

# DATA VISUALISATION



# OBJECTIVES

1. Learn foundational principles for selecting and creating clear and effective data visualizations.
2. Acquire hands-on experience with Microsoft Excel and Power BI to create diverse charts and graphs.
3. Master storytelling techniques to effectively communicate data insights to different audiences.



# AGENDA

1. Exploratory & Explanatory roles of data visualization
2. Case study discussion
3. Evaluating data for visualizations
4. Choosing appropriate visualizations (Excel)
5. Enhancing visualization design
6. Express Effective visualization
7. Data story-telling using visualizations (Power BI)
8. Group activity



# **EXPLORATORY VISUALIZATIONS**

An open process where the user has no goal and/or is looking for no particular outcome – their intention is to understand their data better and perhaps to satisfy their curiosity.



**Observe**

**Explore**

**Understand**

# EXPLANATORY VISUALIZATIONS

Used to communicate the results of your analyses. Well-designed explanatory visualizations convey the results of your analyses in a clear and concise manner. The goal of explanatory data visualization is to communicate findings and inspire action.

## Preparation Stage

Verify data

Define purpose

Consider the audience

Pick an effective visual

Follow best practices

Tell a story

## Creation Stage

# 3 STEPS TO MAKE A STORY





! WHY ?  
? WHAT ?  
? WHO !  
WHEN !



- 1. Foot Traffic Distribution**
- 2. Customer Demographics**
- 3. Shop Popularity**
- 4. Customer Behaviour**
- 5. Signage and Visibility**
- 6. Comparative Shop Activity**

# CASE STUDY

Development of a sales department over time. This **sales dashboard** provides a comprehensive picture of the progress of the department focusing on **sales growth, sales targets, ARPU, CAC, and CLV**. Sales is one of the most important areas for any business offering a product or service. Therefore, being able to build an understandable story of its performance is critical to ensuring growth and profitability.



# Sales Performance Dashboard



358

NEW CUSTOMERS | YTD



1,180,357 €

SALES REVENUE | YTD



930,216 €

PROFIT | YTD

12,924 €

AVERAGE WEEKLY SALES REVENUE



247,234 €

ABOVE SALES TARGET | YTD



MONTHLY SALES GROWTH

13 %

TARGETED SALES GROWTH: 15 %



SALES COUNTRY PERFORMANCE



AUSTRIA  
GERMANY  
SWITZERLAND

394,645 €  
766,324 €  
19,388 €

ACCUMULATED REVENUE | LAST 12 MONTHS

AVERAGE REVENUE PER UNIT

100 €



CUSTOMER LIFETIME VALUE

136 €

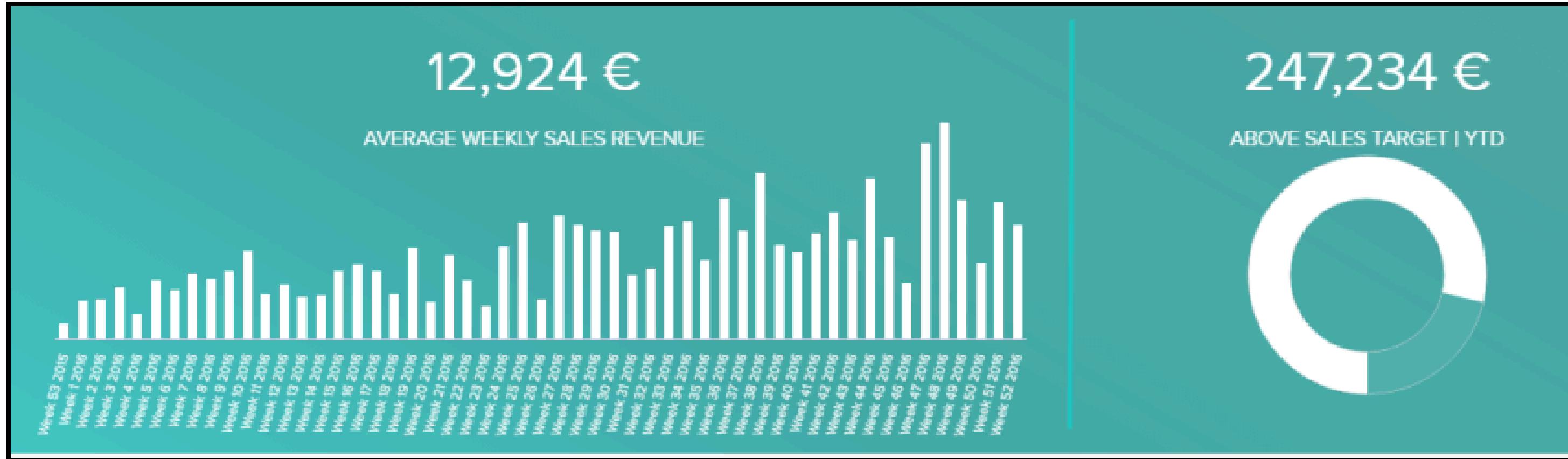
CUSTOMER ACQUISITION COST

364 €

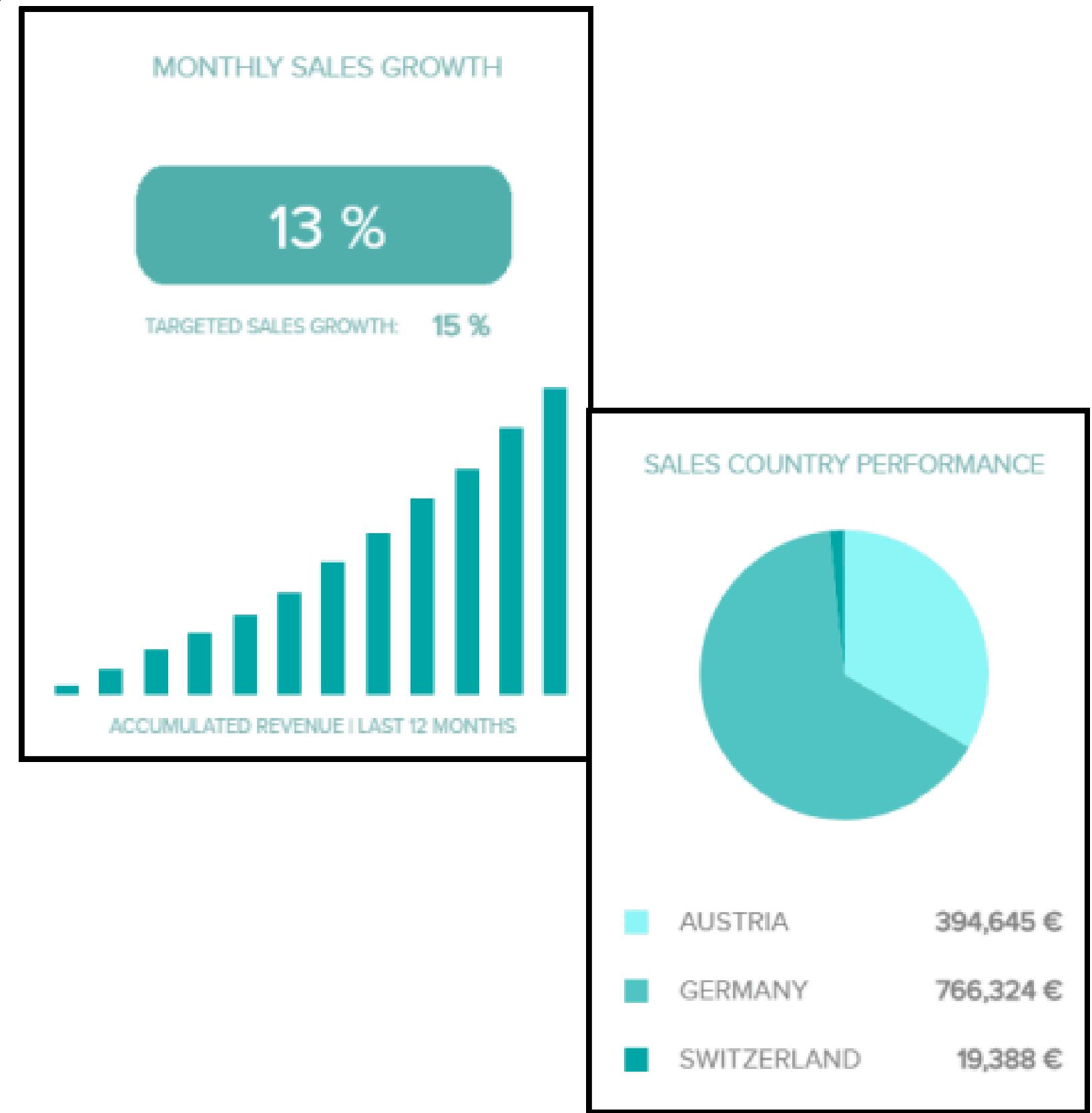




- New Customers YTD (Year To Date):** This shows the number of new customers acquired since the start of the year, which is 358. It's an important metric for understanding business growth.
- Sales Revenue YTD:** Indicates the total sales revenue generated from the start of the year, amounting to €1,180,357. This gives an idea of the overall financial performance.
- Profit YTD:** Displays the total profit earned since the start of the year, which is €930,216. This is calculated by deducting all expenses from the sales revenue and is a critical indicator of the company's profitability.



- Average Weekly Sales Revenue:** This chart shows the weekly sales revenue throughout the year, with an average of €12,924. It helps identify trends, peaks, and troughs in sales over time.
- Above Sales Target YTD:** Represents the amount by which the actual sales exceed the targeted sales, standing at €247,234. The circular chart illustrates the proportion of the target achieved.

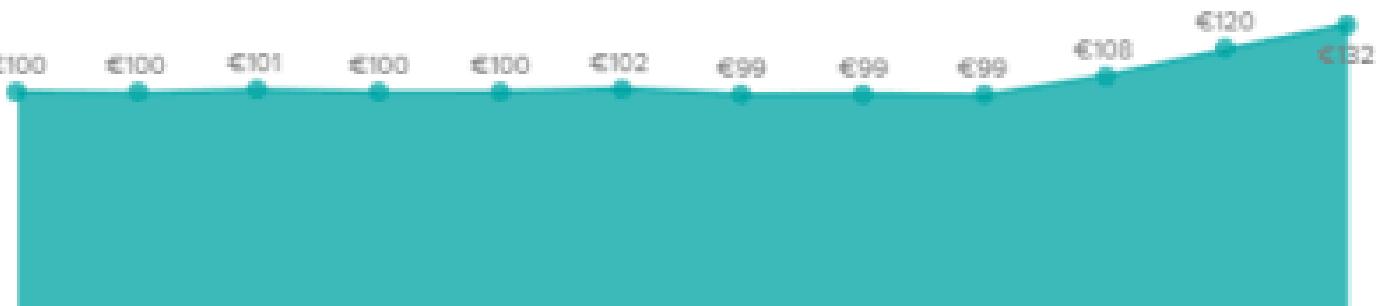


1. **Monthly Sales Growth:** Displays the percentage increase in sales from month to month, currently at 13%. The chart below it shows the accumulated revenue over the last 12 months, indicating a growth trend against a targeted growth of 15%.

2. **Sales Country Performance:** Breaks down the sales revenue by country: Austria (€394,645), Germany (€766,324), and Switzerland (€19,388). This pie chart highlights which regions are contributing most to the sales.

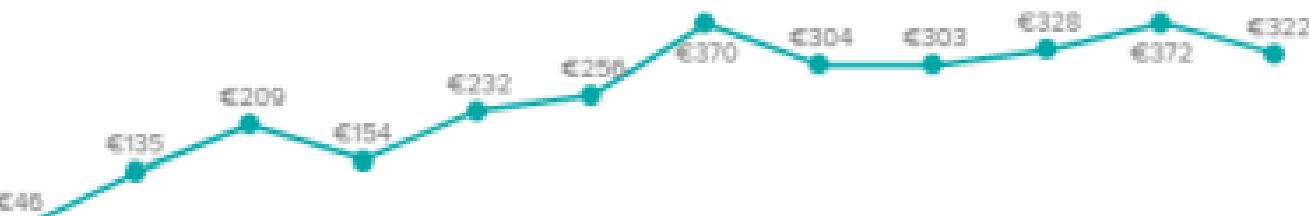
AVERAGE REVENUE PER UNIT

100 €



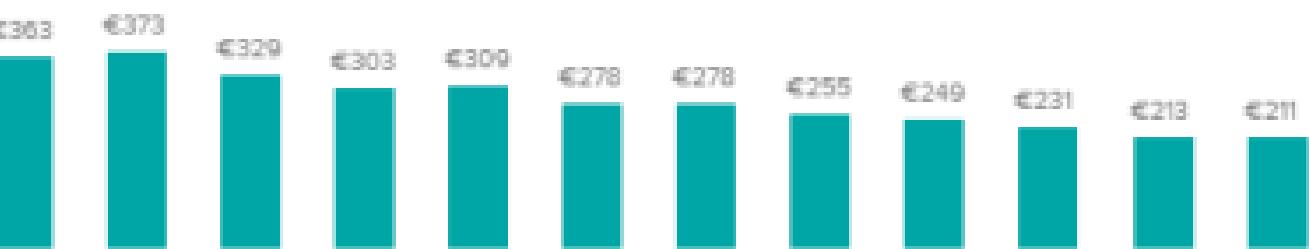
CUSTOMER LIFETIME VALUE

136 €



CUSTOMER ACQUISITION COST

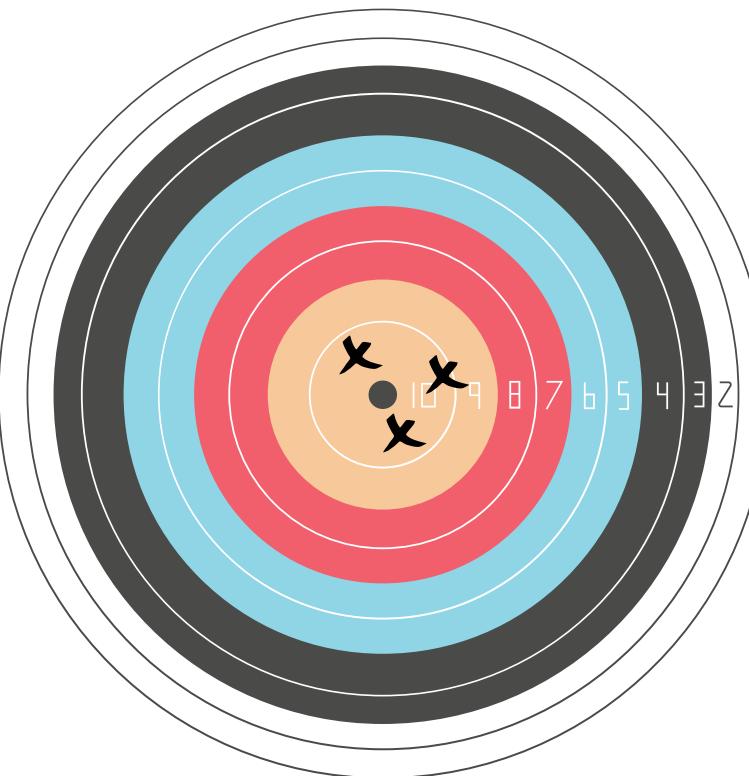
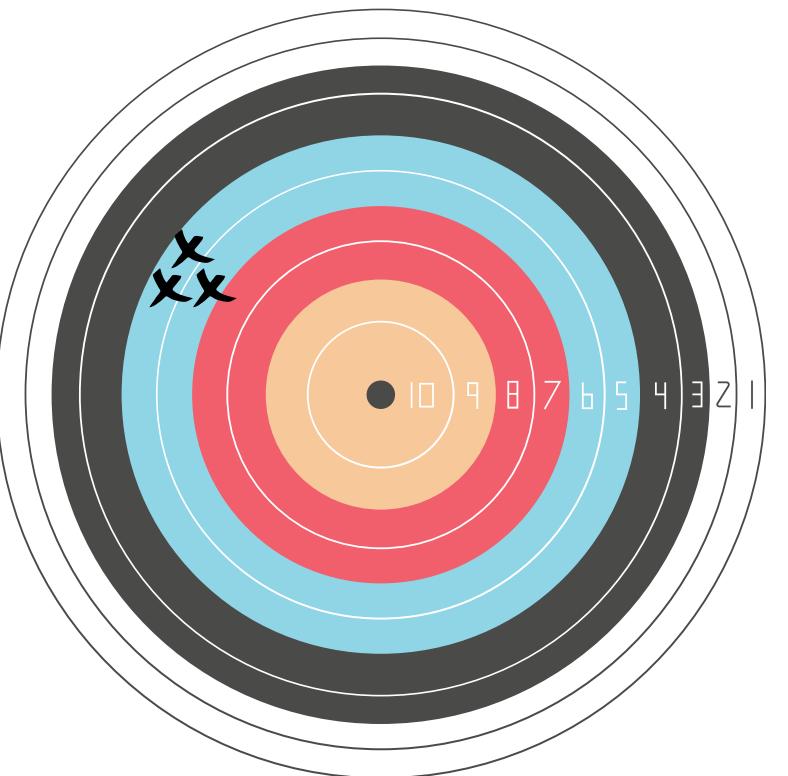
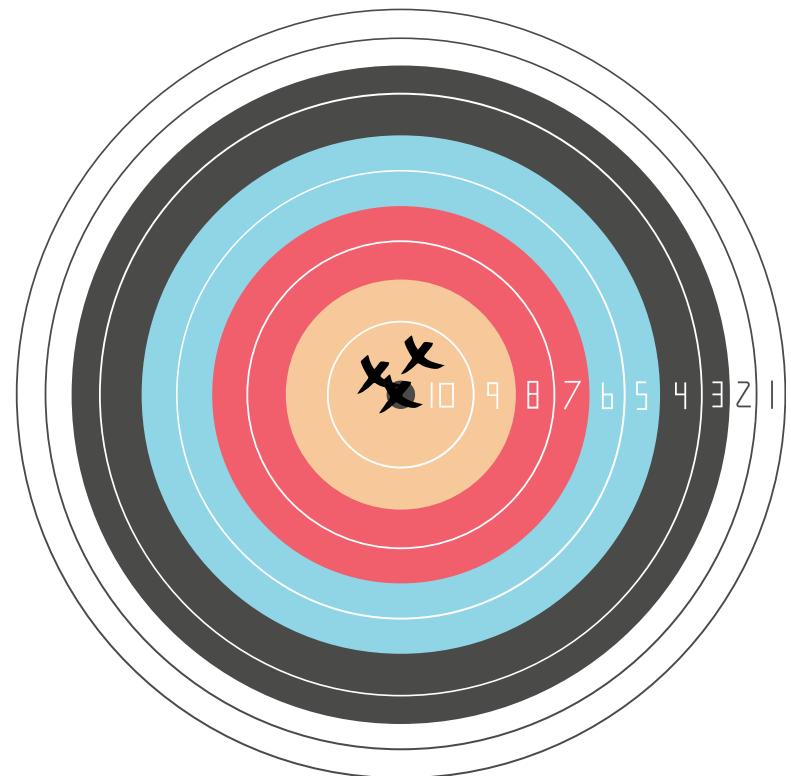
364 €



- Average Revenue Per Unit:** Shows the average income generated per unit sold, which is €100. This can help assess pricing strategies and product performance.
- Customer Lifetime Value (CLV):** The average revenue expected from a customer throughout their relationship with the company, which is €136. This metric is crucial for understanding the long-term value of customers.
- Customer Acquisition Cost (CAC):** Shows the cost incurred to acquire a new customer, currently at €364. This line chart also displays the change in CAC over time, which is vital for evaluating marketing efficiency.

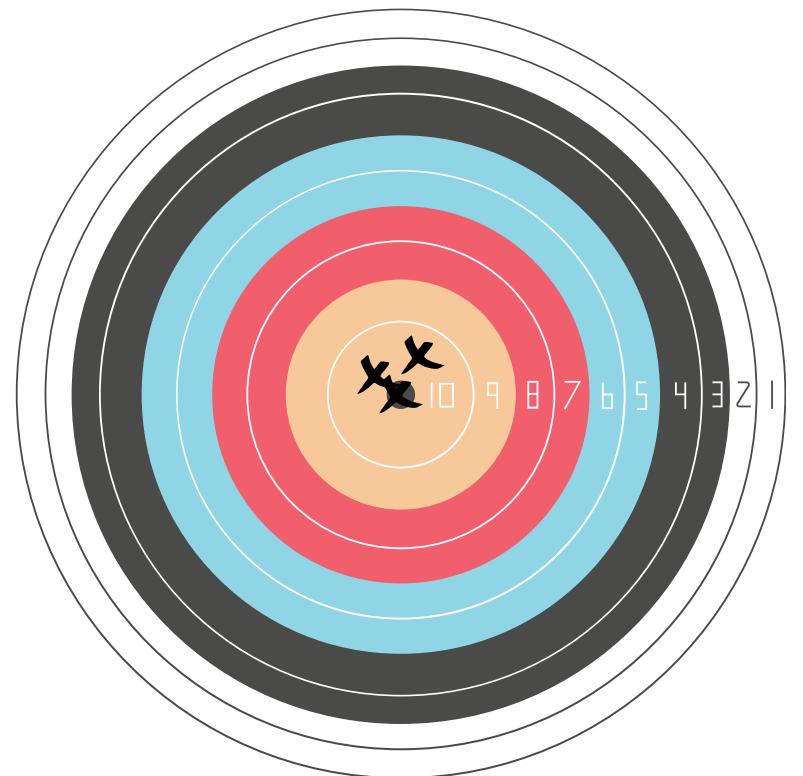
# PULSE CHECK

Which of the targets below displays both accurate and reliable aims? Which displays only accurate aim? Only reliable aim?

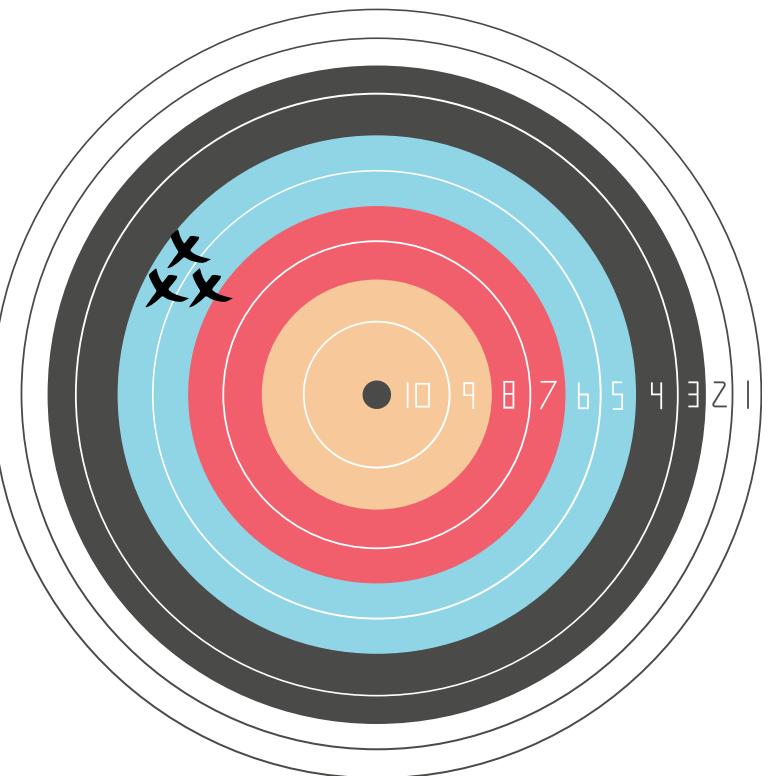


# PULSE CHECK

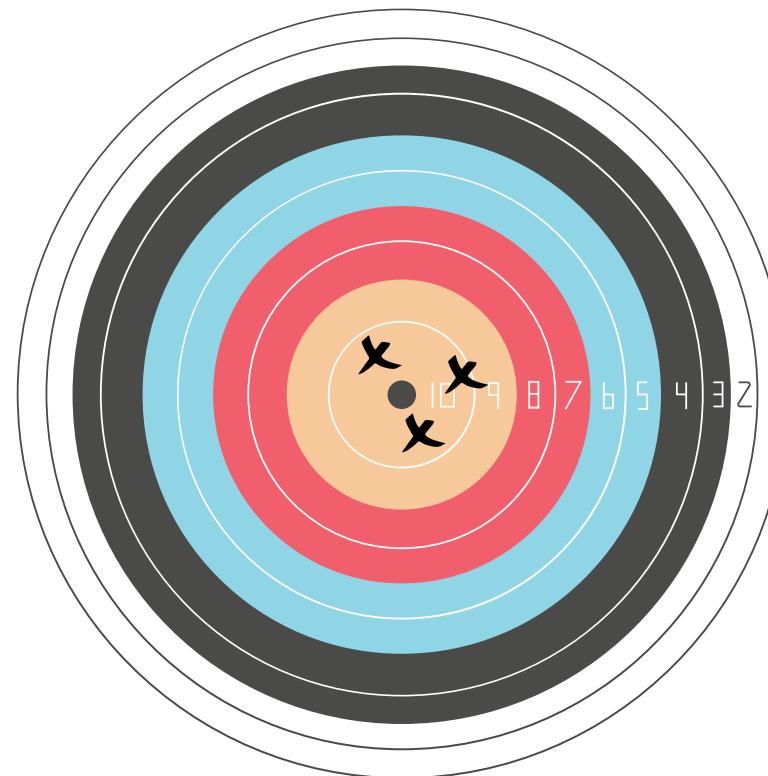
Accurate  
& Reliable



Reliable

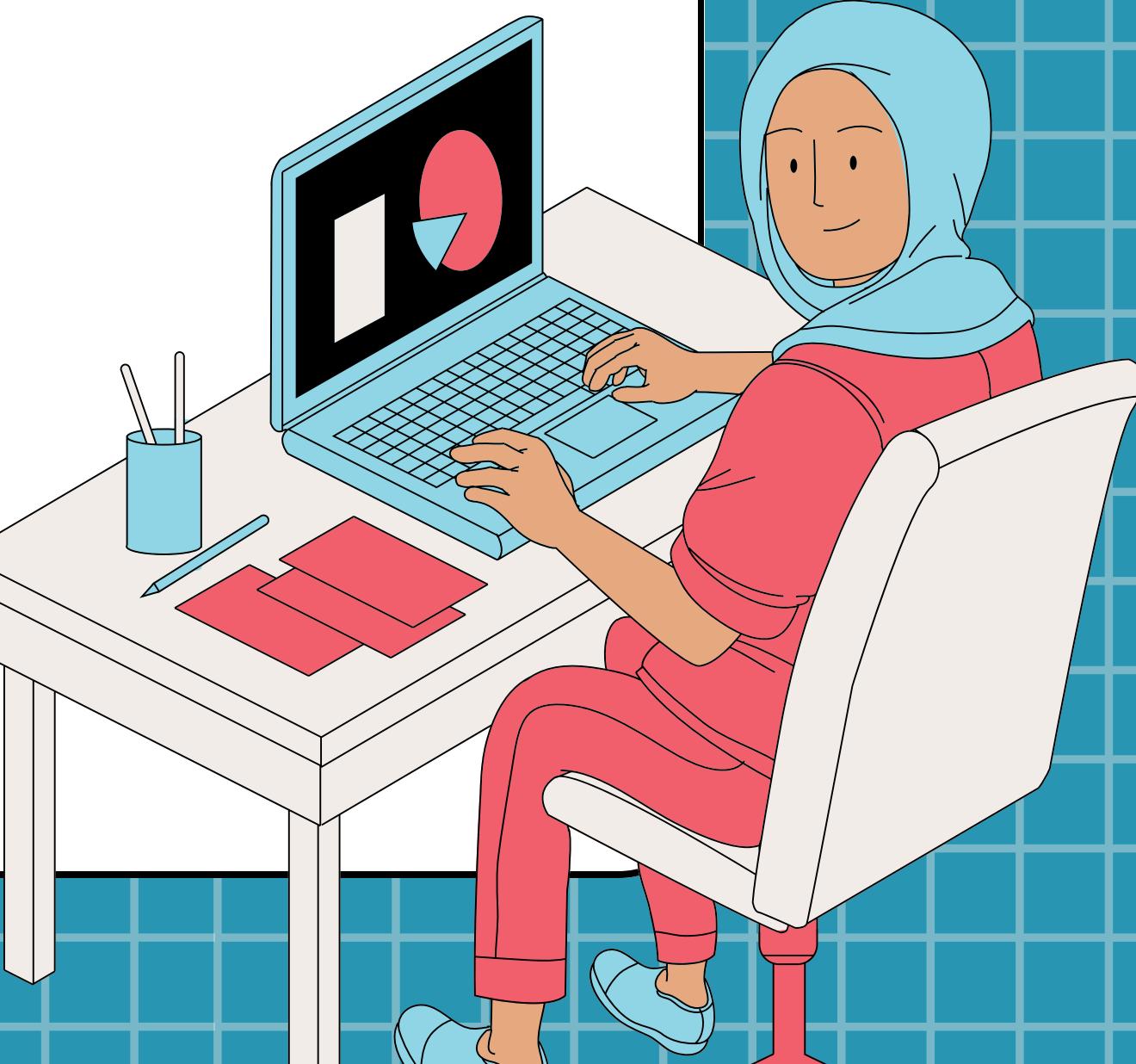


Accurate



# WHAT DO WE NEED TO SHOW?

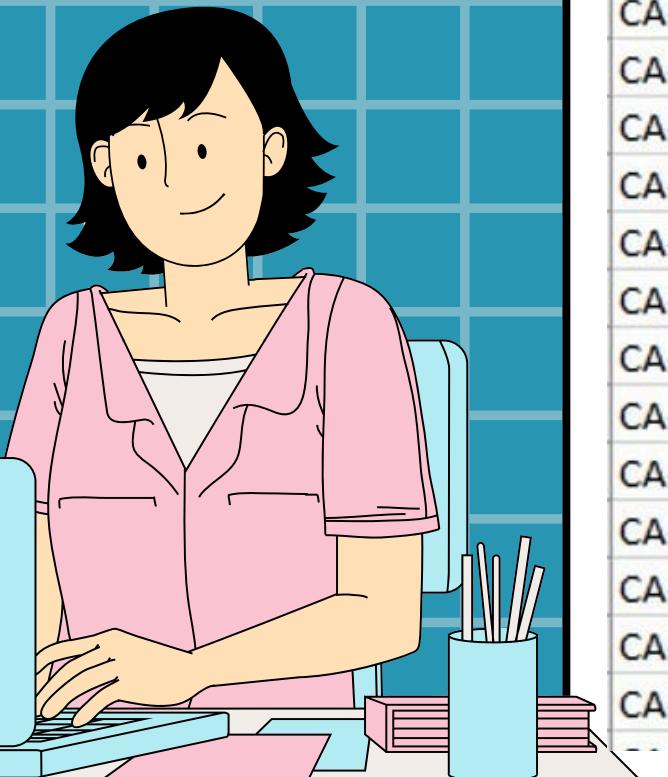
When presenting raw data to an audience, especially in a business context, it's essential to **convert the data into a format that is easy to understand and relevant to the audience's interests and needs**. Here's a guideline on how to approach this



# **1. DATA CLEANING AND PREPARATION**

Before presenting, ensure your data is clean. This means removing or correcting any errors, filling in missing values, and ensuring consistency. This step is crucial as it affects the accuracy of your analysis and the clarity of your presentation.





## Dirty

Segment>>	Consumer				Consumer Total
Ship Mode>>	First Class	Same Day	Second Class	Standard Class	
Order ID					
CA-2011-100293					
CA-2011-100706			129.44		129.44
CA-2011-100895				605.47	605.47
CA-2011-100916					
CA-2011-101266			13.36		13.36
CA-2011-101560					
CA-2011-101770					
CA-2011-102274					
CA-2011-102673					
CA-2011-102988					
CA-2011-103317					
CA-2011-103366	149.95				149.95
CA-2011-103807					
CA-2011-103989					
CA-2011-104283			616.14		616.14
CA-2011-106054					
CA-2011-106810					
CA-2011-107573			23.472		23.472
CA-2011-107811					

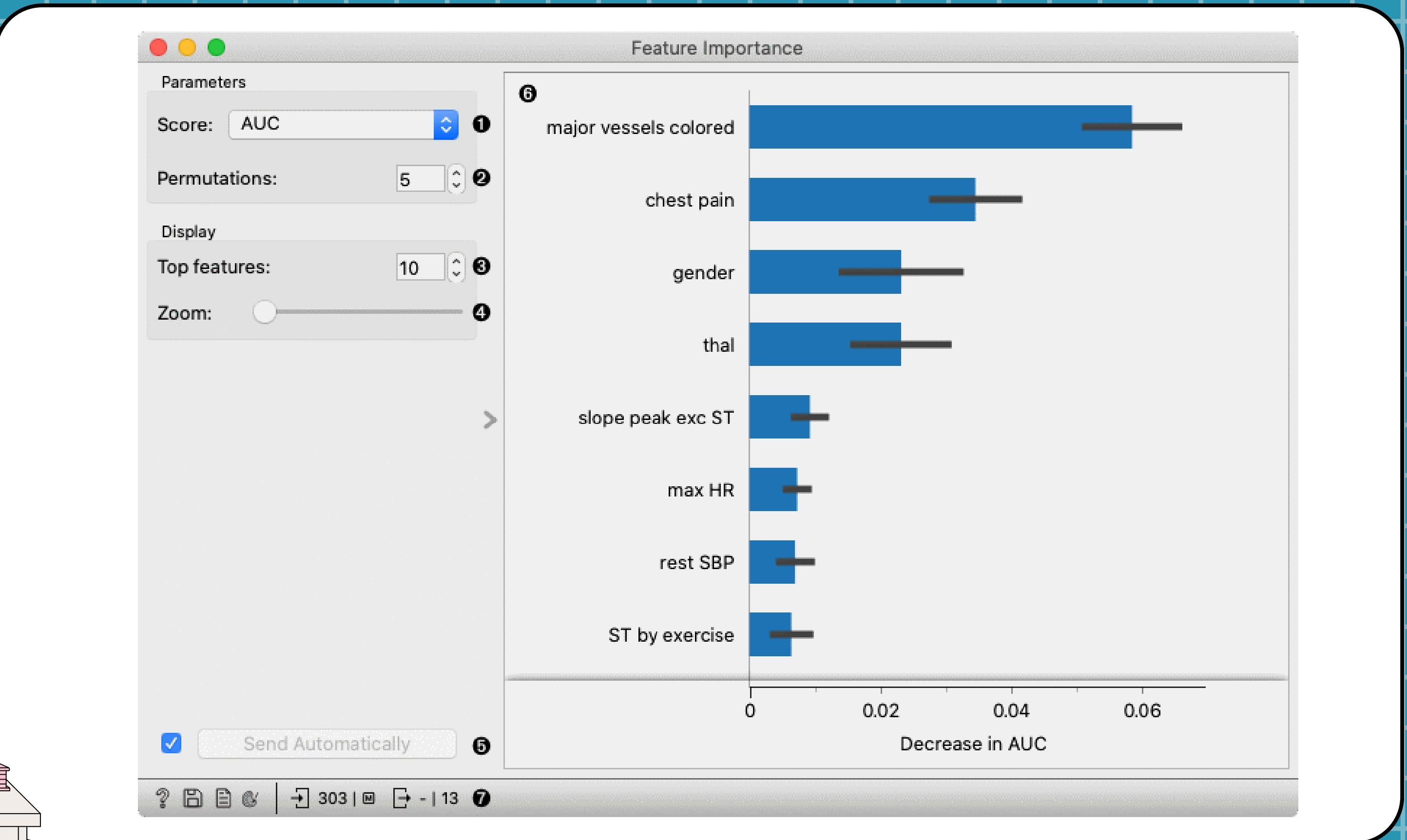
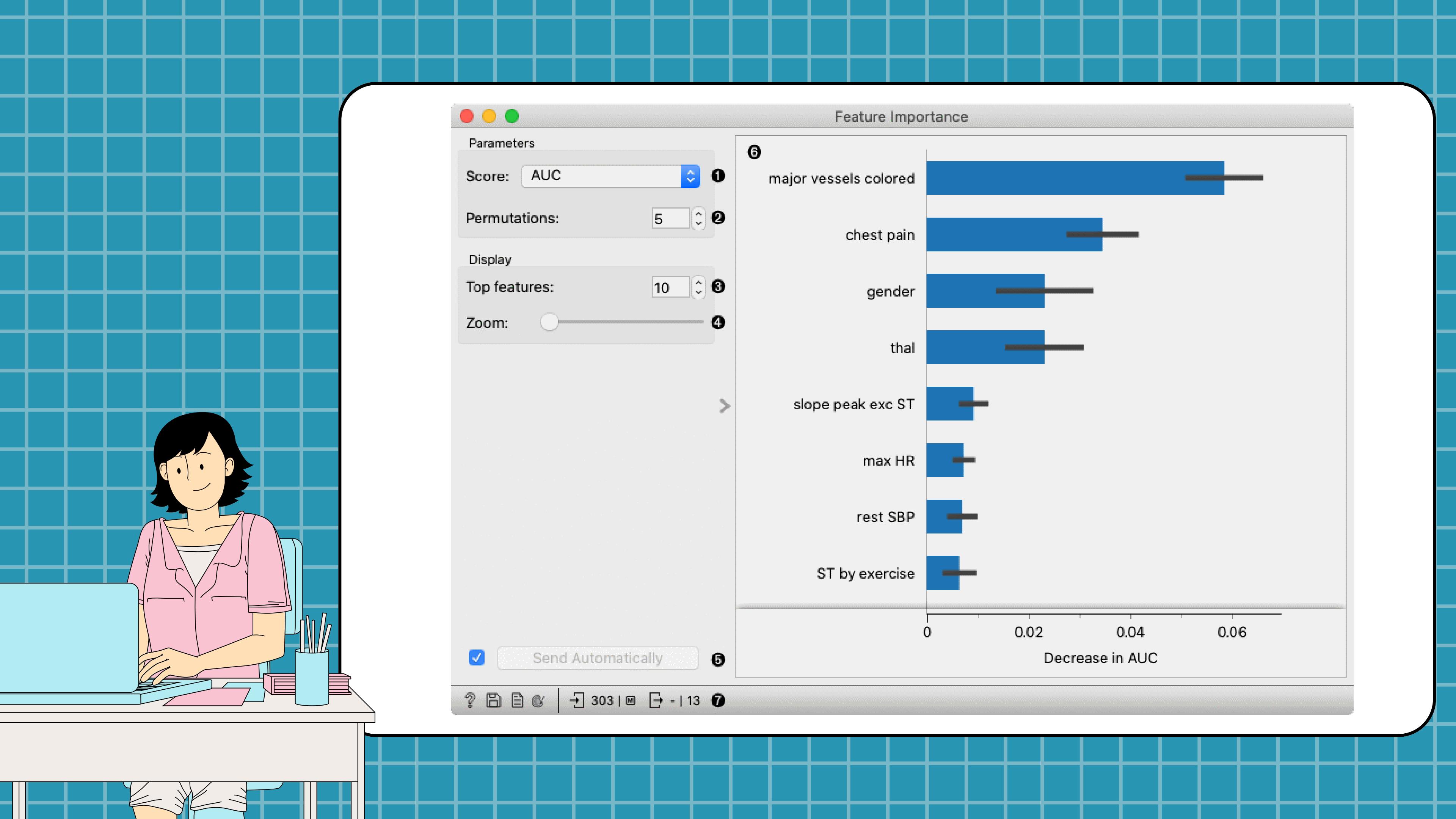
## Clean

Segment	Ship Mode	OrderID	Sales
Consumer	First Class	CA-2011-103366	149.95
Consumer	First Class	CA-2011-109043	243.6
Consumer	First Class	CA-2011-113166	9.568
Consumer	First Class	CA-2011-124023	8.96
Consumer	First Class	CA-2011-130155	34.2
Consumer	First Class	CA-2011-136861	31.984
Consumer	First Class	CA-2011-153927	286.65
Consumer	First Class	CA-2011-157784	514.03
Consumer	First Class	CA-2011-160094	1000.95
Consumer	First Class	CA-2011-164749	9.912
Consumer	First Class	CA-2011-166730	39.128
Consumer	First Class	CA-2012-102722	106.5
Consumer	First Class	CA-2012-102778	18.176
Consumer	First Class	CA-2012-117828	194.32
Consumer	First Class	CA-2012-130218	59.48
Consumer	First Class	CA-2012-132318	182.91
Consumer	First Class	CA-2012-137974	2298.9
Consumer	First Class	CA-2012-138625	197.72
Consumer	First Class	CA-2012-141327	440.144
Consumer	First Class	CA-2012-149300	32.985
Consumer	First Class	CA-2012-150560	196.62

## **2. IDENTIFYING KEY METRICS**

Determine what metrics are most relevant to your audience. In a business context, this could include sales revenue, customer acquisition costs, profit margins, or other KPIs (Key Performance Indicators) relevant to your business goals and audience interests.

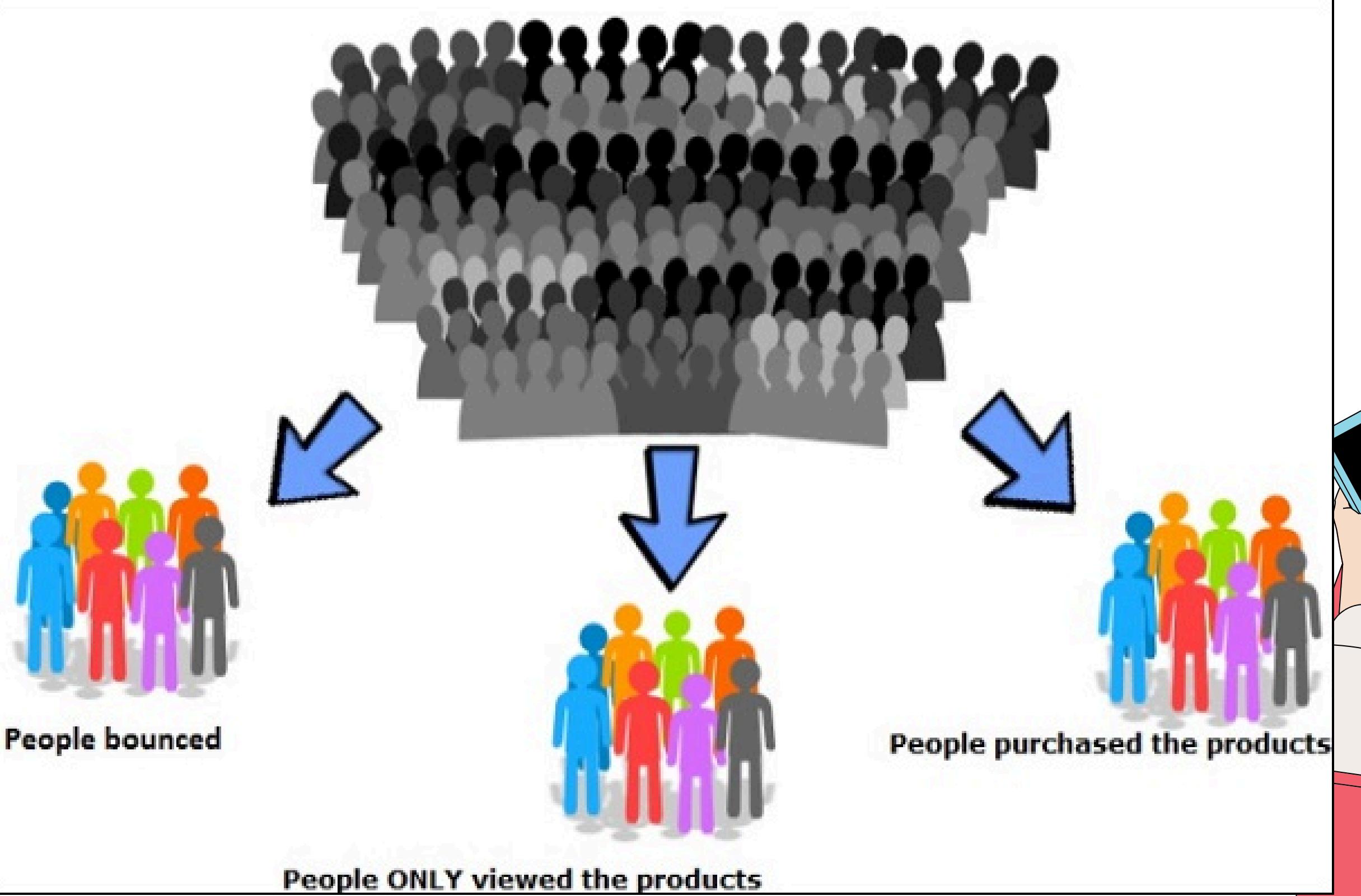


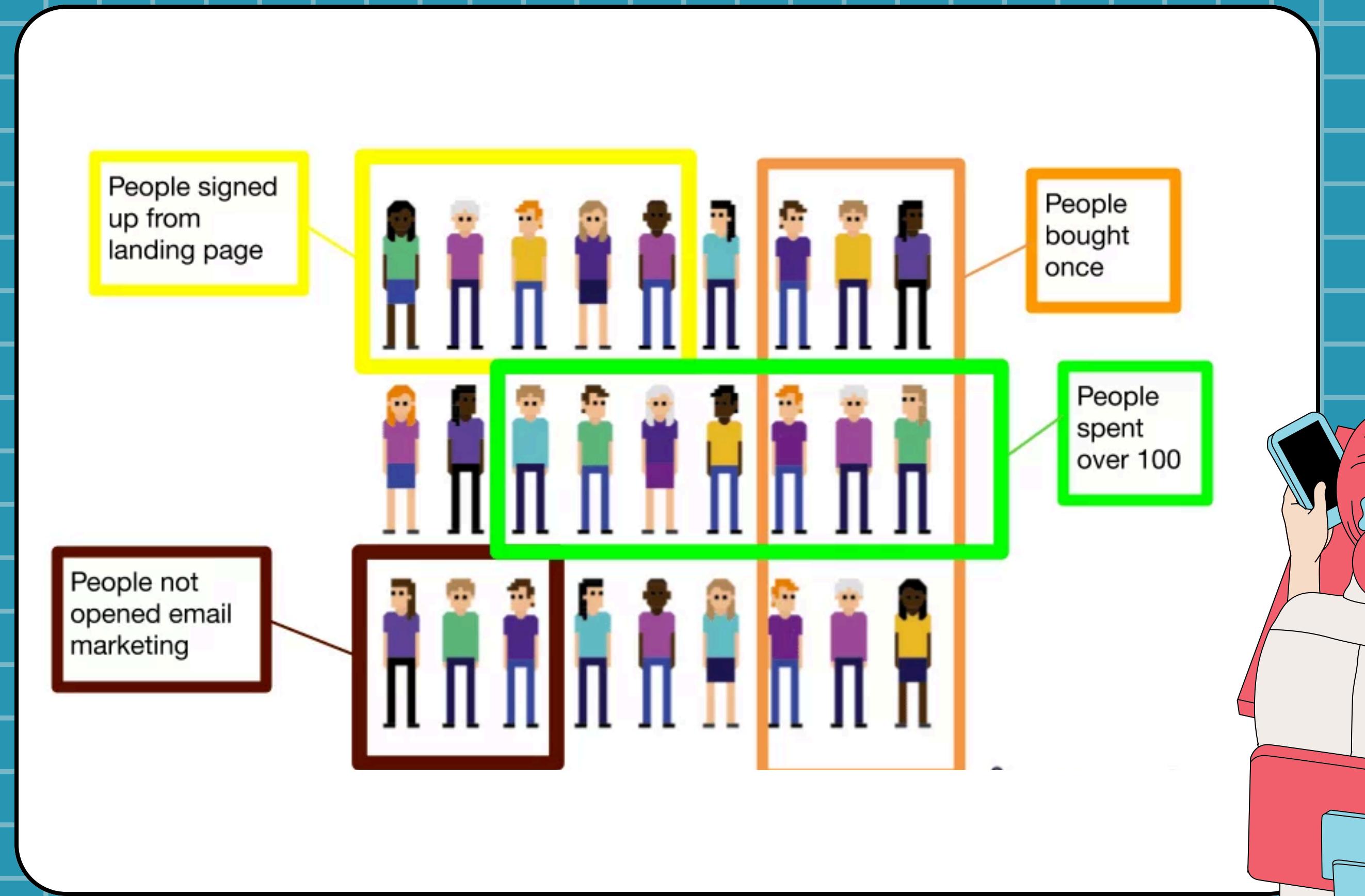


### 3. SEGMENTATION

Segment your data to provide more tailored insights. This could mean breaking down sales by region, product category, or customer demographic. Segmentation helps in pinpointing specific areas of success or opportunities for improvement.

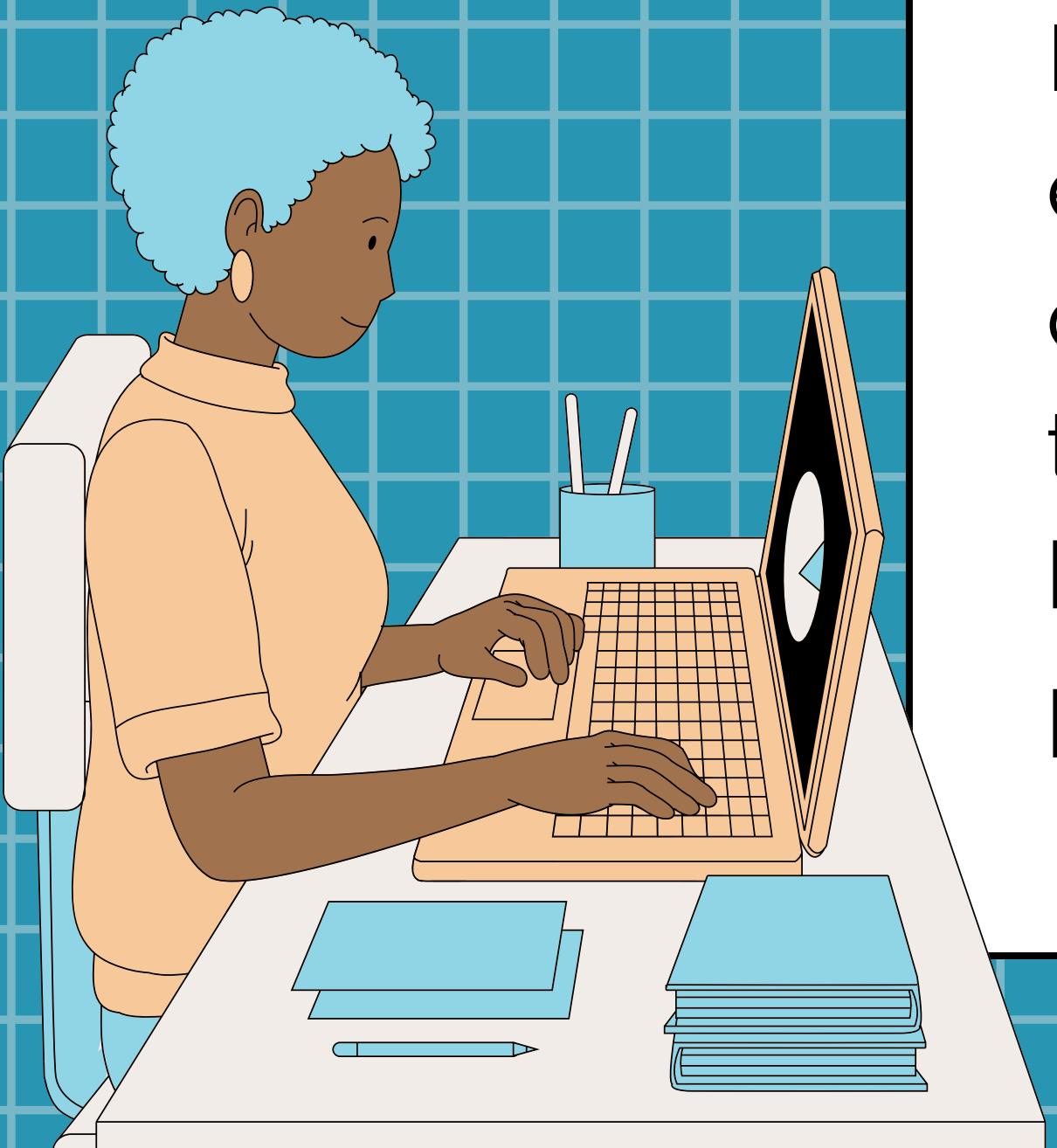






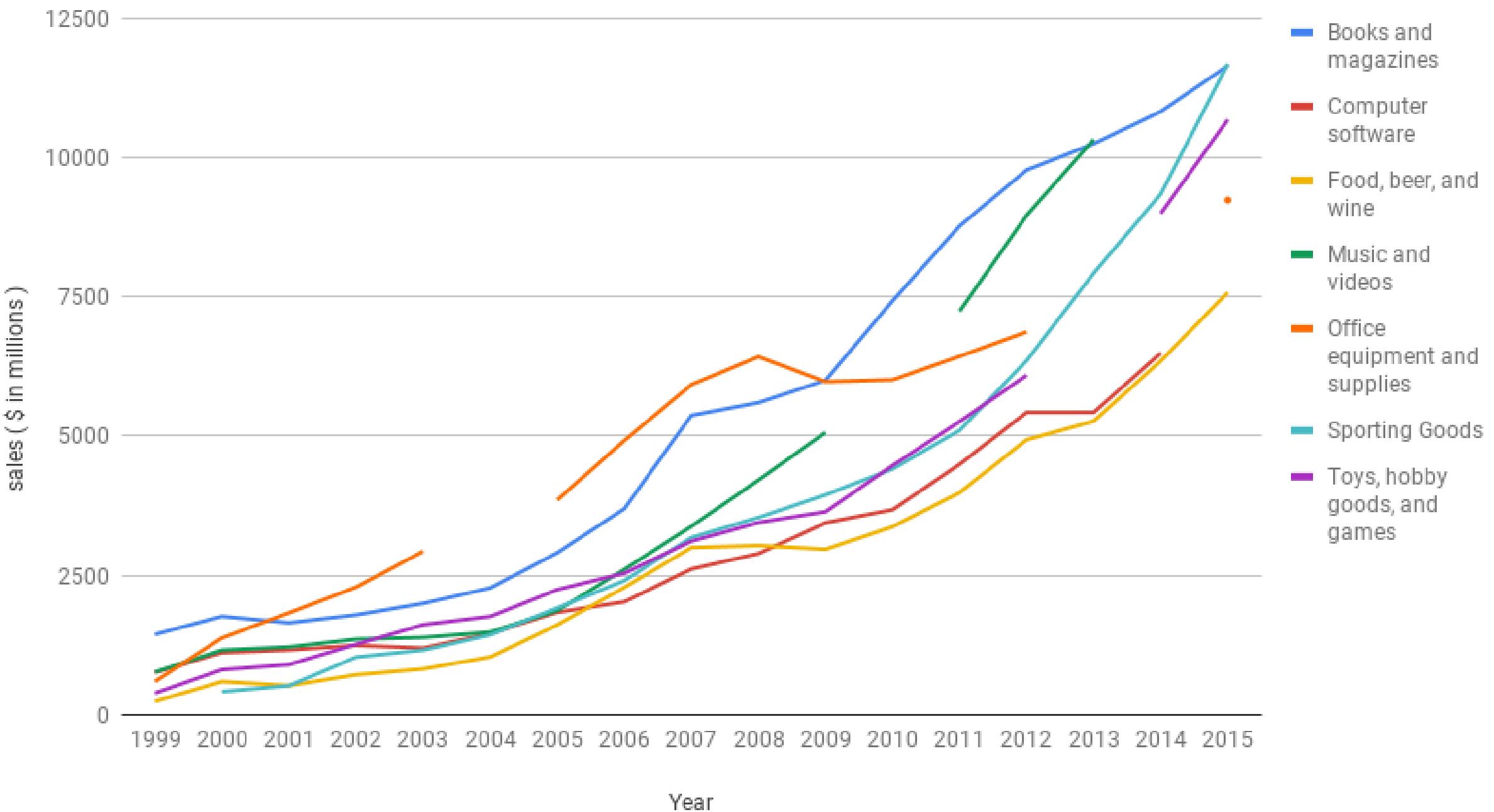
## 4. TREND ANALYSIS

Identify and present trends over time. For example, if your business has seasonal sales cycles, showing monthly or quarterly sales trends can provide valuable insights into the best times for marketing pushes or new product launches.





## Yearly E-commerce Sales of merchandise line ( less than \$12,500M )



## 5. COMPARATIVE ANALYSIS

Compare your data against relevant benchmarks or competitors. This can help in highlighting your business's strengths and areas for improvement relative to the market or industry standards.



V15

X ✓ fx



# Comparative Analysis in Excel

\$488,008,011

CY Sales

\$491,063,233

Budget Sales

**-0.62%**

Budget Variance%

\$331,631,509

PY Sales

**47.15%**

YoY Sales Growth

Year

2014

2015

2016

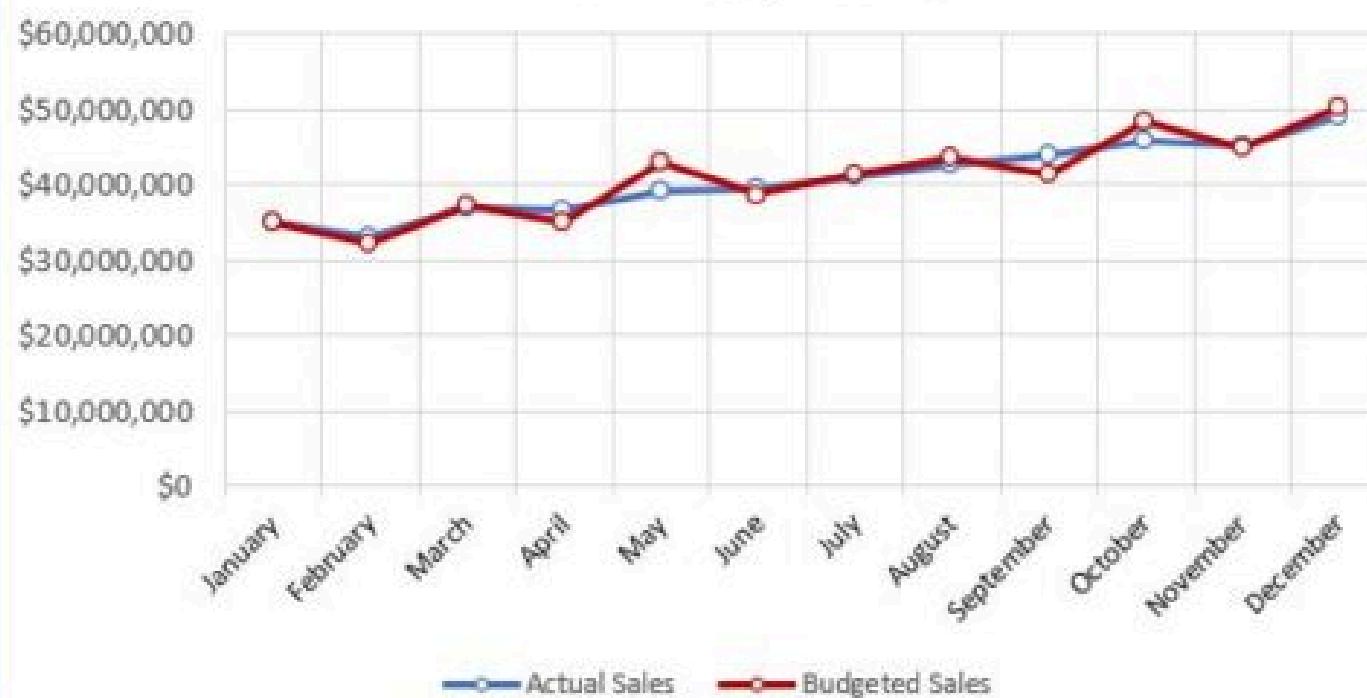
2017

2018

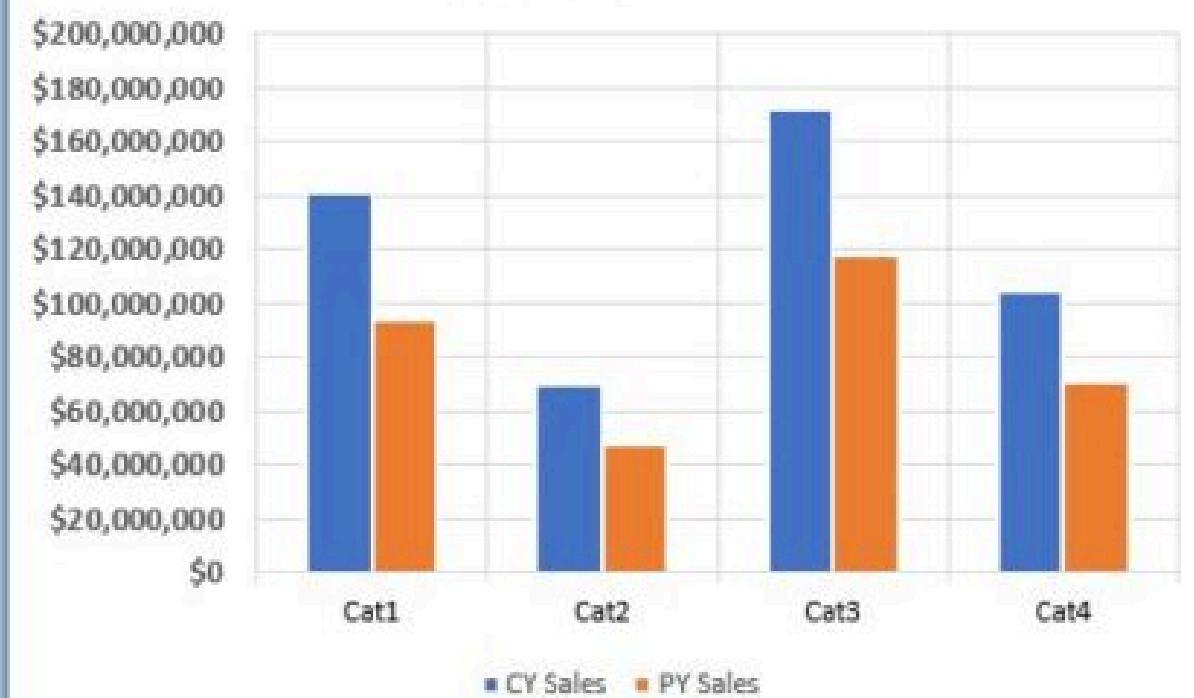
2019

2020

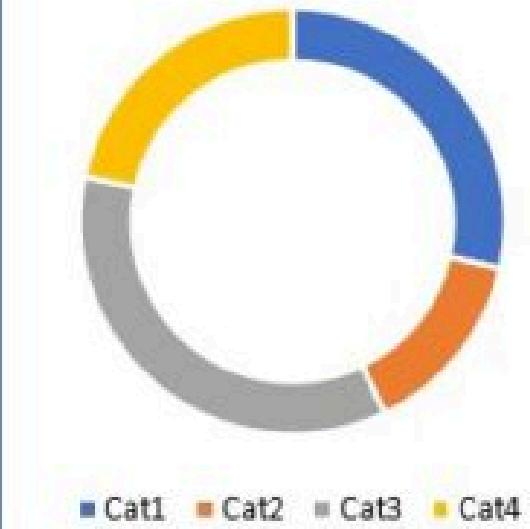
Actual Vs Budget Sales



CY Vs PY Sales



Budget

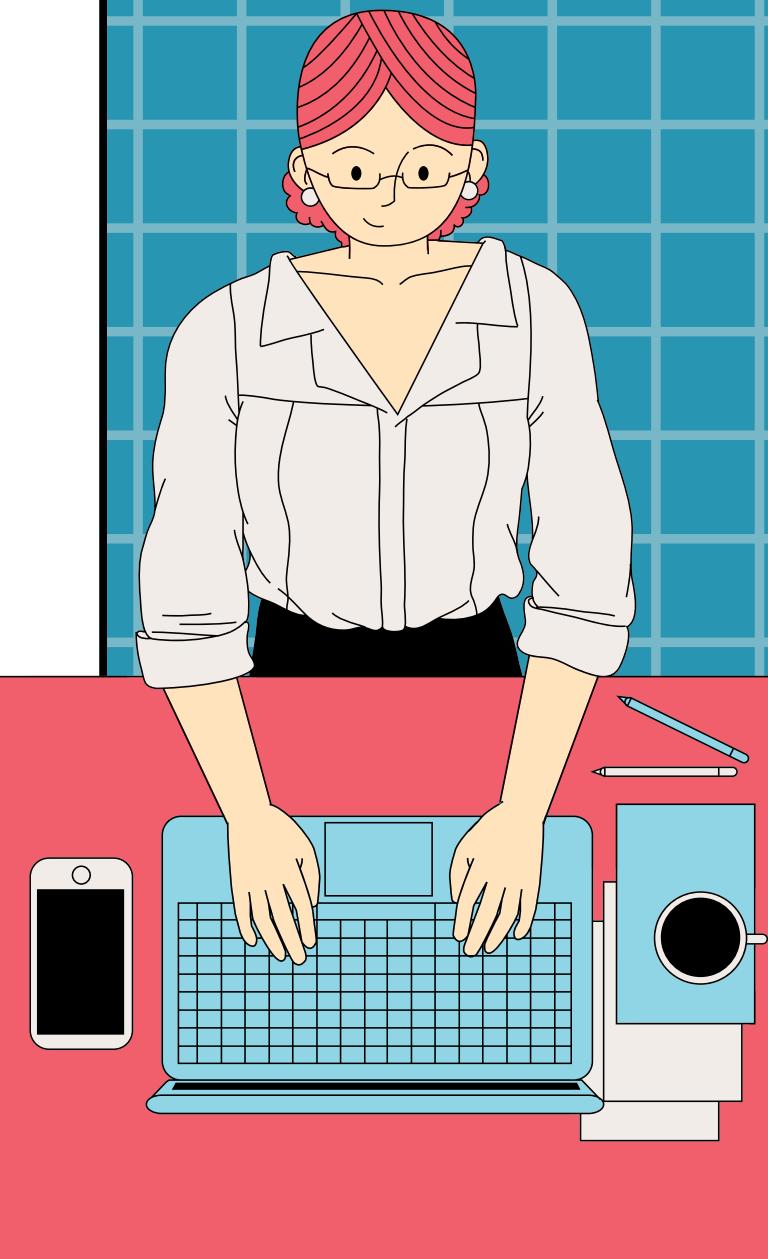


Budget Vs Actual Sales



## 6. ACTIONABLE INSIGHTS

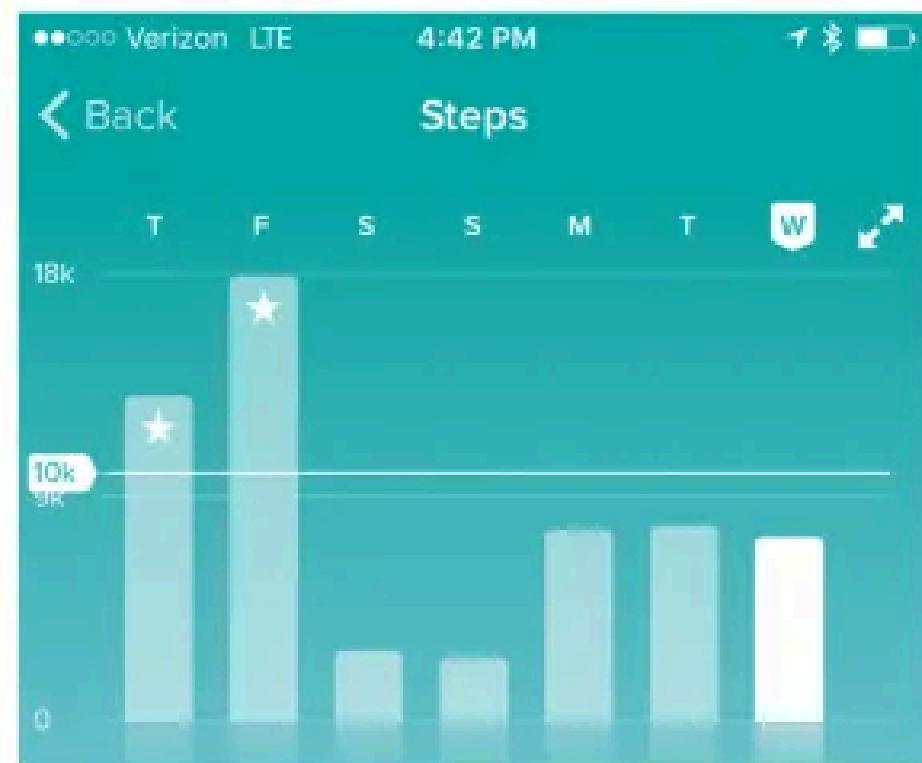
Don't just present data; provide insights that can lead to action. For example, if a particular product line is underperforming, suggest potential reasons and actions to improve sales.



# DATA → INFORMATION → INSIGHT → ACTION

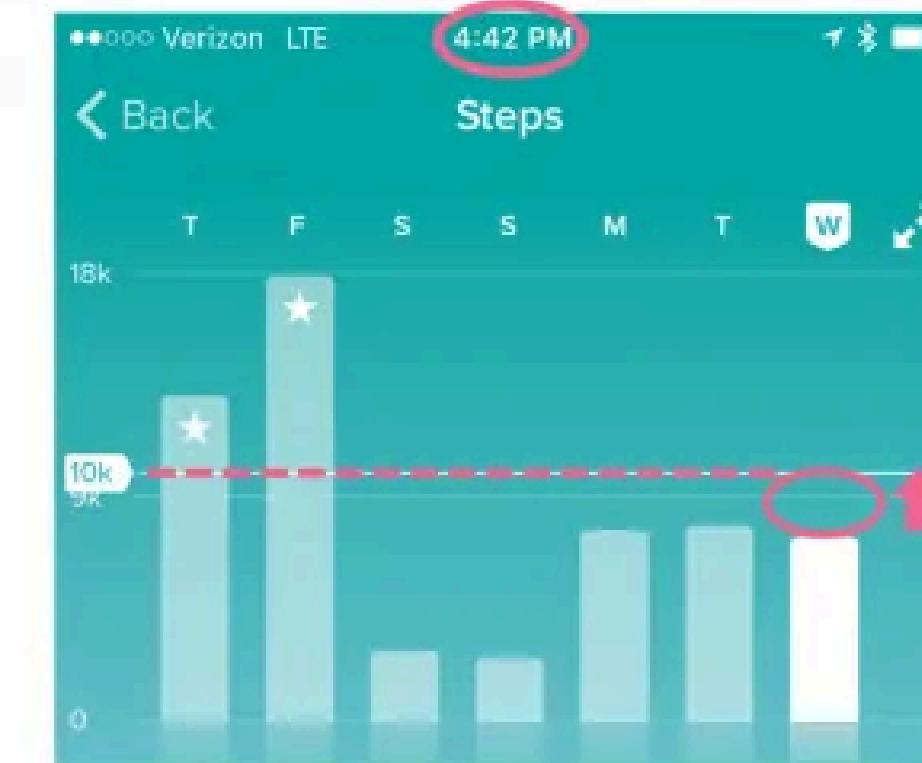
!! STEPS

7,442 steps



Try hitting 10,000 steps a day!  
That's the American Heart Association  
recommendation. [Learn More](#)

This Week		25,707 steps
Today	7,442 steps	>
Tue	7,915 steps	>
Mon	7,753 steps	>



Try hitting 10,000 steps a day!  
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This Week		25,707 steps
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# DASHBOARD



# 1. TOO MUCH CLUTTER



## 2. TOO MANY COLORS

**DASHBOARD**

**Navigation**

- Dashboard
- Emails
- Calendar
- Pages

**Featured**

- Charts
- Articles
- Users
- Favorites
- Speed
- Settings

**All Others**

- Revenue
- Pictures
- FAQs

**World Sales**

40% 12% 11% 10% 18% 9%

**Site Report**

Metric	Value
Sales	65%
Revenue	88%
New Orders	92%

It is a long established fact that a reader will be distracted by the readable content of a page when looking at its layout.

**Today Sale**  
400 New

**Users Trend**

**Users vs Returning**

New Sales

# 3. LACK OF CONTEXT

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**All Others**

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- FAQs

**Revenue**

100  
80  
60  
40  
20  
0

2 4 6 8 10 12 14 16 18

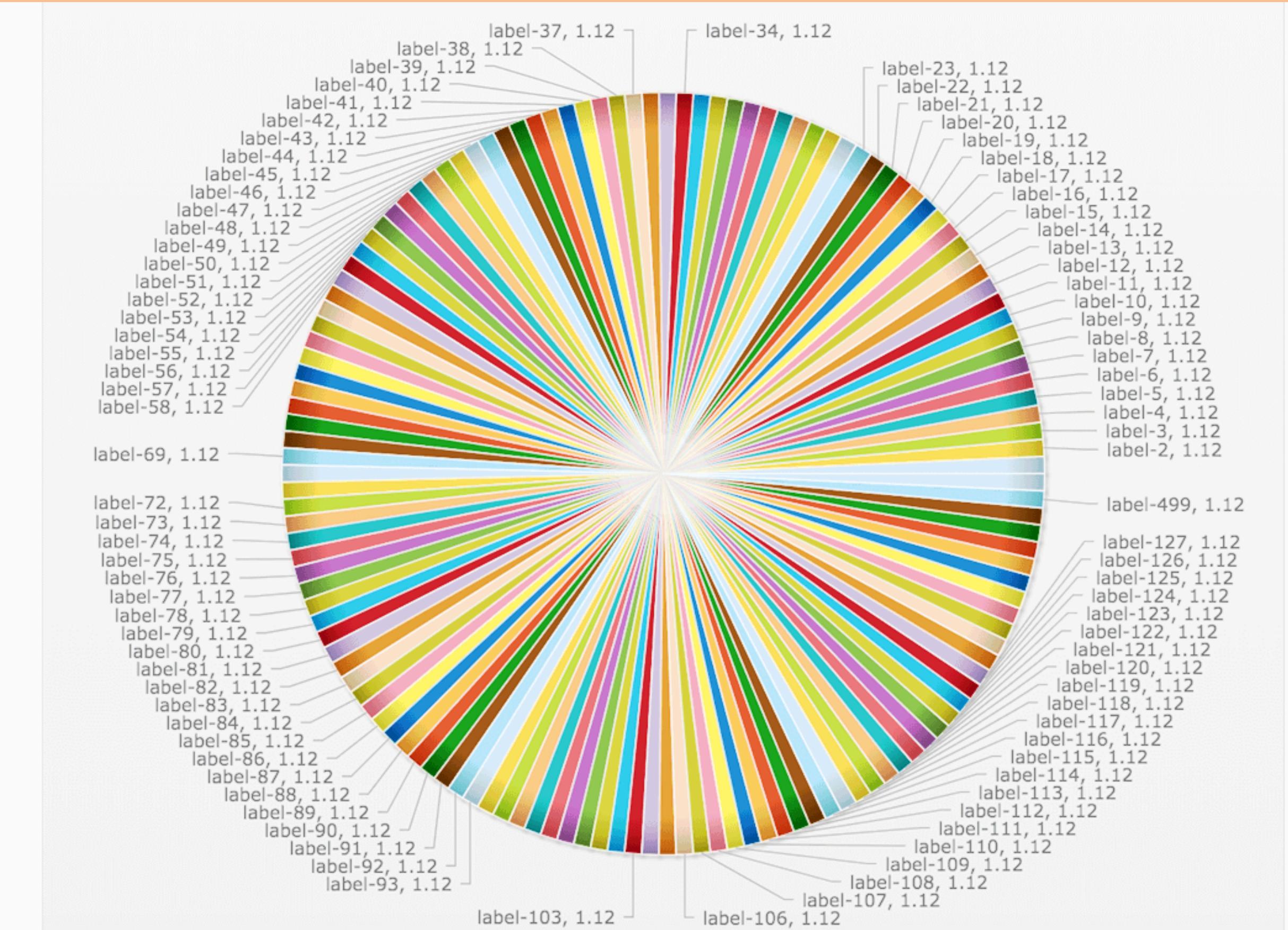
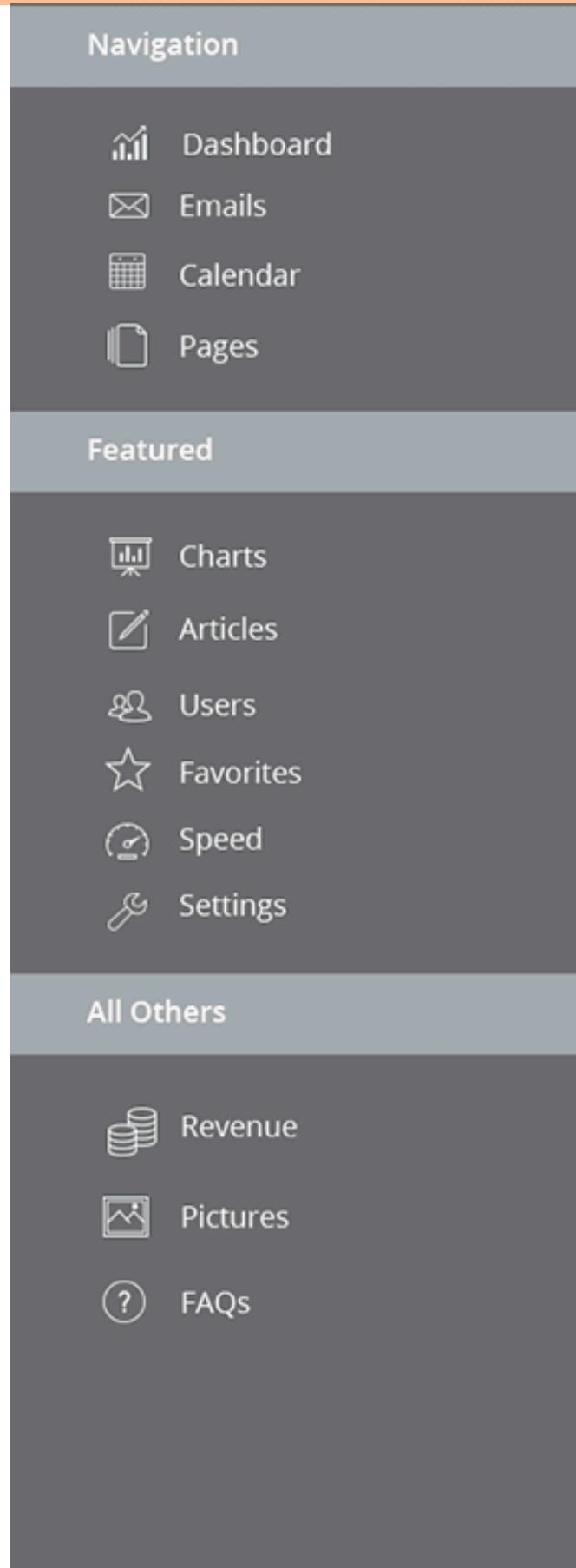
42 TARGET

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Q1 Q2 Q3 Q4

Month	Revenue
JAN	100
FEB	80
MAR	60
APR	70
MAY	50
JUN	70
JUL	90
AUG	70
SEP	50
OCT	100
NOV	80
DEC	100

# 4. BAD DATA-TO-VISUALIZATION PAIRING



# 5. CARELESS ARRANGEMENT

# DASHBOARD

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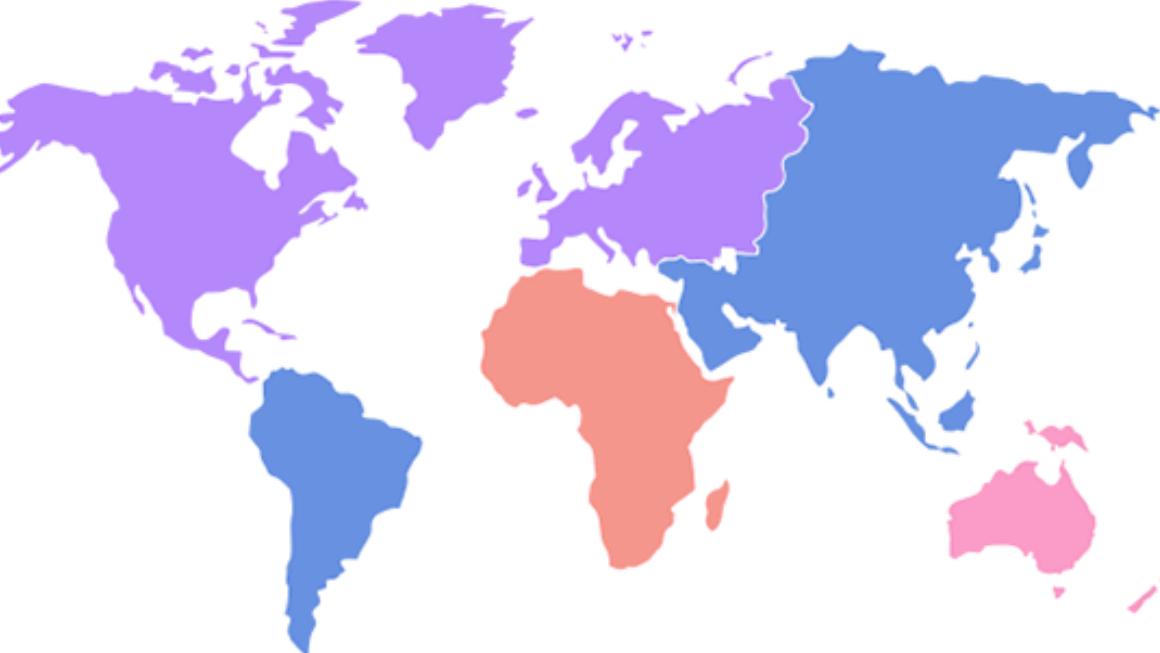
### Client Hours

Working Hours



96  
Working Hours

● Sweet & Simple LTD.	37:45 h
● Nike Running Shoes	16:22 h
● Some Cool Company	3:14 h



Poor      Average      Good      Excellent

0      75      150      300

### Daily Progress

Working Hours

THIS WEEK ▾



Date	Sweet & Simple LTD. (h)	Nike Running Shoes (h)
Monday	53	68
Tuesday	56	48
Wednesday	52	47
Thursday	62	38
Friday	54	53
Saturday	53	42
Sunday	56	15
Total	37:45	16:22



Jake Appleseed  
London, UK

Working hours	Ammount Total
14 hours	\$ 6,269
Overdue	% overall work
\$ 829	48%

# 6. INCORRECT (OR NO) FOCUS

**DASHBOARD**

**Navigation**

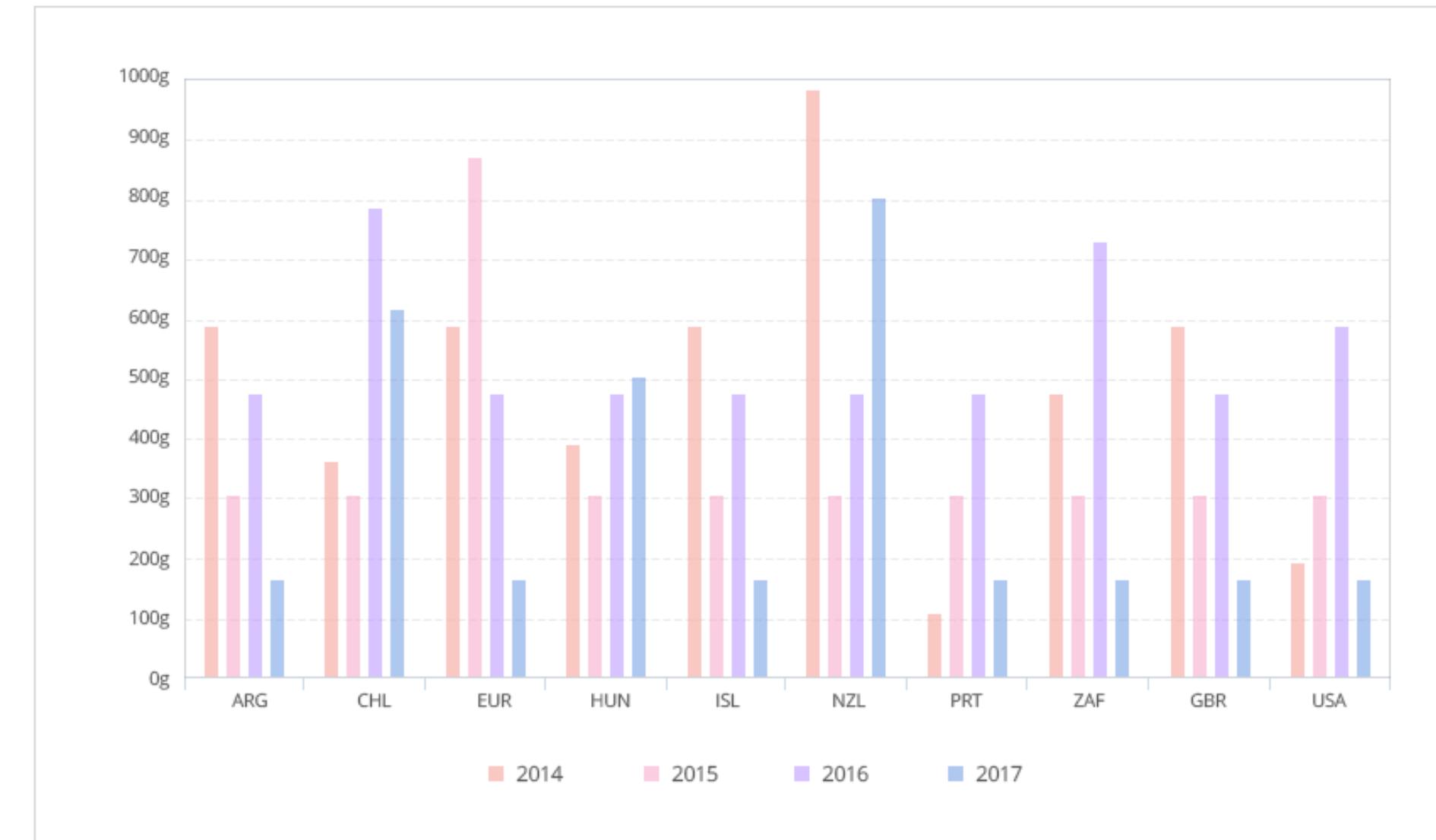
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# 7. UNNECESSARY VARIETY

**DASHBOARD**

**Navigation**

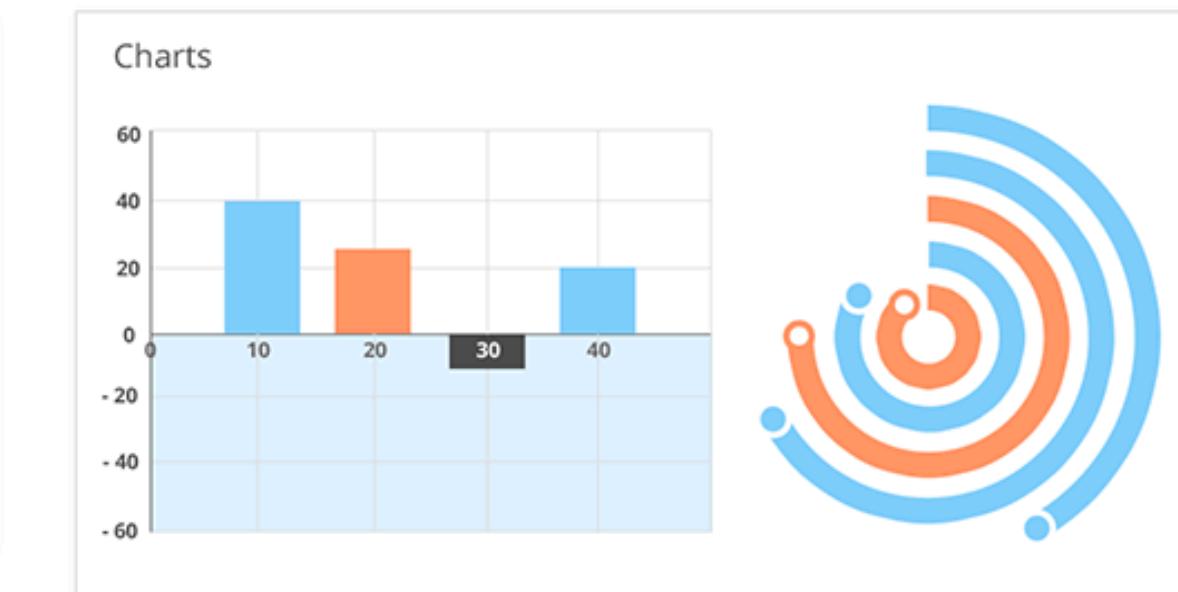
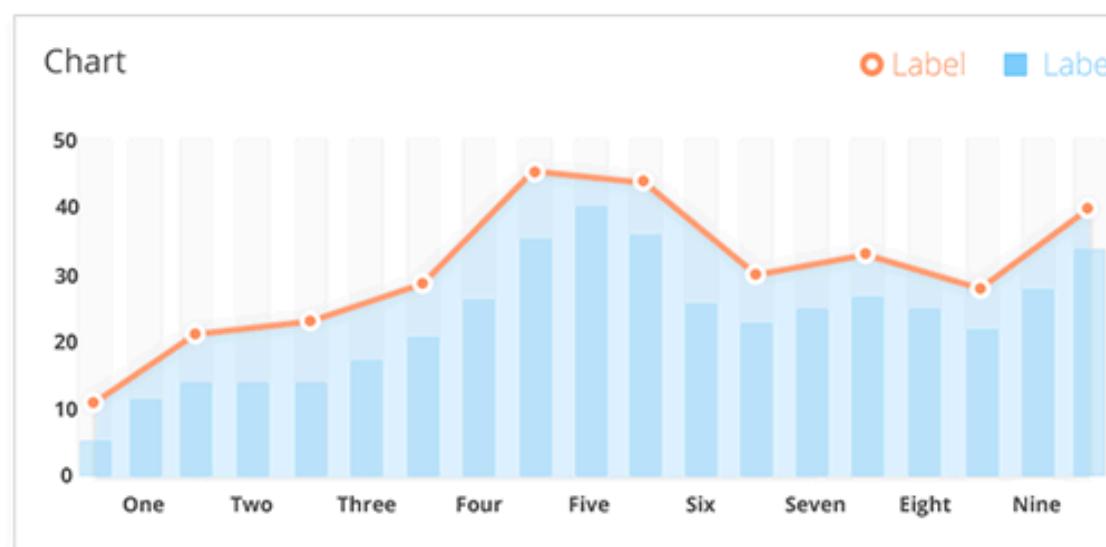
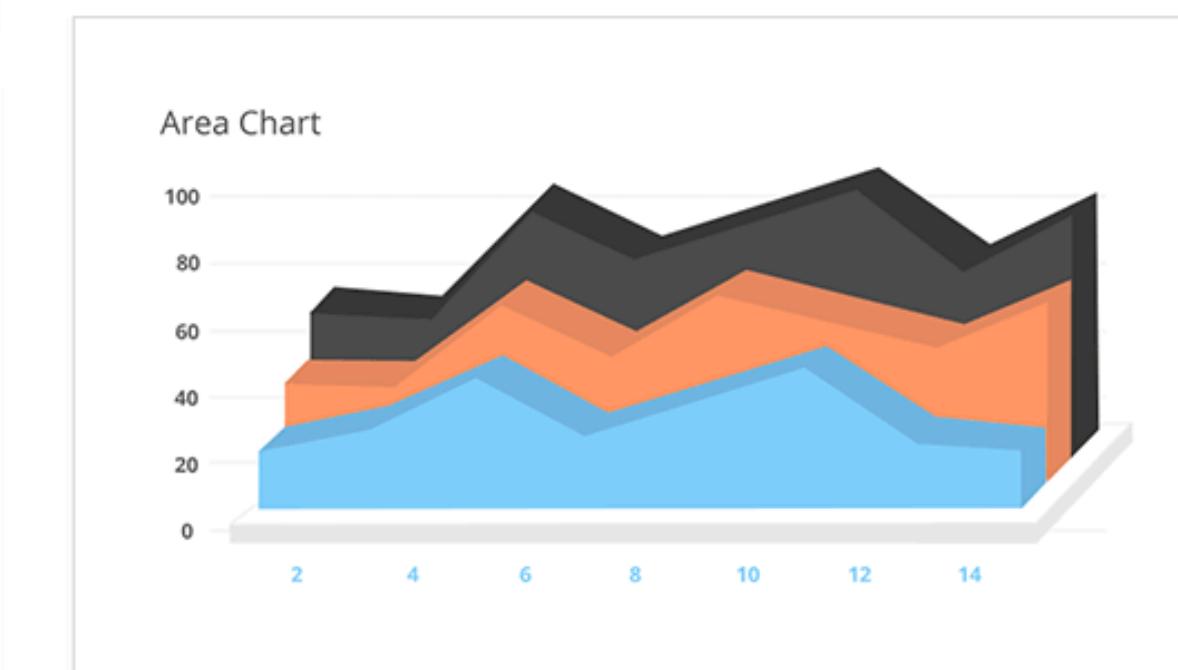
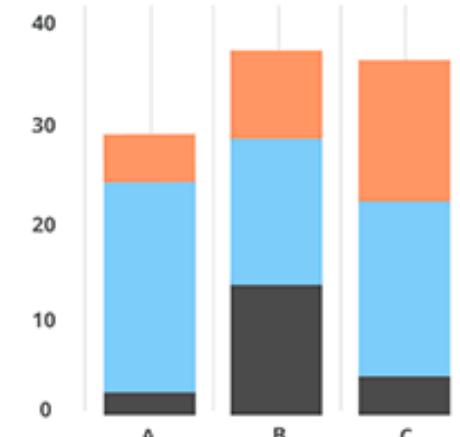
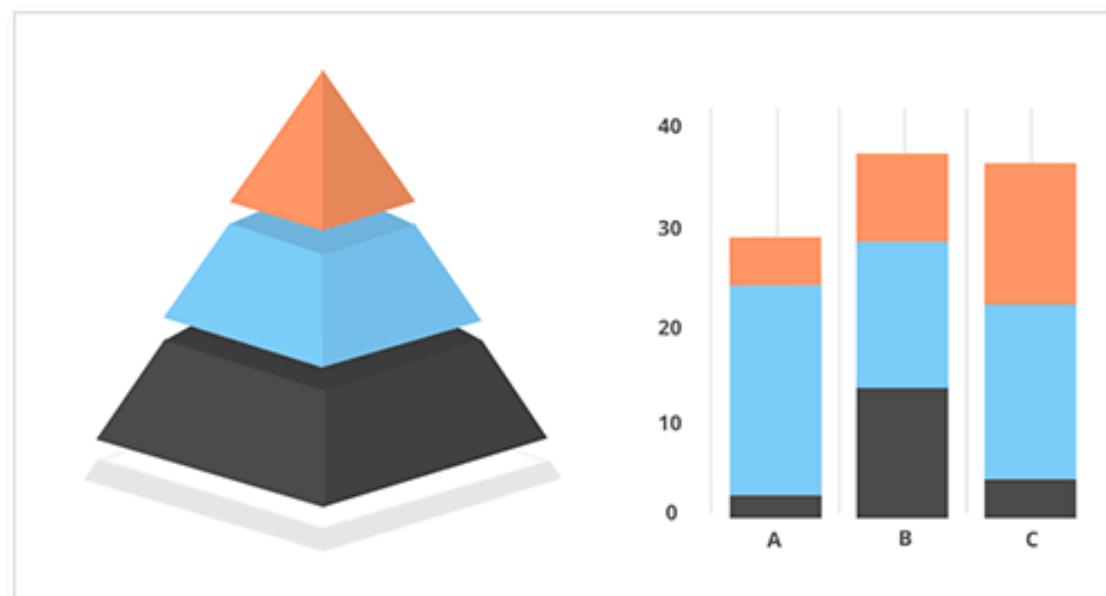
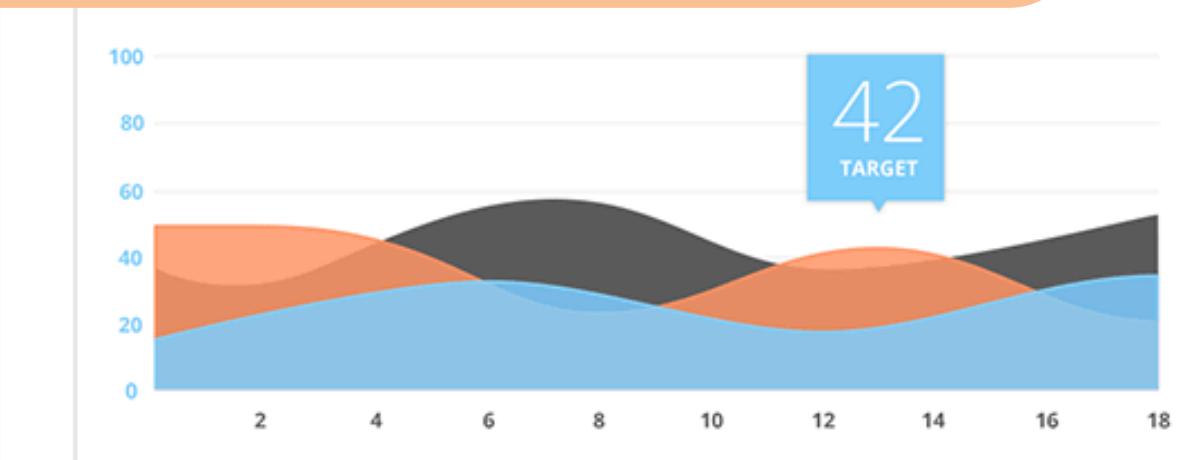
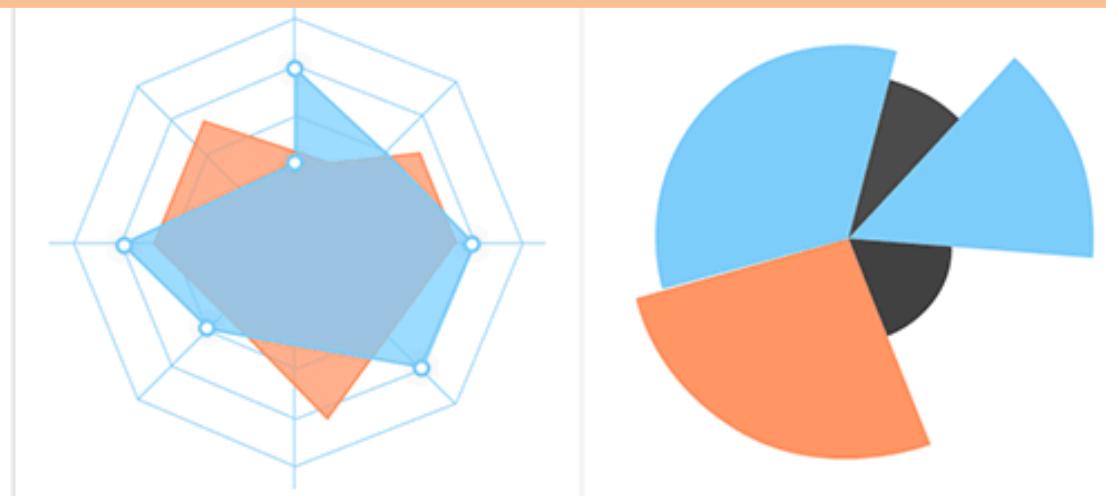
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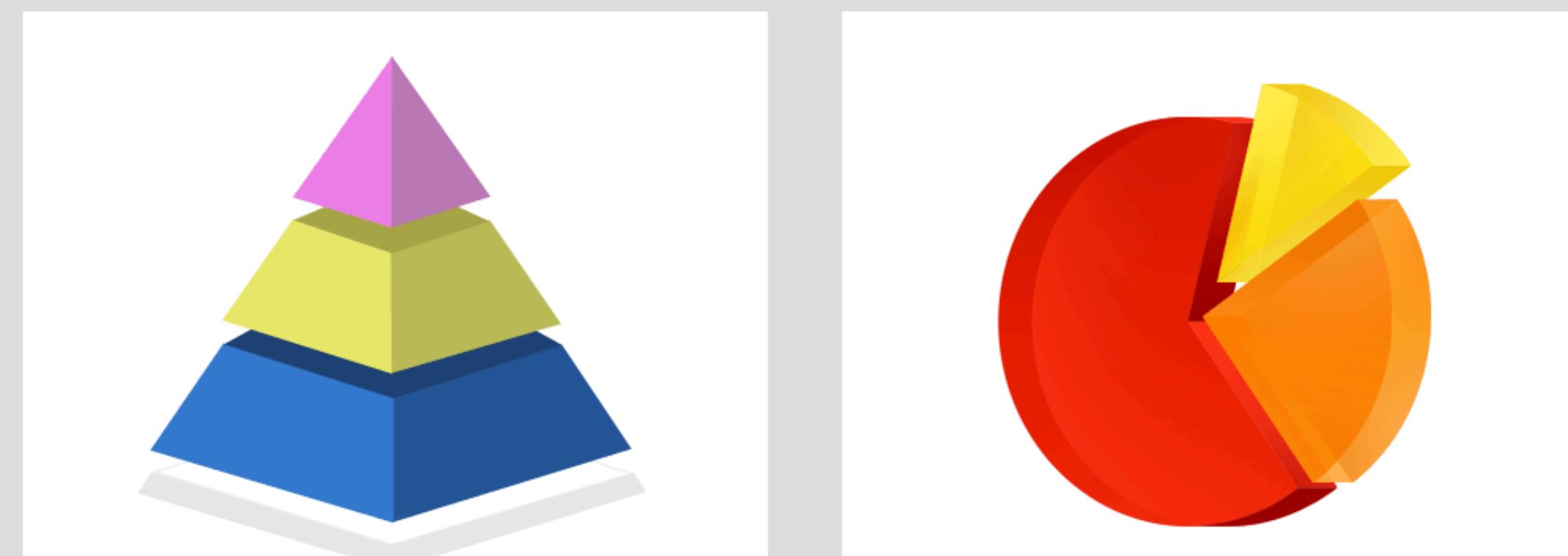
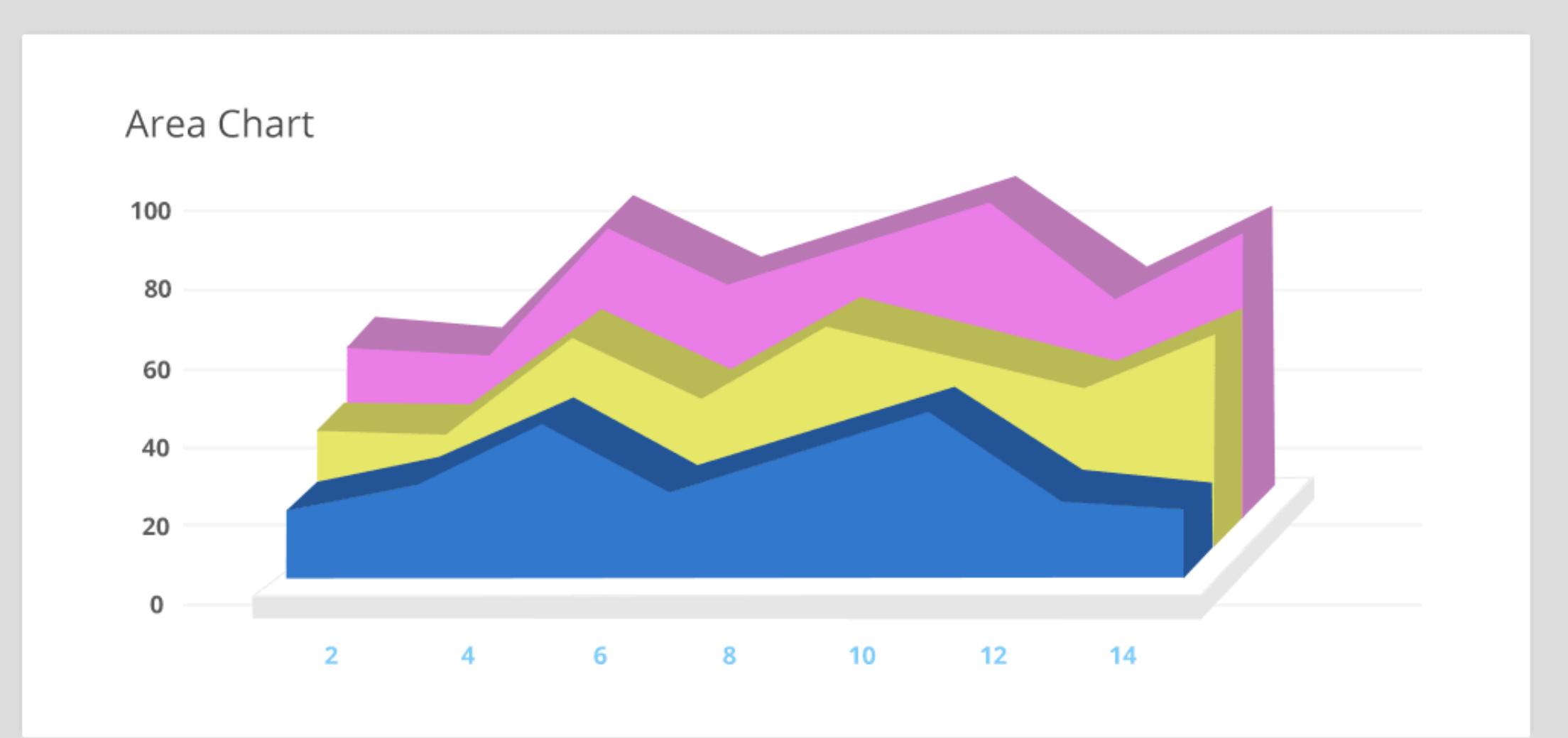
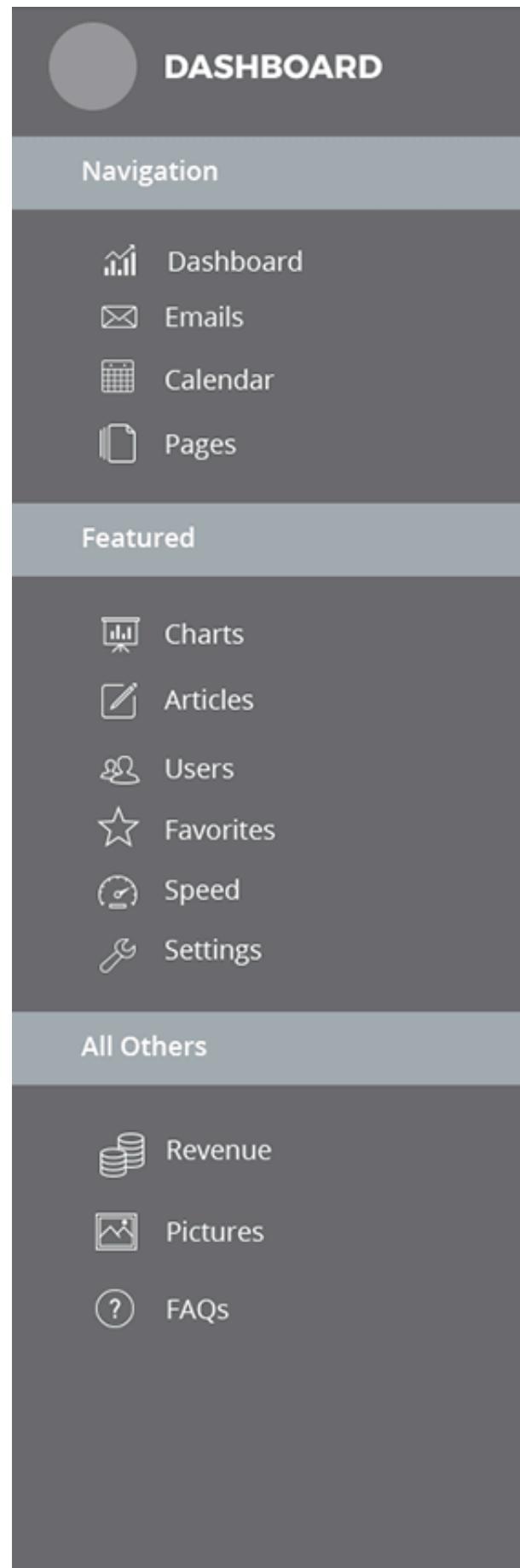
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# 8. CONFUSING RESEMBLANCE



# 9. TOO ORNATE



# 10. JUST PLAIN UGLY

**DASHBOARD**

**Navigation**

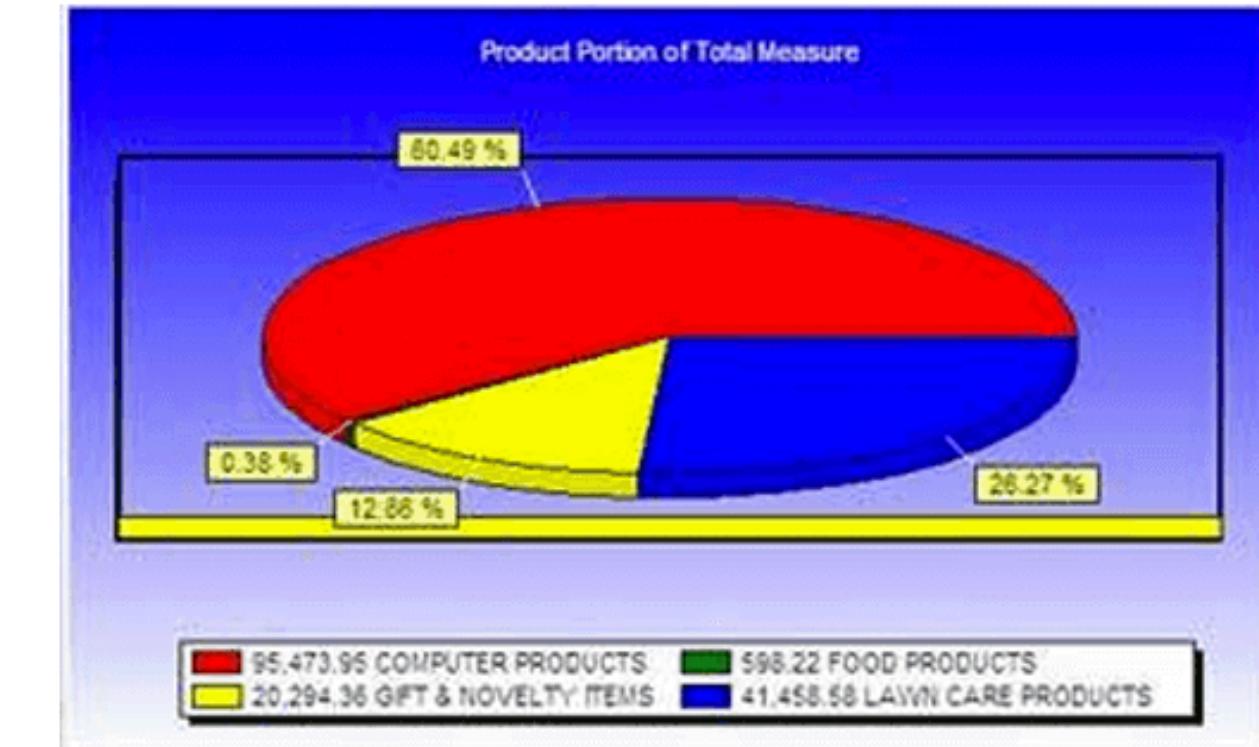
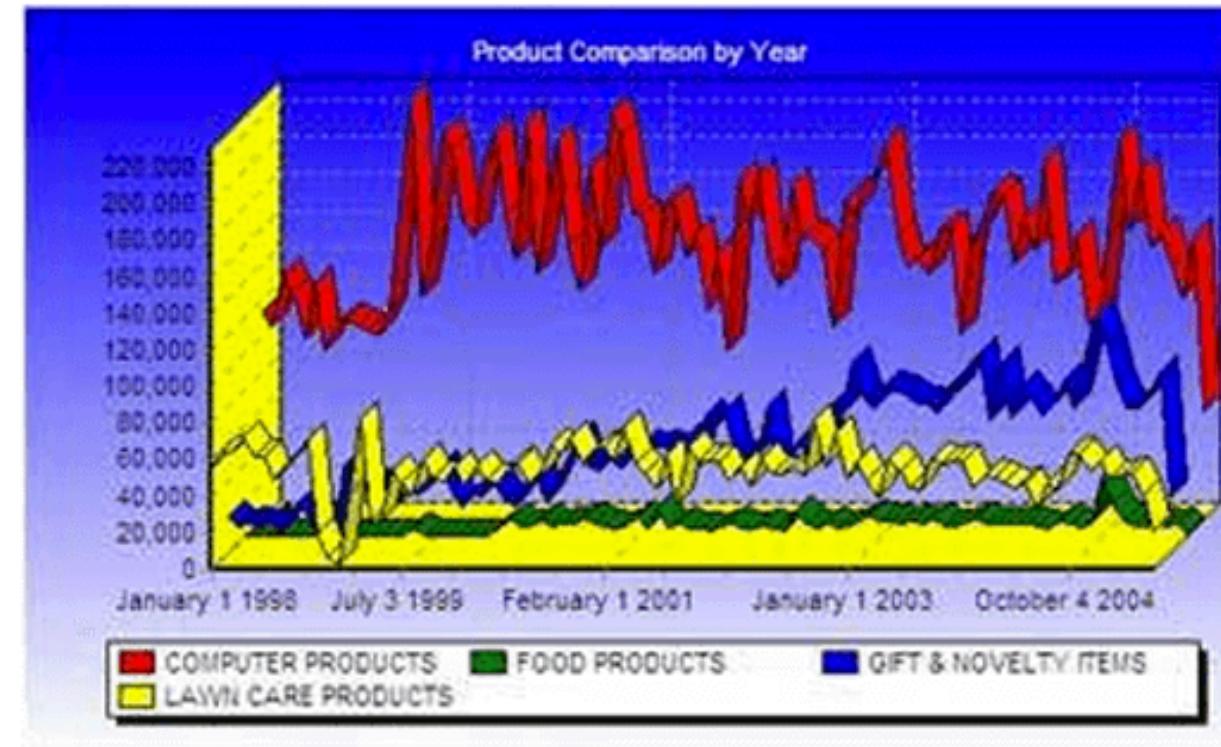
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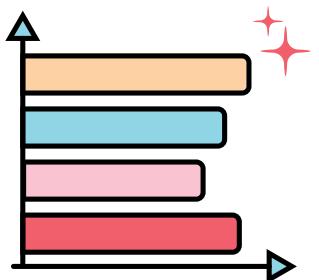
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# SELECT THE BEST CHART



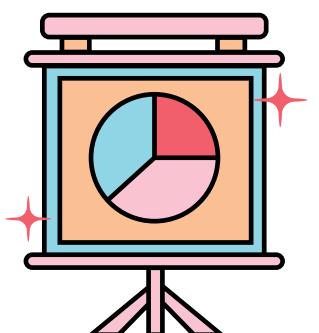
# **TYPES OF GRAPHS**



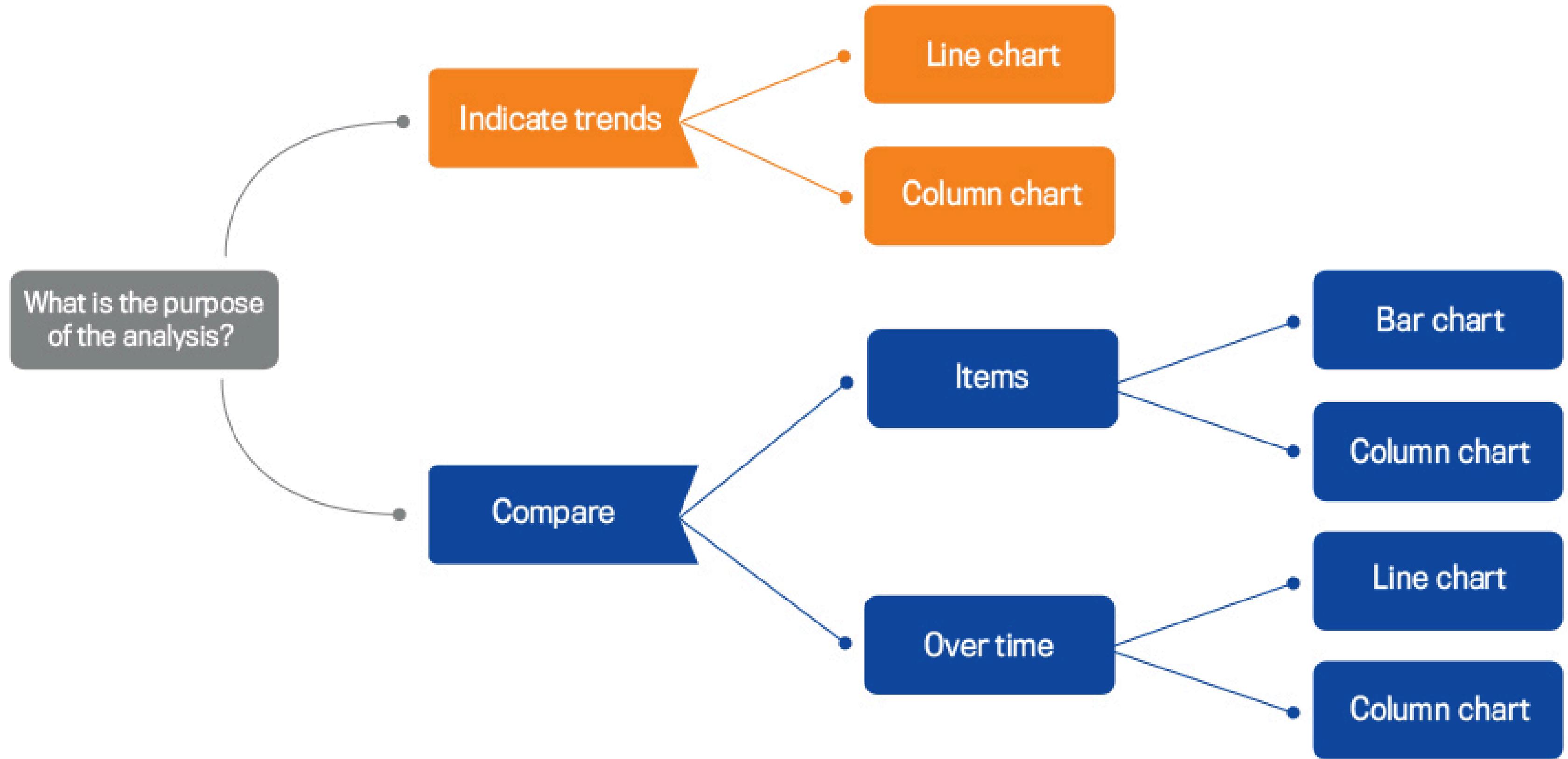
**Bar Graphs:** Used to compare groups



**Line Graphs:** Used to show changes over time



**Bar Graphs:** Used to depict parts of a whole



## VISUALIZATION

### USE

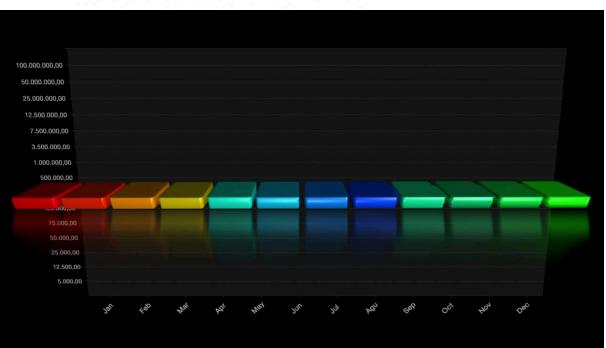
### DATA REQUIRED

### BEST PRACTICES

#### AREA CHART



#### BAR CHART



#### BUBBLE CHART



To represent changes in volume over time

- Data field
- At least one quantitative measure

- To avoid confusion and clutter, don't use with data that have more than four categories.
- Start with y-axis at zero or above.
- Put highly variable data on the top and low variability on the bottom.

To compare parts to a whole, highlight categories, or show changes over time

- Horizontal bars: zero or more categories, one or more measures
- Vertical bars: one or more categories, one or more quantitative measures

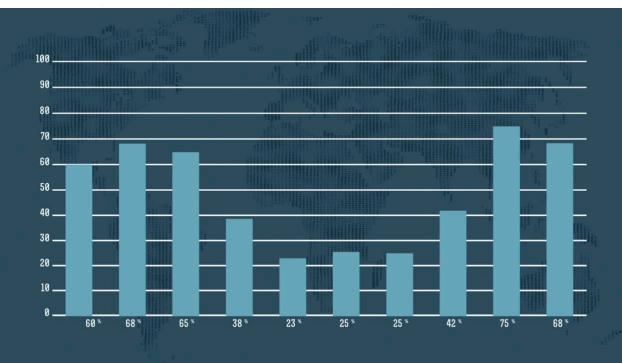
- Compare two to seven categories with vertical bars.
- Use horizontal bars if more than seven categories or long category labels.
- Use horizontal labels for better readability.
- Space bars appropriately and consistently.
- Use color sparingly or as an accent color.
- Always have a zero baseline.

To compare independent values that have distinct gaps or outliers

- One or more categories
- One or more quantitative measures

- Label bubbles and make sure they are visible.
- Scale bubble size by area and not diameter.
- Don't use bubbles if they are similar in size.

## HISTOGRAM CHART



To show frequency distributions

- Must be numerical data

- Use a zero baseline.
- Choose an appropriate number of bins.
  - Bins are numbers that represent the intervals into which you want to group the data.
  - Bins define the groups used for the frequency distribution.
  - There are generally between five and 15 bins.

## LINE GRAPH

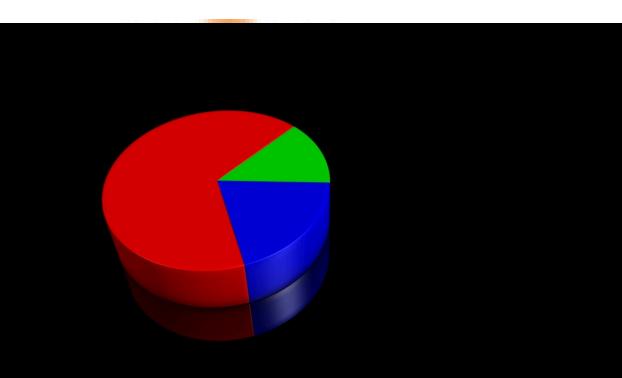


To display one or more series of data. Allows for the use of multiple data series and data points

- For continuous lines, you need one date, zero or more categories, and one or more quantitative measures.

- Time runs from left to right.
- Be consistent in plotting time points.
- Use solid lines, not dotted.
- Use a zero baseline.
- Don't plot more than four lines; instead use multiple charts.

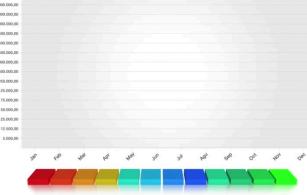
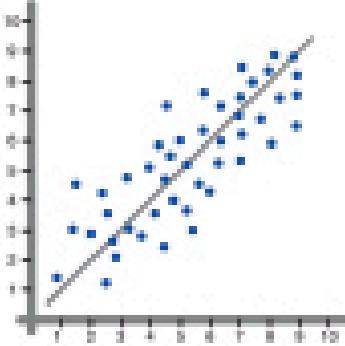
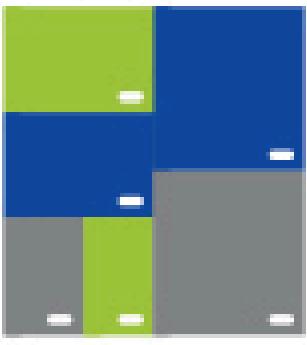
## PIE CHART



Use for illustrating simple part-to-whole relationships. Not a good visual to use to make precise comparisons

- One or more categories
- One or two quantitative measures

- Most impactful with small data sets
- Best to use when you want to show differences within groups based on one variable
- Make sure the data adds to 100%.
- Limit the chart to a maximum of five segments.
- Start the first segment at the 12 o'clock position.

<b>STACKED BAR CHART</b> ■ 	Use when comparing multiple part-to-whole relationships.	<ul style="list-style-type: none"> <li>• One or more categories</li> <li>• One or more quantitative measures</li> </ul>	<ul style="list-style-type: none"> <li>• Can be vertical or horizontal</li> <li>• Follow same best practices as bar charts.</li> </ul>
<b>SCATTER CHART</b> 	Use to highlight correlation and distribution of large amounts of data.	<ul style="list-style-type: none"> <li>• Zero or more categories</li> <li>• One or more quantitative measures</li> </ul>	<ul style="list-style-type: none"> <li>• Data set should be in pairs with an independent variable (x-axis) and a dependent variable (y-axis).</li> <li>• Use if order isn't relevant—otherwise use a line graph.</li> <li>• Do not use if there are only a few pieces of data or if there is no correlation.</li> </ul>
<b>TREE MAP</b> 	Use to visualize a part-to-whole relationship among a large number of categories.	<ul style="list-style-type: none"> <li>• One or more categories</li> <li>• One or two quantitative measures</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate when precise comparisons aren't important</li> <li>• Use bright, contrasting colors so that each box is easily defined.</li> <li>• Label boxes with text or numbers.</li> </ul>

# DATA STORY TELLING



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