

SAS Visual Analytics 101

From ETL to Dashboard Creation

SAS®Institute Canada Inc.

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Marty Hultgren

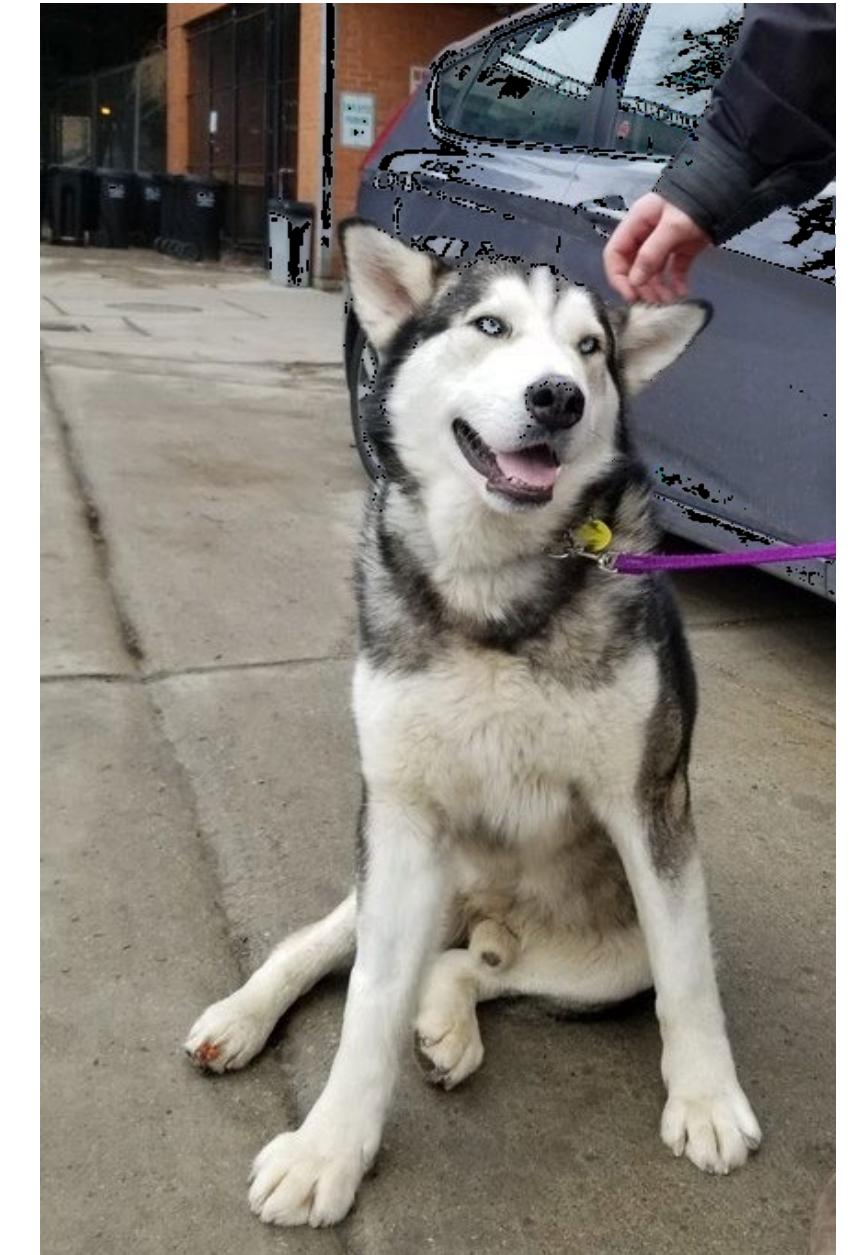


Charu Shankar

With a background in computer systems management. SAS Instructor Charu Shankar engages with logic, visuals, and analogies to spark critical thinking since 2007.

Charu curates and delivers unique content on SAS, SQL, Viya, etc. to support users in the adoption of SAS software.

When not coding, Charu teaches yoga and loves to explore Canadian trails with her husky Miko.



Agenda



- Introduction



- Use principles of good design in reporting



- Explore main report objects in SAS Visual Analytics



- Streamline ETL



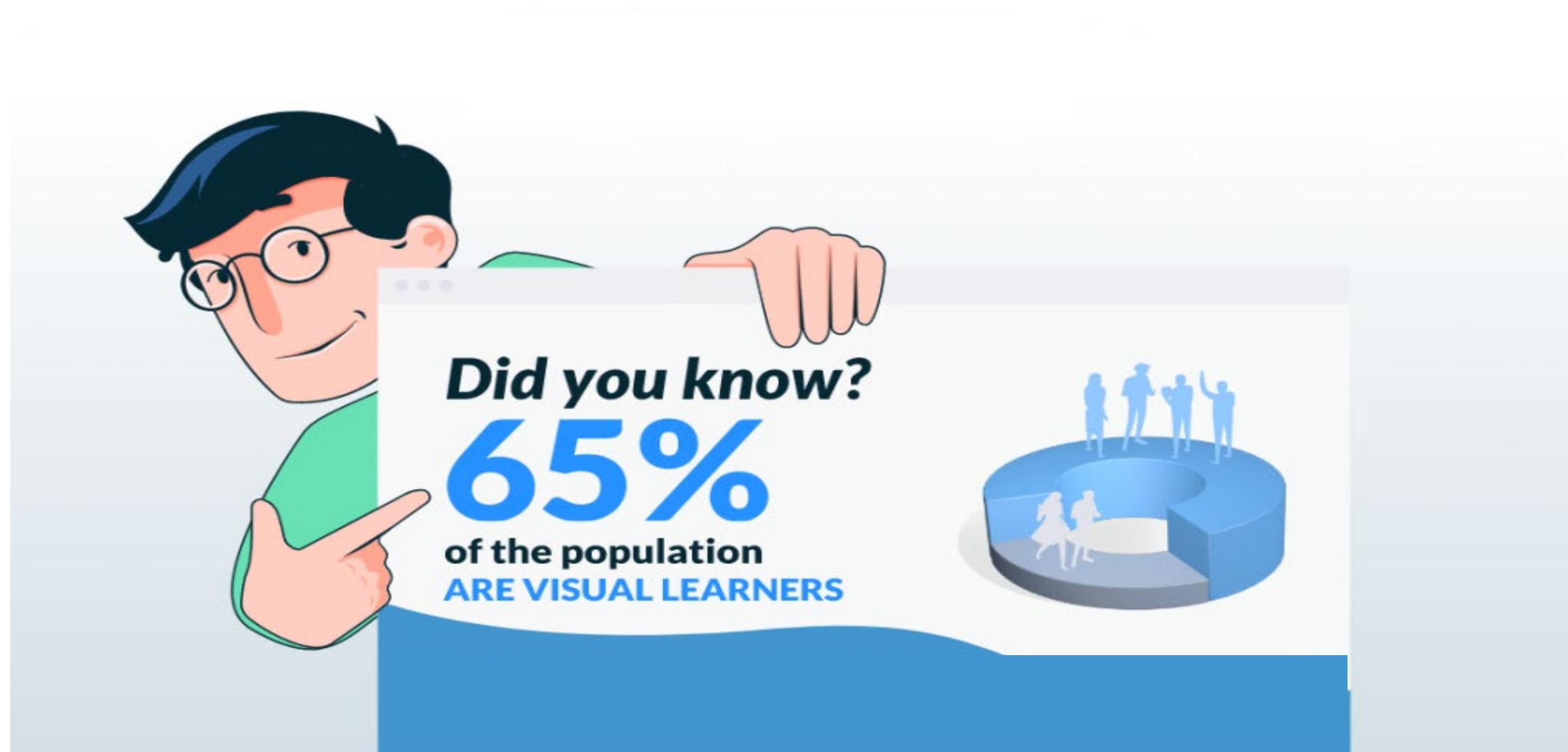
- Create a dashboard with SAS Visual Analytics

Handy Links

Intro	5	Query audience Set stage for talk		
Etl short talk & demo code	15			
Good Reporting short talk	35			
VA Demo				
Q&A	5			

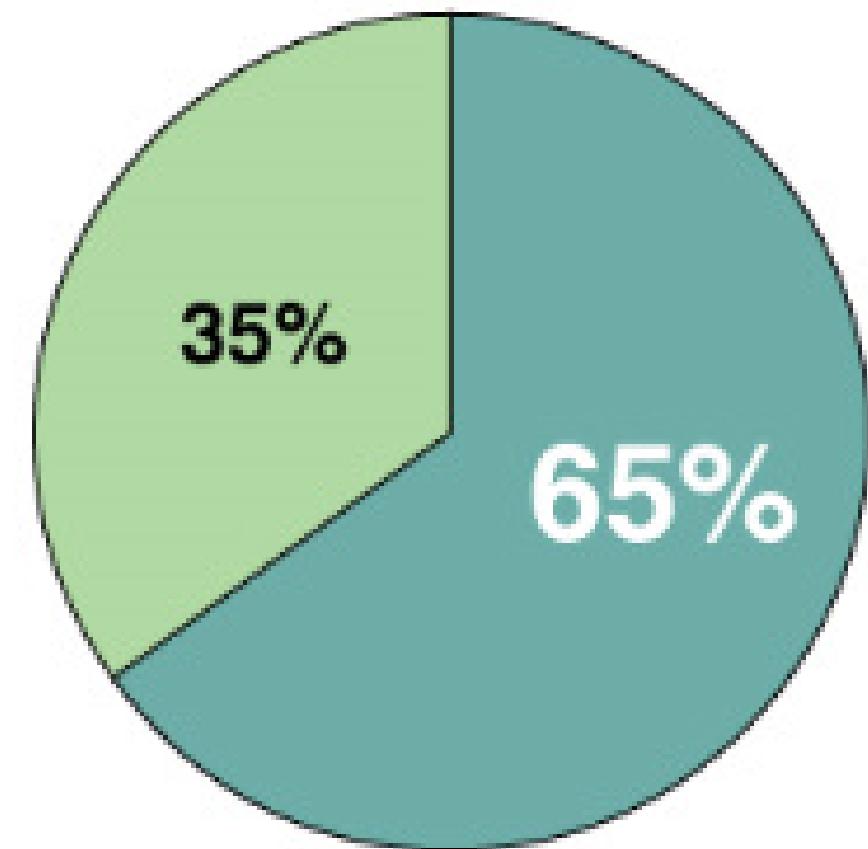
What % of population is visual?

65% of the population are visual learners

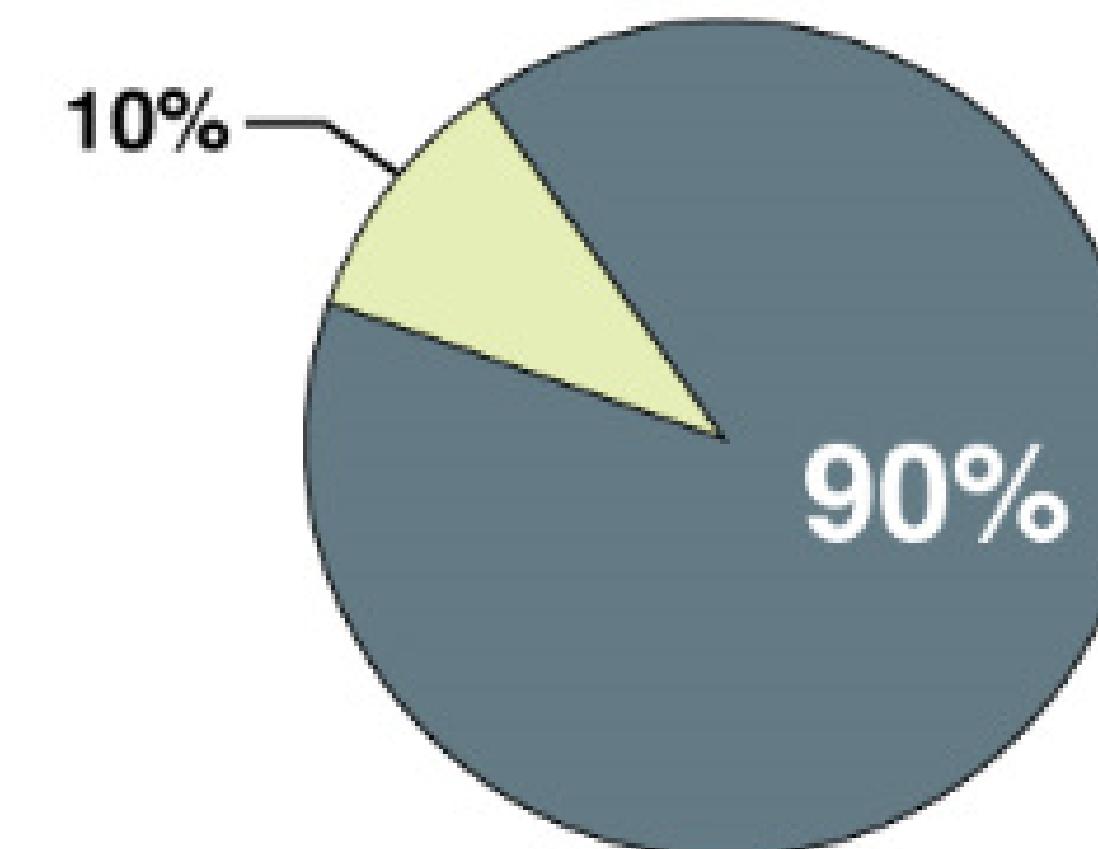


What % of information transmitted to the brain is visual?

Percentage of People Who Are
Visual Learners



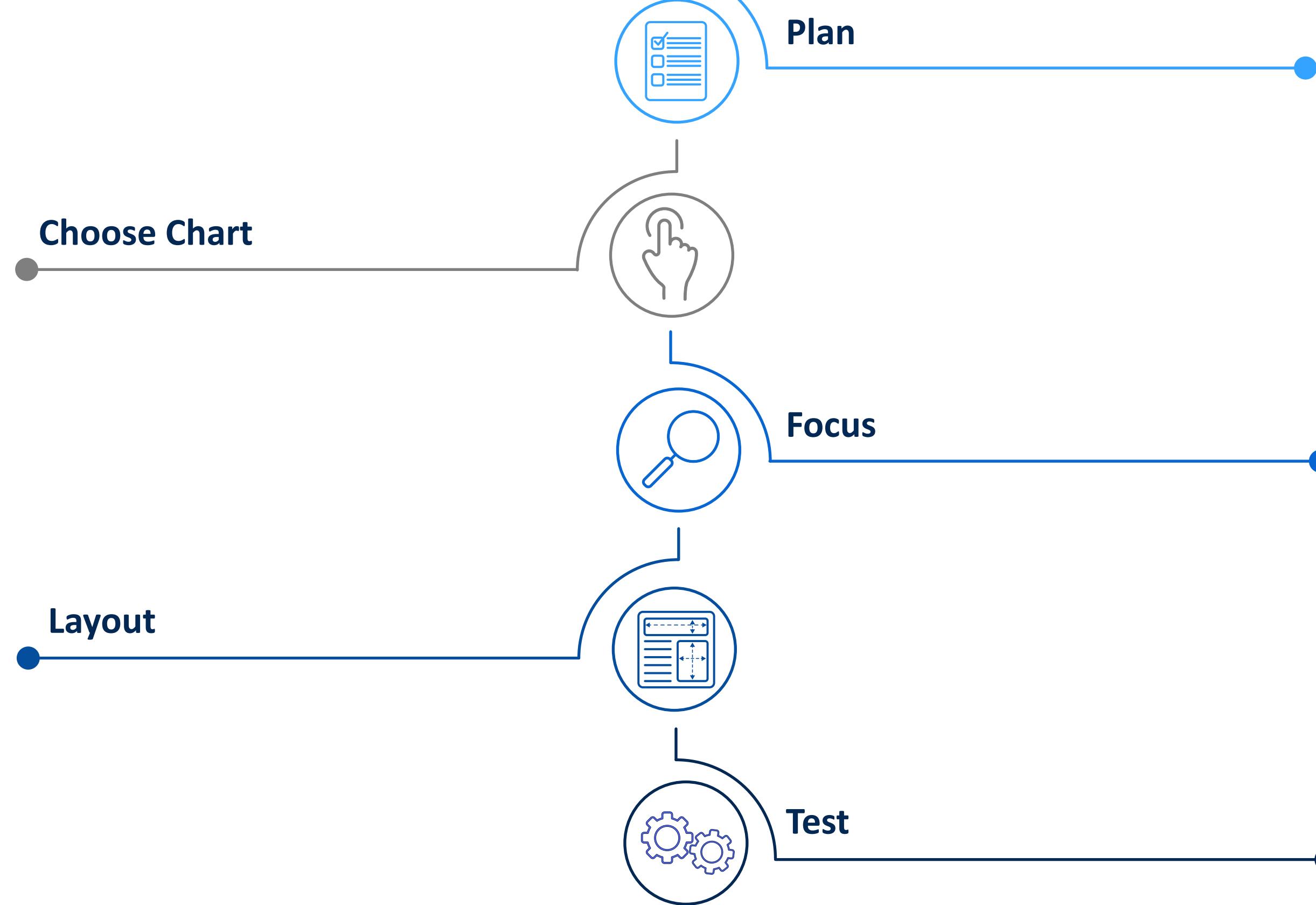
% of Information the Brain Processes That Is
Visual Data

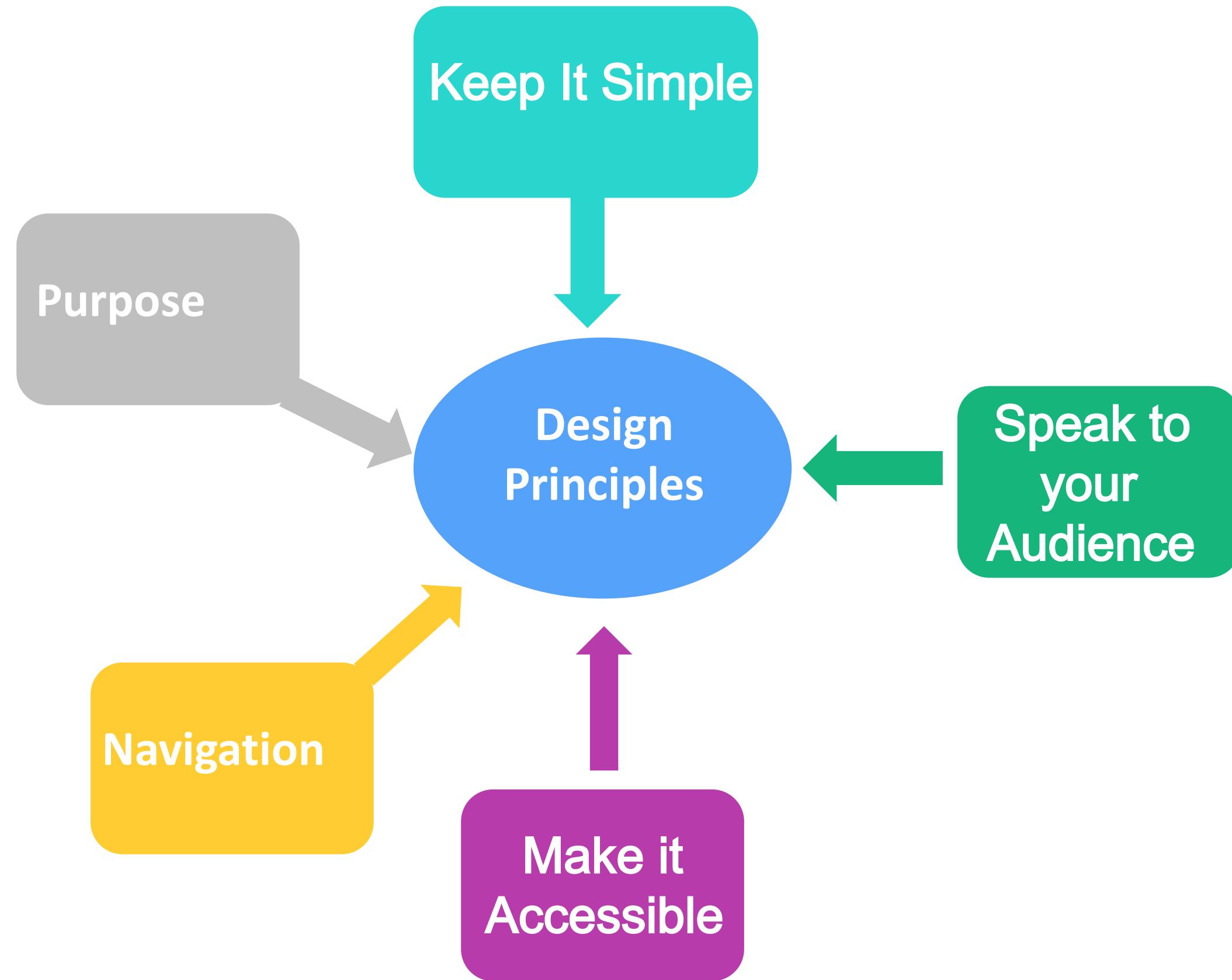


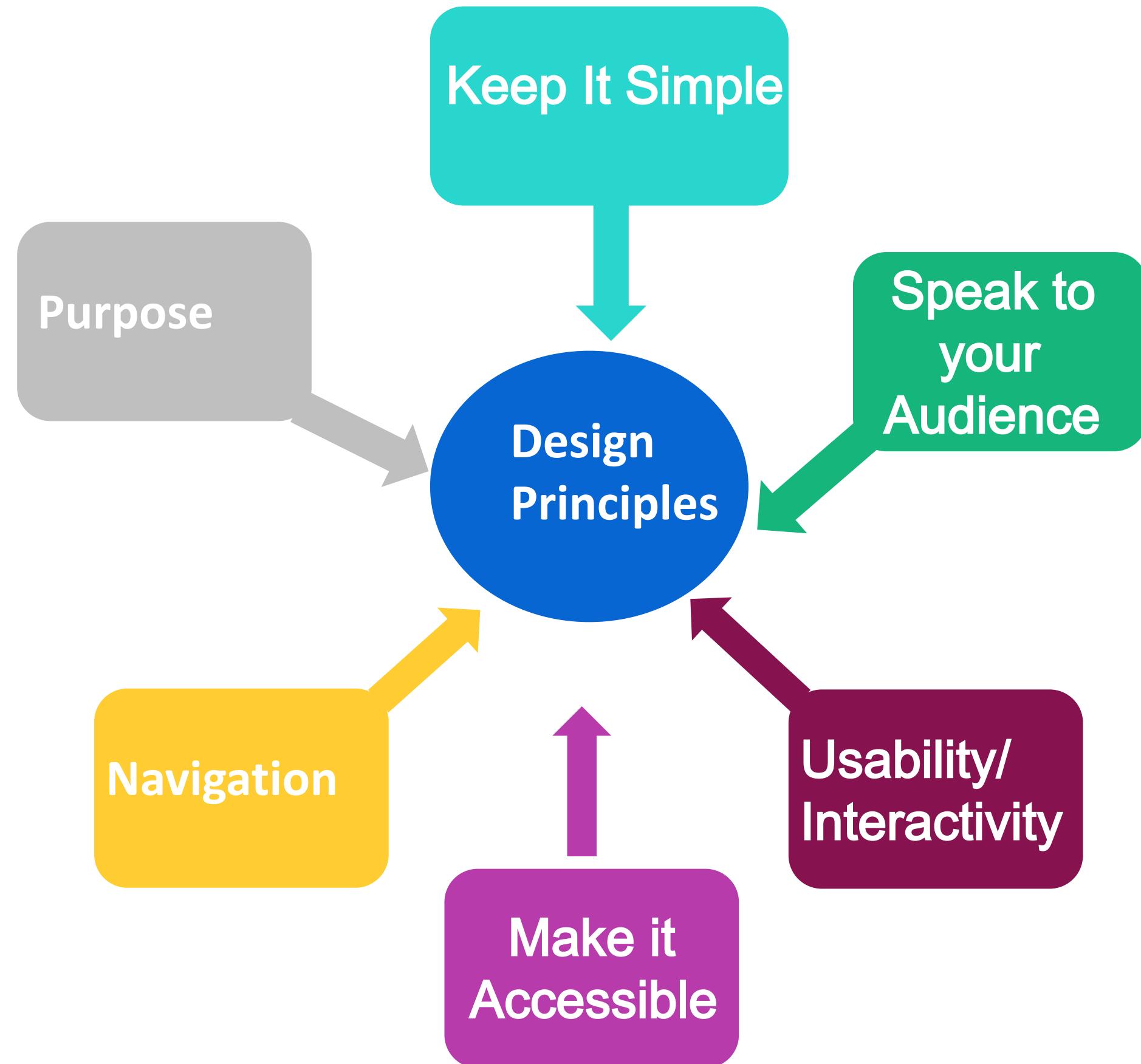
"Readers" and "Do-ers" Visual Learners

Other Senses Visual

Principle	Definition	Action
Rule of Thirds	designs are more interesting and visually appealing when you place the object(s) of your design in one of the thirds sections.	Imagery on one third of each page
Gestalt design	Users see the entirety before the detail	Home Page
Visual Hierarchy	the human mind processes bigger elements as more important.	All Pages
Grid based layout	Users can easily scan predictable gridbased interfaces. A good grid is easy to adapt to various screen sizes and orientations. grid layouts are an essential component of responsive web design.	A.I. collapsible button
Consistency	Pages have a similar look & feel to cut out white noise	All pages
Imagery	Humans are very visual so can digest a lot of information from one image.	Infographic
Movement	Visually objects at diff speeds	Videos on home page/training/hot topics page Carousel on home page







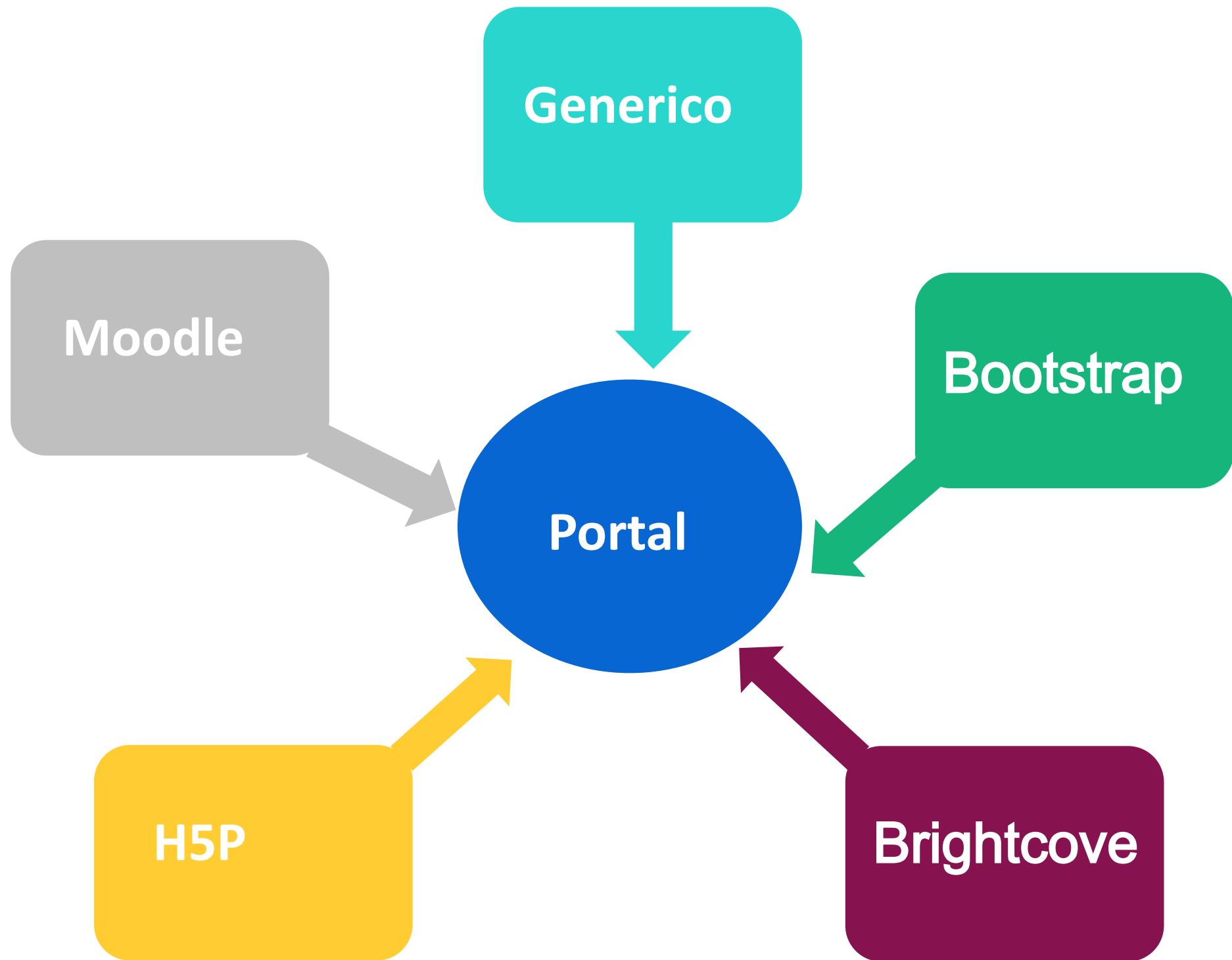
Principles of Good Design

Principle	Definition	Action		
Rule of Thirds	designs are more interesting and visually appealing when you place content along the horizontal and vertical grid lines.	Imagery on one third of each slide		
 Gestalt	 893,000+	 3,000+	 126	 62,750+
 Visual	SATISFIED LEARNERS	COMPANIES SERVED	COUNTRIES REPRESENTED	CERTIFICATIONS AWARDED
 Grid				
 Consistency				
 Image				
Movement	Visually objects at diff speeds	Videos on home page/training/hot topics page Carousel on home page		

Advanced Algorithms

Application Programming
Interfaces (API)

Graphical Processing Units



1 Plan

Select your data

Know your audience

Craft your message or story

Draft your report

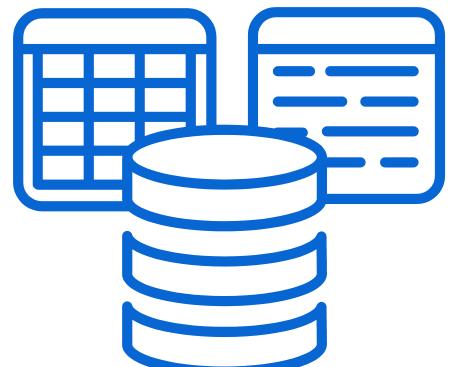
Traditional Reporting vs. Dashboard Reporting

Feature	Dashboards	Reports
Data Type	Real-Time or Near-Real-Time	Historical
Interactivity	Interactive (filtering, drilling down)	Static
Visual Focus	Highly visual (charts, graphs)	Detailed information (tables, narratives)
Purpose	Summarized view for quick decision-making	In-depth analysis and insights
Usage	Continuous monitoring of key metrics	Periodic generation for performance review
Data Update Frequency	Continuous updates	Periodic updates (e.g., weekly, monthly)
User Accessibility	User-friendly, accessible to non-technical users	May require technical expertise to create/interpret
Typical Content	Key Performance Indicators (KPIs)	Comprehensive narratives, tables, annotations
Primary Use Case	Operational contexts requiring ongoing tracking	Compliance, audits, detailed performance analysis



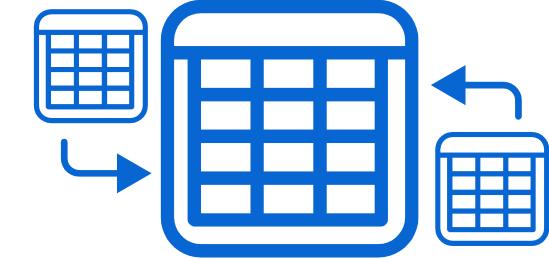
Draft a Plan

Select your data



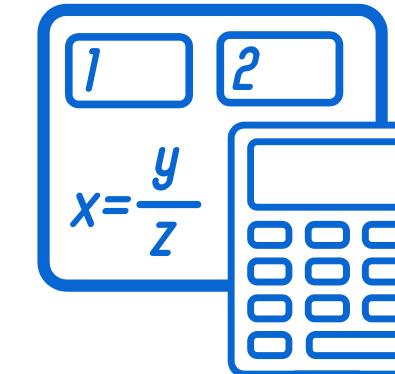
Any format

- 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 level of detail?

What to present?



How to present?



Choose the Best Chart



Draft a Plan

- Select your data
- Know your audience
- Craft your story
- Sketch design



Focus on What's Important



Consider the Layout



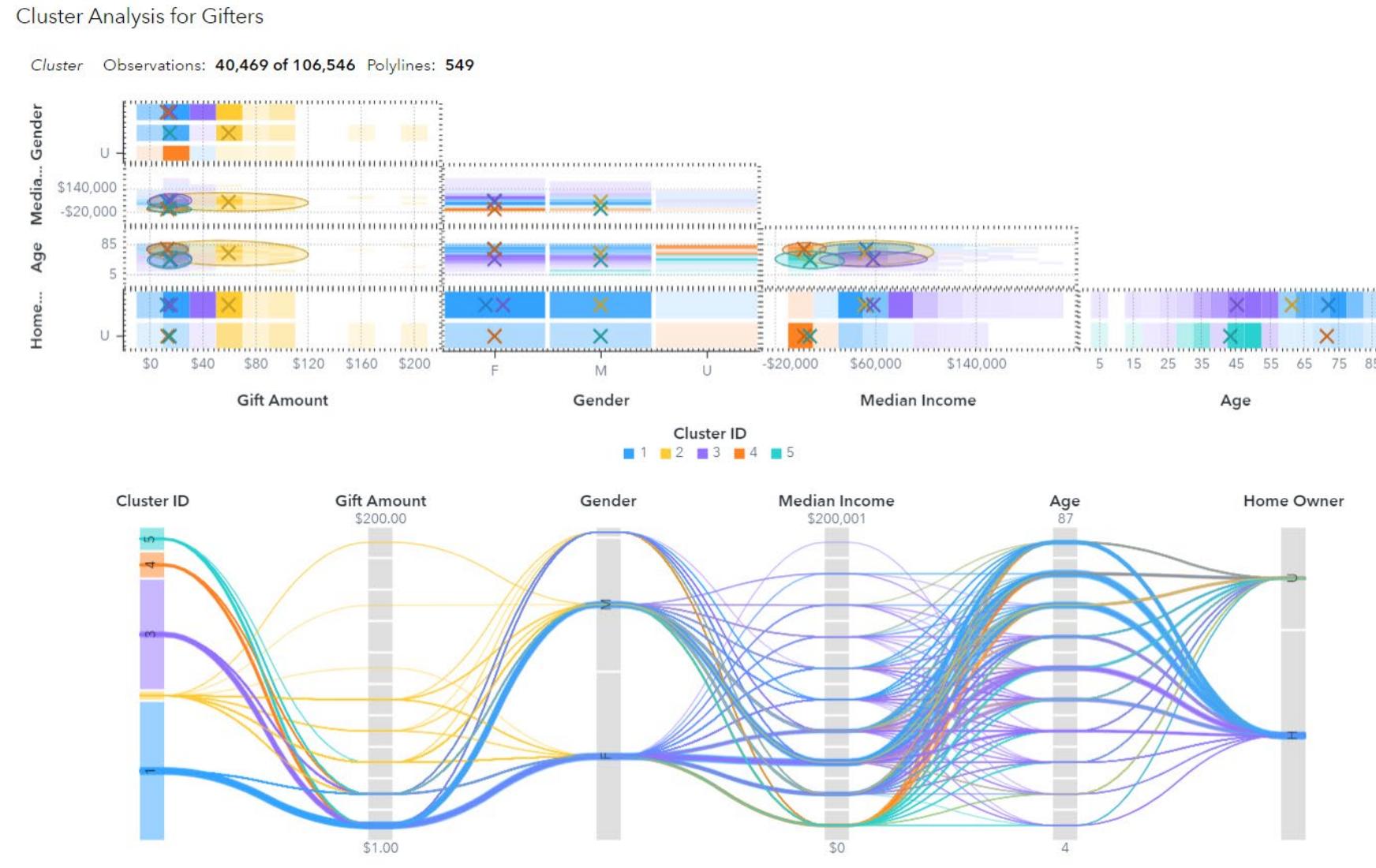
Test, Test, and Test Again





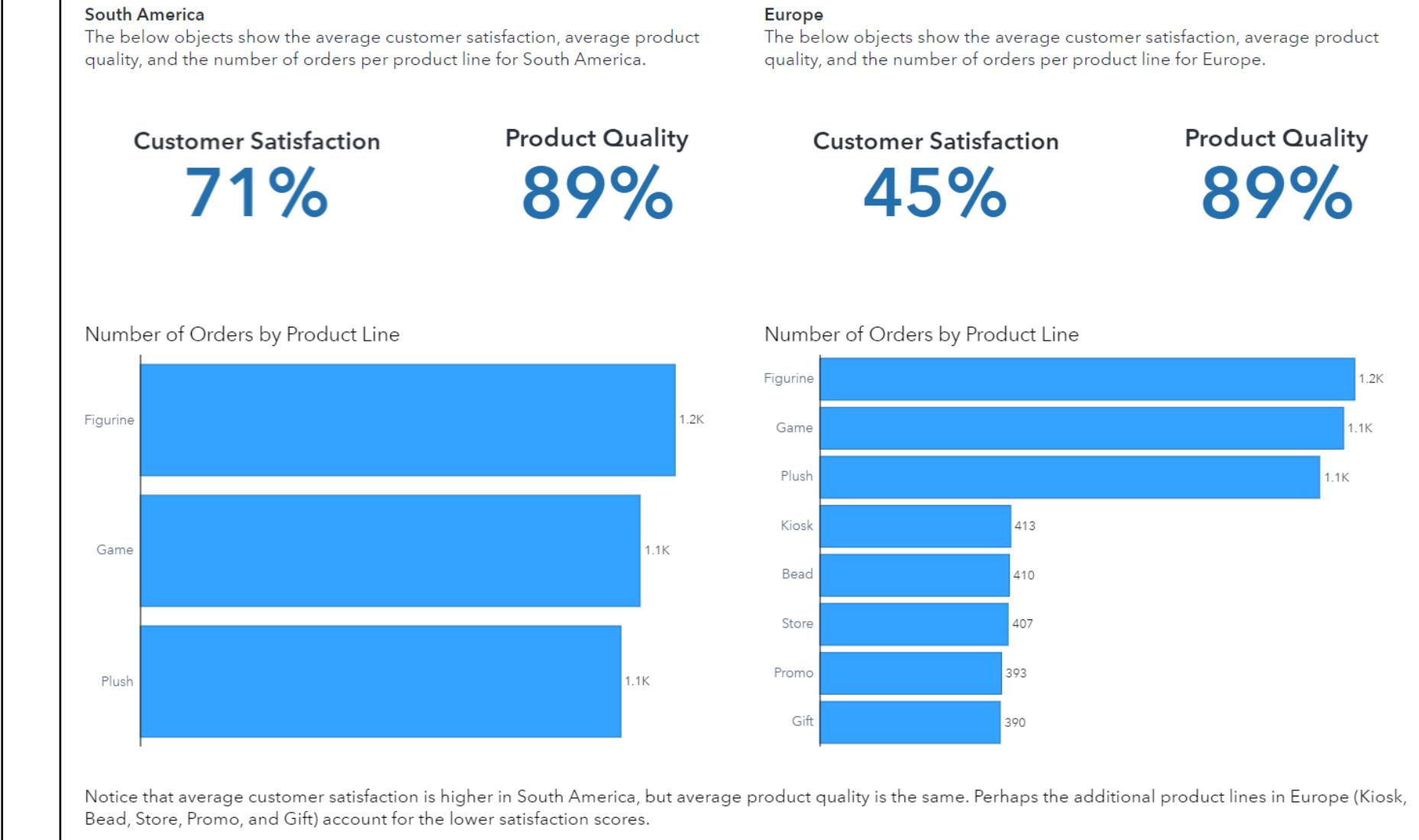
Draft a Plan

Data Scientist/Statistician/Data Analyst



Know your audience

Business User/Audience



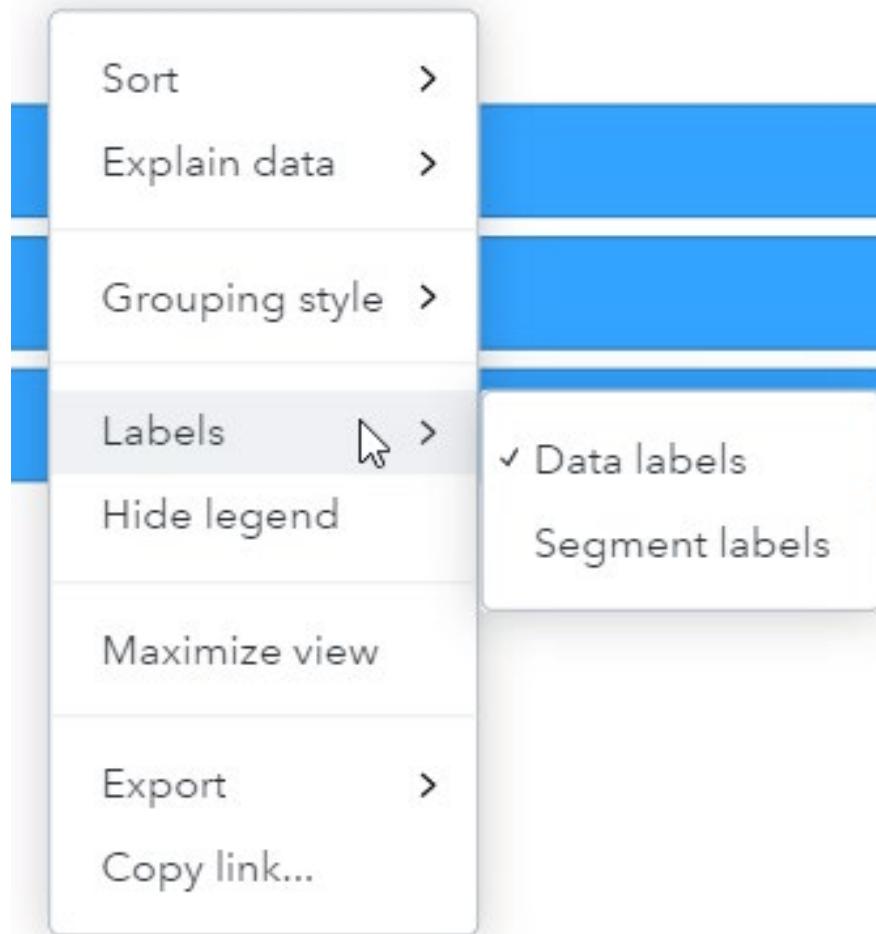
Provide context for graph content



Draft a Plan

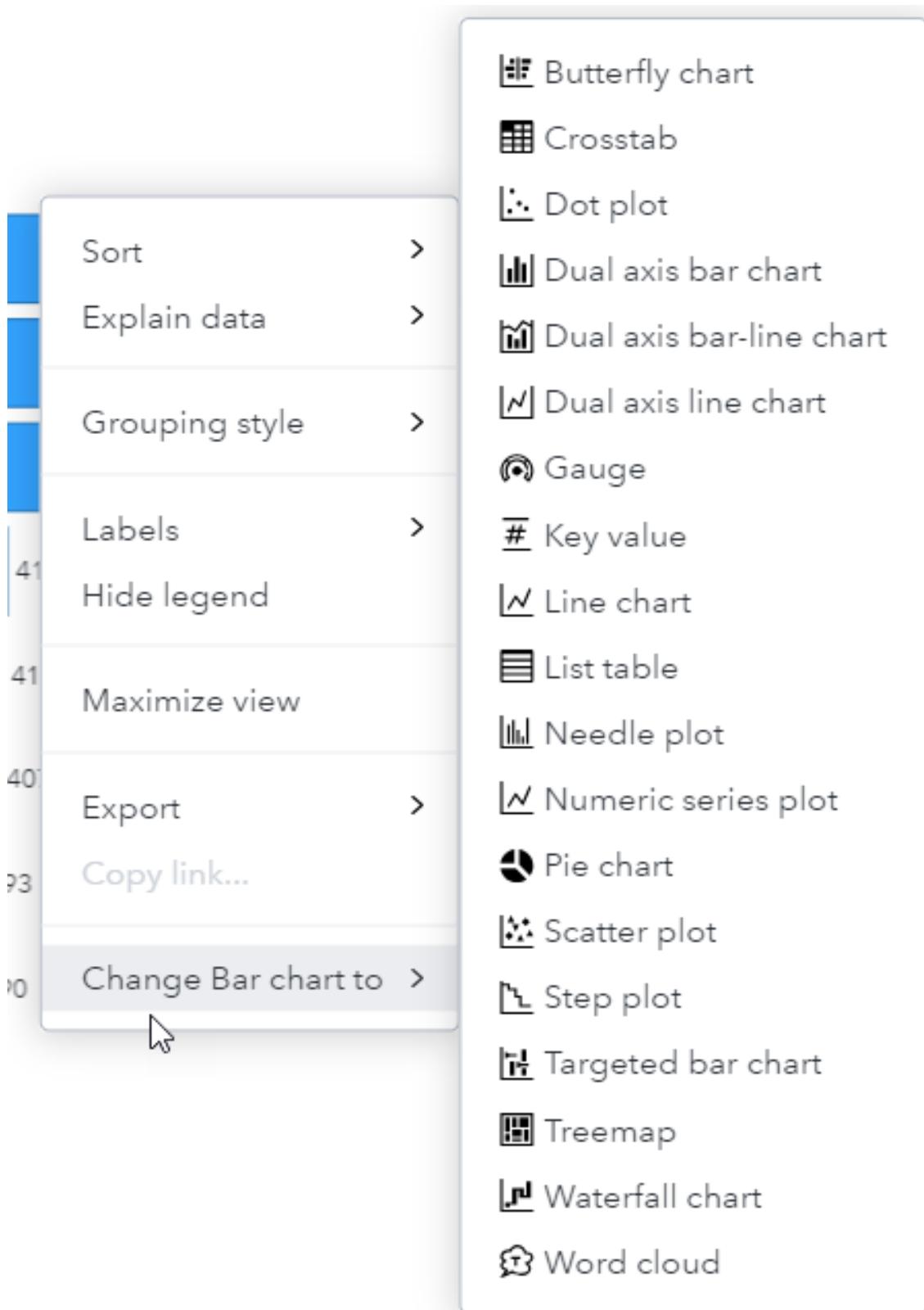
Know your audience

Simple edits

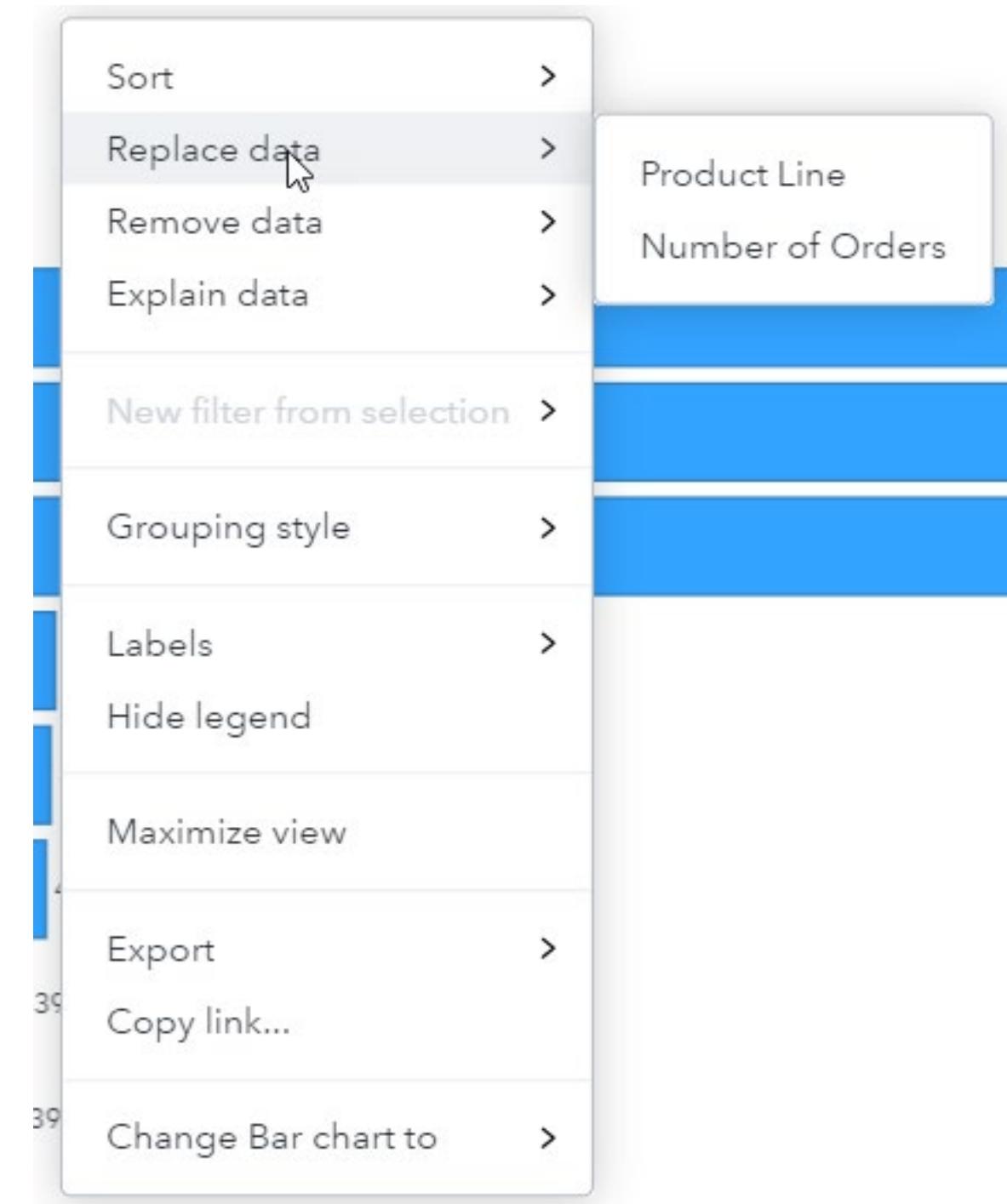


Viewer Customization Level

Comprehensive edits



Data edits





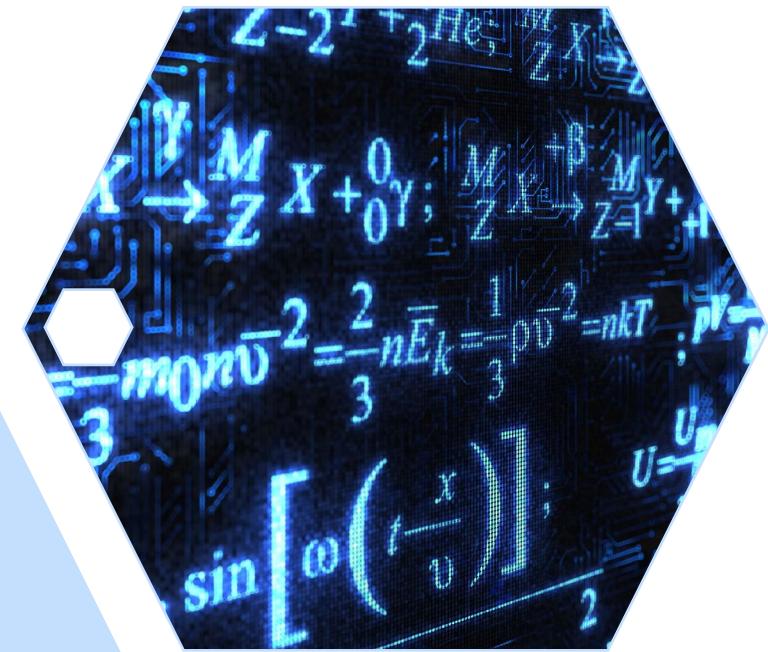
Draft a Plan

Craft your story

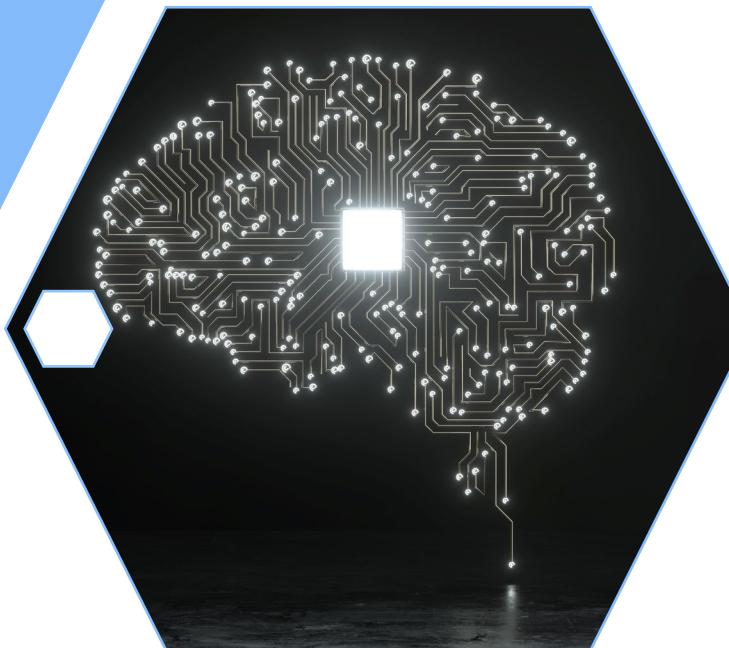


Do you
want the
audience to
take action?

Are you
trying to
persuade?



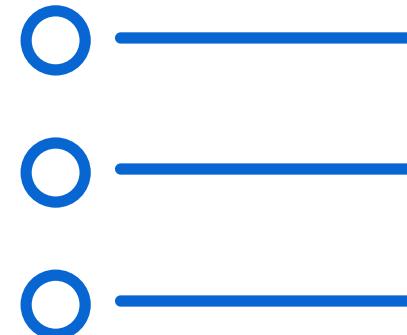
Are you
presenting
facts?



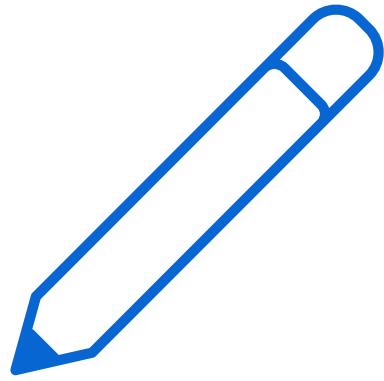


Draft a Plan

Sketch design



Outline



Draft

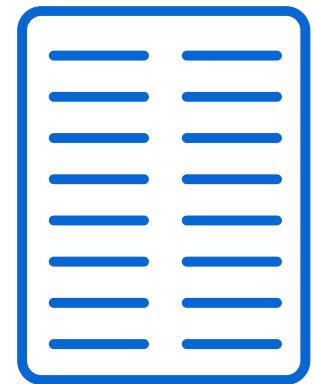
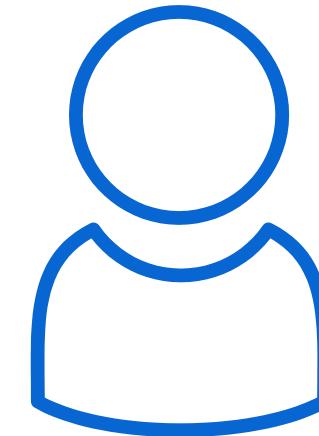
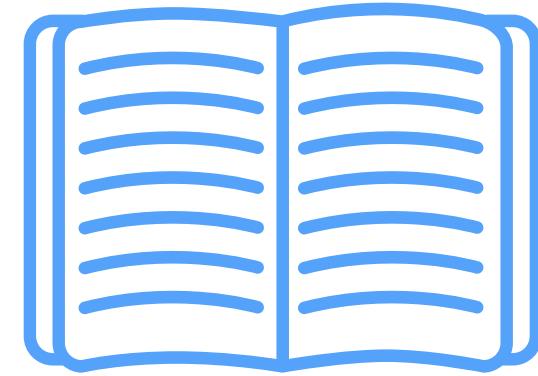


Table of contents



Plan for accessibility



Keep the story in
mind

Choose the Best Chart

Best Practices

- Use the simplest graph
- Use visually appealing, easy to understand objects
- Use only most important data
- Keep graphs simple
- Use a zero baseline
- Use 2-dimensional charts
- Choose colors wisely

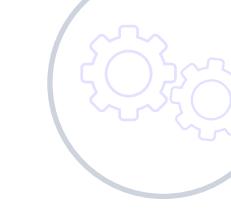
Draft a Plan



Focus on What's Important



Test, Test, and Test Again





Choose the Best Chart (Best Practices)



Who is the
audience?

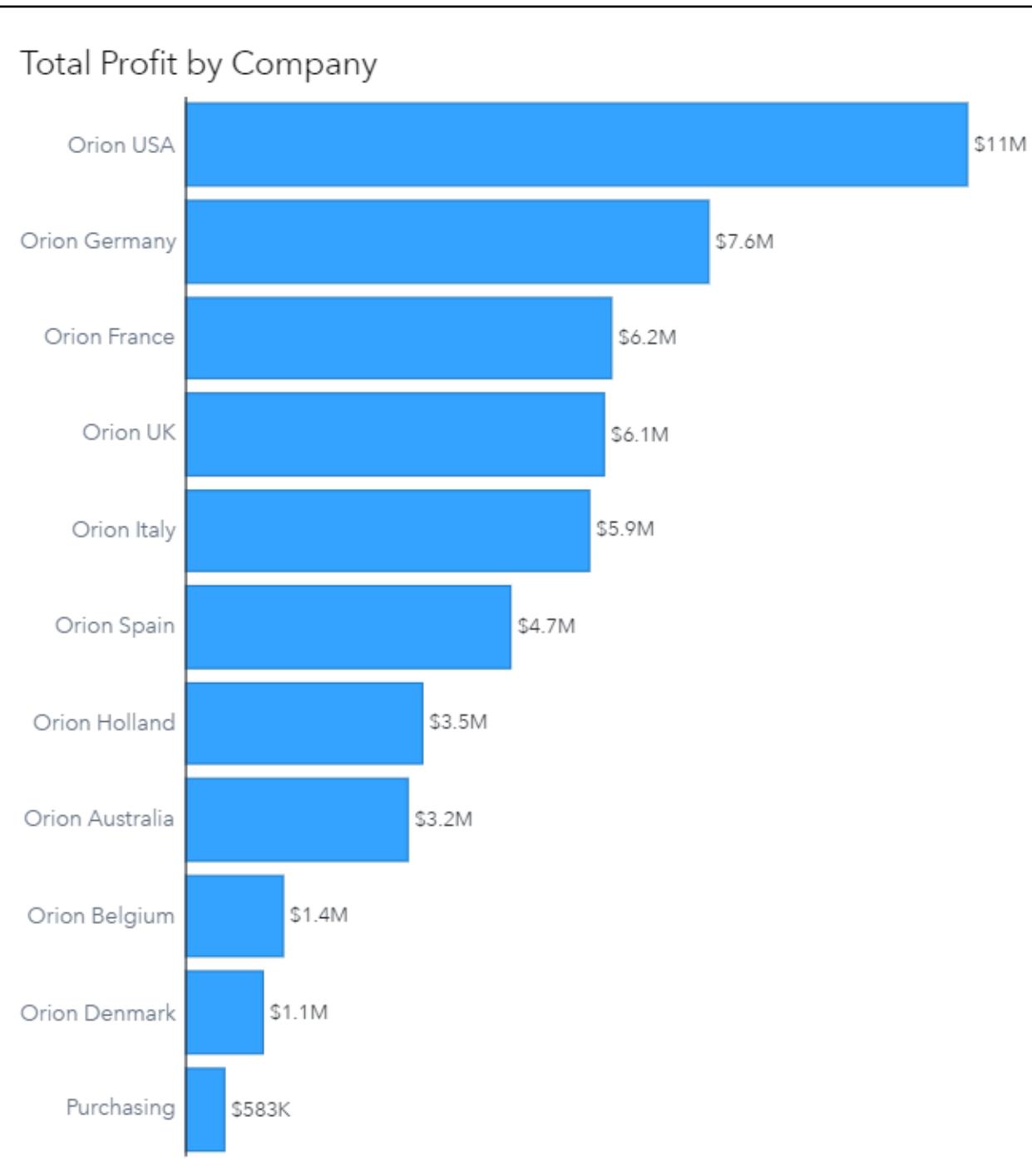
What data
do you
want to
display?





Choose the Best Chart (Best Practices)

Use the simplest graph



Total Profit by Company

Orion France
Orion Belgium
Orion Spain Orion Italy
Orion Australia Orion UK
Orion Holland Orion Denmark
Orion USA
Orion Germany

\$11M
\$583K
Total Profit



- Muddled message
- Less accessible



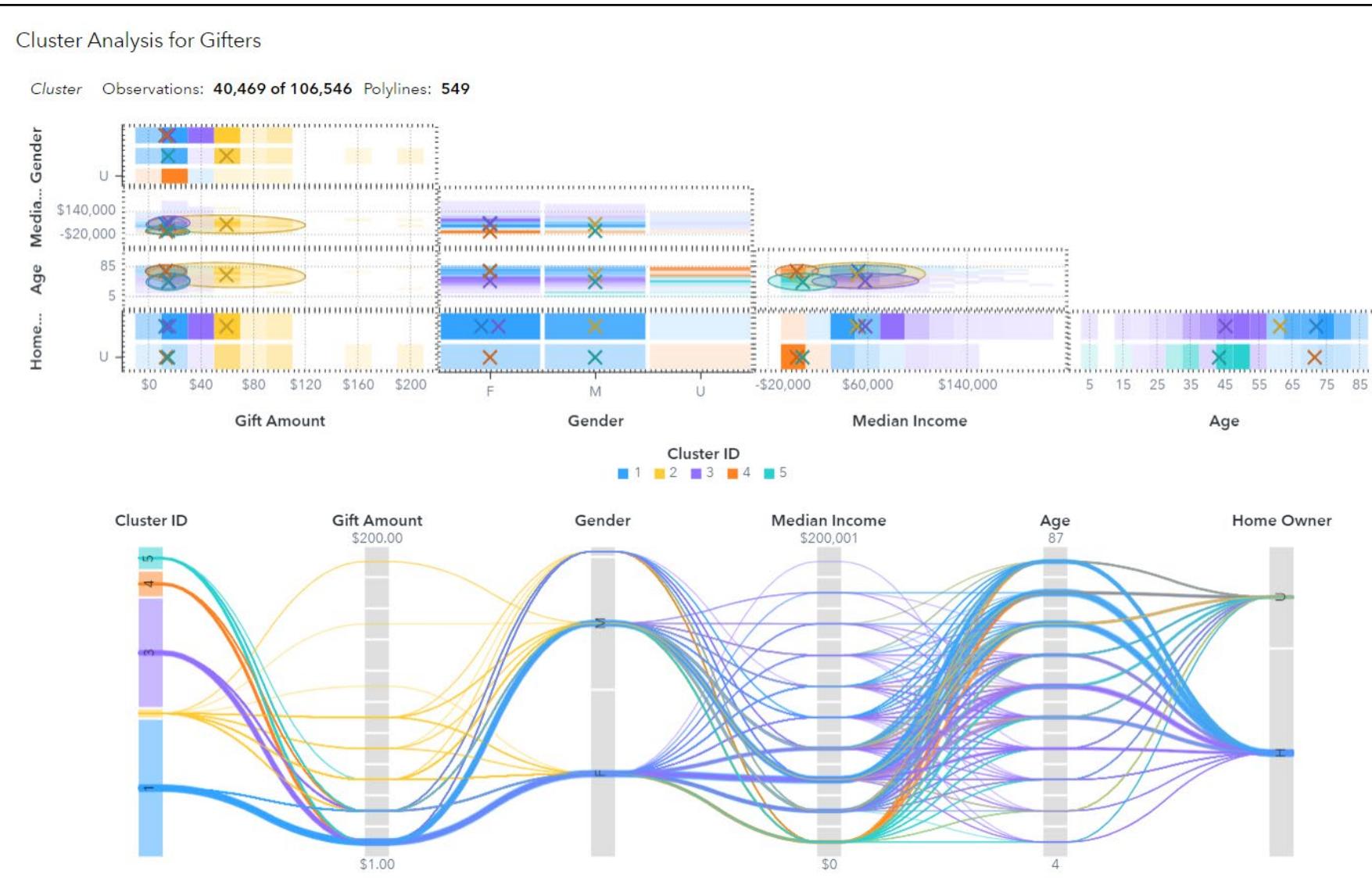
Create object templates to speed up development



Choose the Best Chart (Best Practices)

Use visually appealing, easy to understand objects

Statisticians



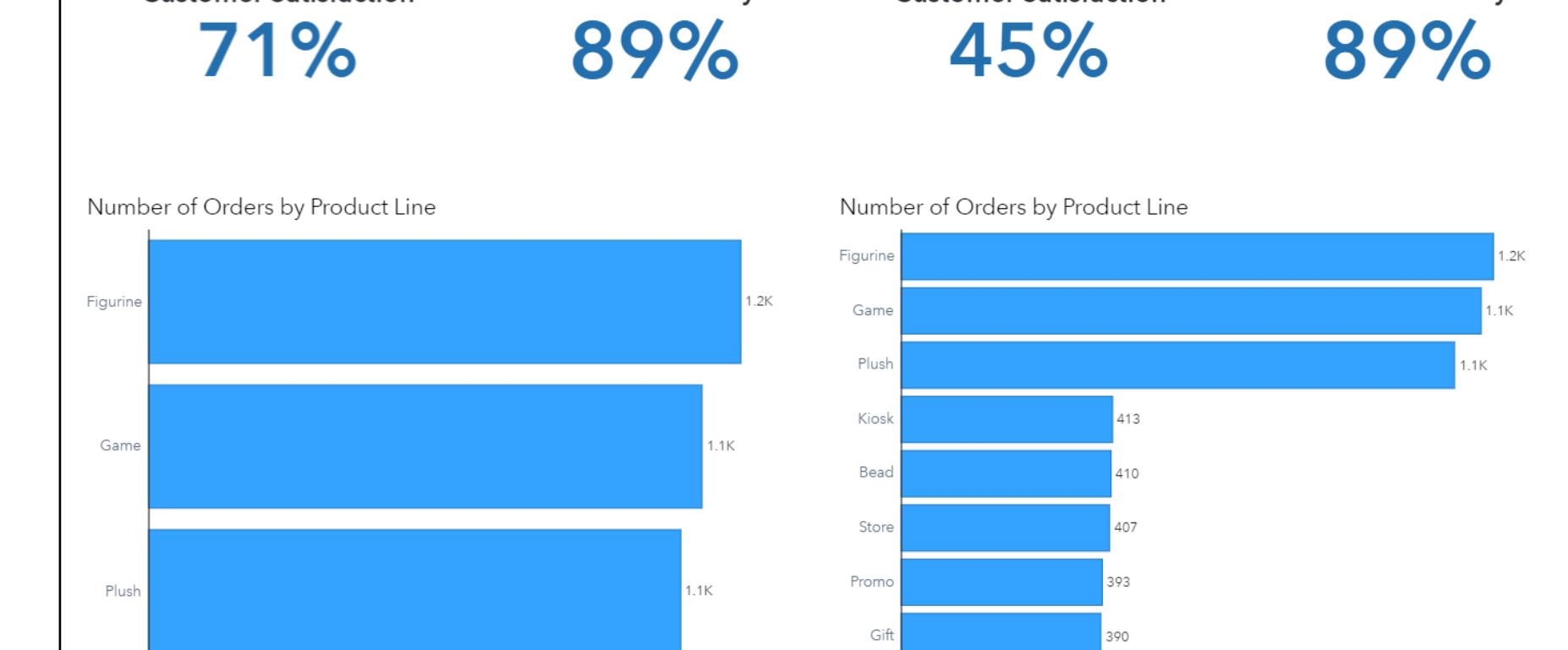
General audience

South America
The below objects show the average customer satisfaction, average product quality, and the number of orders per product line for South America.

Customer Satisfaction
71%

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 audience



Choose the Best Chart (Best Practices)

Use only the most
important data

Customer Satisfaction
47%

Product Sale by Product Line



Product Quality
87%

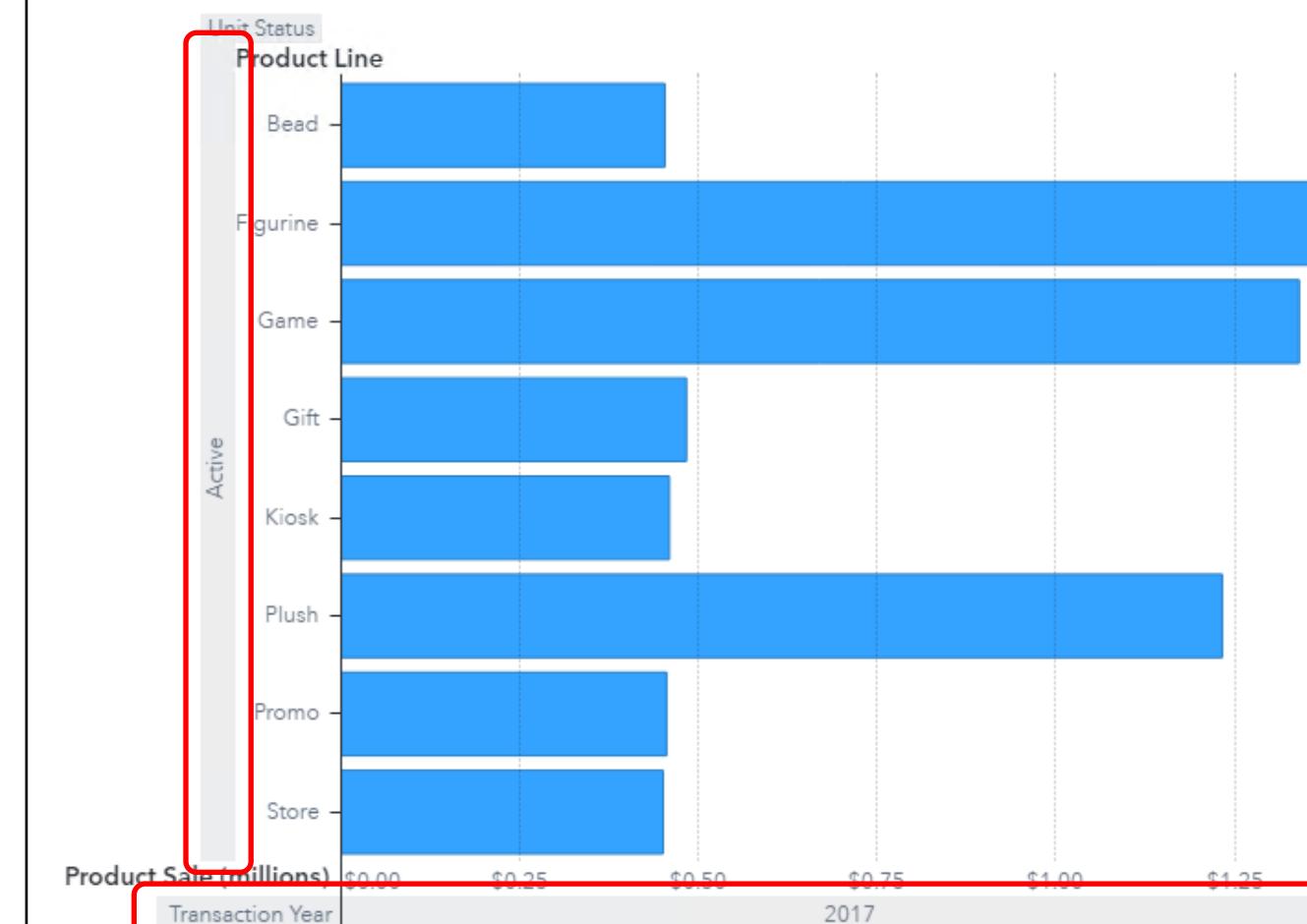
Customer Satisfaction
47%

Transaction Year: 2017

Product Quality
87%

Transaction Year: 2017

Product Sale by Product Line

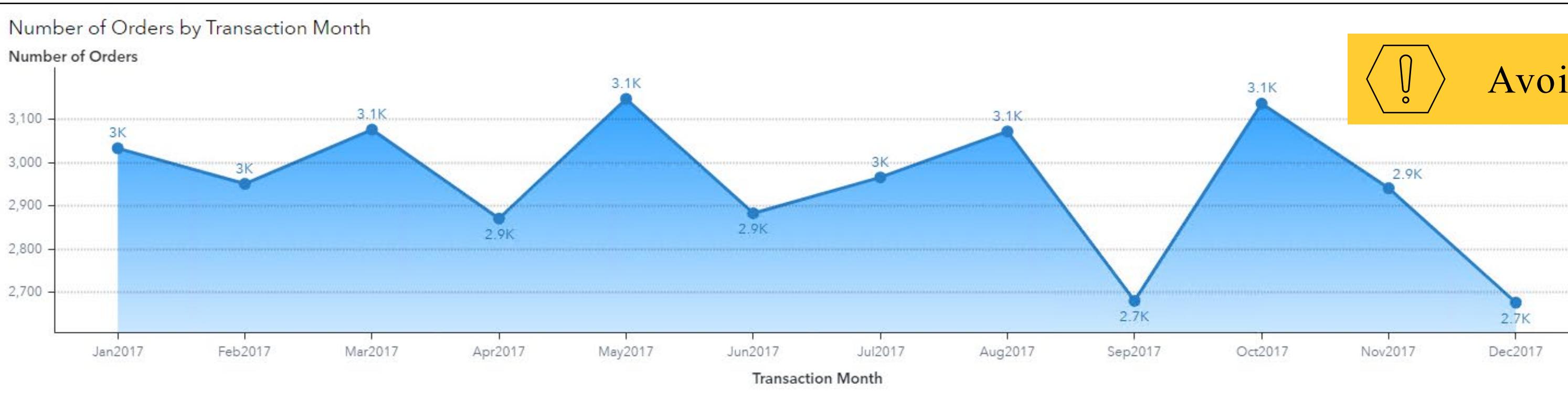
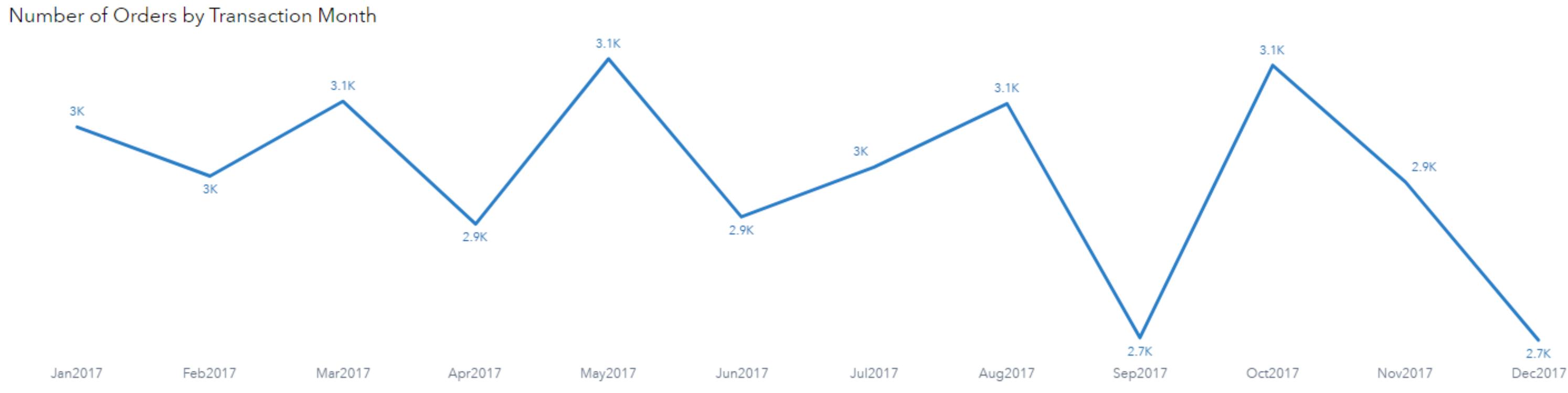


Notify users if lattice columns or lattice rows are used



Choose the Best Chart (Best Practices)

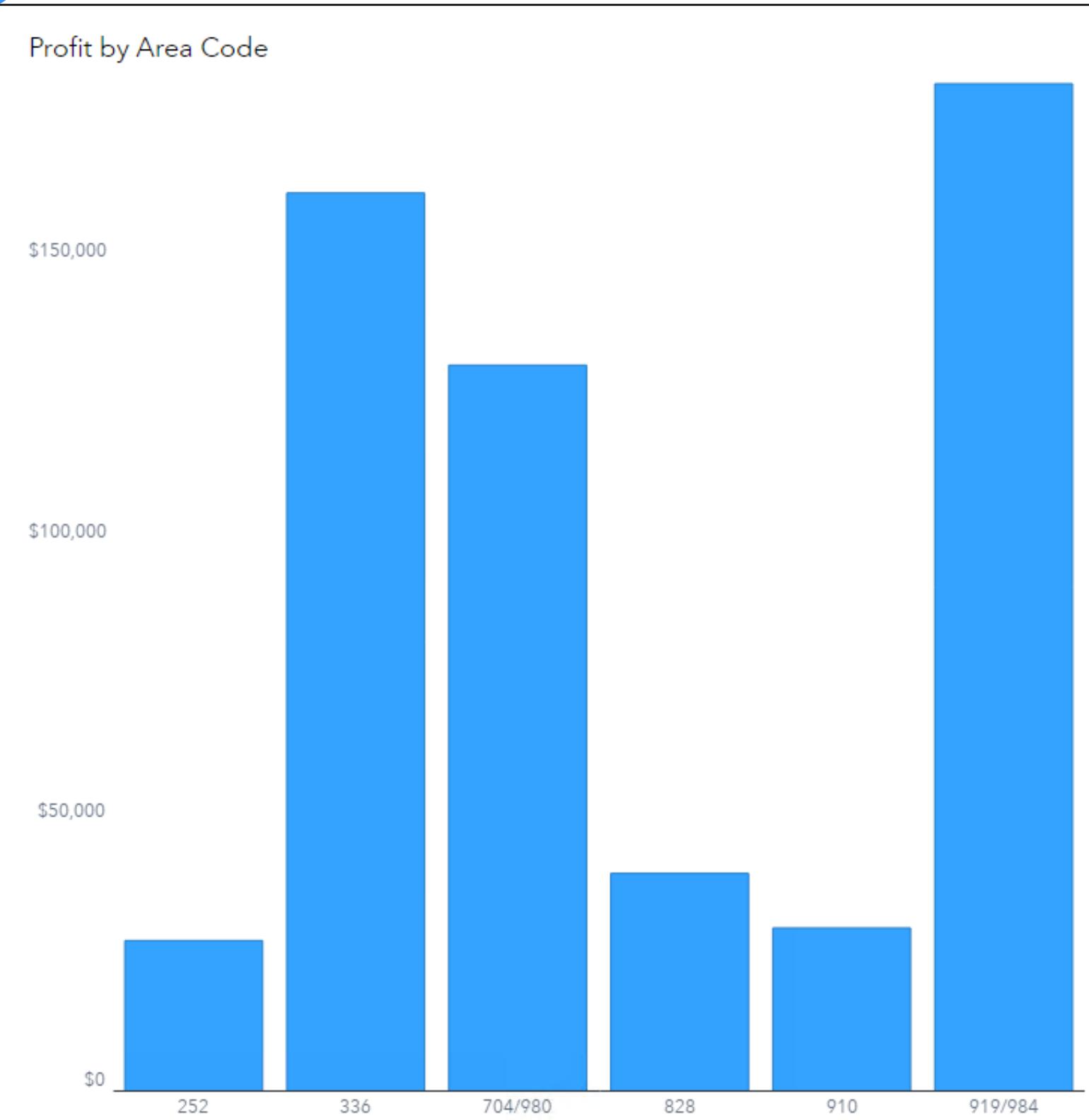
Keep graphs simple





Choose the Best Chart (Best Practices)

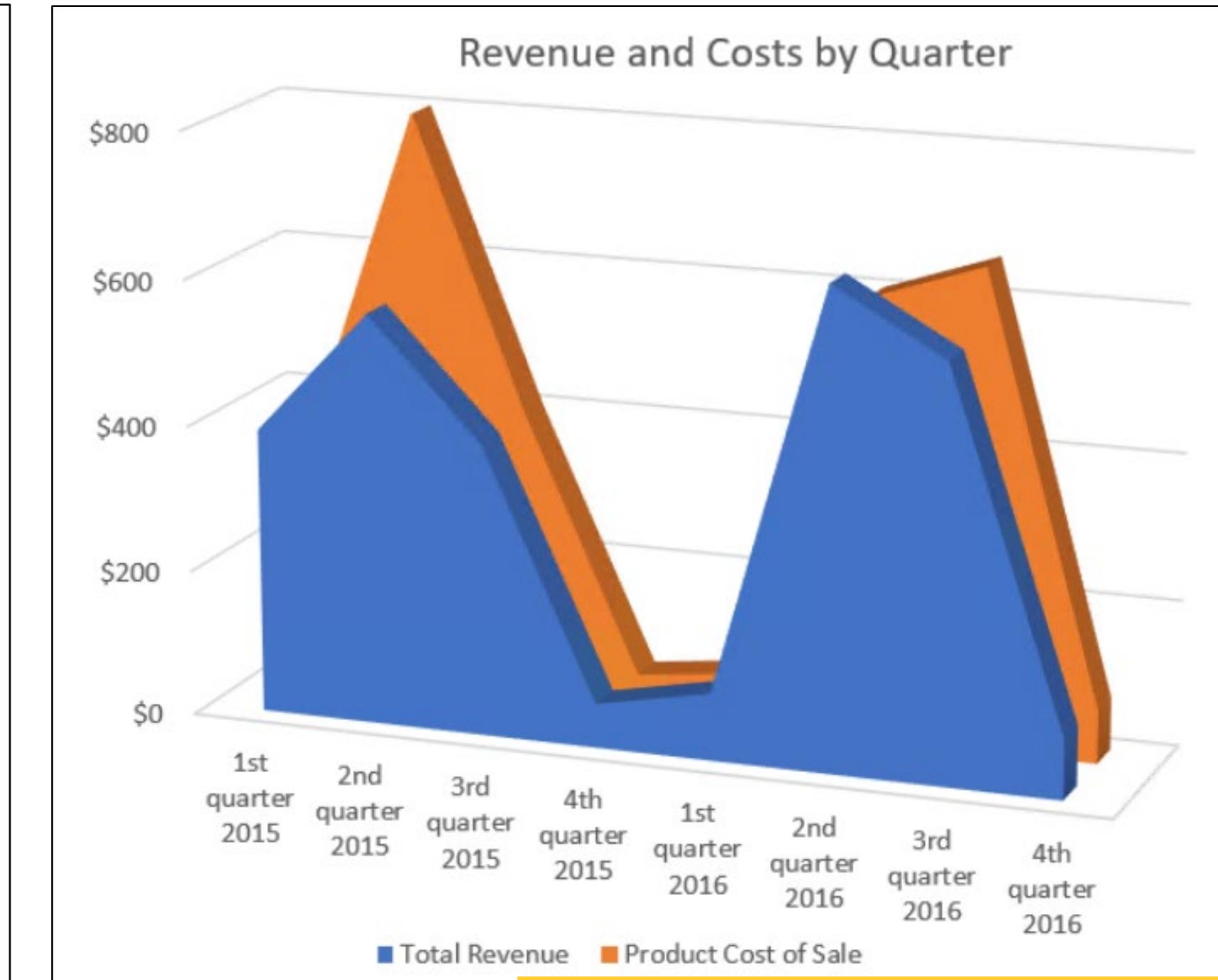
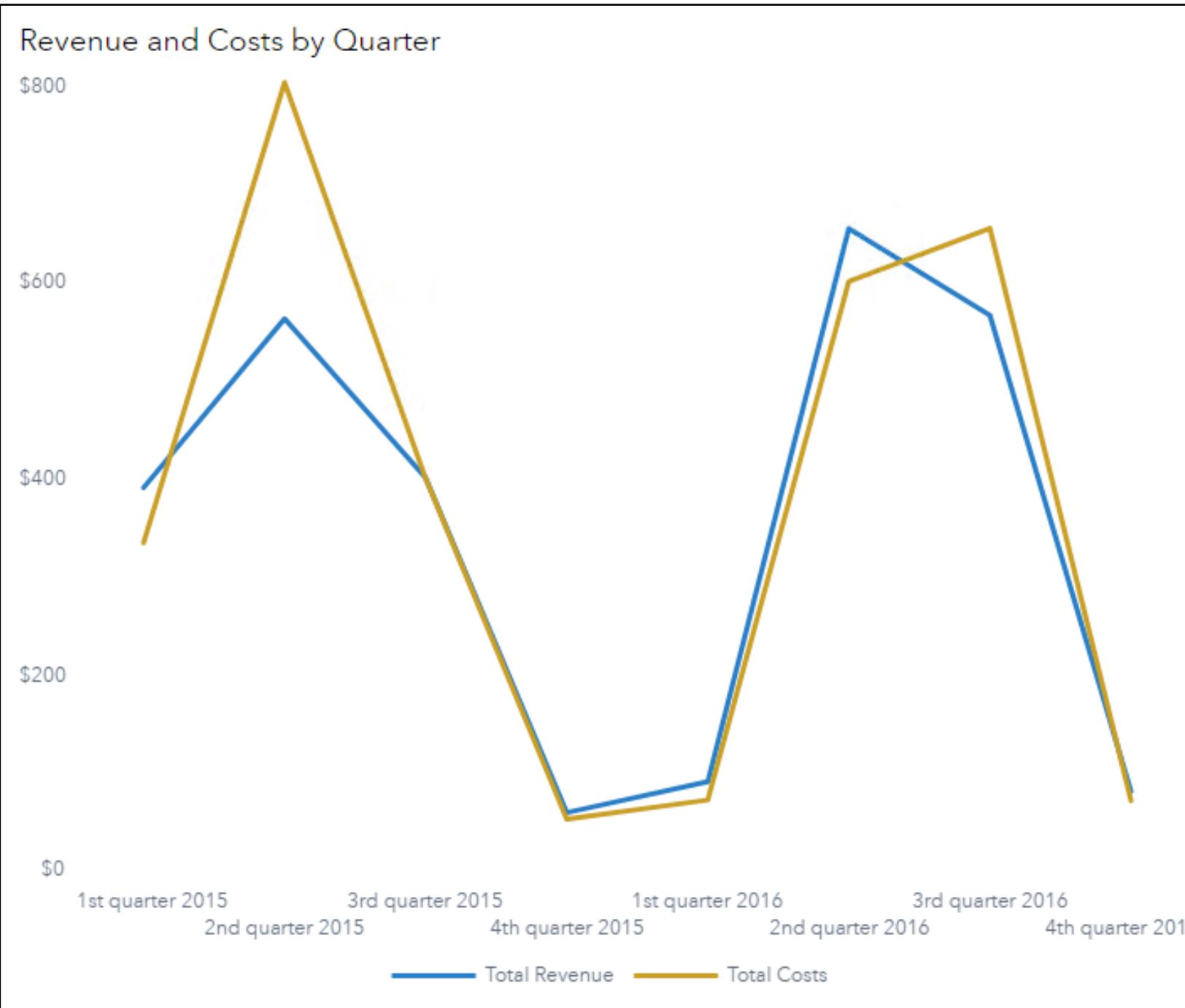
Use a zero baseline





Choose the Best Chart (Best Practices)

Use two-dimensional charts



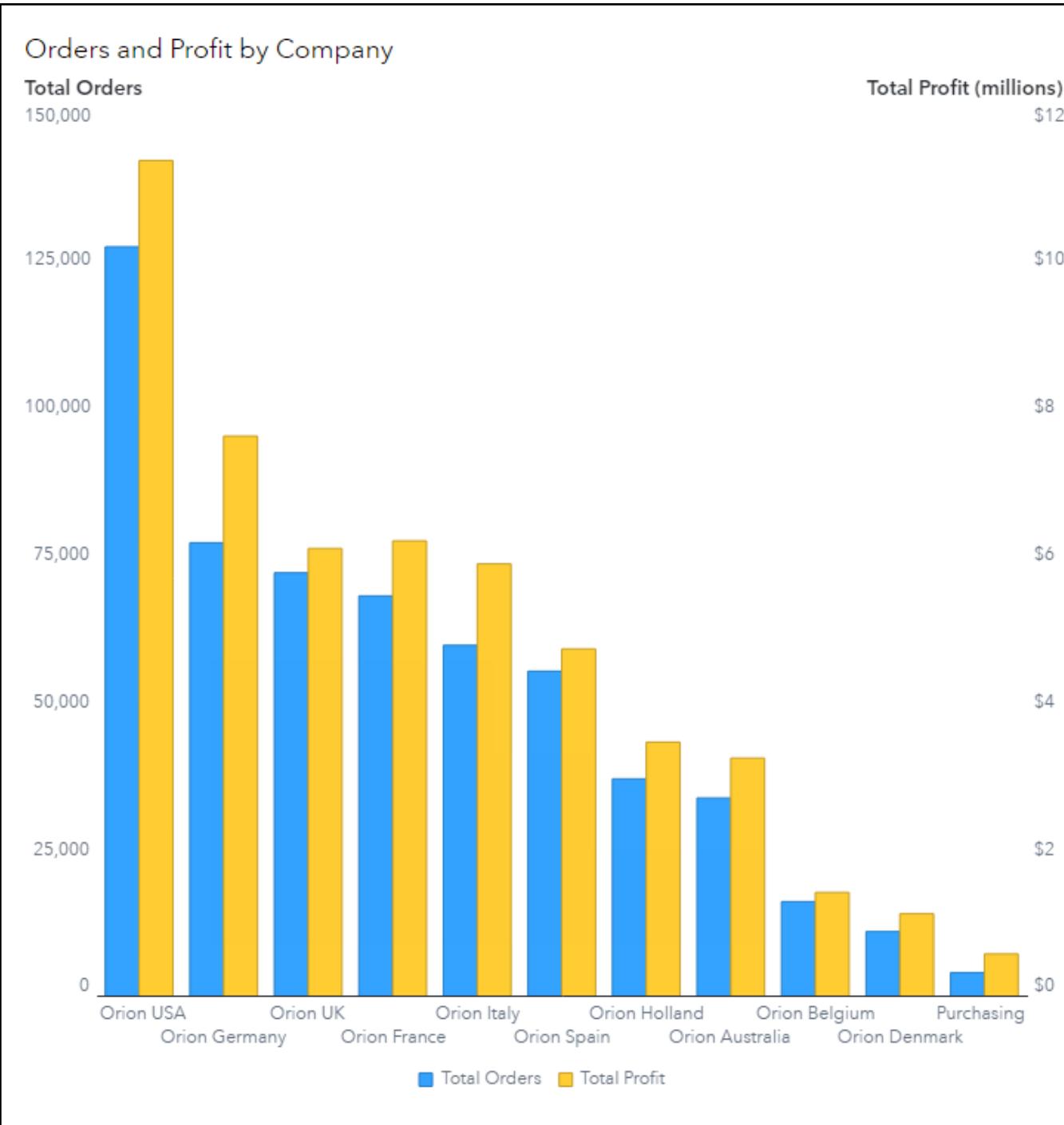
For multi-line charts, rotate attributes for data element styles



- Miss vital information
- Distorts data



Choose the Best Chart (Best Practices)



Choose colors wisely



- Don't overuse
- Think about accessibility



Create custom themes to customize the color palette

Above all else, show the data.

Edward Tufte
- Godfather of data visualization

Choose the Best Chart

Best Practices

- Use the simplest graph
- Use visually appealing, easy to understand objects
- Use only most important data
- Keep graphs simple
- Use a zero baseline
- Use 2-dimensional charts
- Choose colors wisely

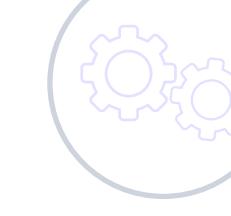
Draft a Plan



Focus on What's Important



Test, Test, and Test Again



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?
- Accessibility

Draft a Plan



Focus on What's Important



Test, Test, and Test Again



Choose the Best Chart (Presentation)

Which chart do I choose?



Highlighting
one
important
fact?



Showing
survey or
questionnaire
results?

Comparing
two or more
things?



Describing
how parts
relate to the
whole?



Showing
relationships
between data
items?



Is a graph
required?



Choose the Best Chart (Presentation)

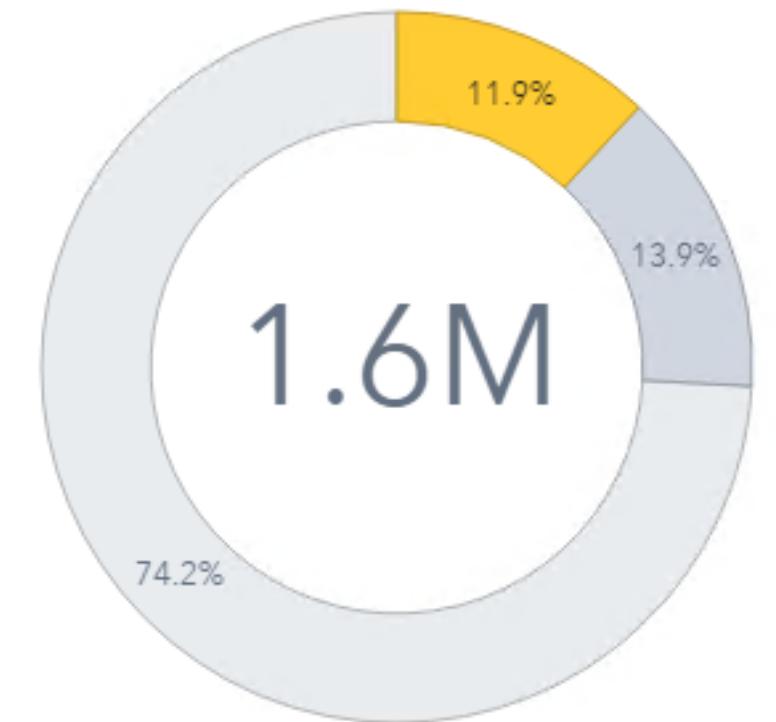
Key value object

Customer Satisfaction

47%

Donut chart

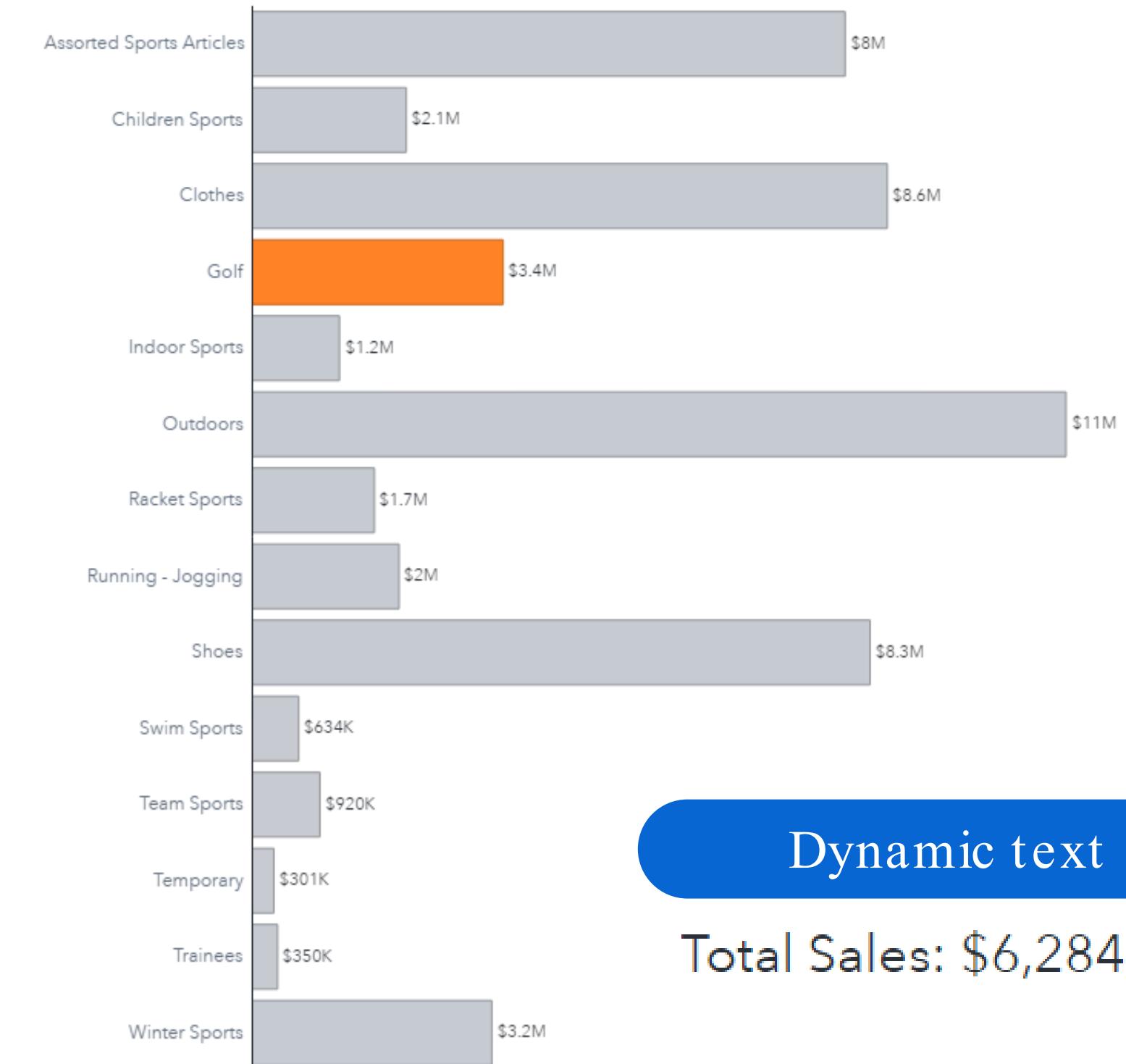
Quantity Ordered by Order Type



Highlight one important fact

Faded bar chart

Total Profit by Group



Dynamic text

Total Sales: \$6,284,652



Use display rules to highlight important values



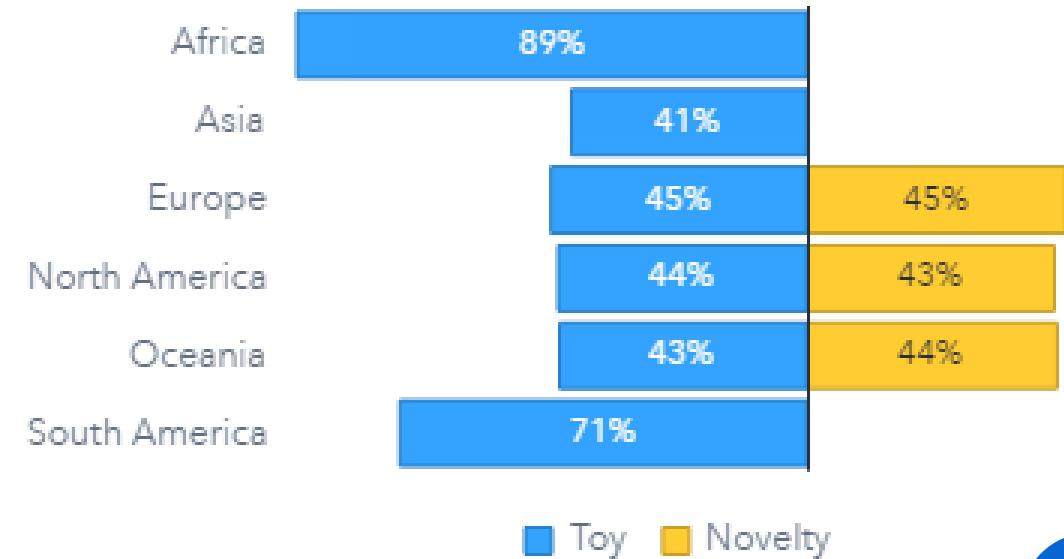
Choose the Best Chart (Presentation)

Compare two or more things
(General)

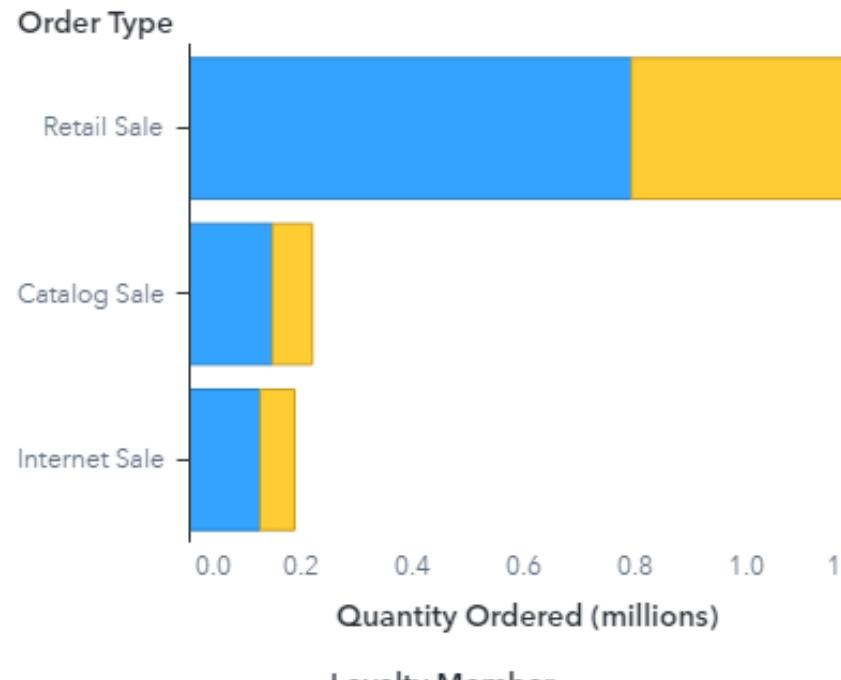
Dot plot

Butterfly chart

Customer Satisfaction by Continent

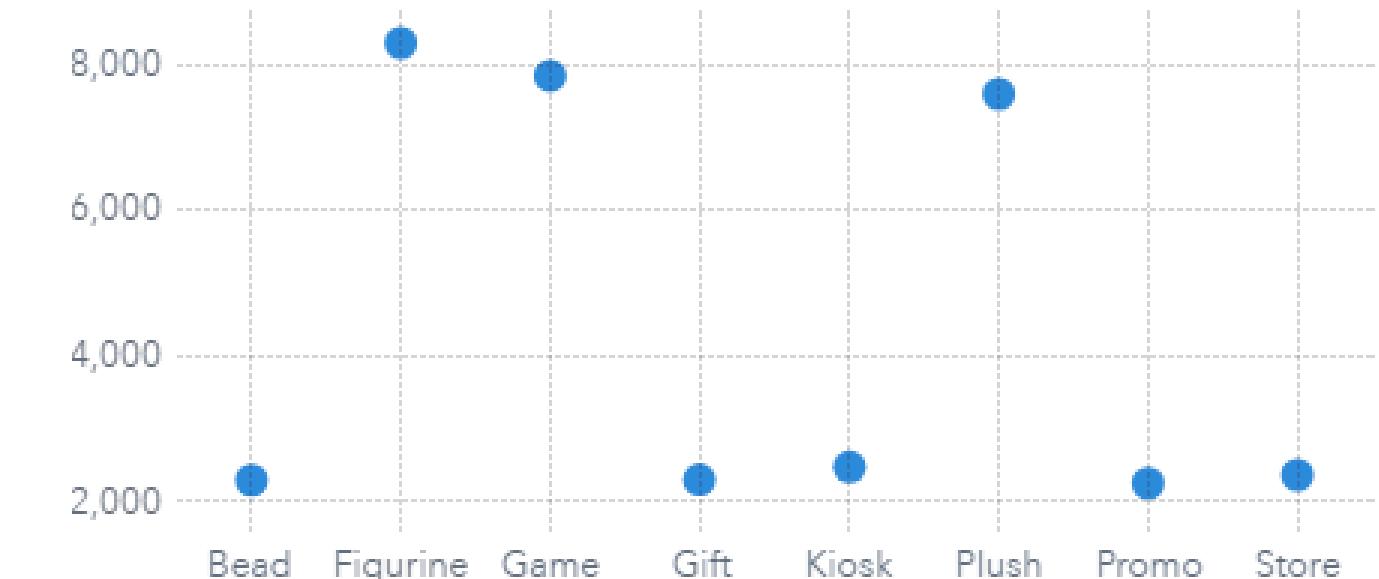


Bar chart

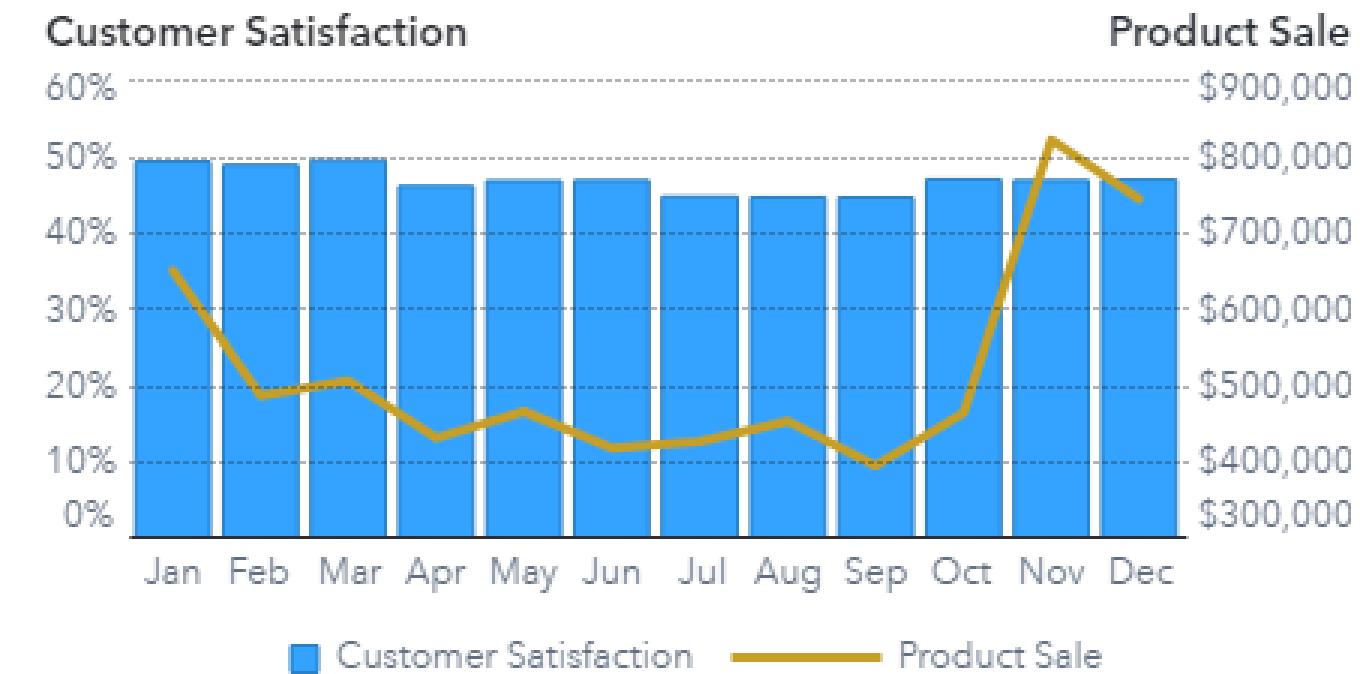


Cautiously consider fixed axis ranges

Number of Orders by Product Line



Dual axis chart



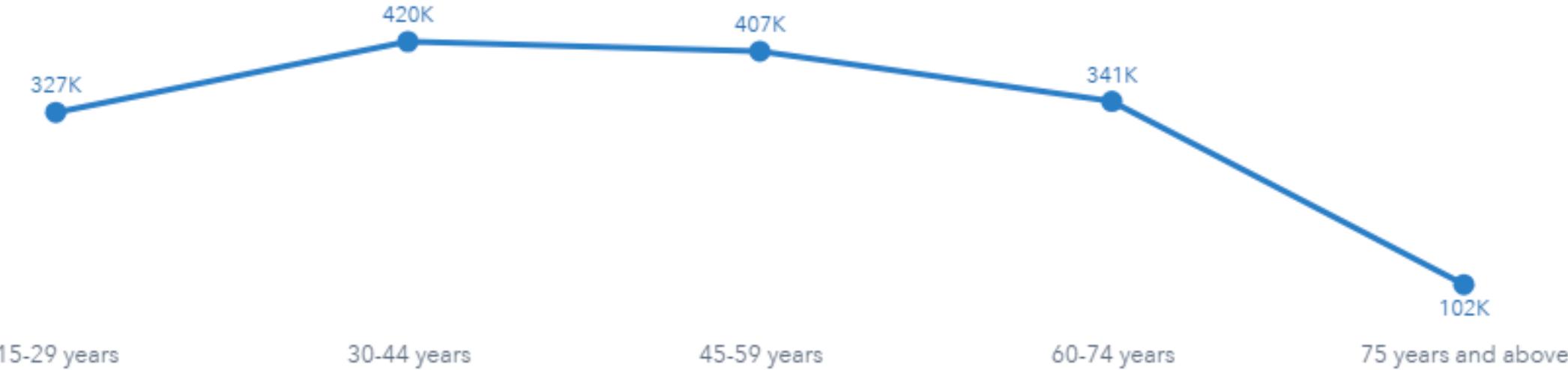


Choose the Best Chart (Presentation)

Compare two or more things
(Over time)

Line chart

Quantity Ordered by Customer Age Group



Time series plot



Avoid using an overview axis, use animation with caution



Choose the Best Chart (Presentation)

Reference lines

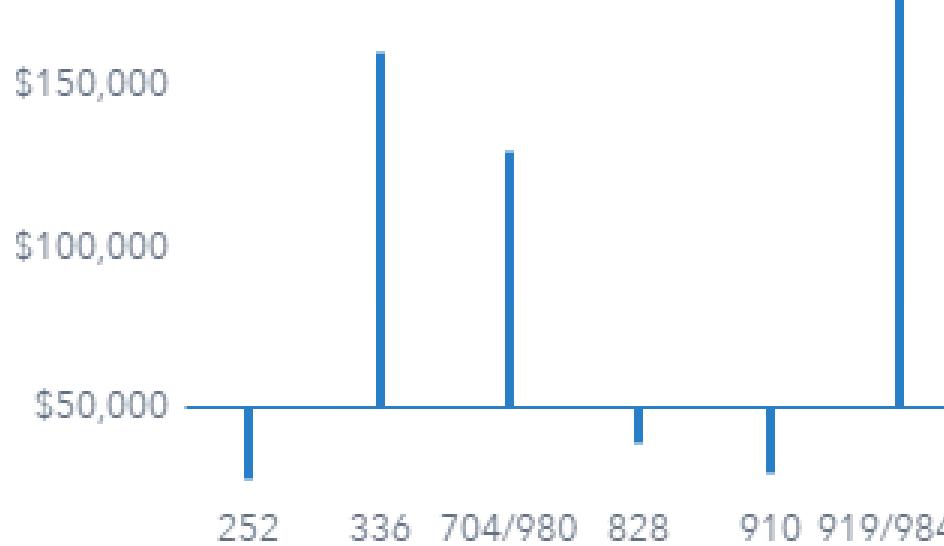


Avoid three-color gradients

Compare two or more things (Benchmark)

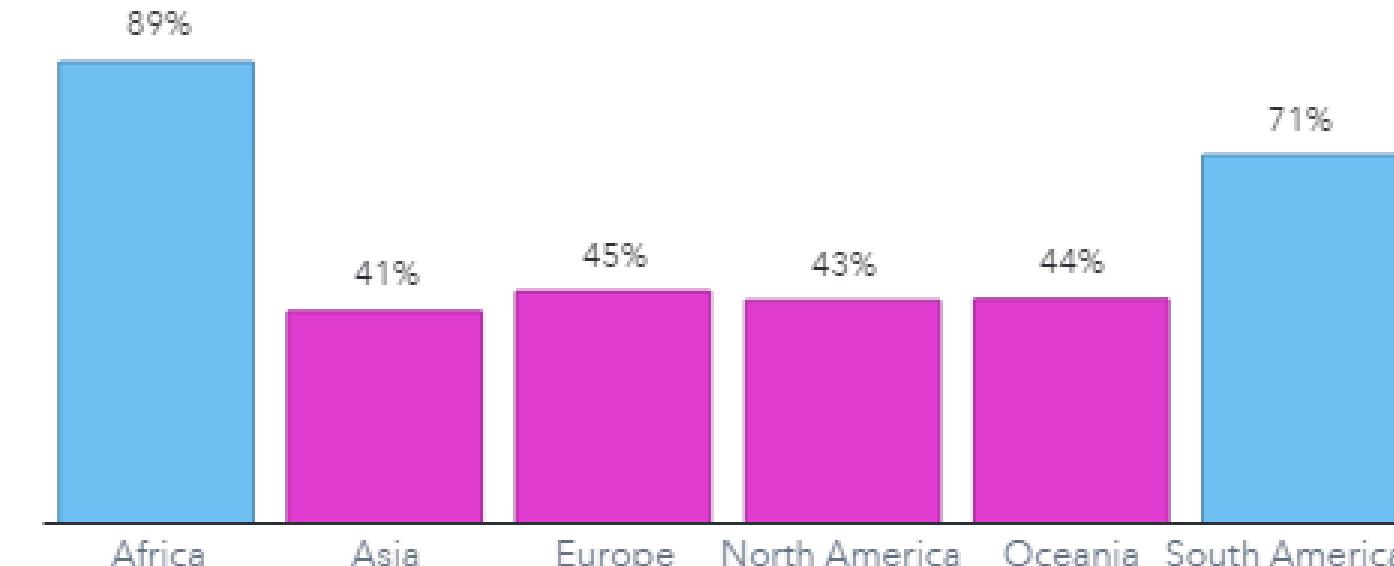
Needle plot

Profit by Area Code



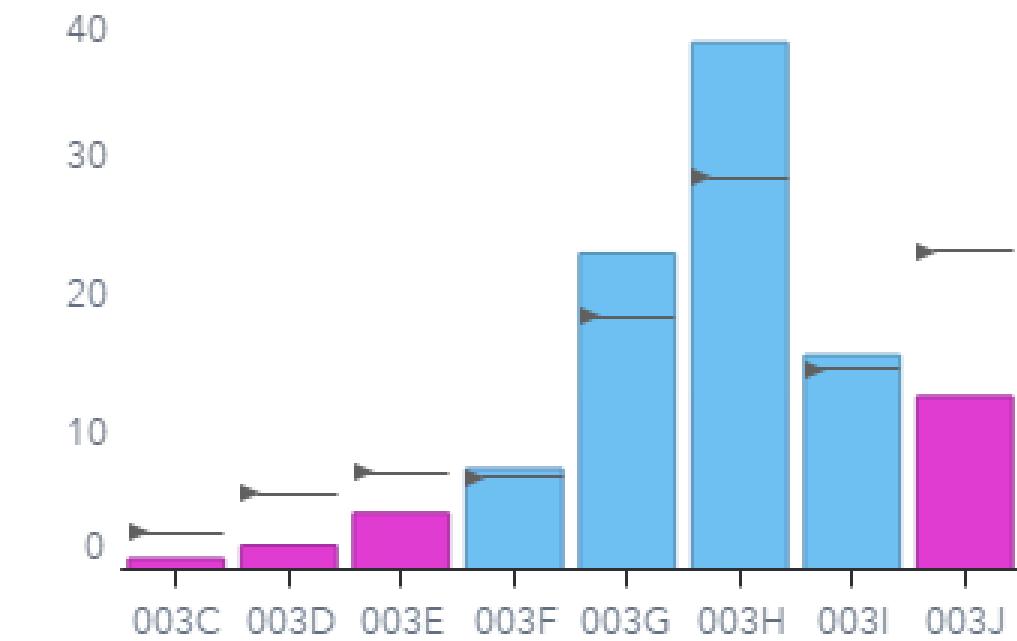
Display rules

Customer Satisfaction by Facility Continent



Targeted bar chart

Total Sales (millions)



Bullet gauge

Sales Goal





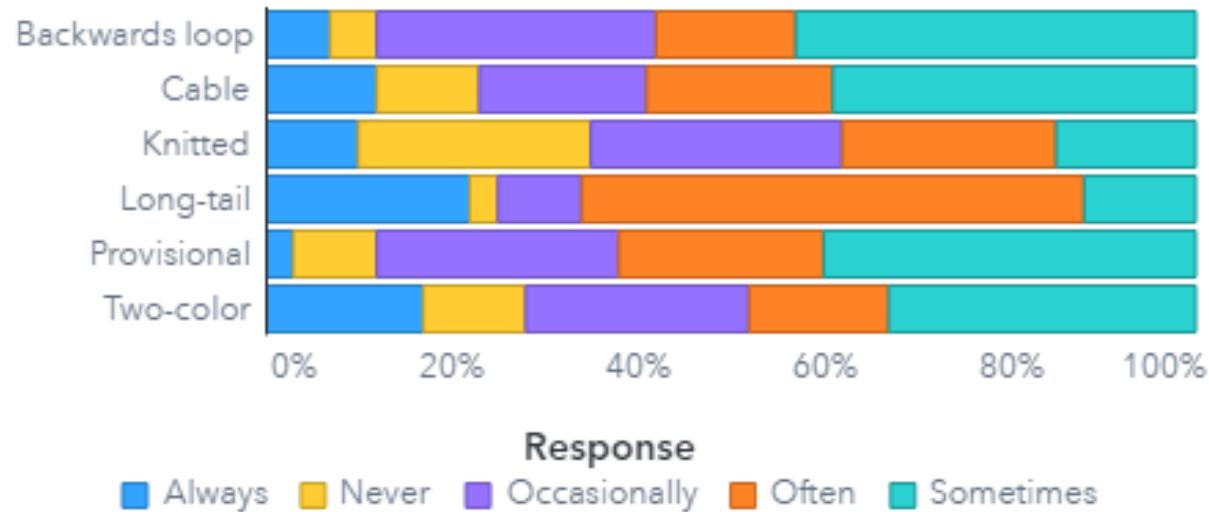
Choose the Best Chart (Presentation)

Show survey or questionnaire
results

Vertical bar chart

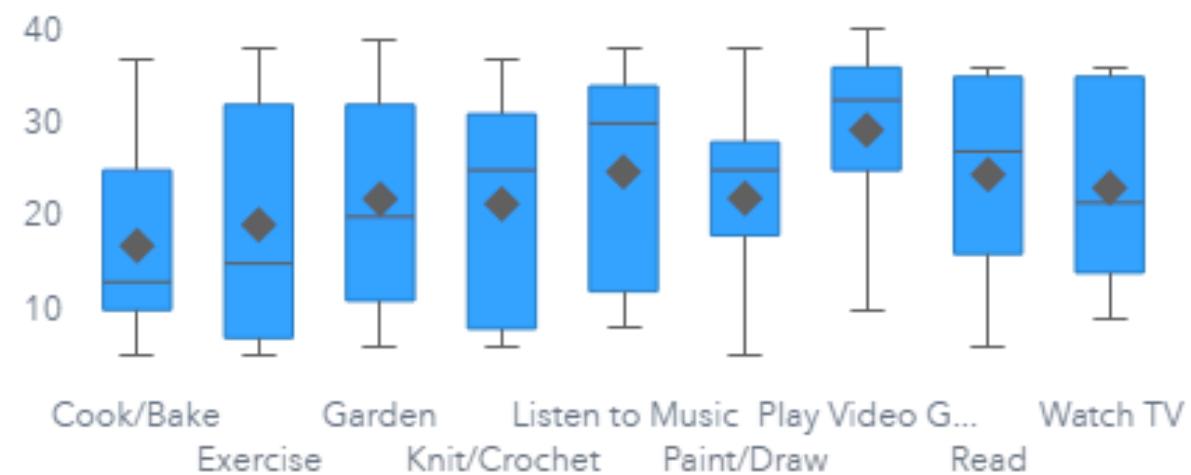
Stacked bar chart

How often do you use these cast on methods?

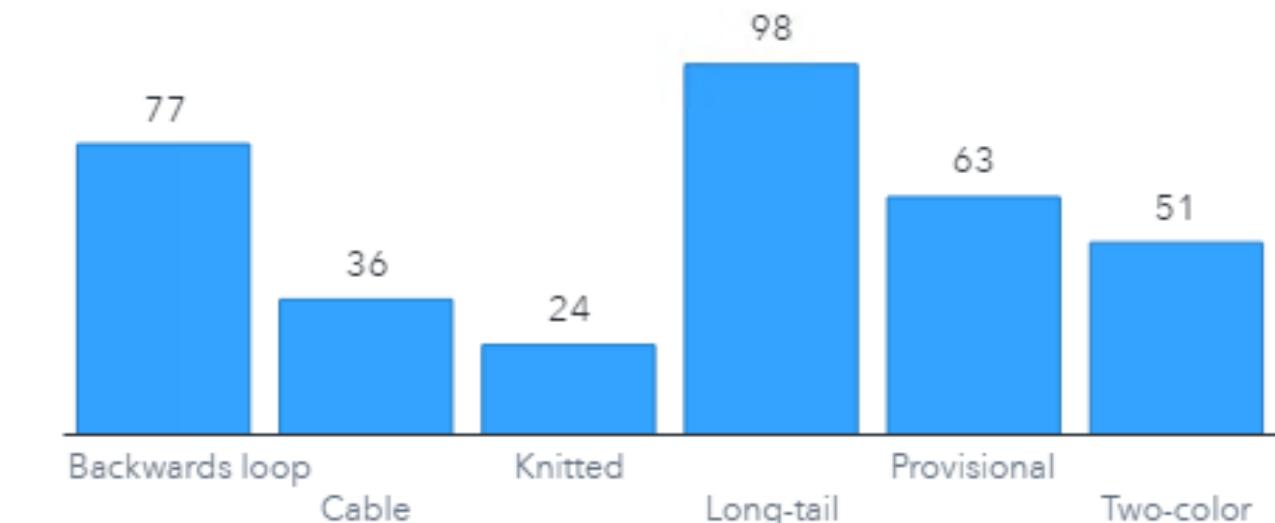


Box plots

How many hours a week do you ...?



Which cast on methods do you use regularly?



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

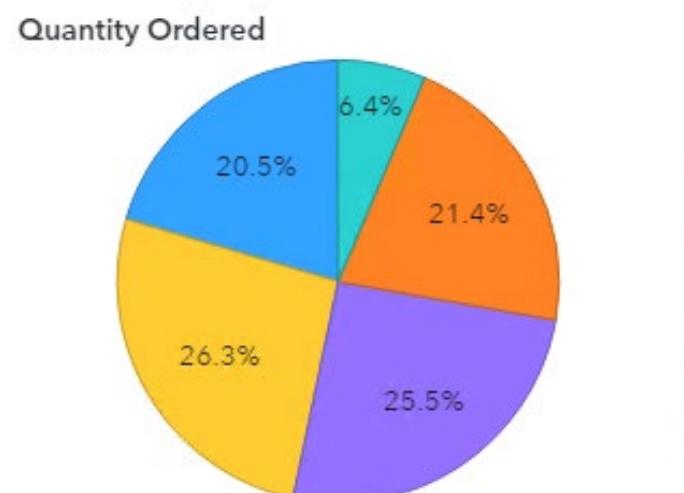


Choose the Best Chart (Presentation)

Donut chart



Pie chart

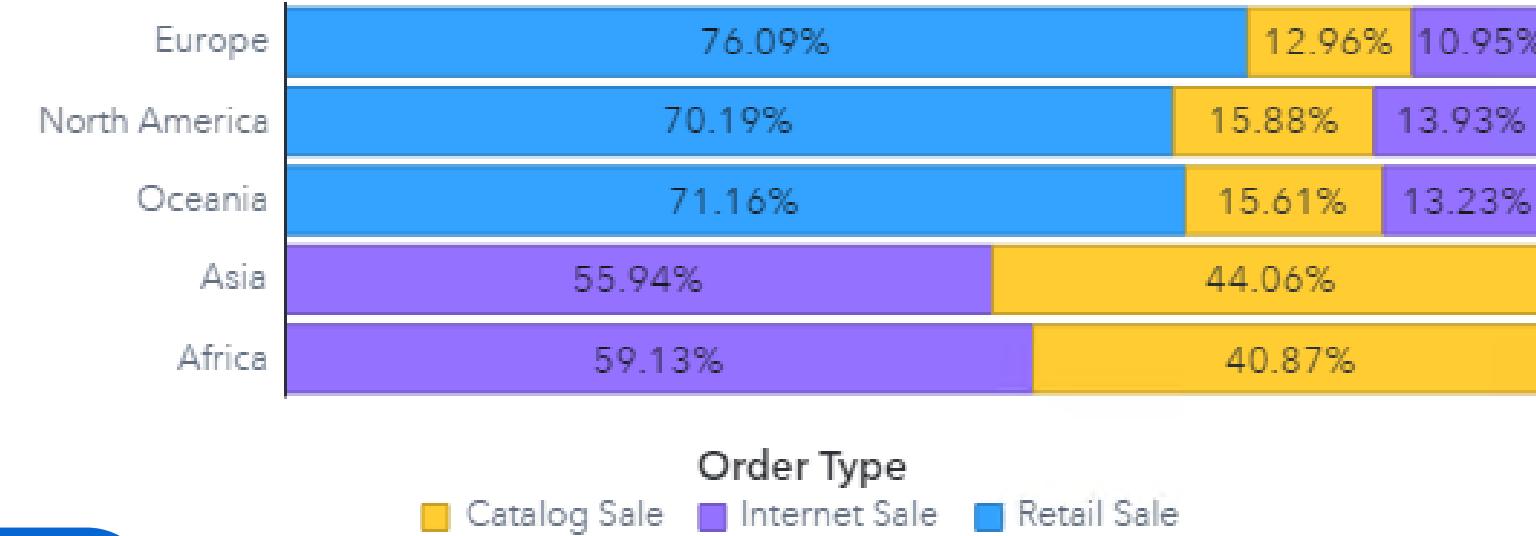


Use pie charts sparingly

Describe how parts relate to the whole

Stacked bar chart

Quantity Ordered by Continent and Order Type



Geo map

Customer Locations



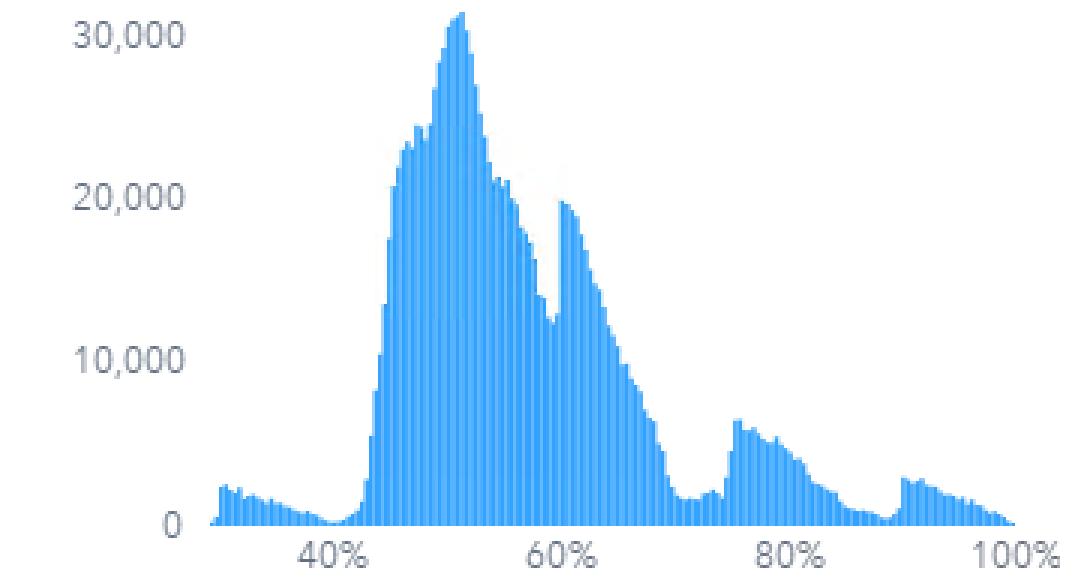
Treemap

Product Make



Histogram

Distribution of Vendor Satisfaction



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

“Save the pies for dessert.” – Stephen Few



Choose the Best Chart (Presentation)

Show relationships between
data items

Bubble plot

Scatterplot



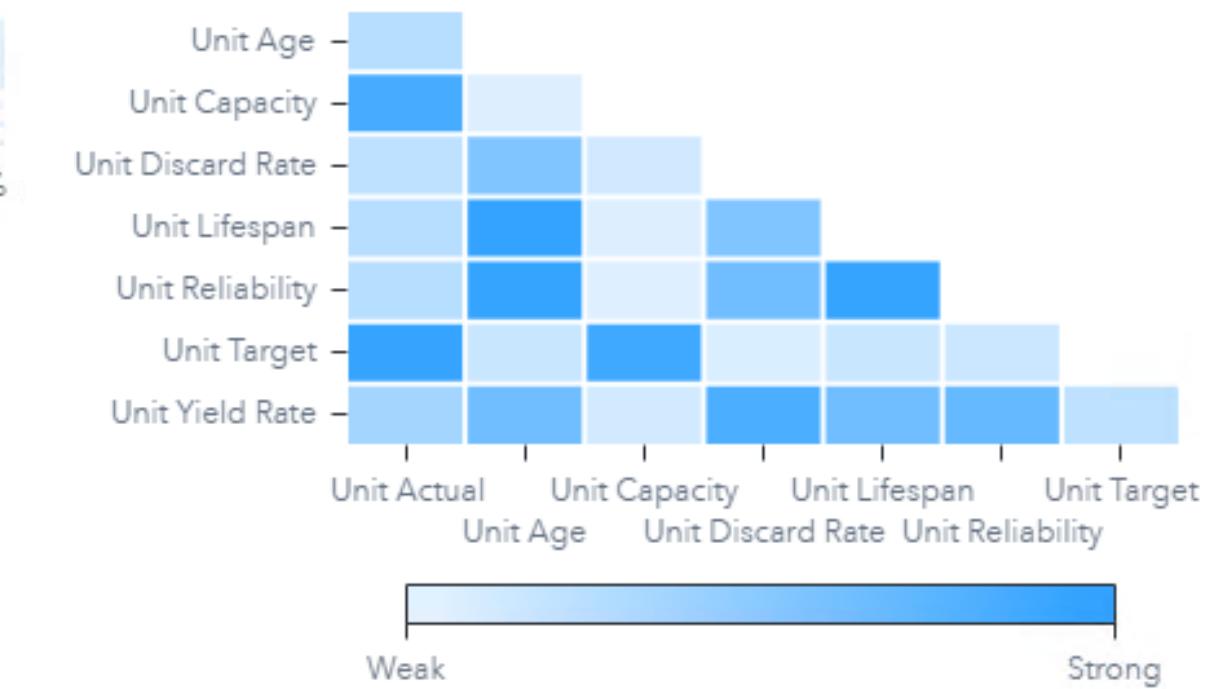
Heat map



Limit digits after decimal points

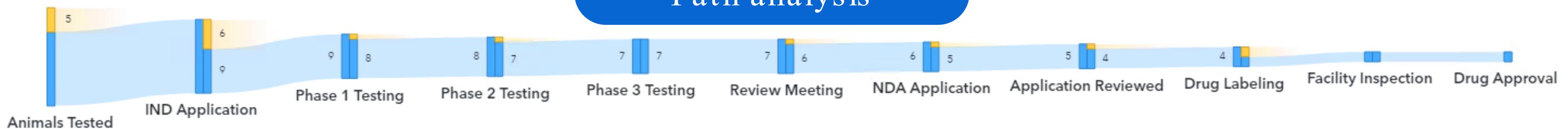


Correlation matrix





Choose the Best Chart (Presentation)



Text object

Moving To-Do List

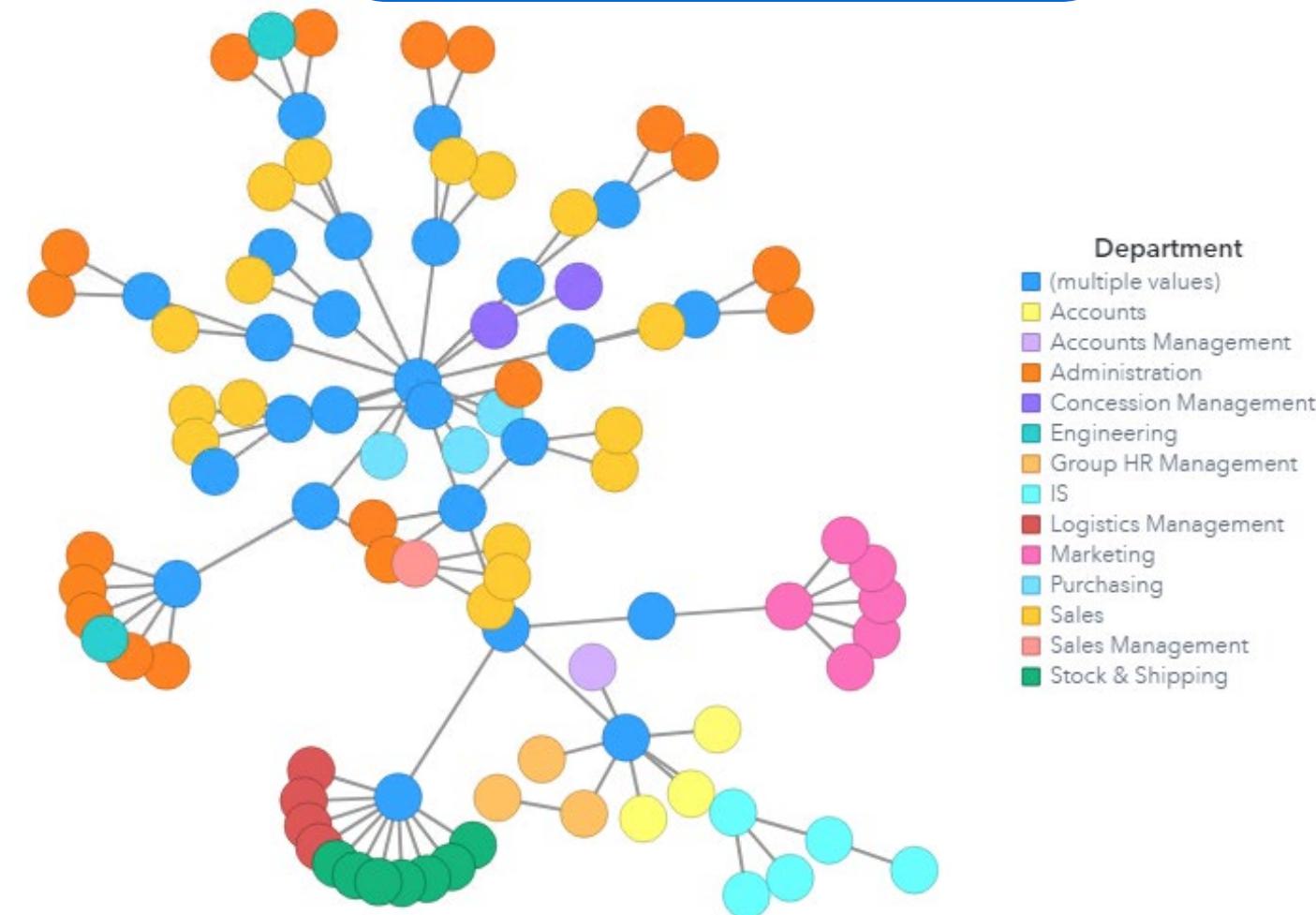
- Schedule movers
- Obtain packing supplies
- Cancel existing utilities
- Start new utilities
- Pack
- Change address
- New driver's license
- Register car
- Register to vote
- Find new providers



Ensure legends can be displayed on all screen sizes

Path Frequency by Link Drop Off

Network diagram





Choose the Best Chart (Presentation)

Is a graph required?

Word cloud

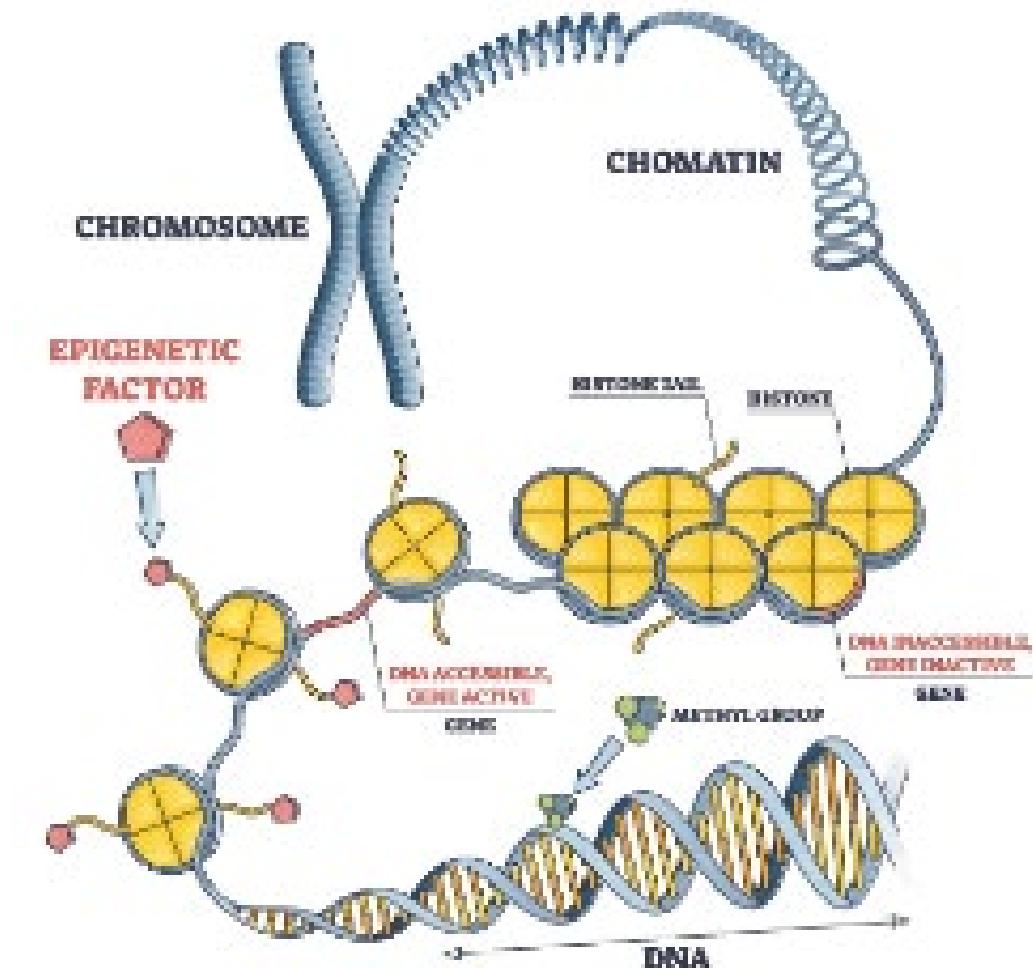


Images



Illustrations

EPIGENETIC MECHANISMS



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.



Limit sensitivity characteristics (size, shape, position)

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?

Draft a Plan



Focus on What's Important



Test, Test, and Test Again

Choose the Best Chart

Draft a Plan

Consider the Layout

Focus on What's Important

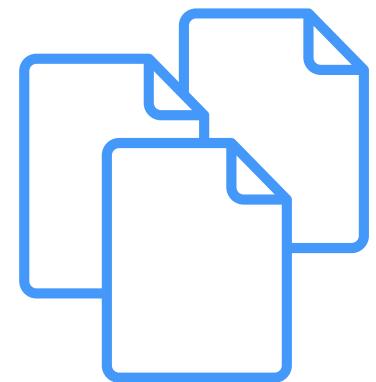
- Organized
- Easy to navigate
- Versatile
- Attractive

Test, Test, and Test Again

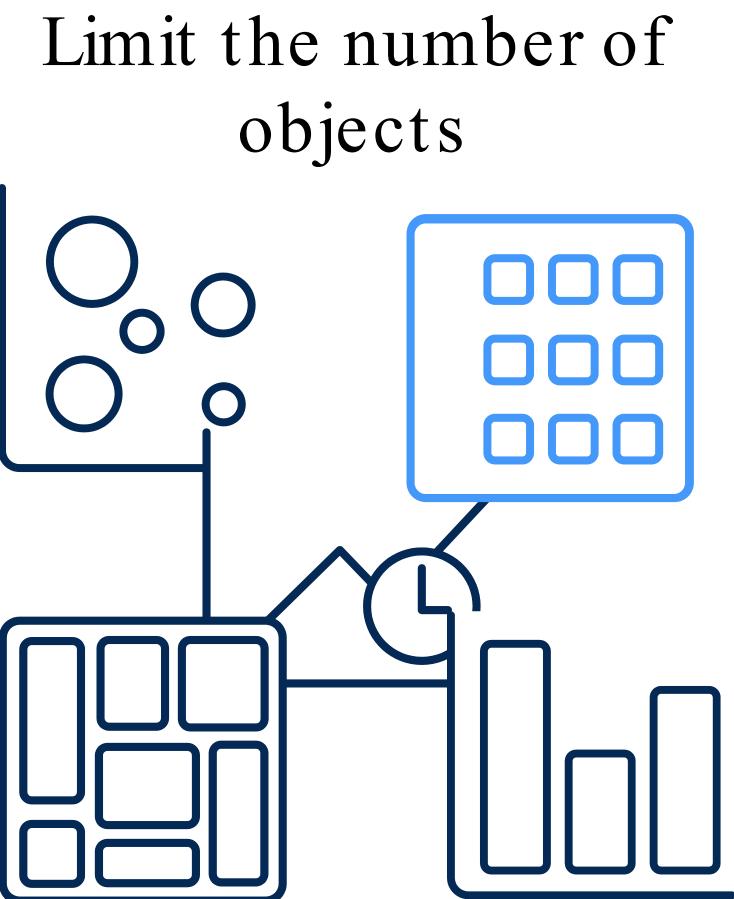


Focus on What's Important

Organized

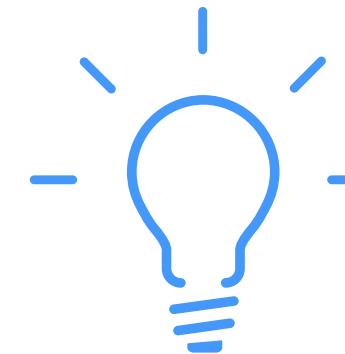


Multiple pages



Limit the number of objects

Focus on a single idea



Use hidden and pop-up pages to provide details



Stand on its own



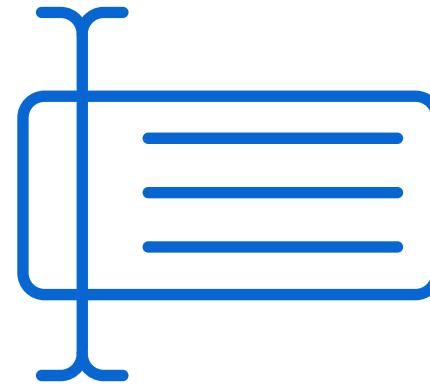
Limit the number of pages





Focus on What's Important

Easy to navigate



ADD DESCRIPTIONS

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



ADD INSTRUCTIONS

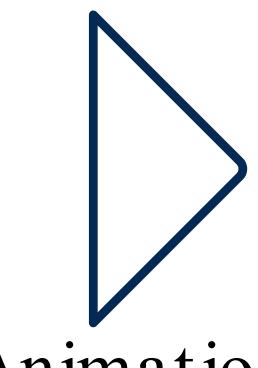
- Table of contents
- Introductory page
- Instructions for each page
- Explain report actions



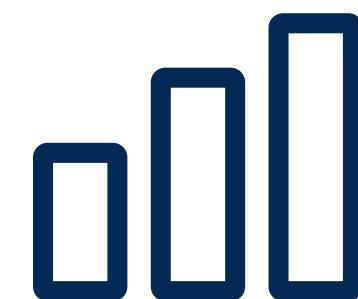
Use consistent fonts, provide details for keyboard shortcuts



Focus on What's Important



- View changes over time
- Focus on differences



Ranks

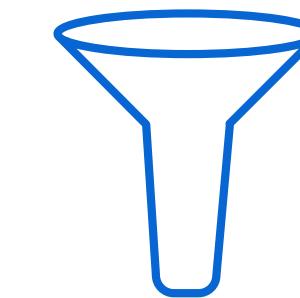
- Focus on important values
- Identify leaders or laggards

Versatile



Prompts

- Focus on specific areas
- Filter report or page



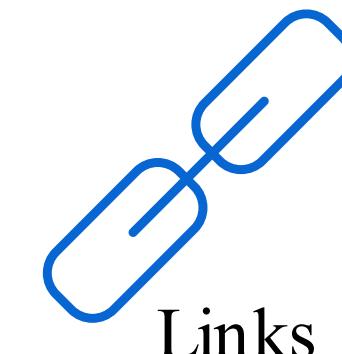
Actions

- Add interactivity
- Aid in self discovery



Viewer
customization

- Modify options
- Change chart types
- Select the data



Links

- Provide additional information



Use automatic actions to speed up development



Focus on What's Important

Attractive

Excitement Danger
Energy Revolution
Passion
Love

Happiness Cowardice
Optimism Caution
Warmth
Joy

Nature Depression
Freshness Jealousy
Wealth
Youth

Warmth
Autumn
Visibility
Harvest

Royalty
Wealth
Nobility
Honor

Immortality Sadness
Peace
Trust
Security

Purity
Elegance
Peace
Cleanliness

Sophistication
Mystery
Formality

Death
Mourning
Illness



Specify labels for display rules, choose WCAG-compliant colors

Choose the Best Chart

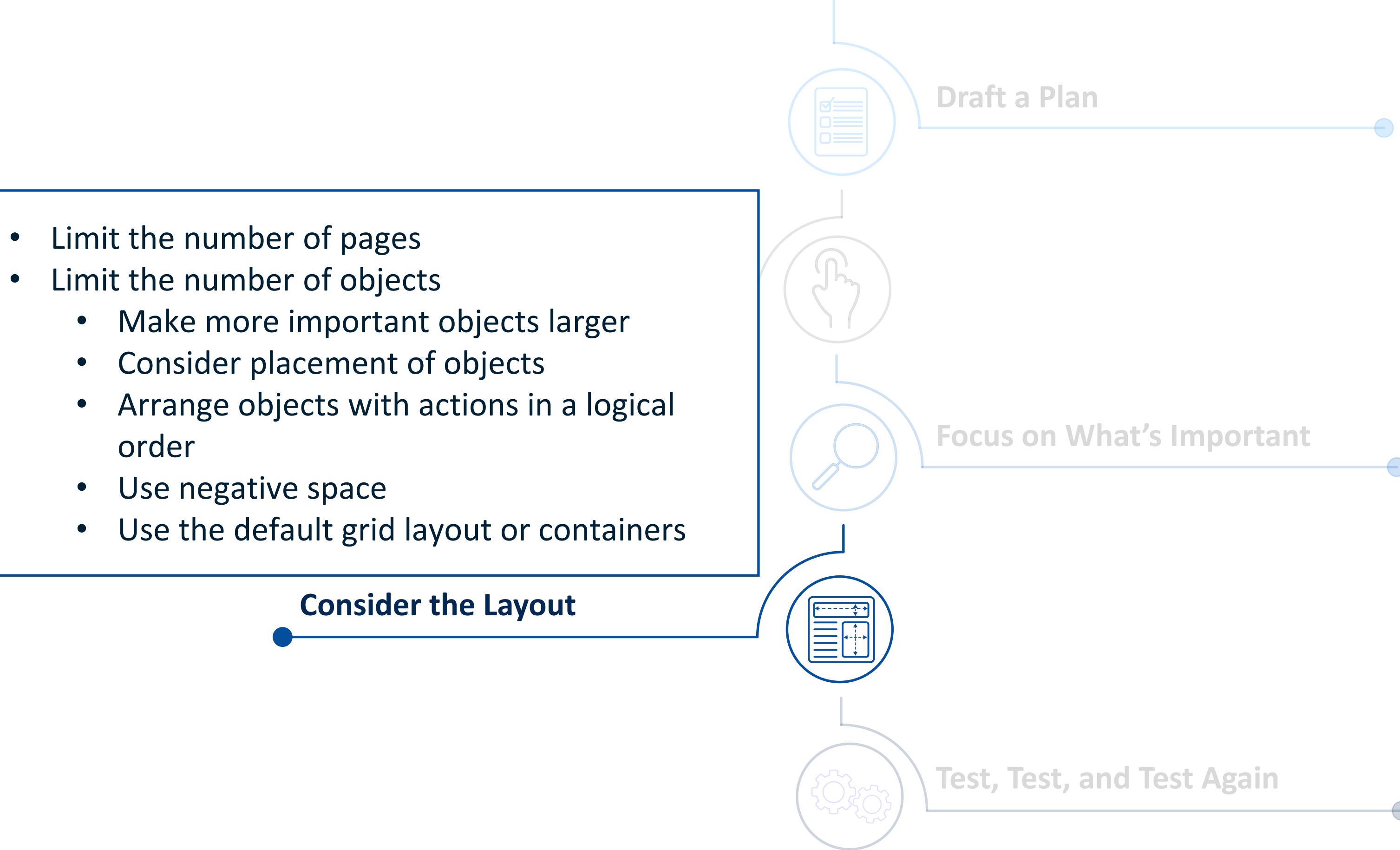
Draft a Plan

Consider the Layout

Focus on What's Important

- Organized
- Easy to navigate
- Versatile
- Attractive

Test, Test, and Test Again





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](#)

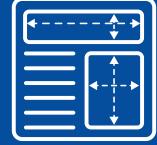
Arrange the pages to advance your data story

Limit the number of pages (less than 6)

Add a table of contents or introductory page

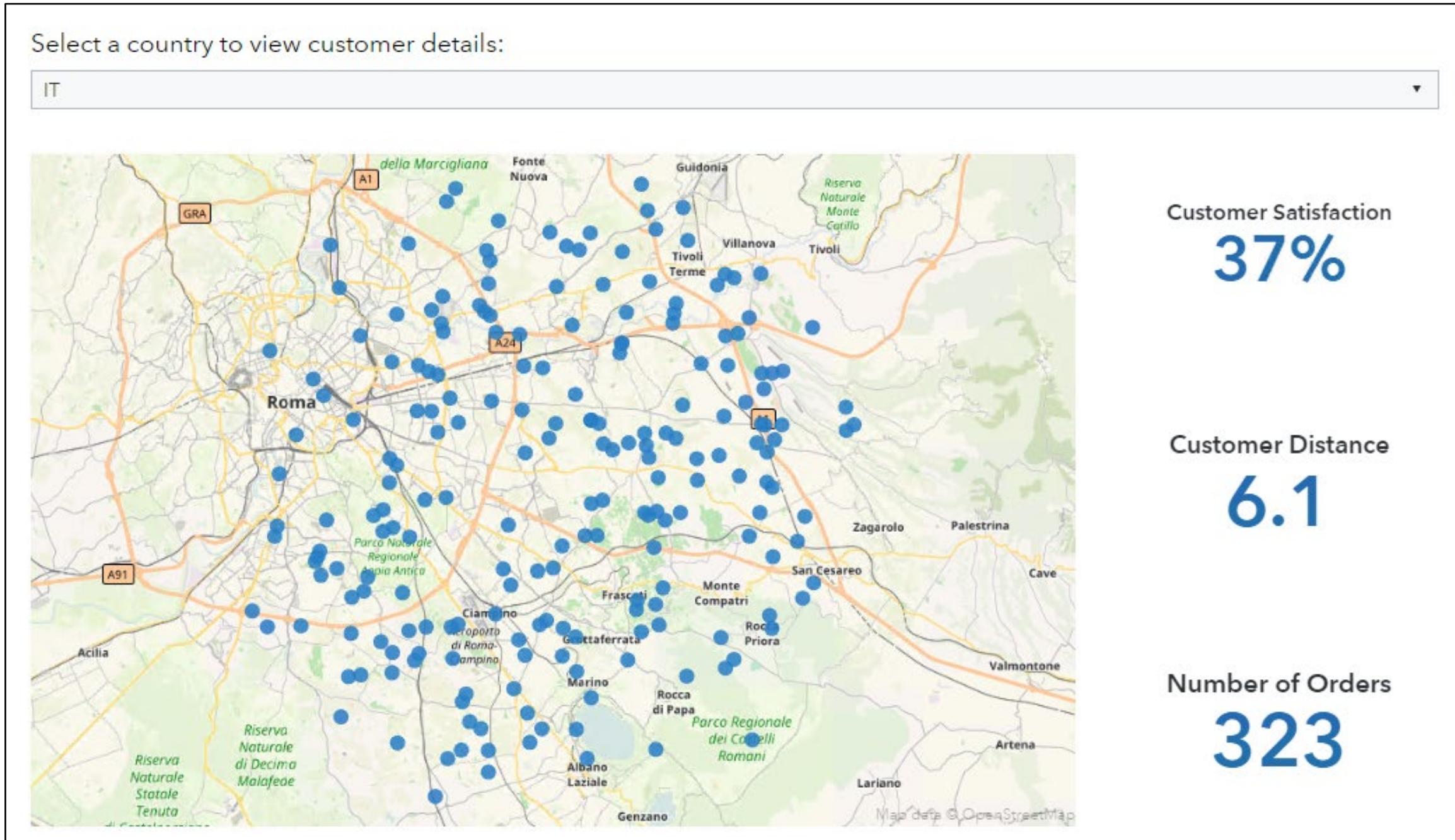
Use page links to control navigation

Use pop-up pages to provide additional details



Consider the Layout

Make more important objects larger



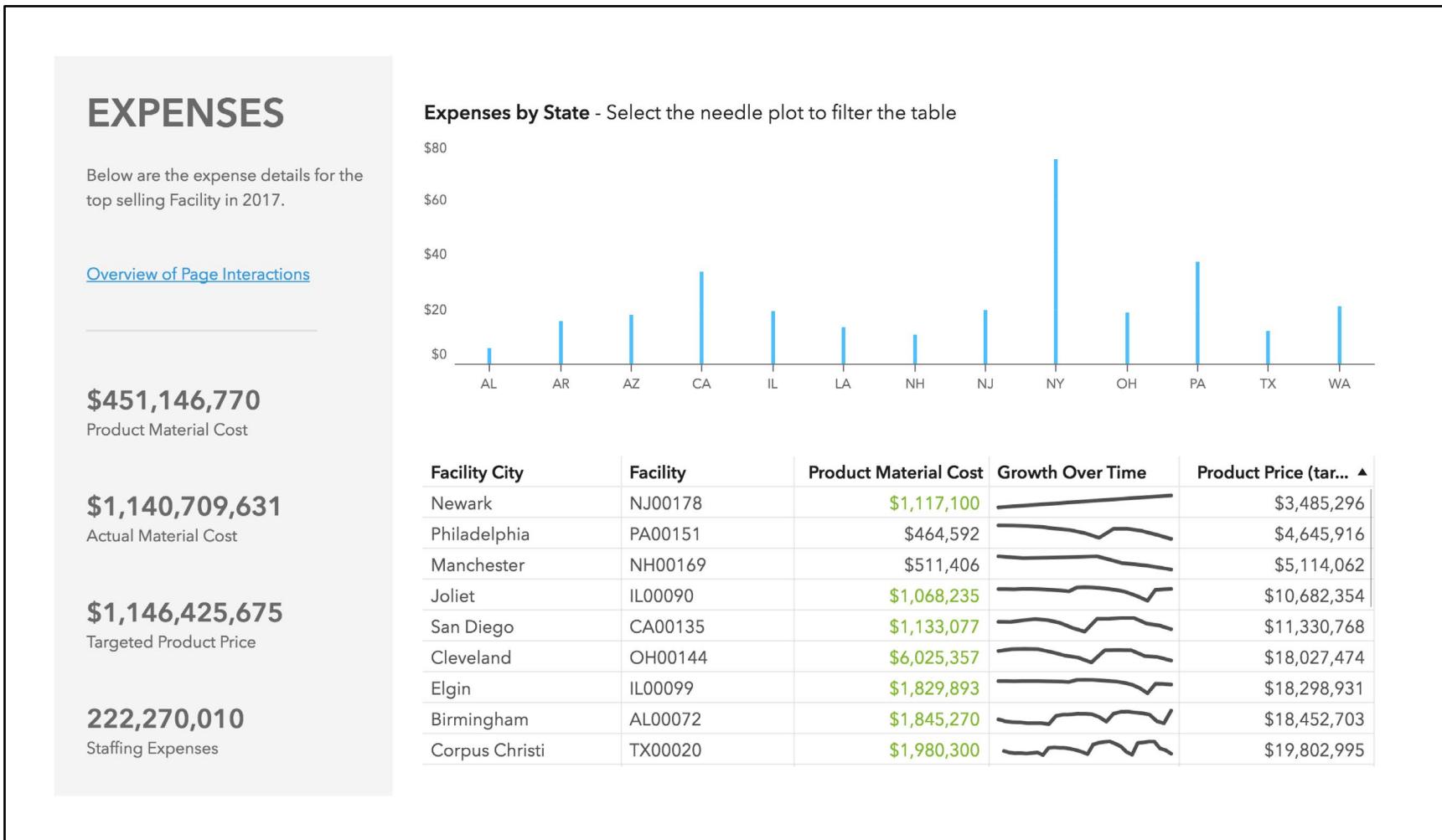
Use page templates to speed up development



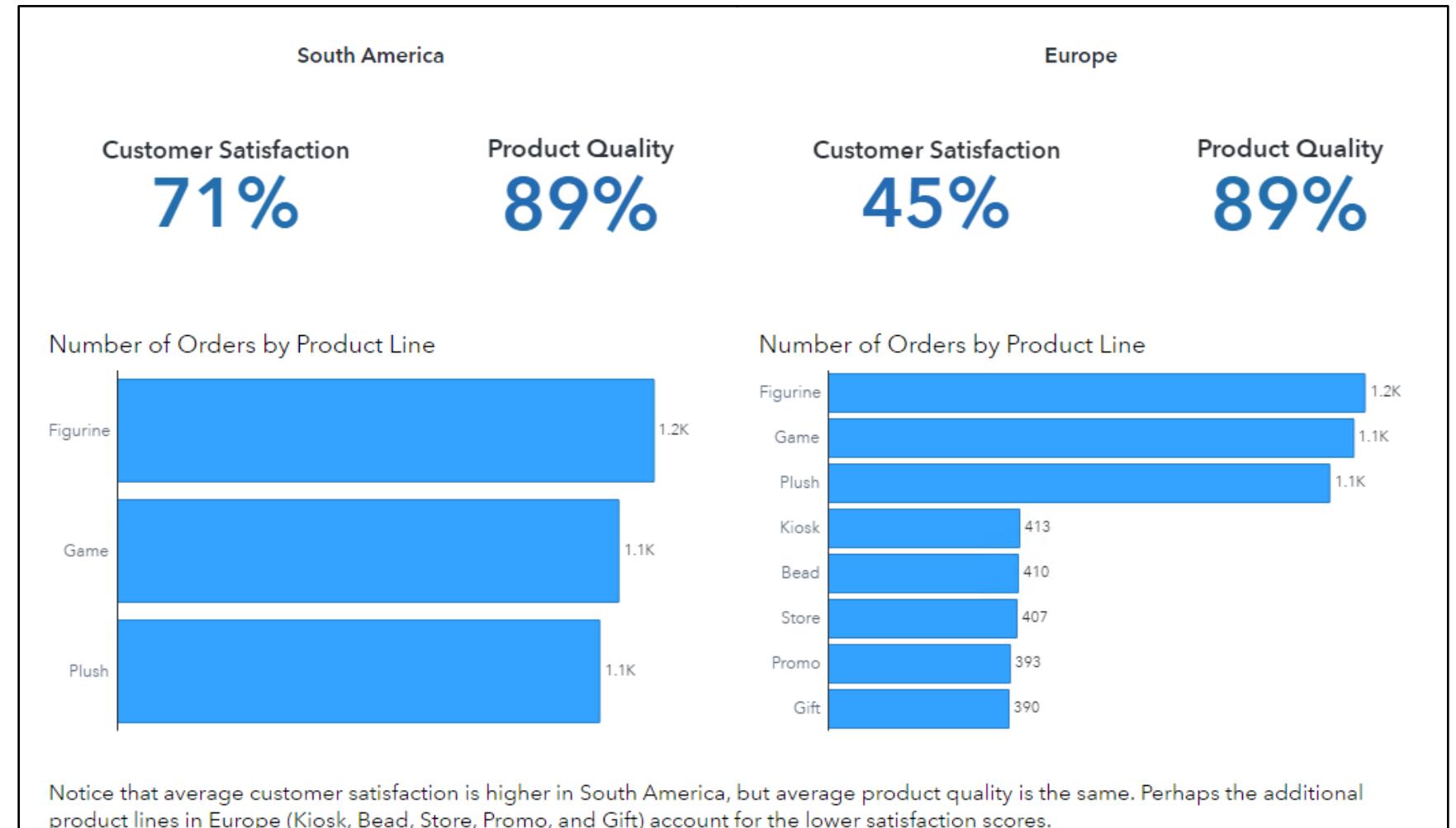
Consider the Layout

Consider the placement
of objects

Focal point



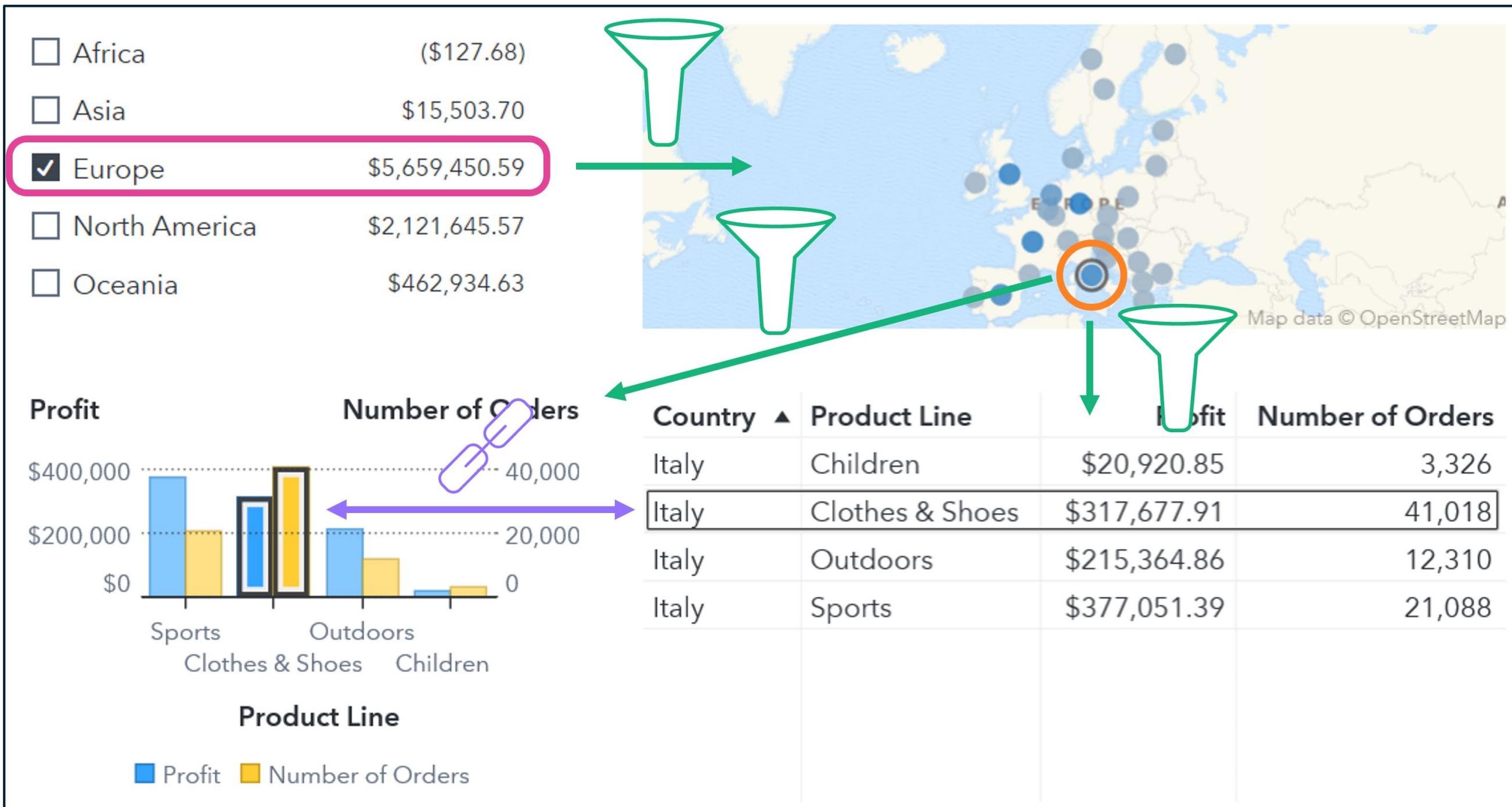
Related objects





Consider the Layout

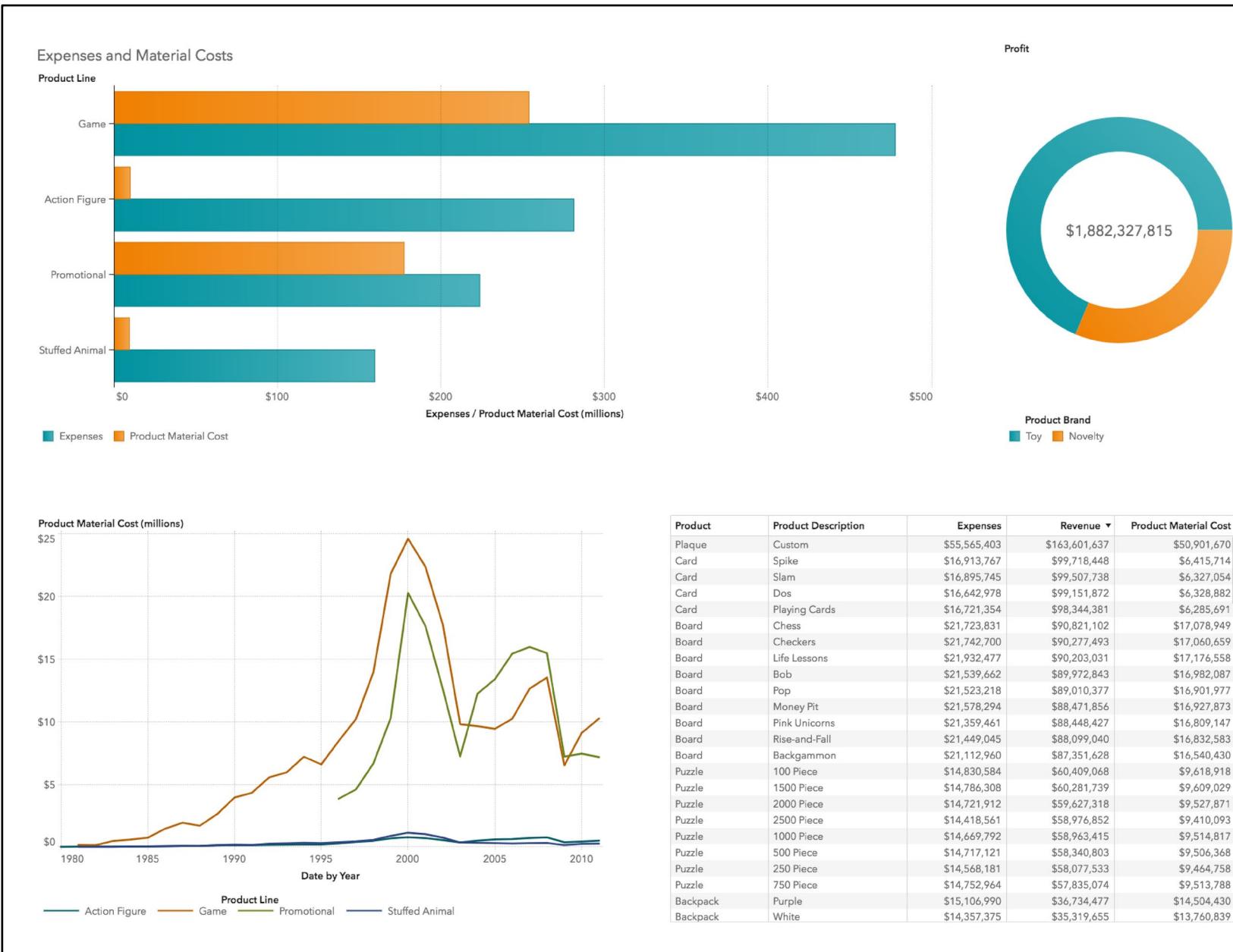
Arrange objects with actions
in a logical order



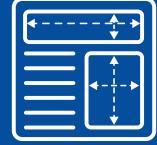


Consider the Layout

Use negative space



Use caution when modifying padding from default



Consider the Layout

Use the default grid layout
or containers

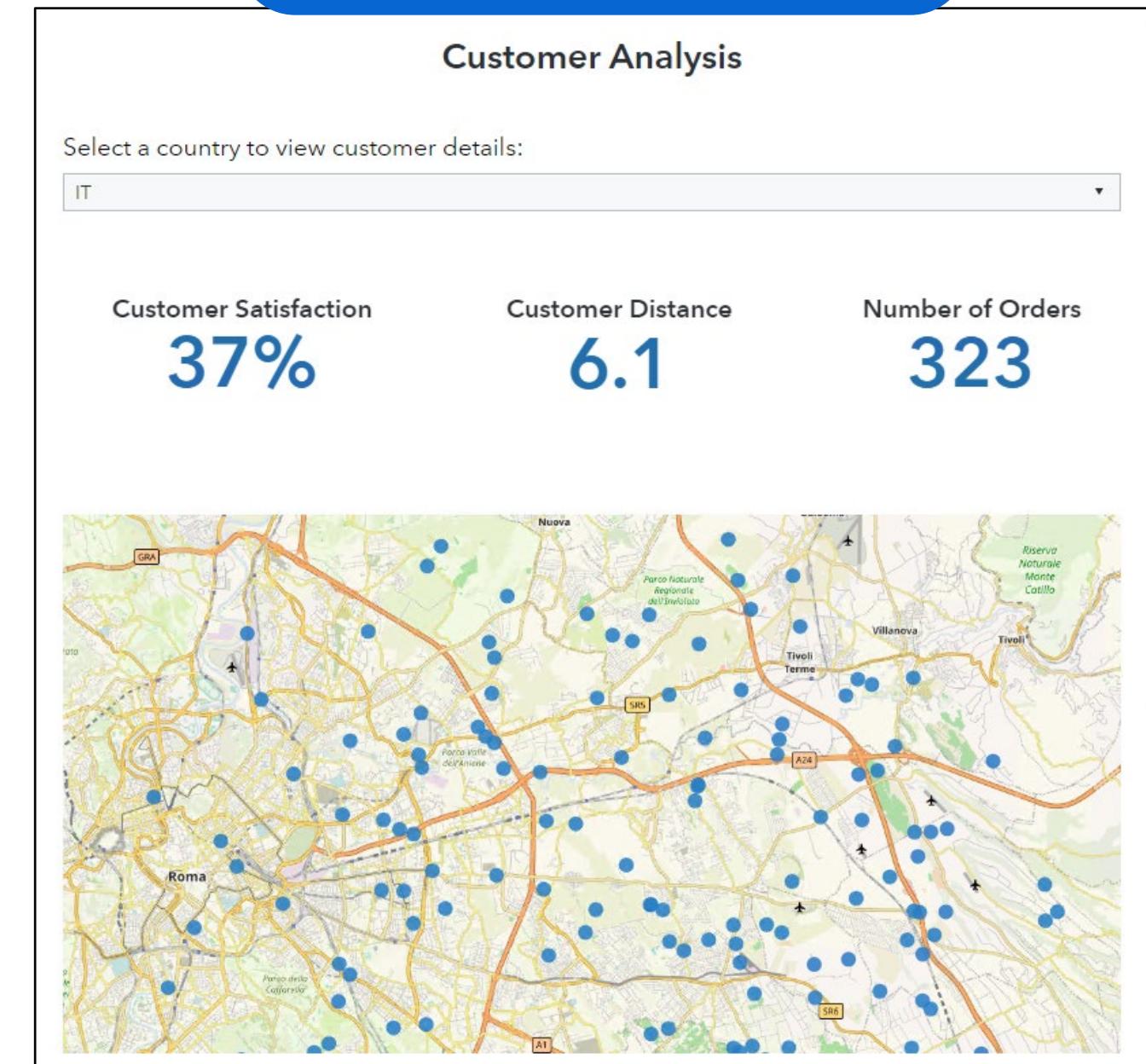
Prompt container

Stacking container



Avoid precision containers

Scrolling container



Prompts

Novelty Toy

Plush

Cheetah

Dachshunds

German Shepherds

Gibbon

Golden Retrievers

Gorilla

Labrador Retrievers

Lepoard

Lion

Lioness

Maine Coon

017JIN

Close

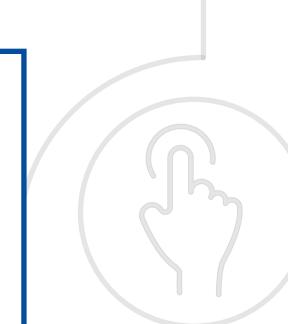
- Limit the number of pages
- Limit the number of objects
 - Make more important objects larger
 - Consider placement of objects
 - Arrange objects with actions in a logical order
 - Use negative space
 - Use the default grid layout or containers

Consider the Layout

Draft a Plan



Focus on What's Important



Test, Test, and Test Again

Choose the Best Chart

Draft a Plan

- Report Review pane
- Peer review
- Test on multiple devices
- 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

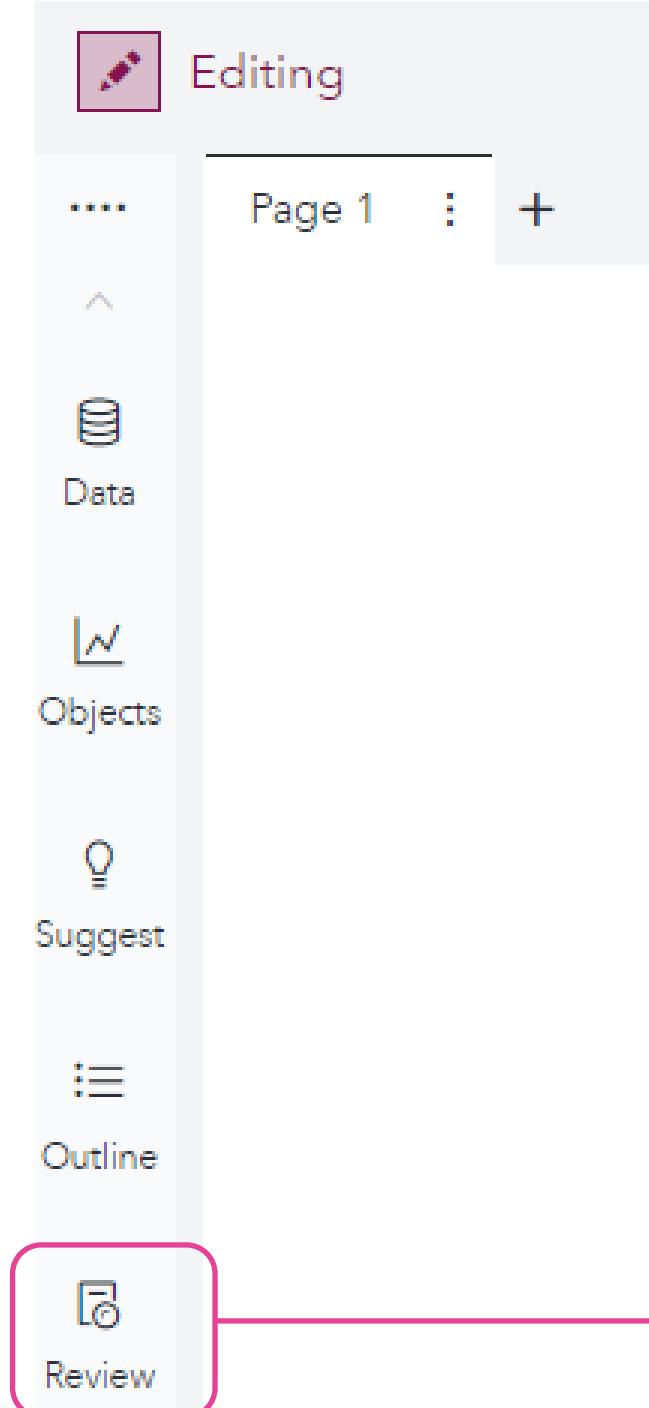
Consider the Layout

Test, Test, and Test Again



Test, Test, and Test Again

Report Review pane



Performance issues

Accessibility issues



Provide meaningful titles for accessibility



Test, Test, and Test Again

Peer review

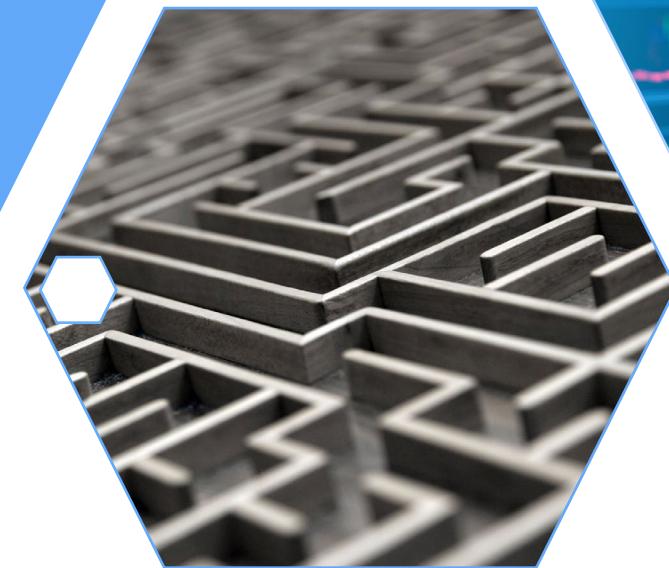


Is the report
easy to
navigate?

What is the
story?



Did you get
lost?



Did all the
actions
work?



Were all the
features
apparent?



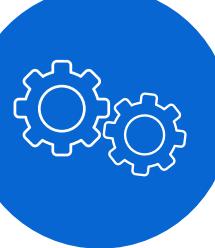


Test, Test, and Test Again

Test on multiple devices

The screenshot shows a web browser interface with the following elements:

- Toolbar:** Includes icons for New tab, New window, New Incognito window, History, Downloads, Bookmarks, Google Password Manager, Extensions, Zoom (set to 100%), Print..., Cast..., Find..., More tools, Edit, Cut, Copy, Paste, Settings, Help, and Exit.
- Developer Tools:** A menu item "Developer tools" is highlighted with a pink border and a tooltip "Managed by your organization".
- Device Simulation:** An arrow points from the "Elements" tab in the developer tools to a list of devices. The "Responsive" option is selected. The list includes:
 - ✓ Responsive
 - 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
 - Facebook for Android v407 on Pixel 6



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

Choose the Best Chart

Draft a Plan

- Report Review pane
- Peer review
- Test on multiple devices
- 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

Consider the Layout

Test, Test, and Test Again

Handy Links

[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 Stories are Data With a Soul](#) by Ted Stolarczyk

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

[Types of Charts: Choose the Best Chart to Convey Your Message](#)

[Visual Explanations](#) by Edward Tufte

✓ Did you
enjoy this
session, Let us
know in the
[evaluation](#)

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The SAS[®] Viya[®] ETL Playbook

Charu Shankar

The SAS® Viya® ETL Playbook

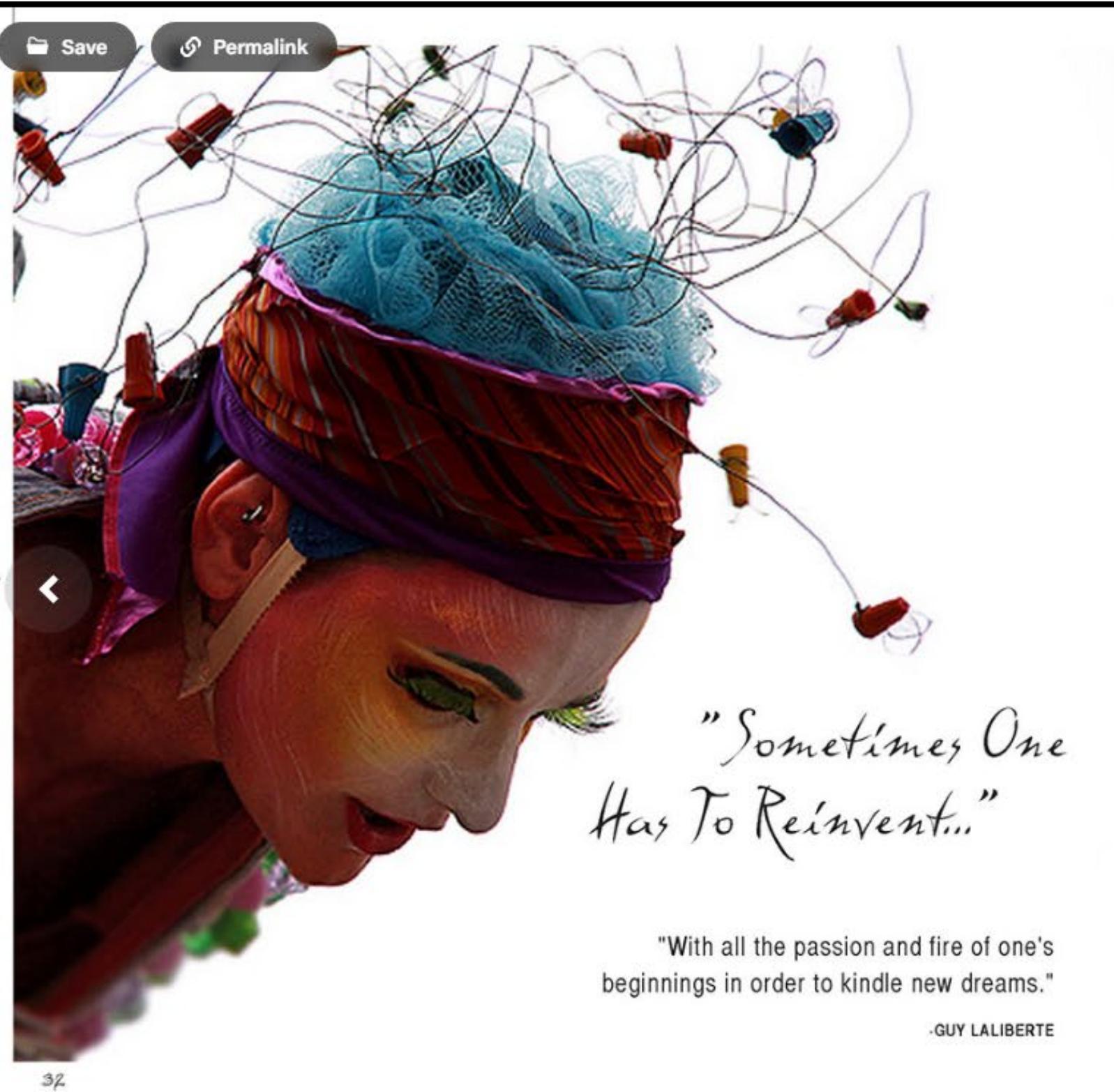
Charu Shankar, SAS® Institute

With a background in computer systems management. SAS Instructor Charu Shankar engages with logic, visuals, and analogies to spark critical thinking since 2007.

Charu curates and delivers unique content on SAS, SQL, Viya, etc. to support users in the adoption of SAS software.

When not coding, Charu teaches yoga and loves to explore Canadian trails with her husky Miko.

Data Used In This Presentation



Agenda

ETL or Extract, transform, and Load is an integral process for data engineers to extract data from different sources, transform the data into a trusted resource, and load that data into systems that end users such as data scientists can use for computation and analysis. In all the buzz around analytics, ETL is often relegated to the background, but data scientists depend deeply on this solid foundational task before they can deep dive into analytics.

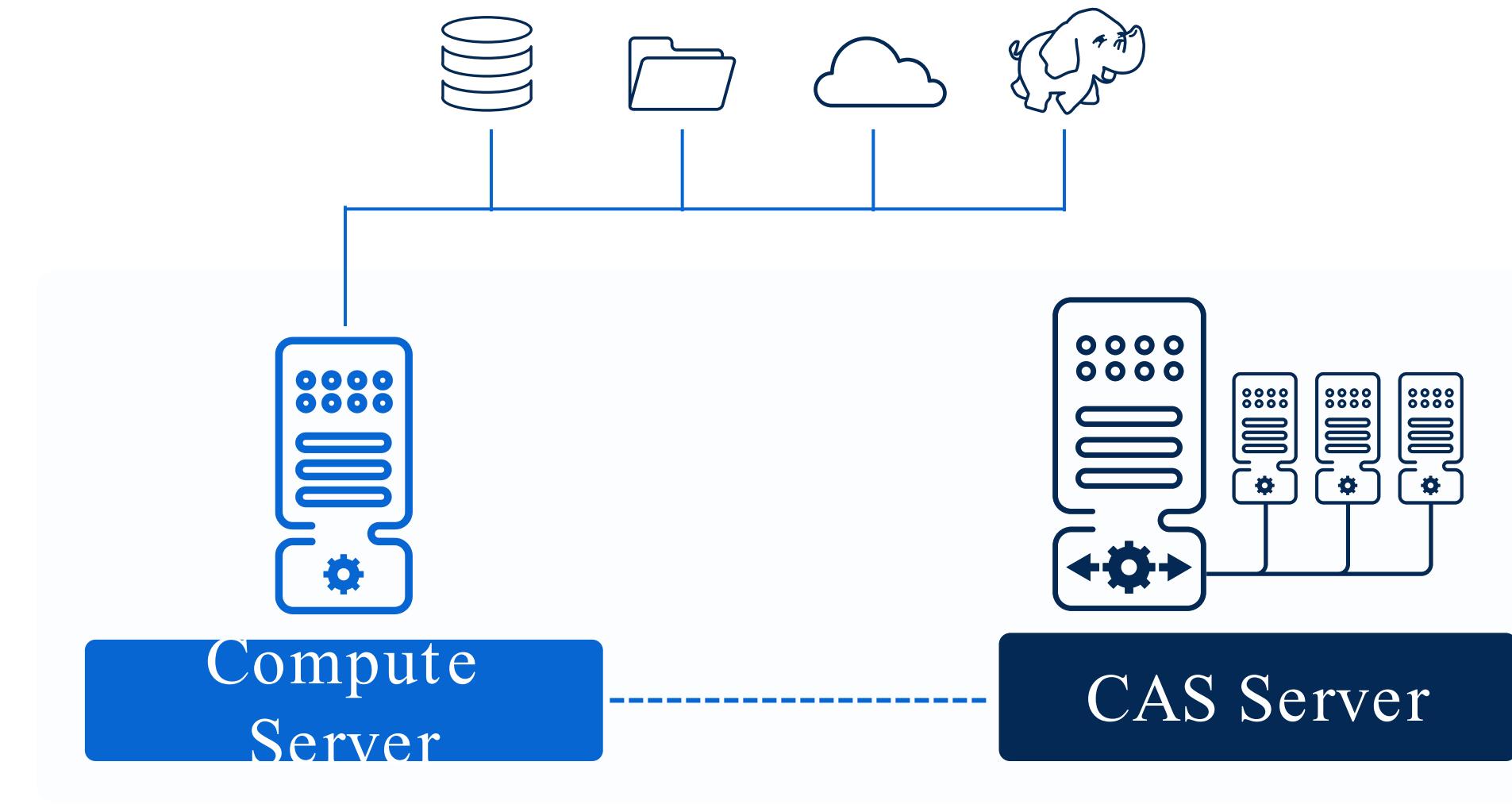
Leverage the power of the Cloud to extract, transform and load data using SAS programs executed in the SAS Viya Compute Server. The good news is that if you are already programming in SAS 9, you'll feel right at home in Viya!

1 Introduction

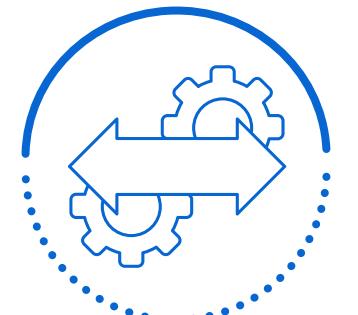
2 Servers on SAS 9 vs. SAS Viya

3 Live Demo

SAS Viya Compute Server Overview



Program using
SAS®9 code



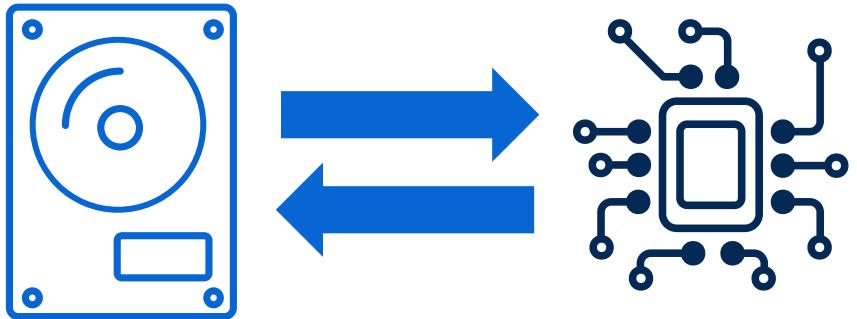
Access data using
SAS/ACCESS



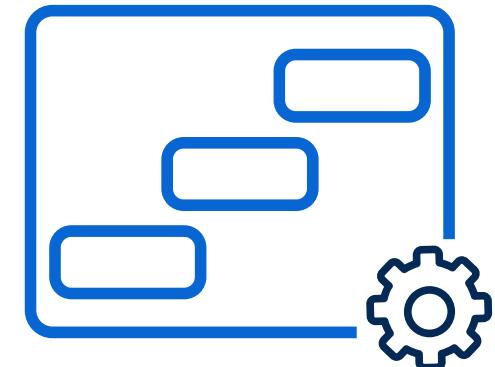
Client to the
CAS server



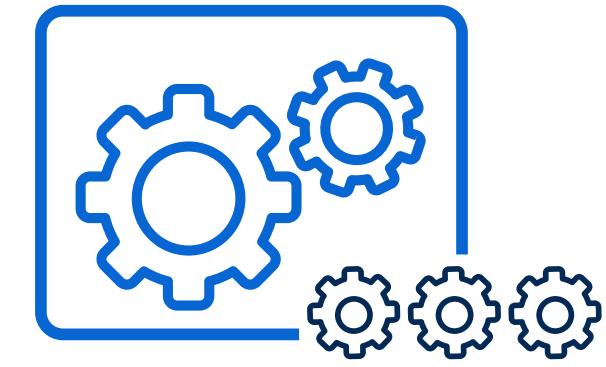
- DISK
- RAM
- CPU



Data is transferred from **disk** to **memory**.

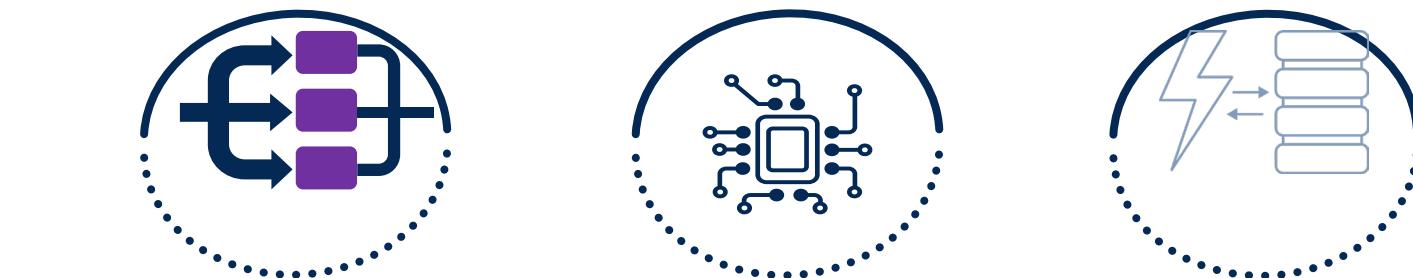
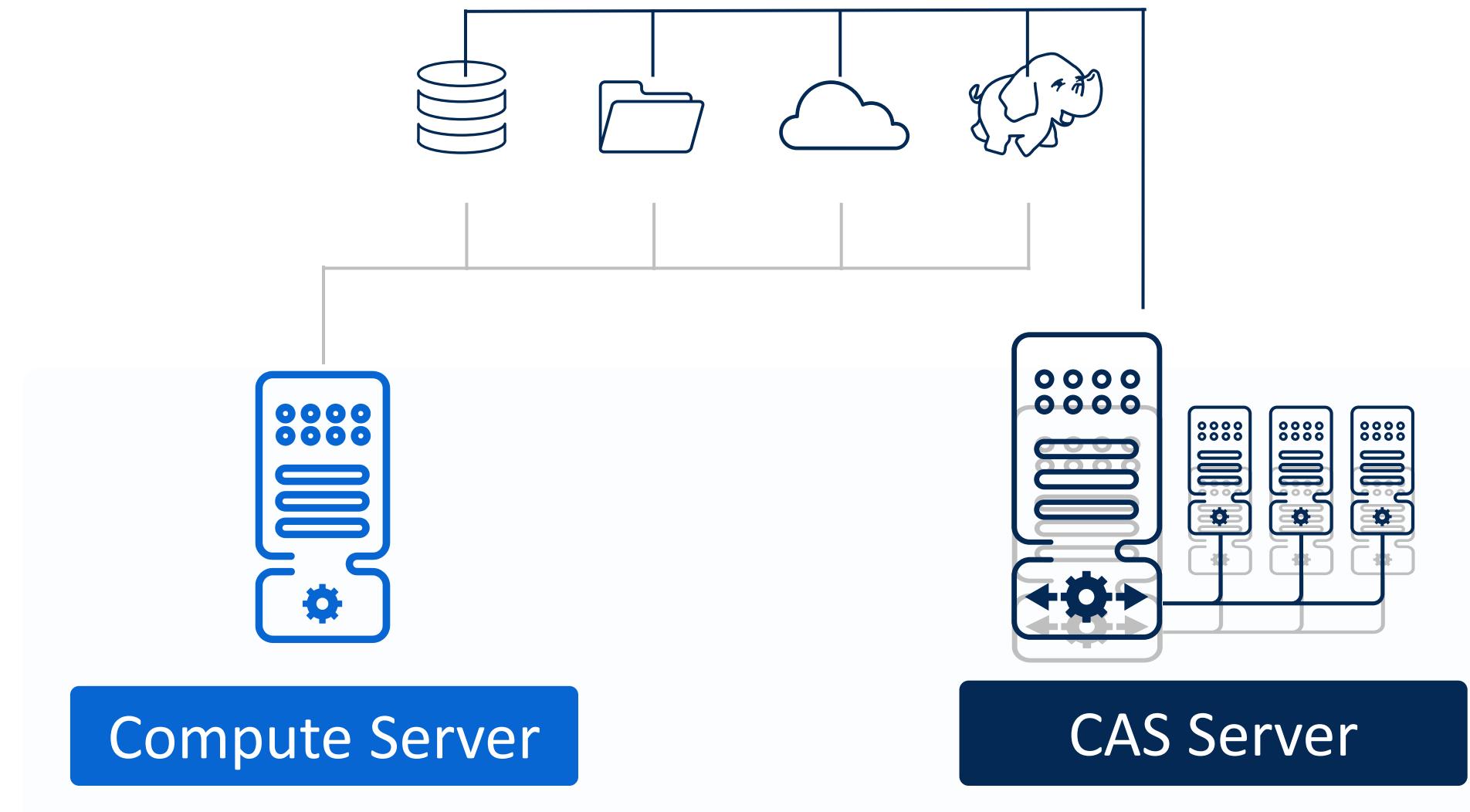


DATA step is processed **single-threaded**.



Many PROCS are **multi-threaded**.

CAS Server on SAS Viya



Parallel
In-
Processin Memo

SAS
Viya

SAS Viya Servers and Processing Environments

SAS Viya



Traditional SAS processing engine

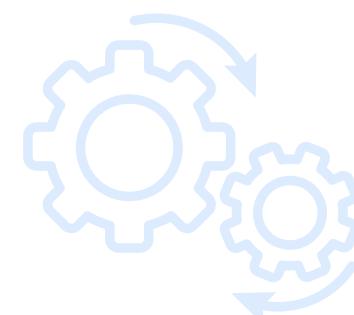
Executes traditional SAS®9 code

SAS Compute Server

SAS Cloud Analytic Services (CAS)

Next-gen SAS processing engine

Executes CAS-enabled code in parallel on in-memory data

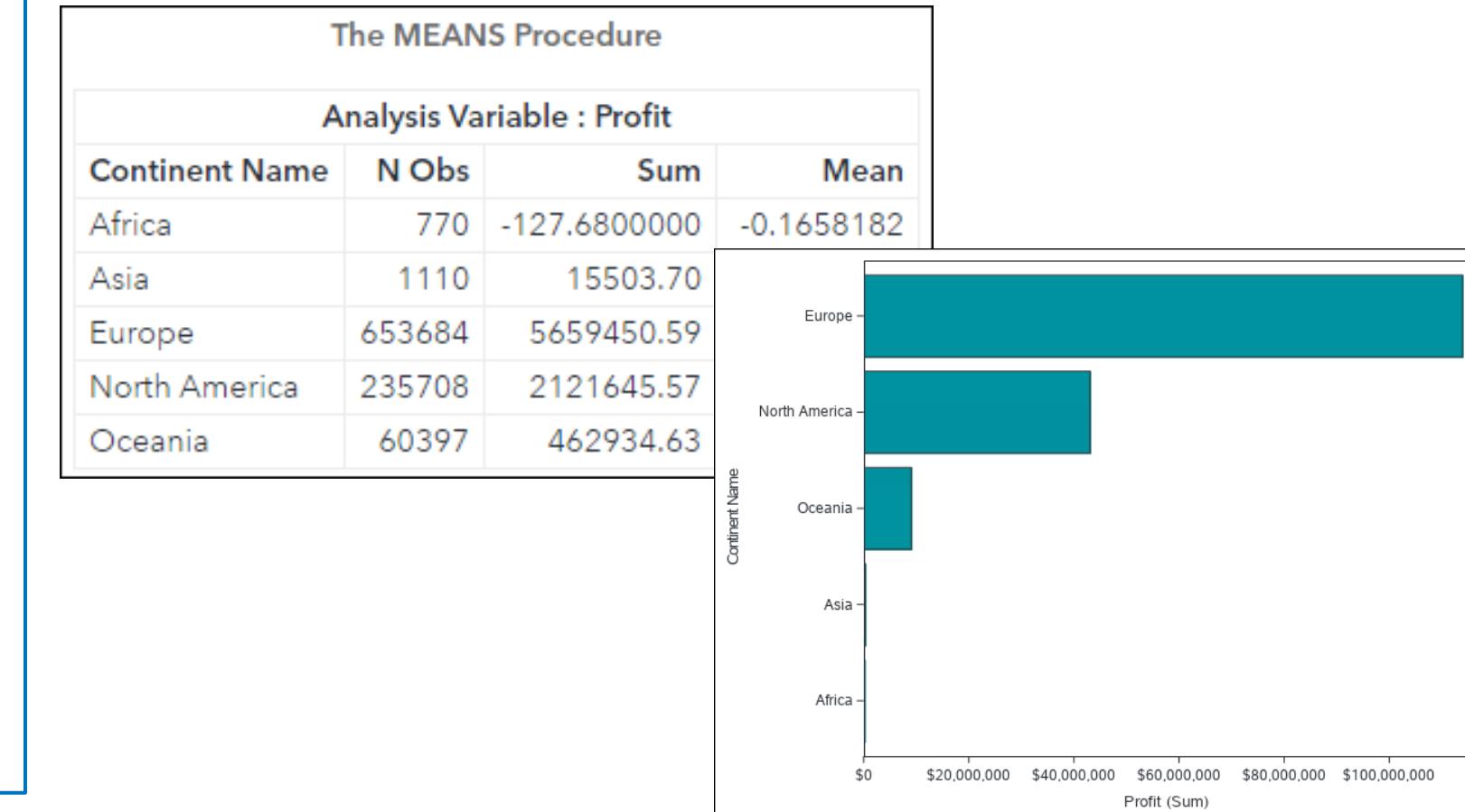


SAS Viya Servers

SAS
Compute
Server

Standard SAS code
executes on the SAS
Compute Server.

```
libname pibase "&path/data";  
  
data profit;  
  set pibase.orders;  
  ...  
run;  
  
proc means data=profit;  
  ...  
run;
```



SAS Viya Programming Interface

SAS Studio

SAS® Studio - Develop SAS Code

New Options View Open Save All

Libraries

- MAPS
- MAPSGFK
- MAPSSAS
- PV
 - ALLCOSTS
 - CLIENT_I...
 - COUNTR...
 - CUST_SU...
 - CUSTOM...
 - EMPLOY...
 - ORGANI...
 - PRODUCTS
 - PRODUC...
 - PROFIT
- SASHelp
- SASUSER
- WORK

pv01d01.sas

Run Cancel Copy to My Snippets Debug

Log Results Output Data

The MEANS F

Analysis Vari

Continent Name	N Obs	Mean Profit	Std Dev Profit
Africa	770	1770000.57	227.7500000
Asia	1110	300452.68	270.6780901
Europe	653684	113934067	174.2953282
North America	235708	43059411.16	182.6811613
Oceania	60397	9045283.93	149.7637951

Continent Name N Obs Mean Profit Std Dev Profit

Europe -

North America -

Oceania -

Profit

```
%let homedir=%sysget(HOME);
%let path=&homedir/Courses/PGVY35;

libname pv "&path/data";

data profit;
  set pv.customers;
  Profit=(RetailPrice-Cost)*Quantity;
  format Profit dollar8.;
run;

ods excel file="&path/output/customers.xlsx";
proc means data=profit sum mean;
  var Profit;
  class Continent;
run;

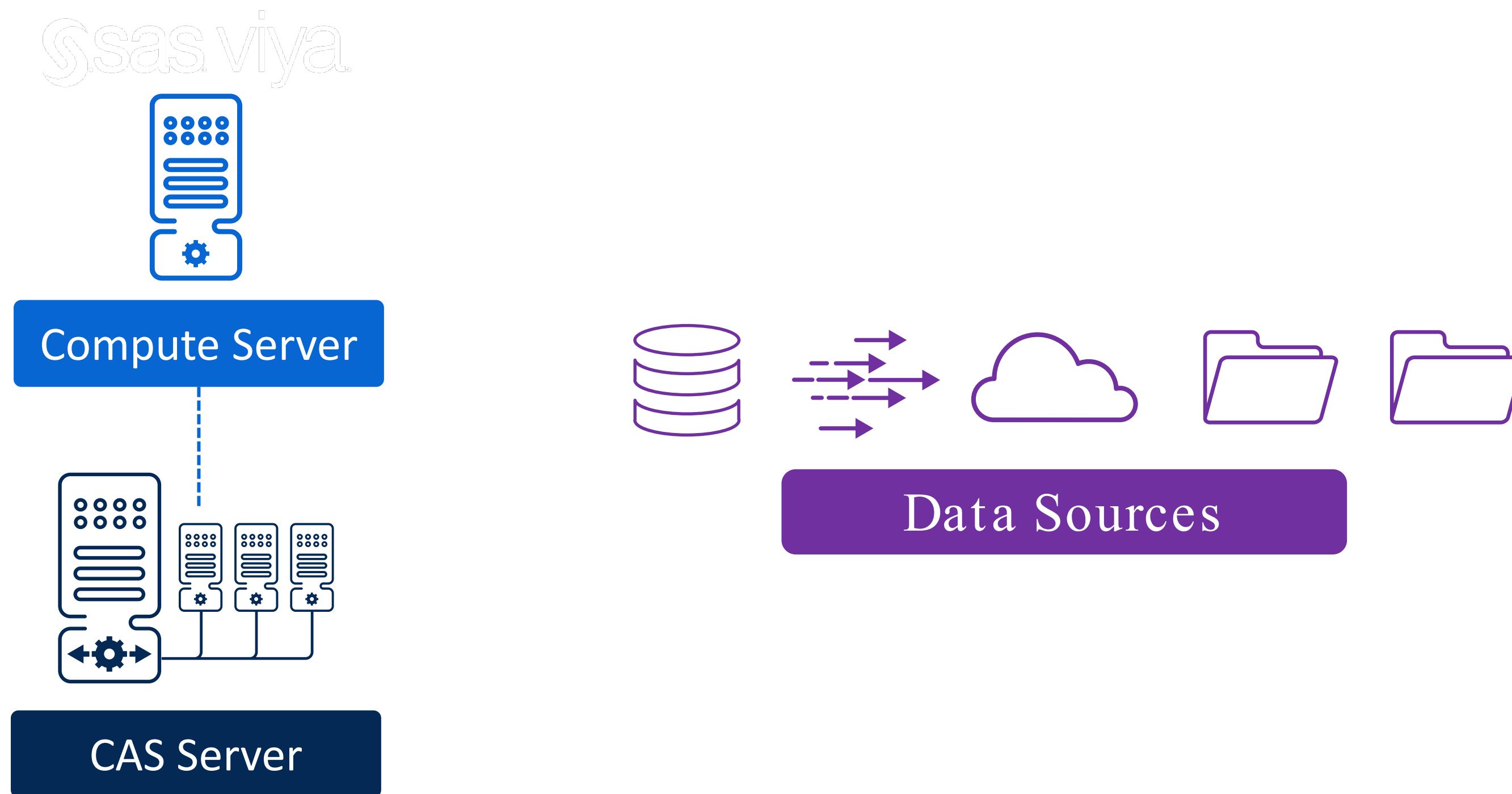
proc sgplot data=profit;
  hbar Continent / response=Profit stat=sum
                 categoryorder=respdesc;
run;
ods excel close;
```

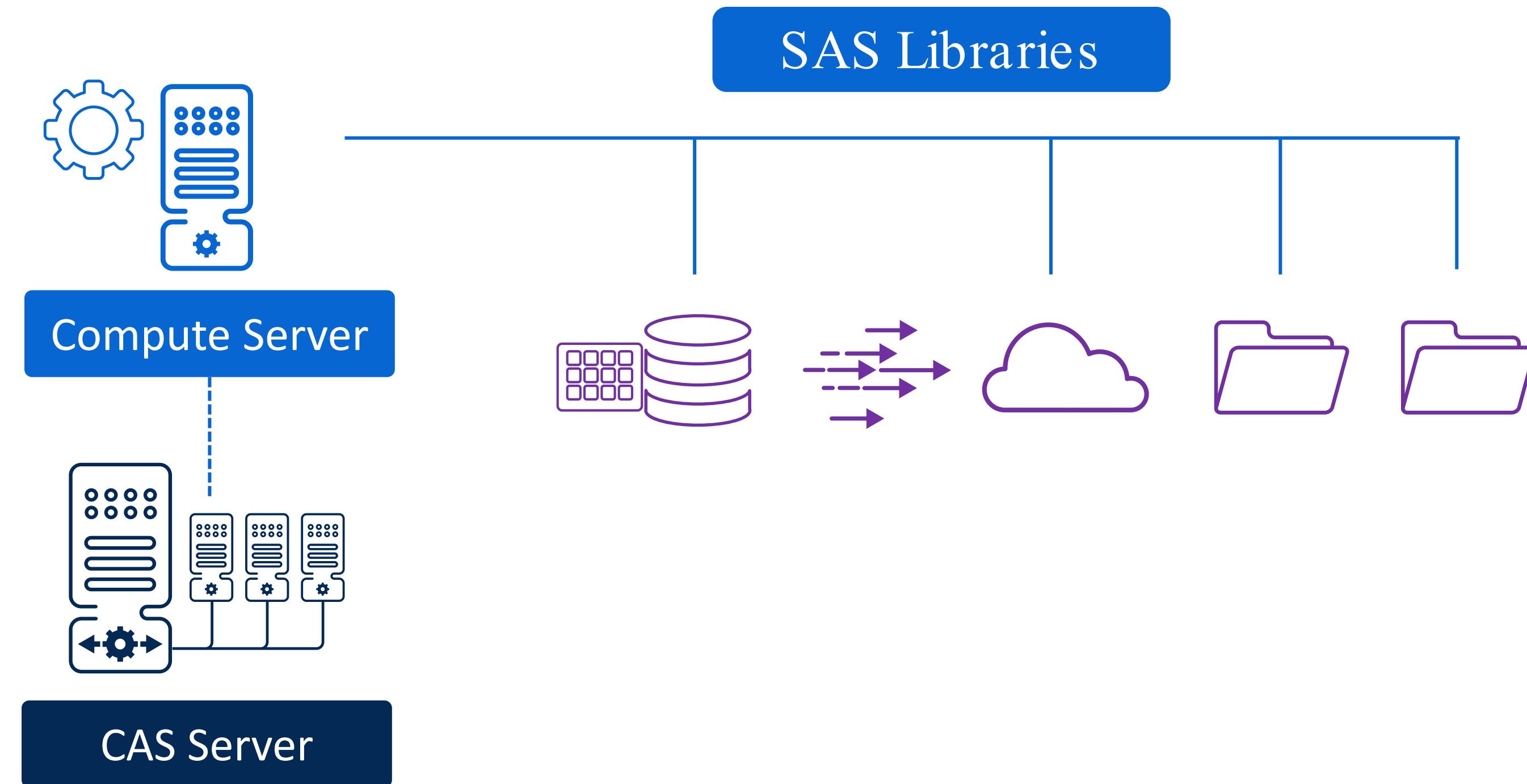
- web-based application
- access data and programs
- write new programs
- store code for common actions
- generate code with tasks

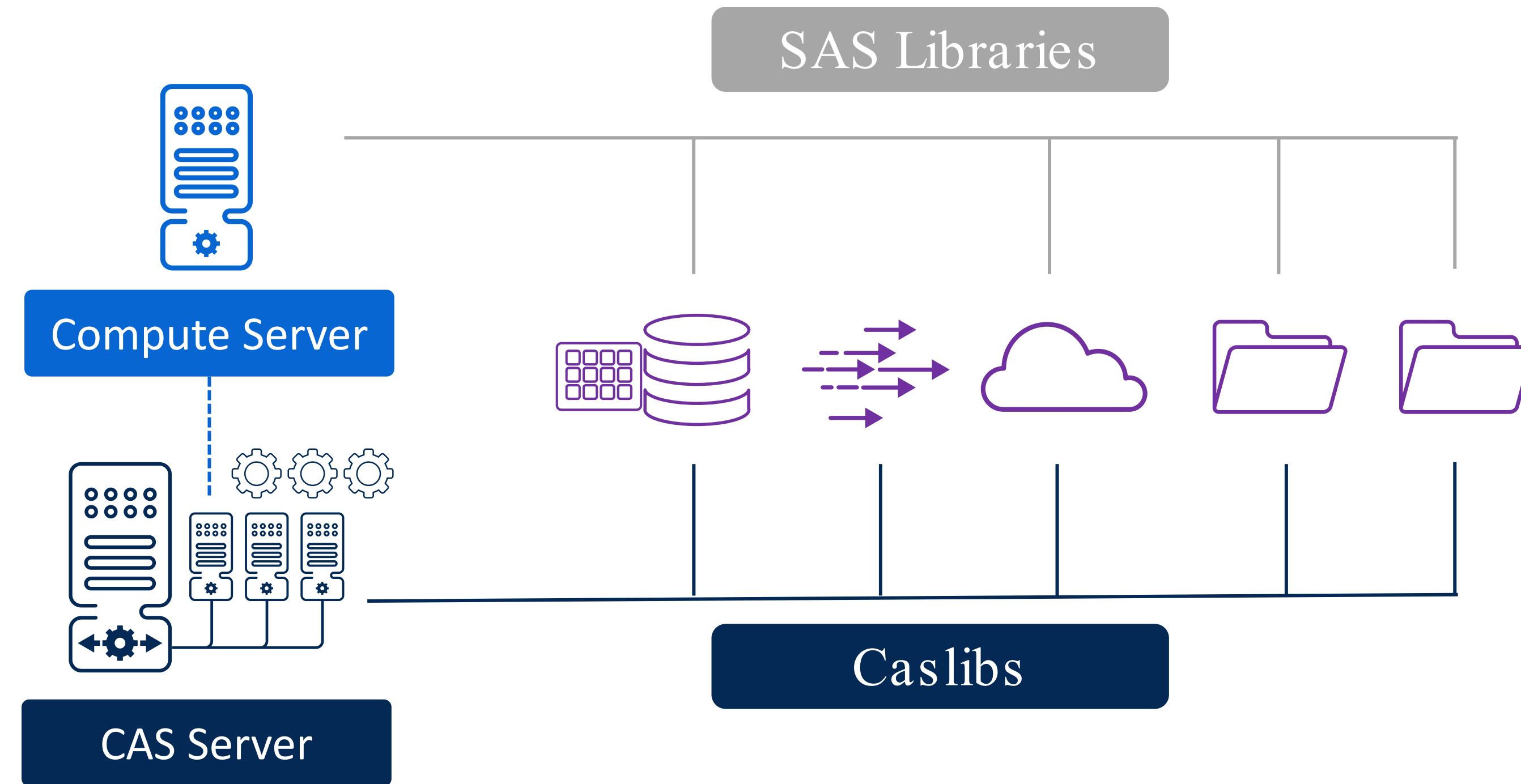
Copyright © SAS Institute Inc. All rights reserved.

sas

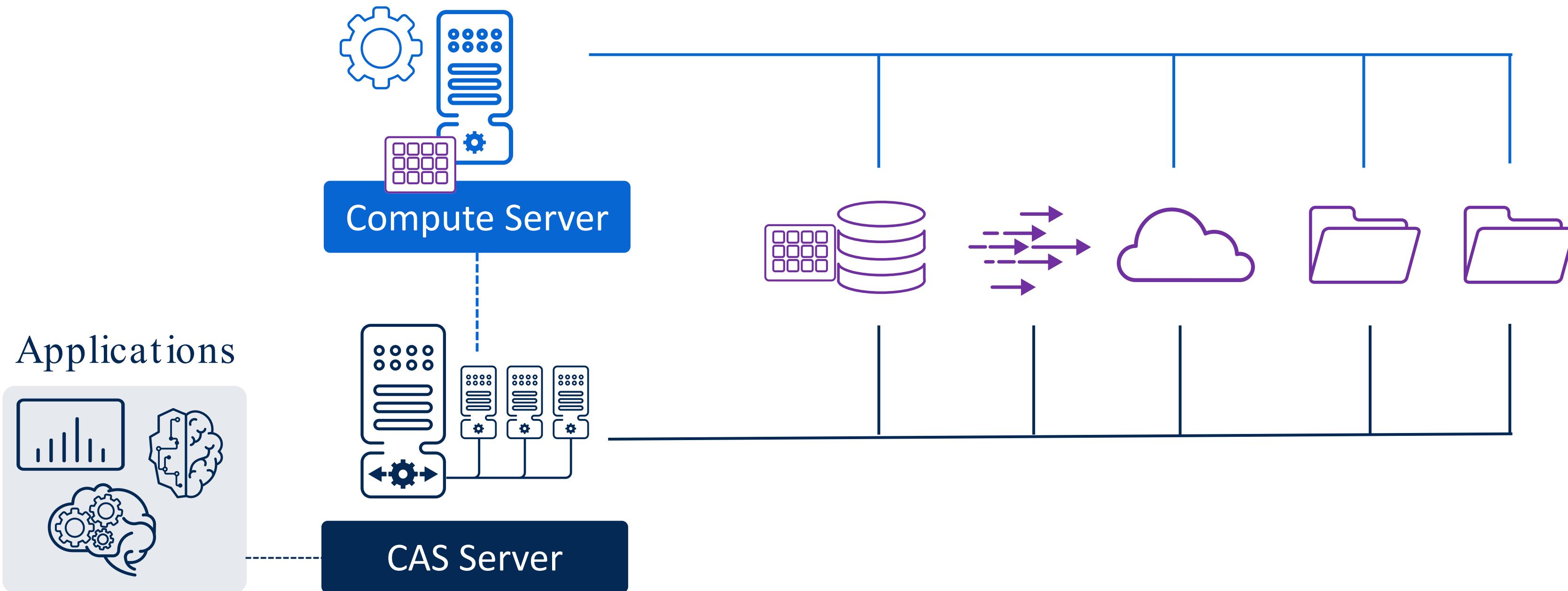
Accessing Data Sources with Compute or CAS



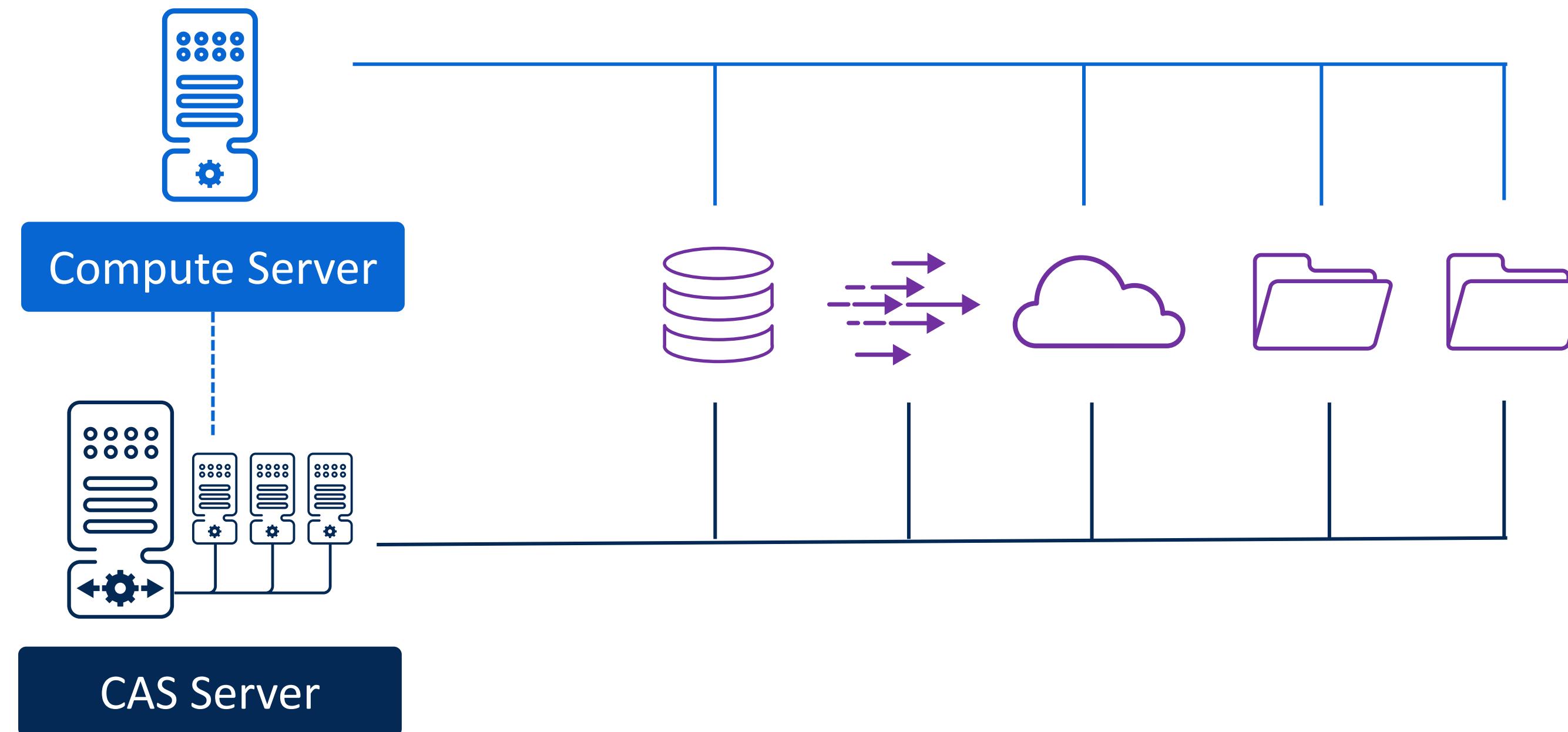




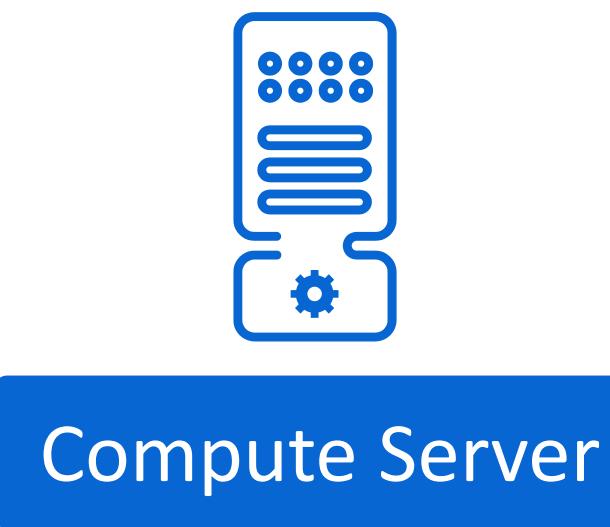
You can transfer data from **Compute** to **CAS**.



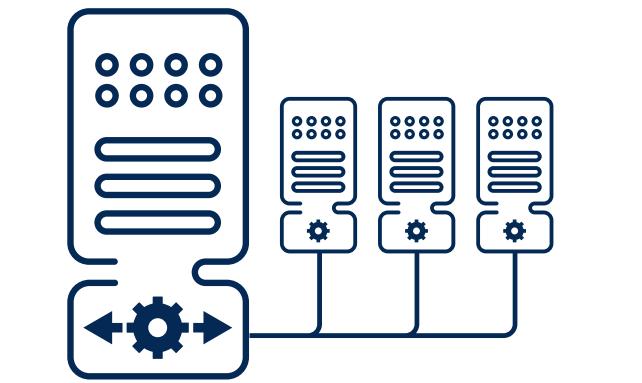
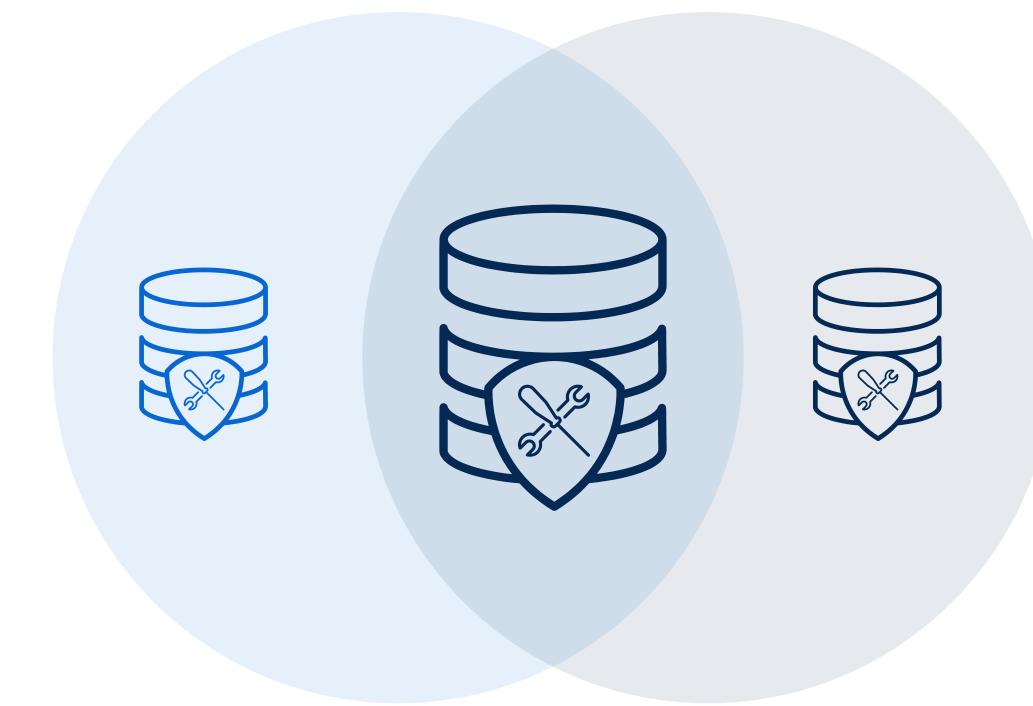
Depending on the **data size** and your **objectives**, you will want to read the data from the data source into the **appropriate server**.



Data Sources



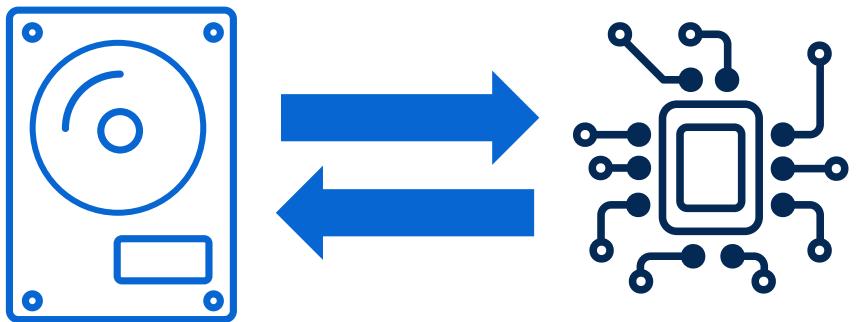
SAS/ACCESS
Interfaces



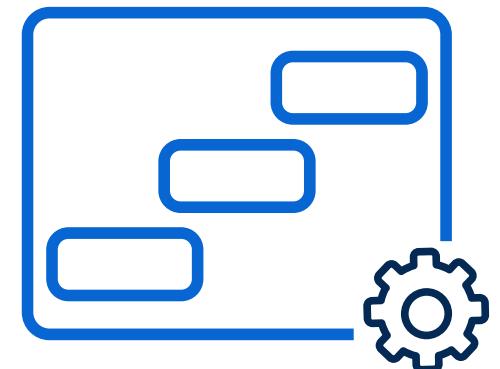
SAS Viya Data
Connectors



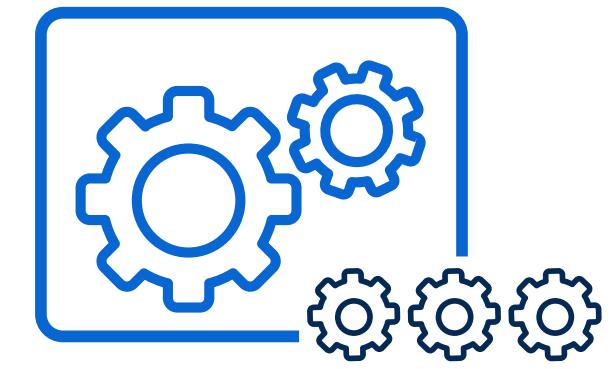
- DISK
- RAM
- CPU



Data is transferred from **disk** to **memory**.

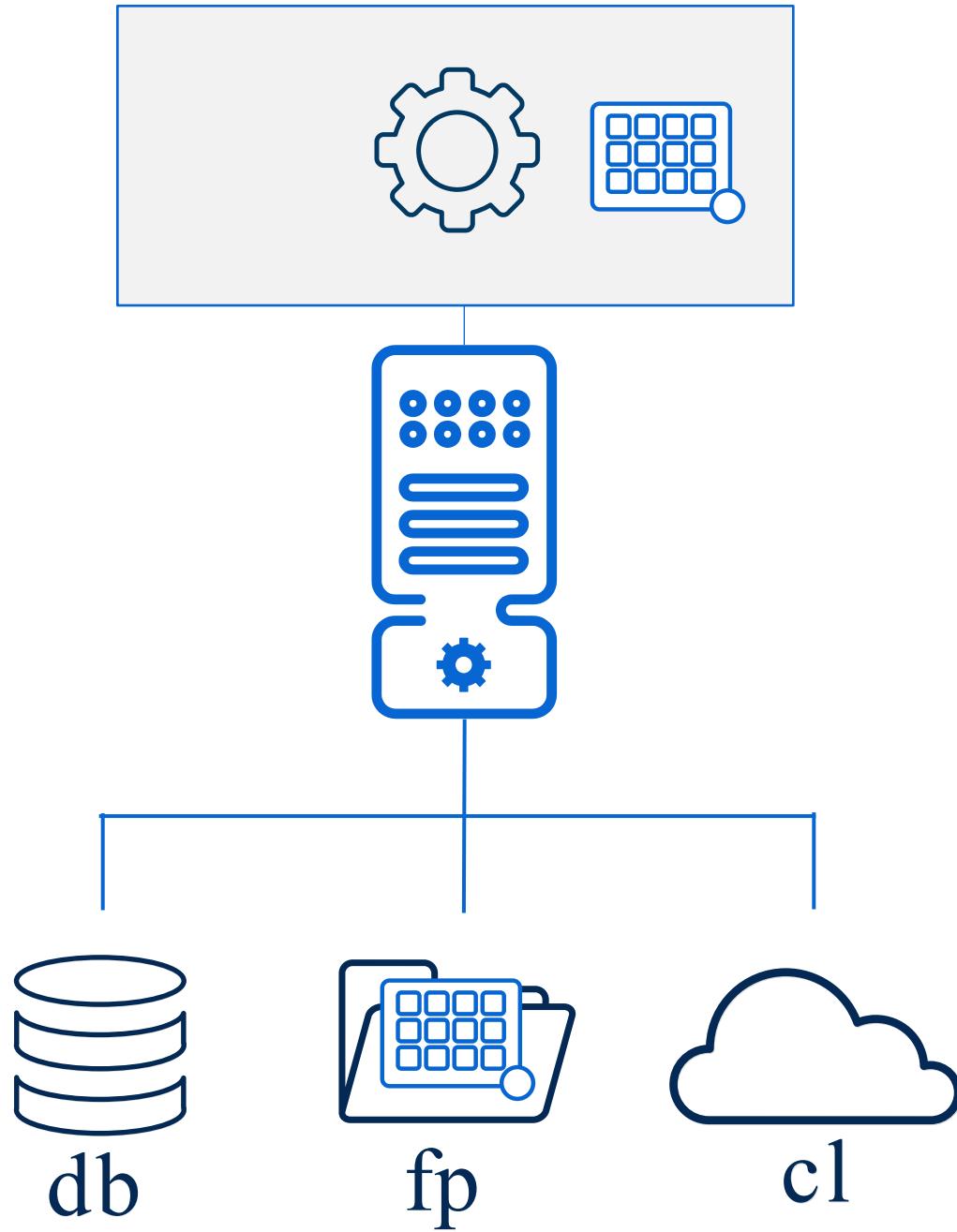


DATA step is processed **single-threaded**.



Many PROCS are **multi-threaded**.

memory



SAS libraries

1

```
data fp.final;  
  set fp.new;  
run;
```

2

```
proc freq data=fp.new;  
run;
```

3

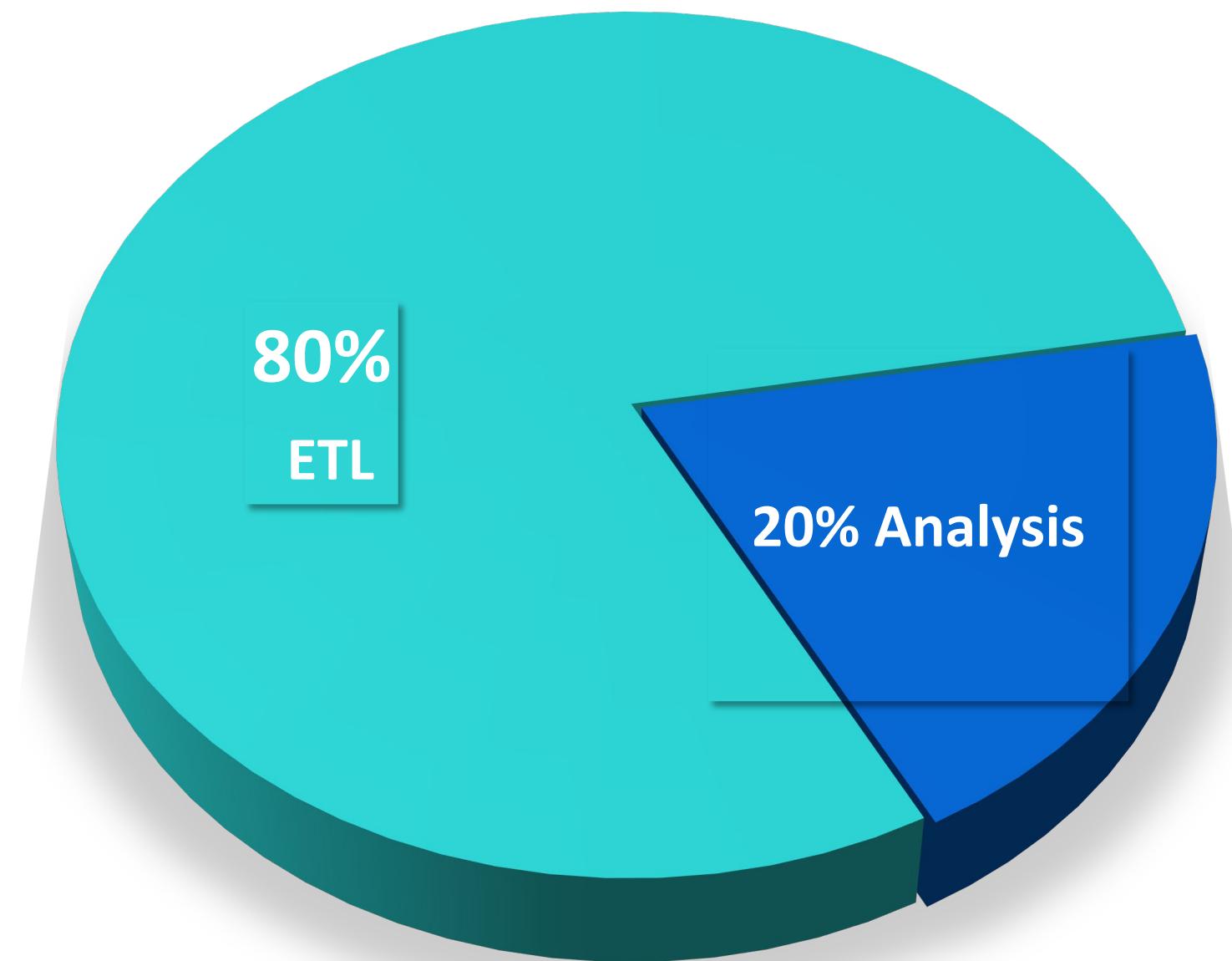
```
proc means data=fp.new;  
run;
```

Data is loaded and
unloaded from memory
three times.

1 Introduction

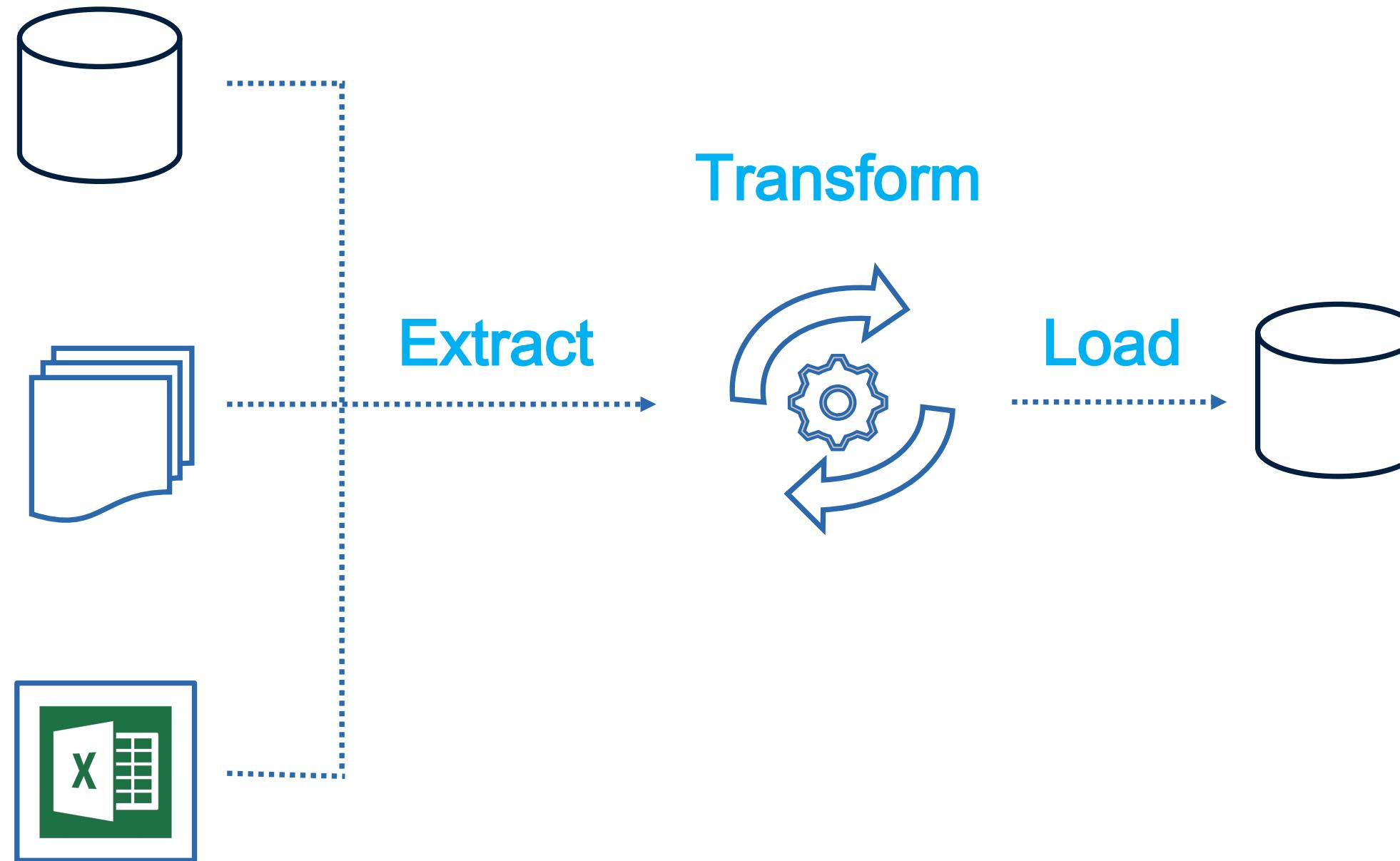
ETL Purpose

ETL allows businesses to consolidate data from multiple databases and other sources into a single repository with data that has been cleansed and qualified in preparation for analysis. This unified data repository allows for simplified access for analysis and additional processing. It also provides a single source of truth, ensuring that all enterprise data is consistent and up-to-date.



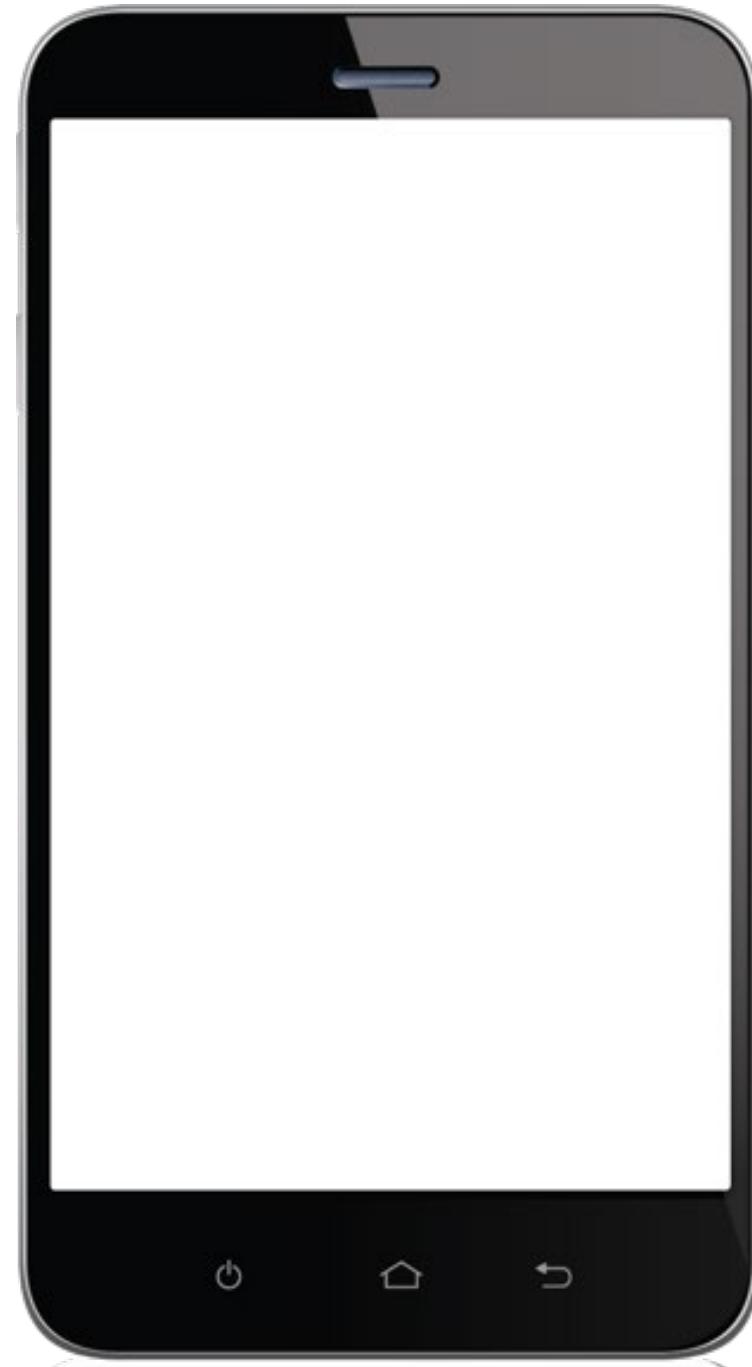
1 Introduction

ETL The Big Picture



Viya
applications,
personas-data
scientist

5 ETL Demo



LINKS

[Loading and joining tables in cas](#)

Thank you!

Charu Shankar
charu.shankar@sas.com

Thank You



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SAS Institute Toronto

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Charu.shankar@sas.com

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CharuYogaCan

LINKEDIN

<https://www.linkedin.com/in/charushankar/>

LinkedIn Group <https://www.linkedin.com/groups/5095978>

