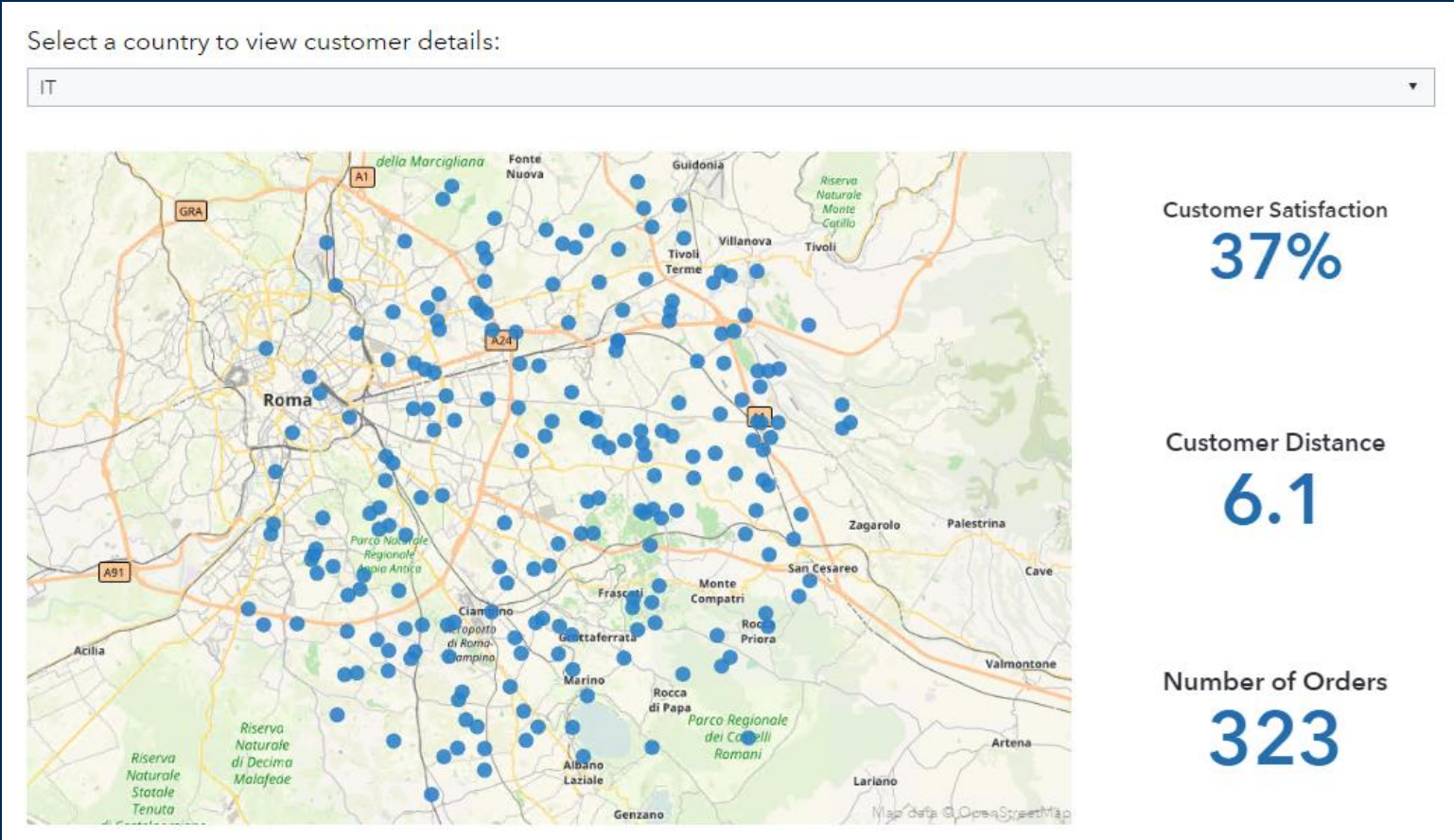
This report was last updated on: September 19, 2017 02:11:33 PM

For more information about this report, contact John Smith at john.smith@email.com.



Consider the Layout

Make more important objects larger



Use page templates to speed up development



Consider the Layout

Consider the placement of objects

Focal point

EXPENSES

Below are the expense details for the top selling Facility in 2017.

[Overview of Page Interactions](#)

\$451,146,770
Product Material Cost

\$1,140,709,631
Actual Material Cost

\$1,146,425,675
Targeted Product Price

222,270,010
Staffing Expenses

Expenses by State - Select the needle plot to filter the table

Facility City	Facility	Product Material Cost	Growth Over Time	Product Price (tar... ▲
Newark	NJ00178	\$1,117,100		\$3,485,296
Philadelphia	PA00151	\$464,592		\$4,645,916
Manchester	NH00169	\$511,406		\$5,114,062
Joliet	IL00090	\$1,068,235		\$10,682,354
San Diego	CA00135	\$1,133,077		\$11,330,768
Cleveland	OH00144	\$6,025,357		\$18,027,474
Elgin	IL00099	\$1,829,893		\$18,298,931
Birmingham	AL00072	\$1,845,270		\$18,452,703
Corpus Christi	TX00020	\$1,980,300		\$19,802,995

Related objects

South America

Customer Satisfaction **71%** Product Quality **89%**

Number of Orders by Product Line

Europe

Customer Satisfaction **45%** Product Quality **89%**

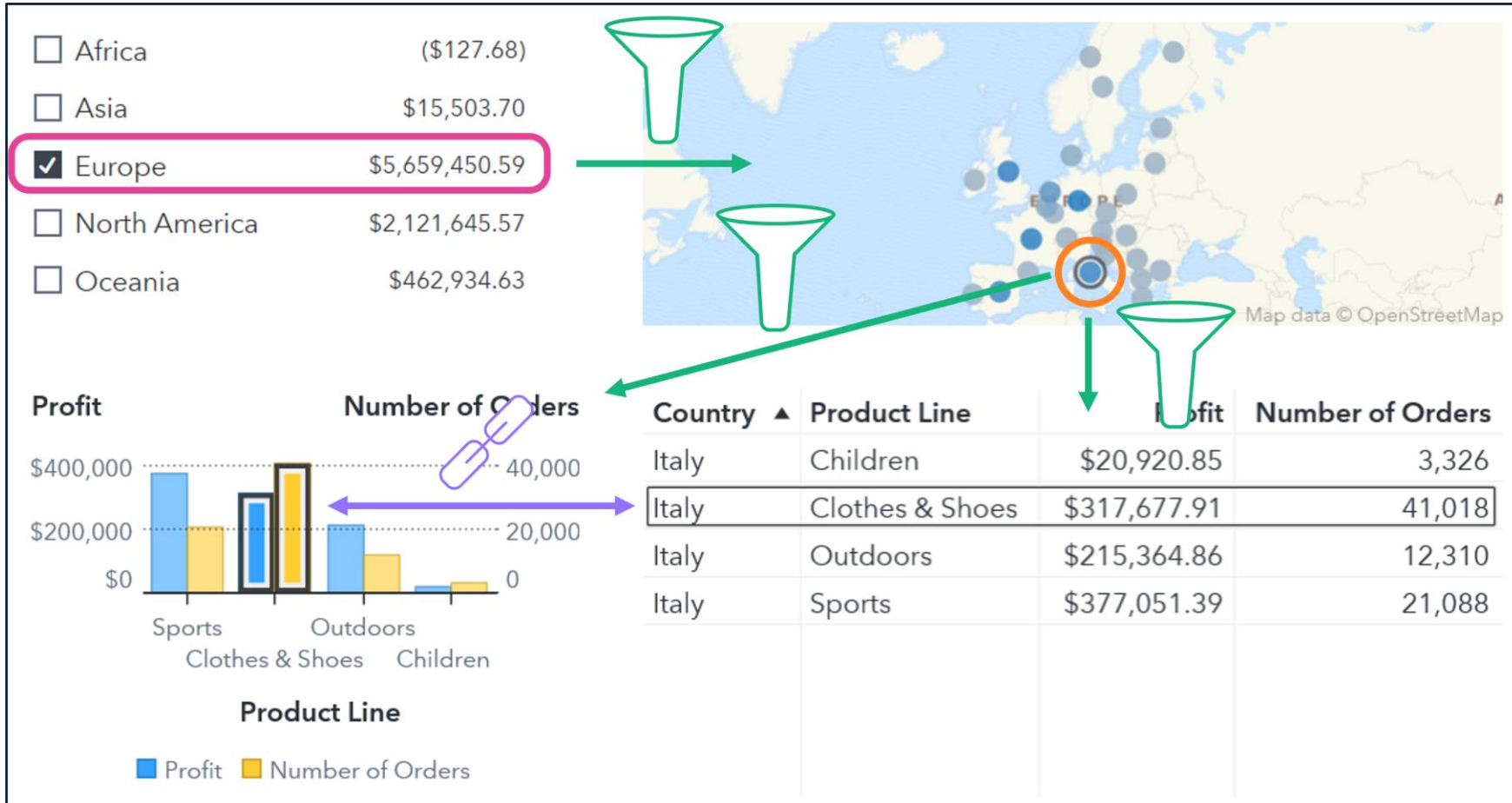
Number of Orders by Product Line

Notice that average customer satisfaction is higher in South America, but average product quality is the same. Perhaps the additional product lines in Europe (Kiosk, Bead, Store, Promo, and Gift) account for the lower satisfaction scores.



Consider the Layout

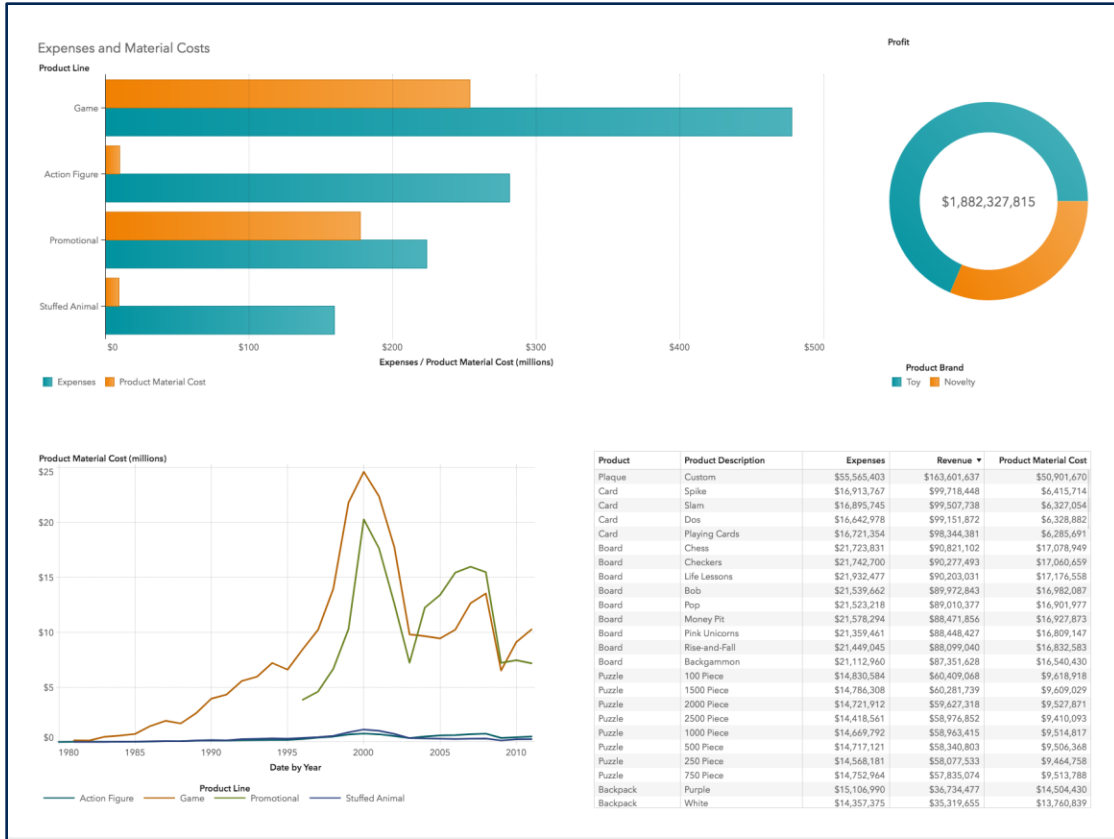
Arrange objects with actions
in a logical order





Consider the Layout

Use negative space



Use caution when modifying padding from default

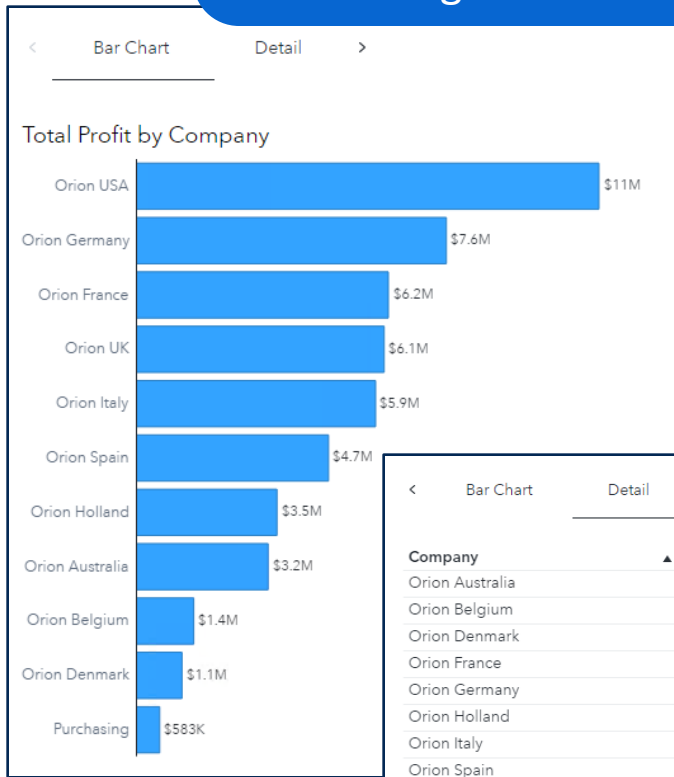


Consider the Layout

Use the default grid layout or containers

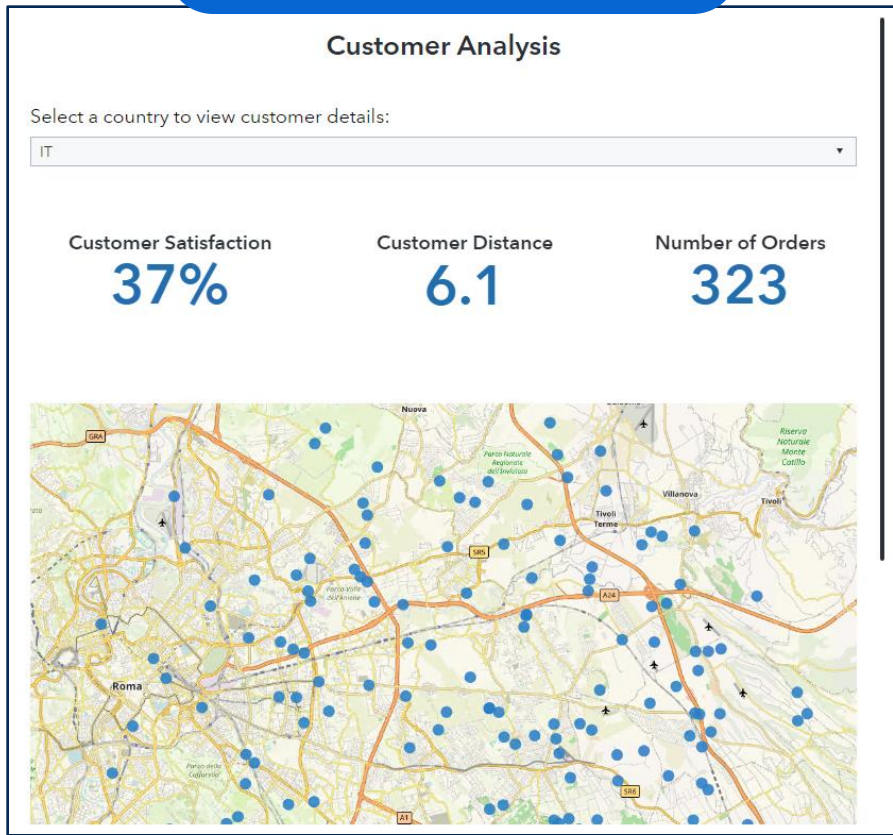
Prompt container

Stacking container



Company	Total Profit
Orion Australia	\$3,236,066.44
Orion Belgium	\$1,416,796.66
Orion Denmark	\$1,128,257.91
Orion France	\$6,178,261.41
Orion Germany	\$7,598,004.94
Orion Holland	\$3,452,916.96
Orion Italy	\$5,866,333.71
Orion Spain	\$4,714,697.53
Orion UK	\$6,075,871.05
Orion USA	\$11,330,640.75
Purchasing	\$583,320.66

Scrolling container



Avoid precision containers

Prompts

Novelty Toy

Plush

- Cheeta
- Dachshunds
- German Shepherds
- Gibbon
- Golden Retrievers
- Gorilla
- Labrador Retrievers
- Leopard
- Lion
- Lioness
- Maine Coon

017JIN

Close

- Limit the number of pages
- Limit the number of objects
 - Make more important objects larger
 - Consider placement of objects
 - Arrange objects with actions in a logical order
 - Use negative space
 - Use the default grid layout or containers

Consider the Layout



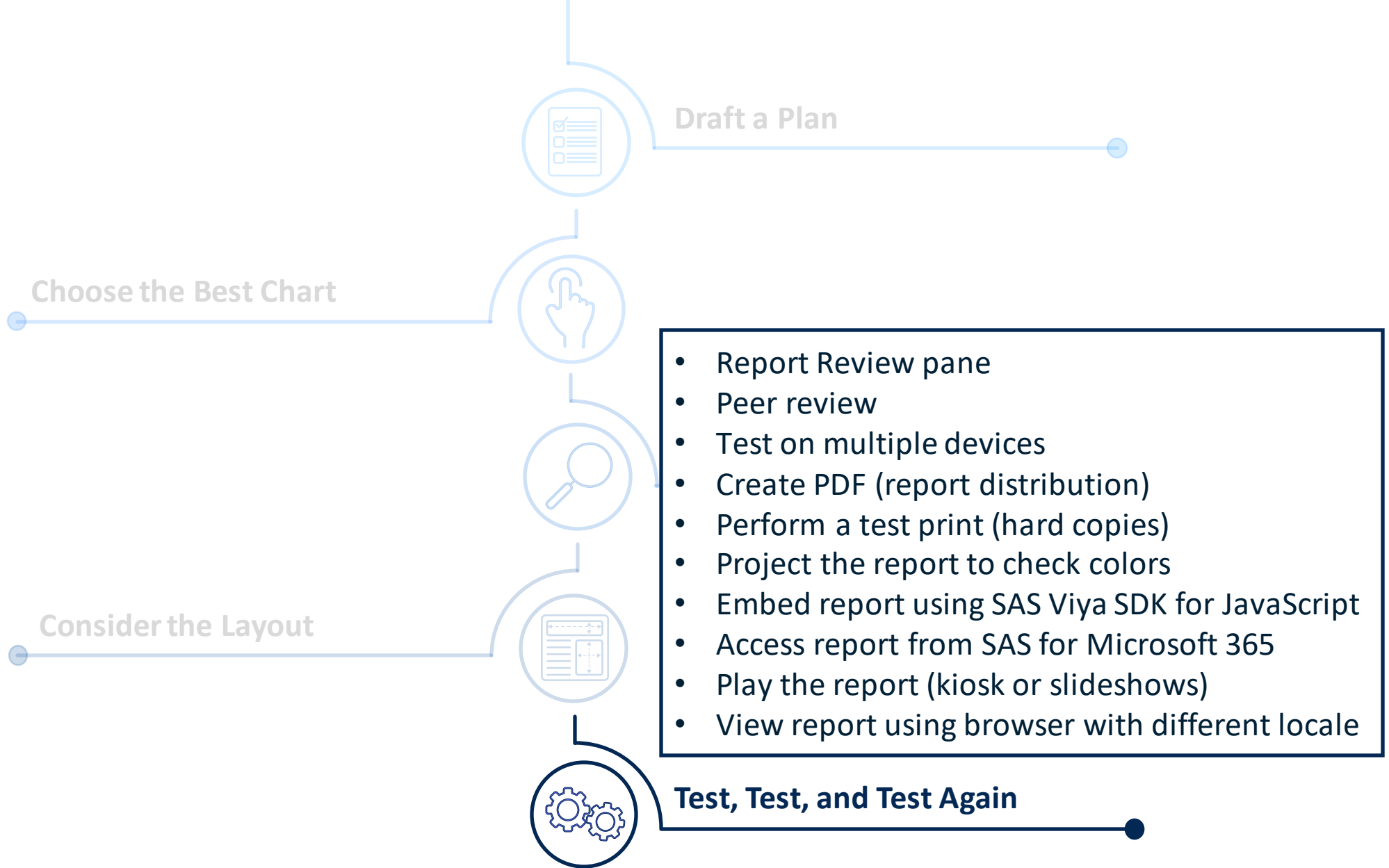
Draft a Plan



Focus on What's Important



Test, Test, and Test Again





Test, Test, and Test Again

Report Review pane

Editing

Page 1

- Data
- Objects
- Suggest
- Outline
- Review**

Report Review

1 2 44

Evaluate Performance

Filter

- > Data Source Count (1)
- > Page Count (1)
- > Unused Data Sources (1)
 - Unused data is assigned to your report. To improve performance, consider removing the unused data.
 - PARKS
- > Color-Dependent Display Rules (4)
- > Lattices (1)
- > Object Count (1)
- > Object Names (33)
- > Unused Calculations (3)
- > User-Defined Formats (2)

Severity

Performance issues

Accessibility issues

Provide meaningful titles for accessibility



Test, Test, and Test Again

Peer review





Test, Test, and Test Again

Test on multiple devices

The image shows a Chrome browser window with the 'More tools' menu open. The 'Developer tools' option is highlighted with a red box. A red arrow points from this box to the 'Device emulation' panel in the developer tools. The 'Device emulation' panel shows a list of virtual devices, including iPhone SE, iPhone XR, iPhone 12 Pro, Pixel 5, Samsung Galaxy S8+, Samsung Galaxy S20 Ultra, iPad Air, iPad Mini, Surface Pro 7, Surface Duo, Galaxy Fold, Samsung Galaxy A51/71, Nest Hub, Nest Hub Max, and Facebook for Android v407 on Pixel 6. The 'Responsive' option is checked, and the dimensions are set to 400 x 844.



Test, Test, and Test Again

Other tests

Create PDF (report distribution)

Perform a test print (hard copies)

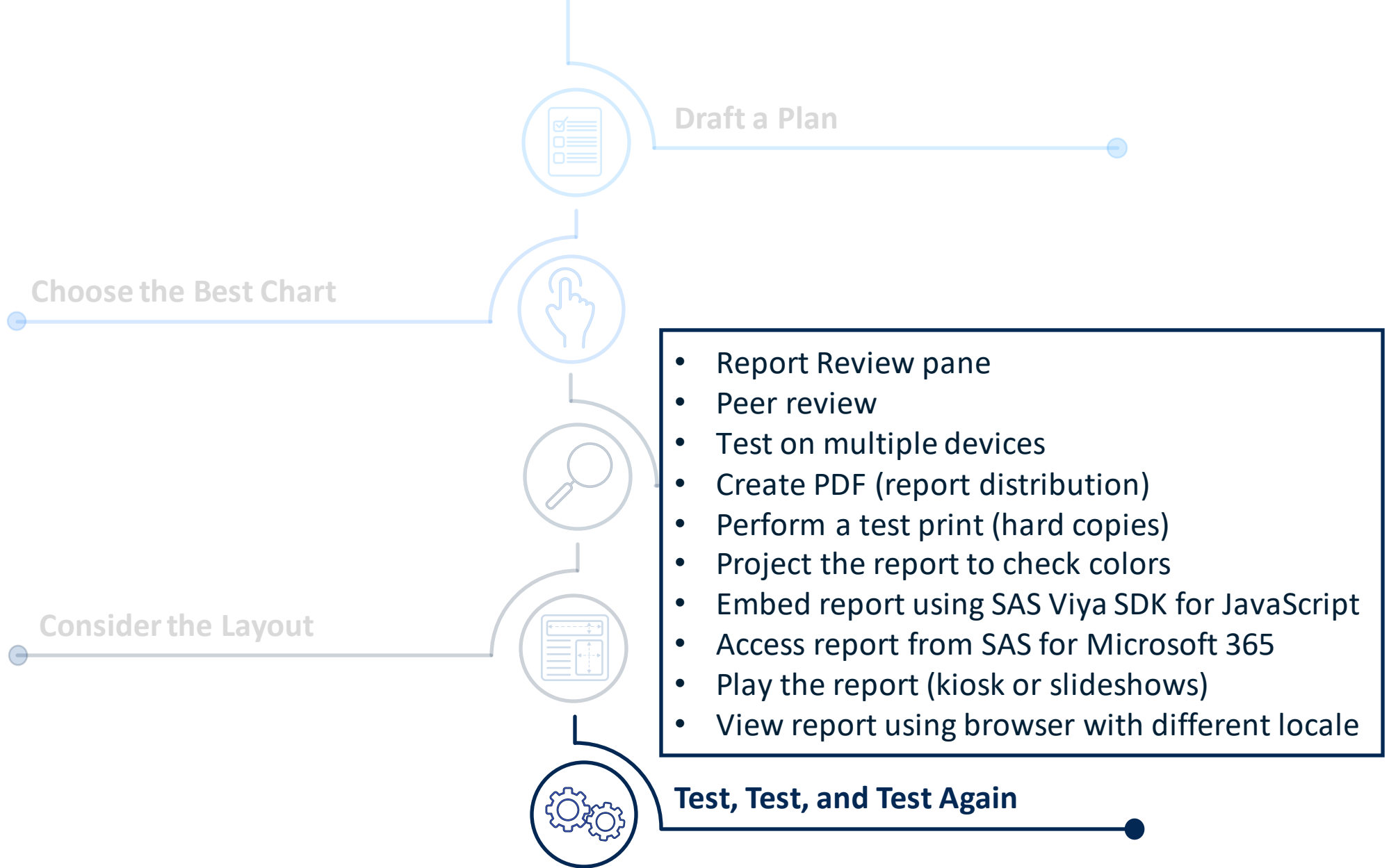
Project the report to check colors

Embed report using SAS Viya SDK for JavaScript

Access report from SAS for Microsoft 365

Play the report (kiosk or slideshows)

View report using browser with different locale



Resources

[Beautiful Reports](#)

[Creating Accessible Reports Using SAS Visual Analytics](#)

[Envisioning Information](#) by Edward Tufte

[Gallery of SAS Visual Analytics Objects](#)

[Telling Your Data Story](#) by Atrin Assa

[Tips and Techniques for Designing the Perfect Layout with SAS Visual Analytics](#) by Ryan Norris and Brian Young

[Tips for Building Rich Interaction in Your SAS Visual Analytics Reports](#) by Jeanne Marie Tan and Sierra Shell

[SAS Visual Analytics Stores are Data With a Soul](#) by Ted Stolarczyk

[The Visual Display of Quantitative Information](#) by Edward Tufte

[Visual Explanations](#) by Edward Tufte

Thank you!

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