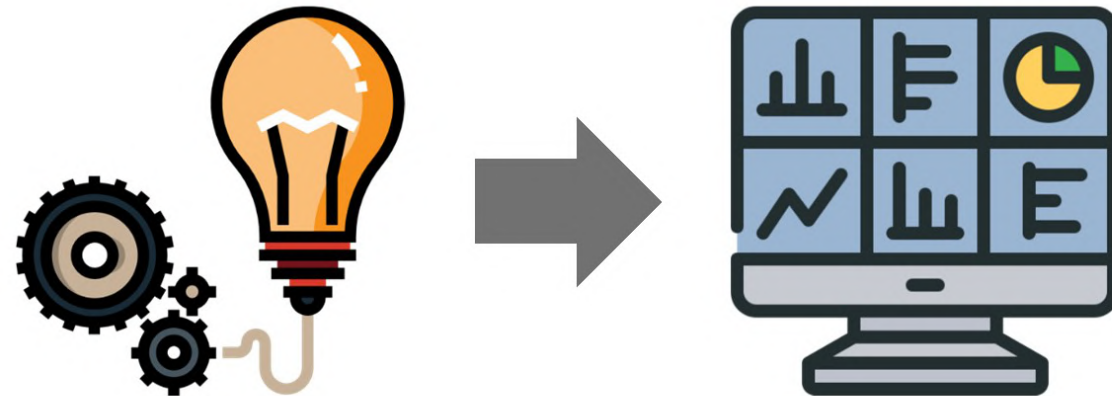


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Demystifying **Chart Types** and **Design Principles** in Power BI



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Presenter Introduction

- **Reid Havens**

- Founder | BI Evangelist | Consultant
- Microsoft MVP
- PBI User Group Co-Organizer – Redmond, WA
- Nickname: “The Viz Wiz”
- Specializes in teaching, consulting, and design

<https://www.havensconsulting.net>

reid@havensconsulting.net

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Session Agenda



Defining a Report

- Descriptions of report components and characteristics



Design Principles

- Practices for designing more effective reports



Data Visualizations

- Methodologies for creating impactful visualizations



Apply Practices

- Implementation of principles on a Power BI report



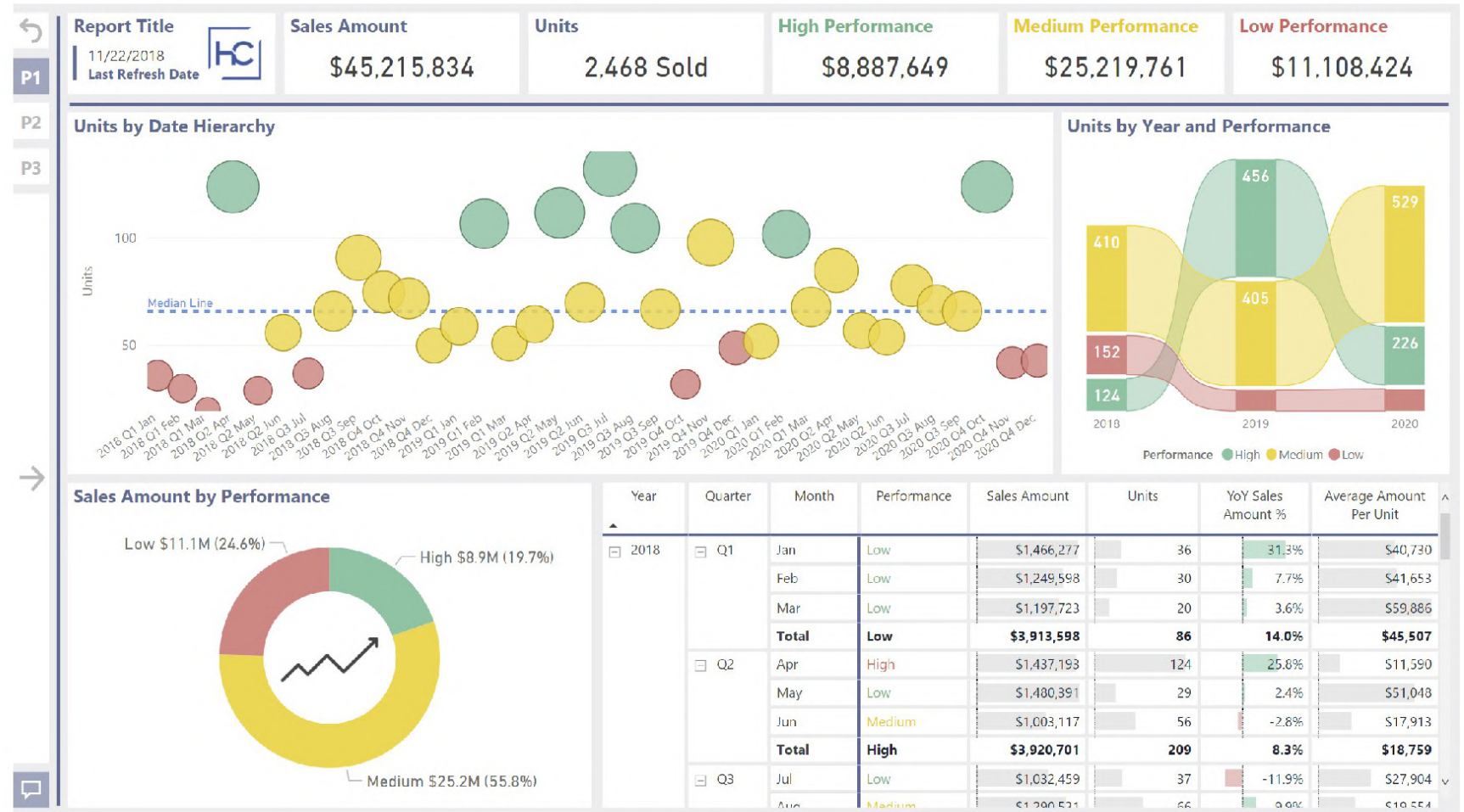


Defining a Report

- Descriptions of report components and characteristics

Defining a Report

“A report is a visual display of the most important information needed to achieve one or more objectives; consolidated and arranged...so the information can be monitored at a glance.”
~Stephen Few



Defining a Report

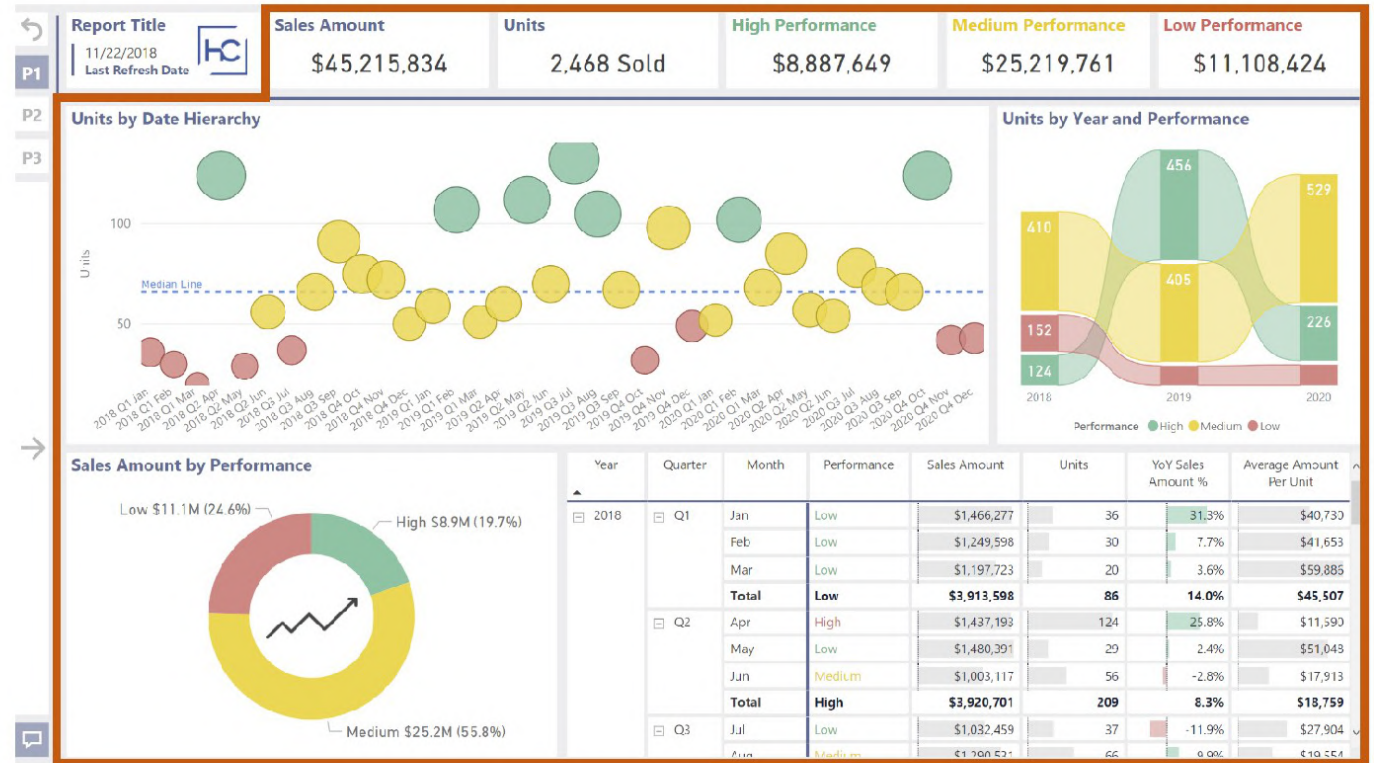
Essential Report Components

Three primary components of a report



Visualizations

- Displays patterns, trends, or outliers in the data



Defining a Report

Essential Report Components

Three primary components of a report



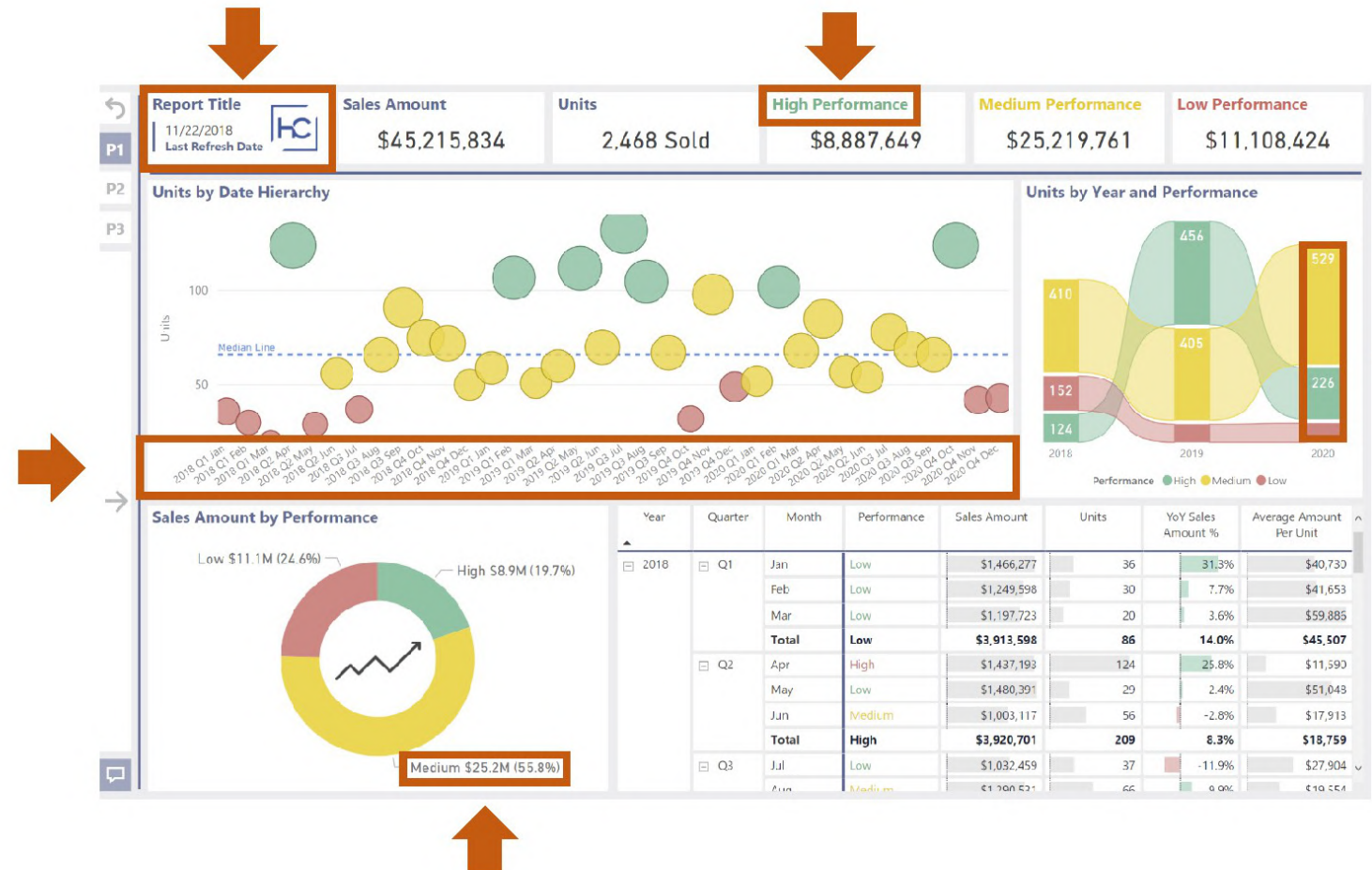
Visualizations

- Displays patterns, trends, or outliers in the data



Information

- Gives additional information about the data or report



Defining a Report

Essential Report Components

Three primary components of a report



Visualizations

- Displays patterns, trends, or outliers in the data



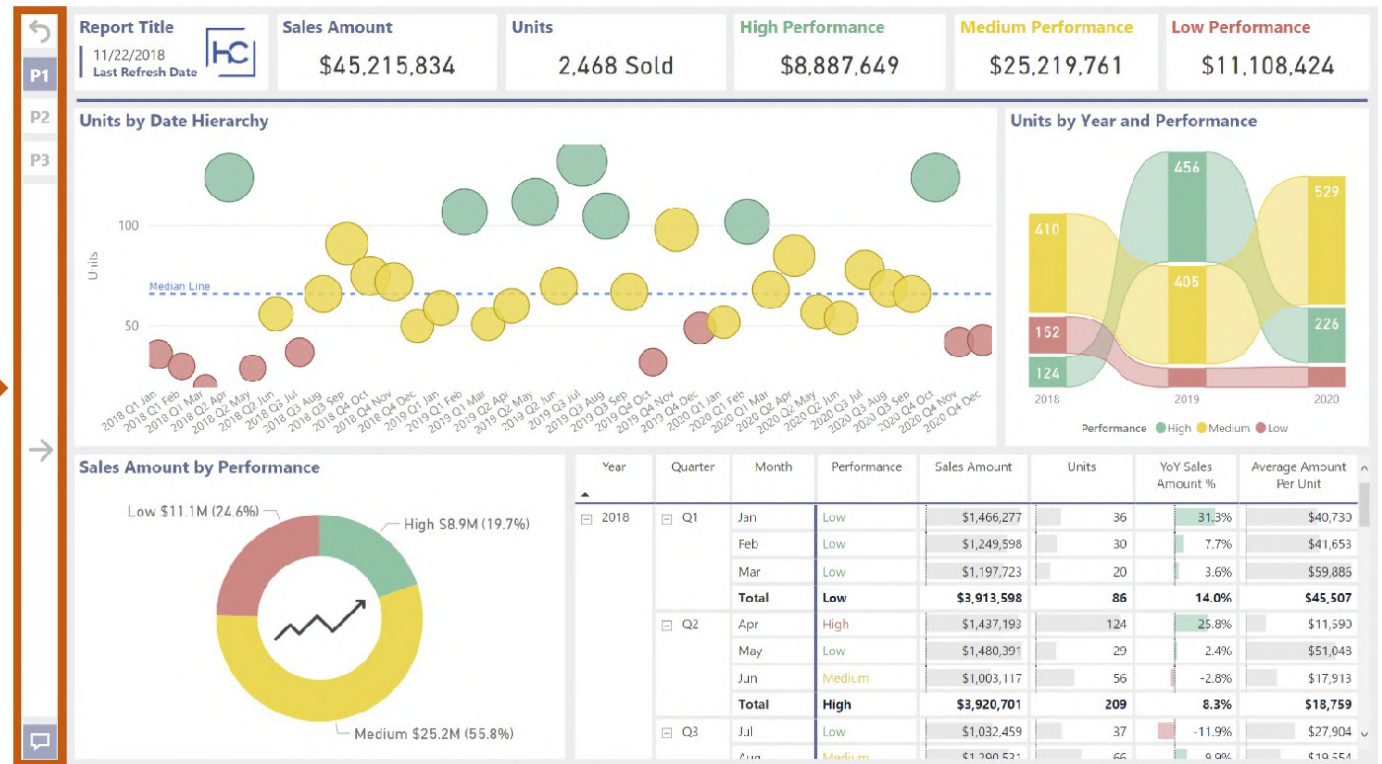
Information

- Gives additional information about the data or report



Filters / navigation

- Provides ways to interact with and drill into the data



ALL THREE ARE NEEDED TO CREATE AN EFFECTIVE REPORT



Defining a Report

Essential Report Components ► Visualizations

Defining visualizations

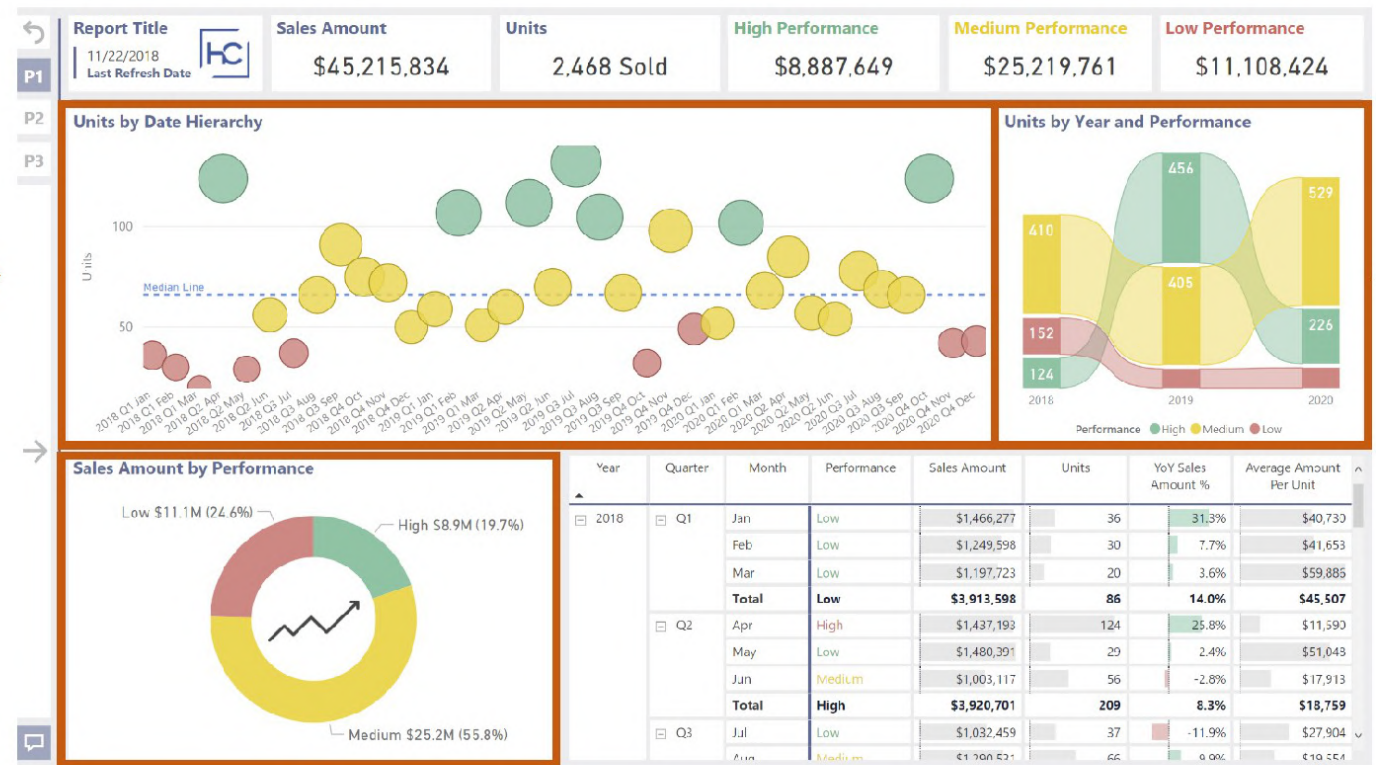
- Displays summarized data that has been categorized and sorted
- Tells a story about the data

Types of visuals



Charts / graphs

- Data represented graphically across time or categories



Defining a Report

Essential Report Components ► Visualizations

Defining visualizations

- Displays summarized data that has been categorized and sorted
- Tells a story about the data

Types of visuals



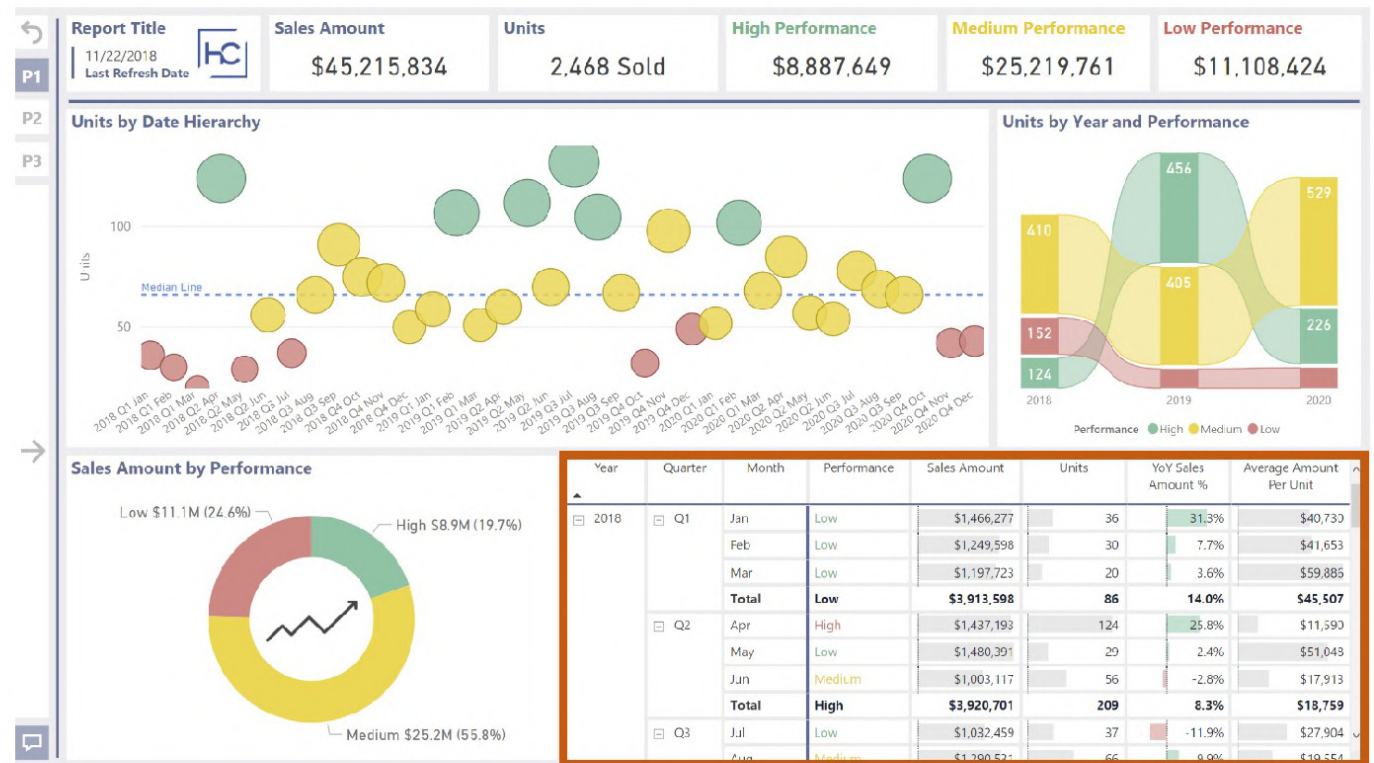
Charts / graphs

- Data represented graphically across time or categories



Tables

- Data displayed on columns and rows



Defining a Report

Essential Report Components ► Visualizations

Defining visualizations

- Displays summarized data that has been categorized and sorted
- Tells a story about the data

Types of visuals



Charts / graphs

- Data represented graphically across time or categories



Tables

- Data displayed on columns and rows



Key performance indicators (KPI's)

- Quantifiable values used to measure performance



Defining a Report

Essential Report Components ► Visualizations

Defining visualizations

- Displays summarized data that has been categorized and sorted
- Tells a story about the data

Types of visuals



Charts / graphs

- Data represented graphically across time or categories



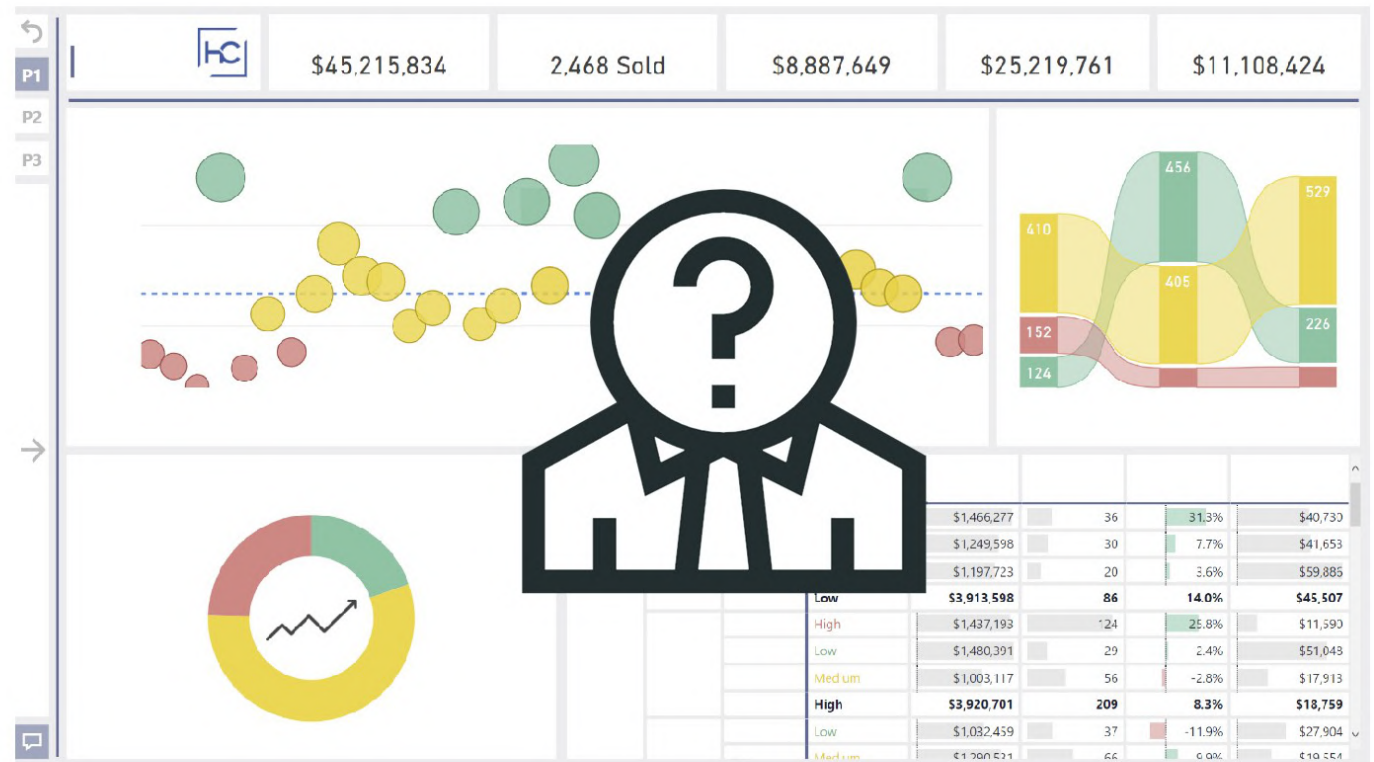
Tables

- Data displayed on columns and rows



Key performance indicators (KPI's)

- Quantifiable values used to measure performance



REPORTS NEED INFORMATION TO INTERPRET DATA



Defining a Report

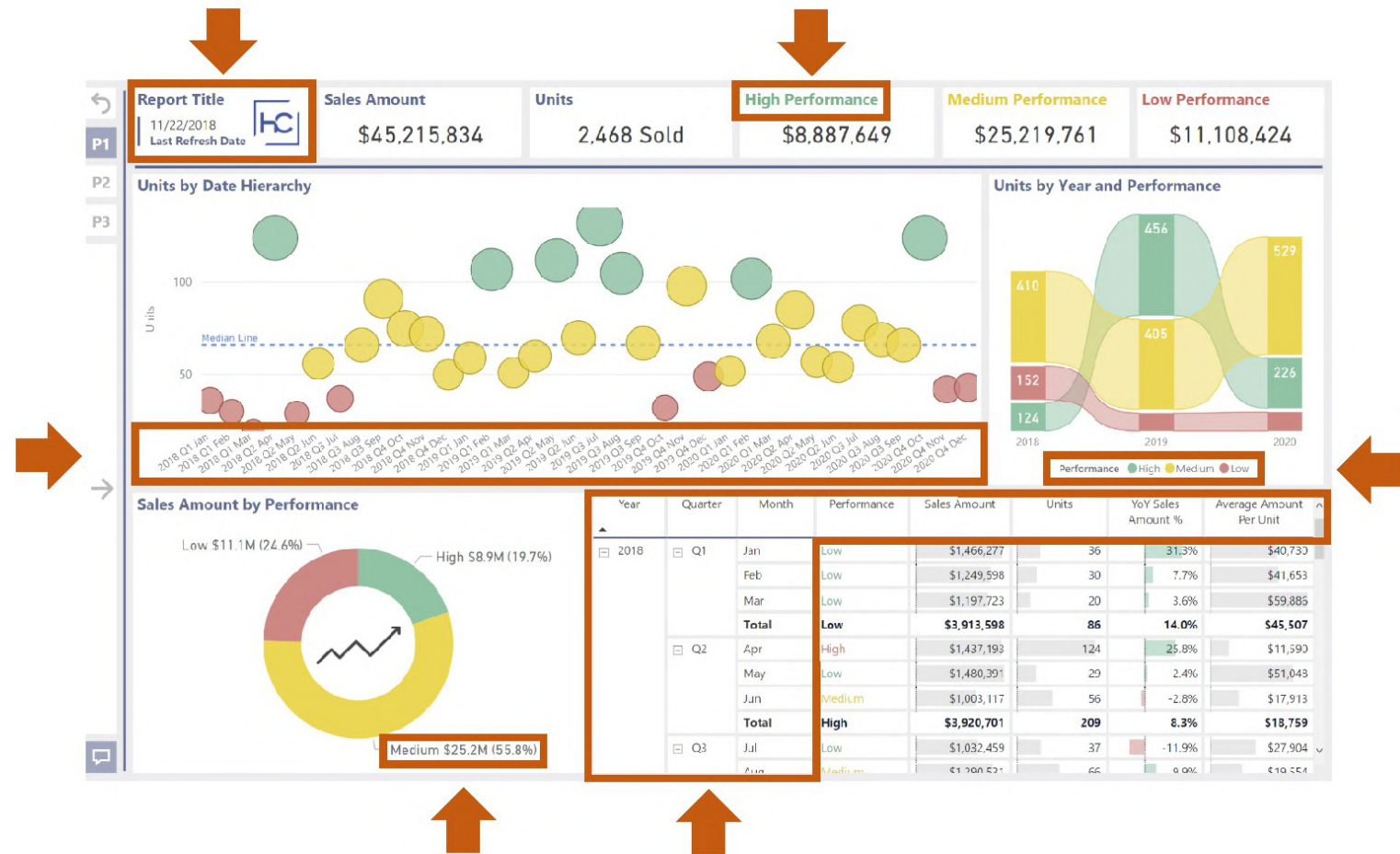
Essential Report Components ► Information

Defining information

- Gives meaning to visualizations
- Provides context for the report

Types of information

- Visualization details
 - Axis
 - Data labels
 - Legend
 - Title
 - Row / column headers
- Report context
 - Report title
 - Refresh date(s)



VISUALS NEED INFO TO PROVIDE A COMPLETE STORY

Defining a Report

Essential Report Components ► Filters

Defining filters

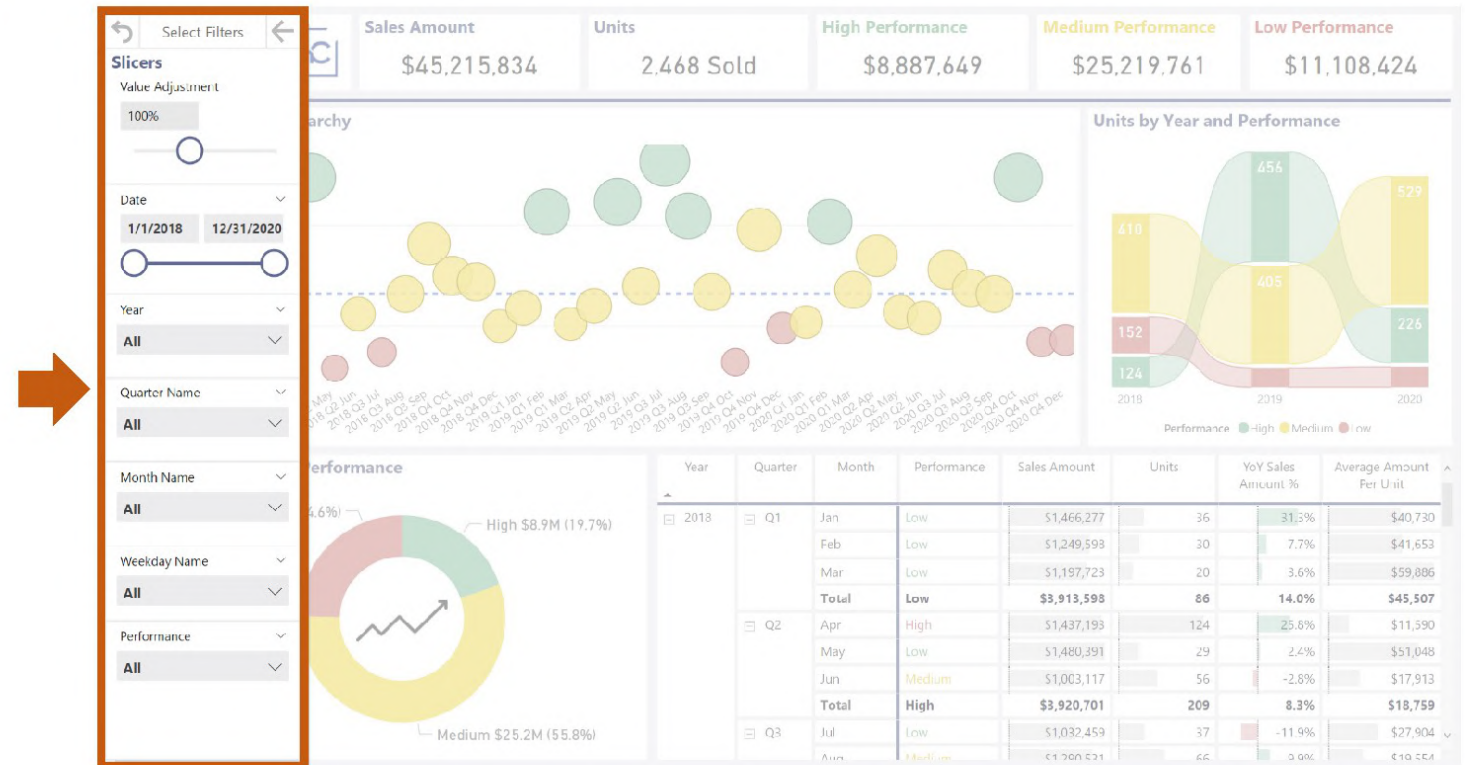
- Allows users to filter on different data segments
- Provides report interactions to derive insights from data

Types of filters



Report slicers

- Objects that can filter in various ways based on data type



Defining a Report

Essential Report Components ► Filters

Defining filters

- Allows users to filter on different data segments
- Provides report interactions to derive insights from data

Types of filters



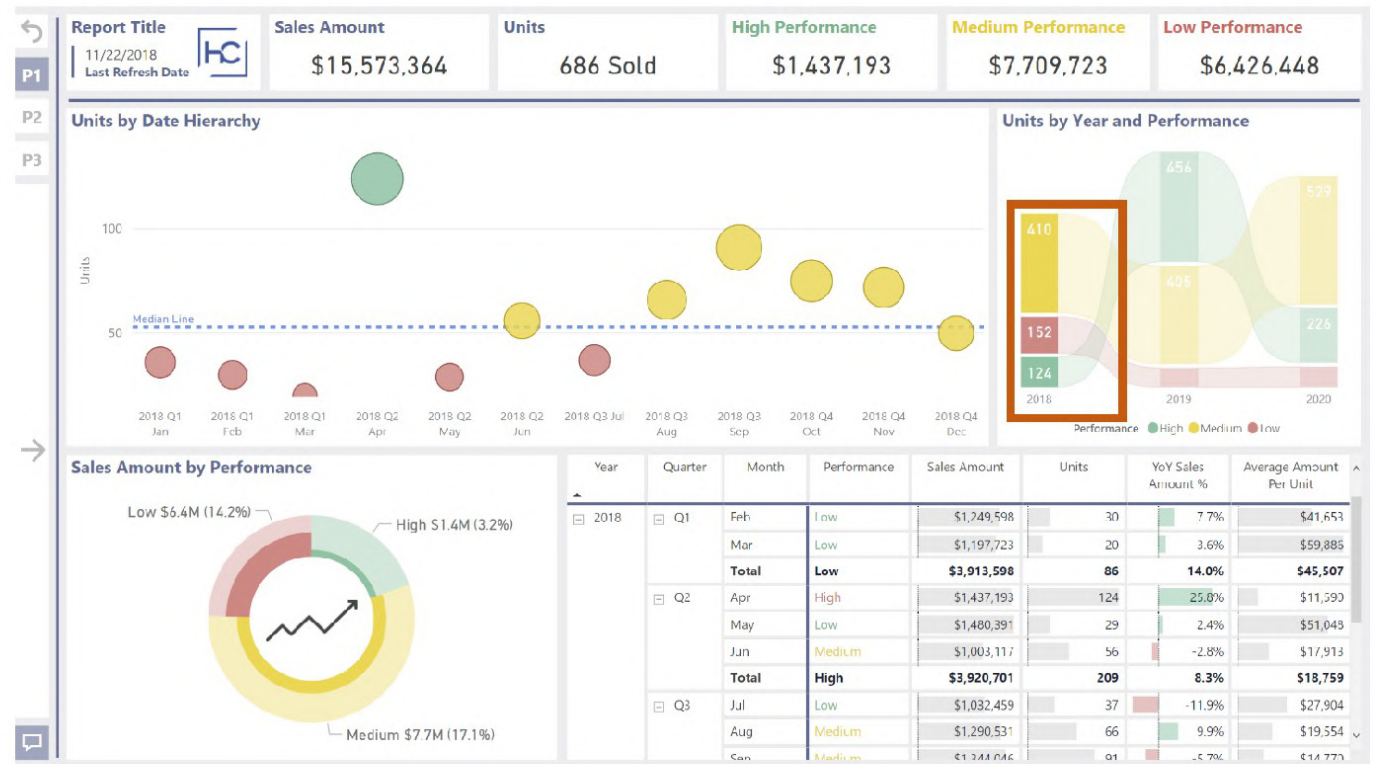
Report slicers

- Objects that can filter in various ways based on data type



Visual cross-filters

- Visual category selection that cross-filters other objects

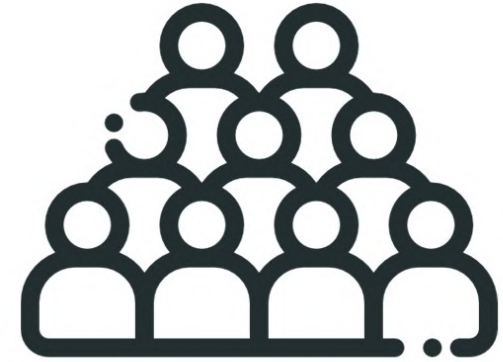


Defining a Report

Primary Report Types

Know your audience

- Audience determines the **type of report** to build, what to include, and what not to include
- There are different types of primary reports to build, and **levels of detail** to consider, depending on the audience



Types of reports



Operational

- Shows up-to-date metrics related to business process
- Notifies users when data deviates from acceptable standards



Strategic

- Shows key information to measure the health of the organization
- Helps identify areas for improvement or organizational changes



Analytical

- Provides data to identify patterns and trends across time or categories
- Contains larger datasets for discovery and analysis of the data

Less Detailed

More Detailed



Three Primary Components of a Report



**Knowledge
Check**





Questions?



Design Principles

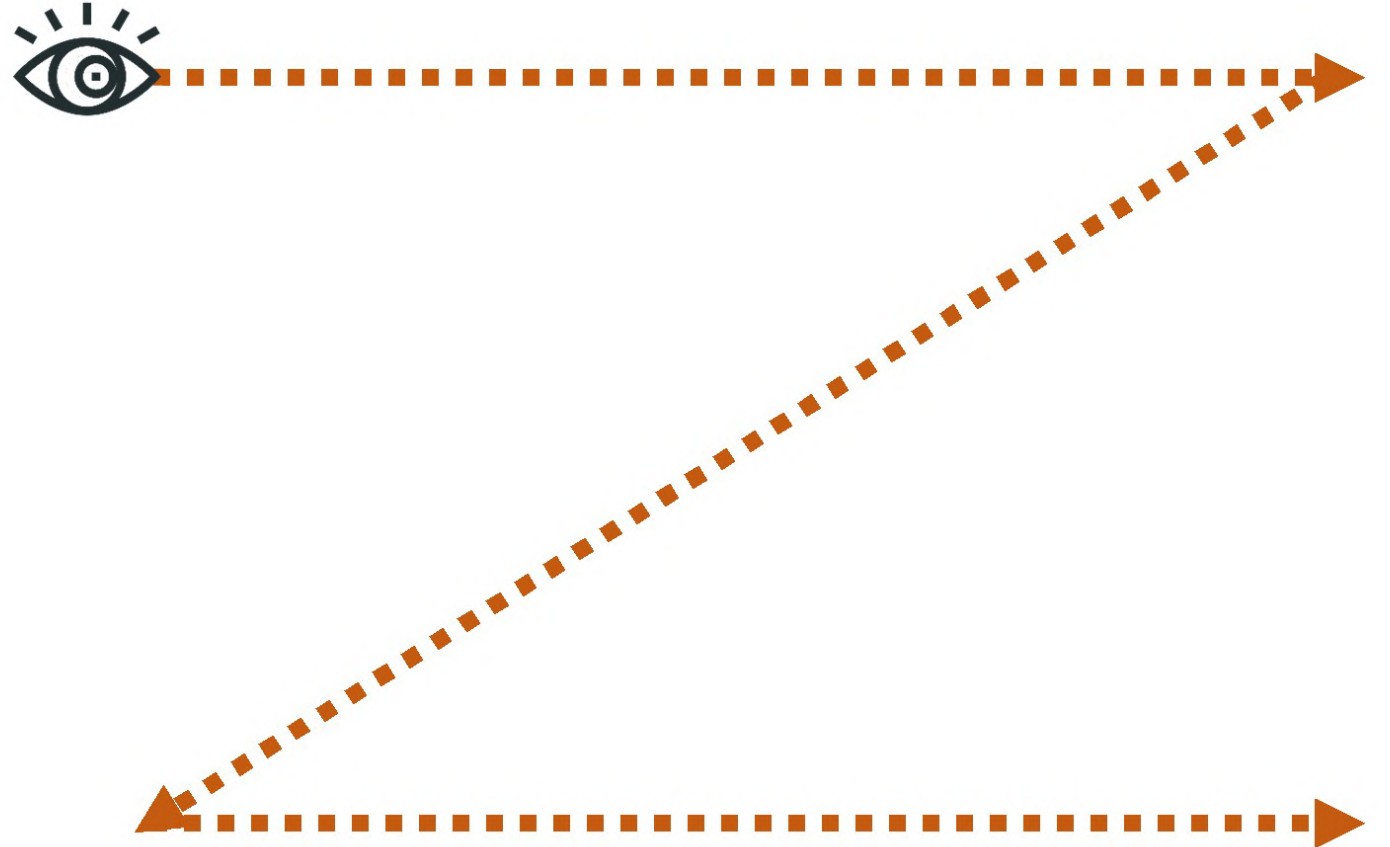
- Practices for designing more effective reports

Design Principles

Information Processing

How we process information

- ⇒ Information is read left to right
 - Most people are accustomed to read in the direction of **left to right**.

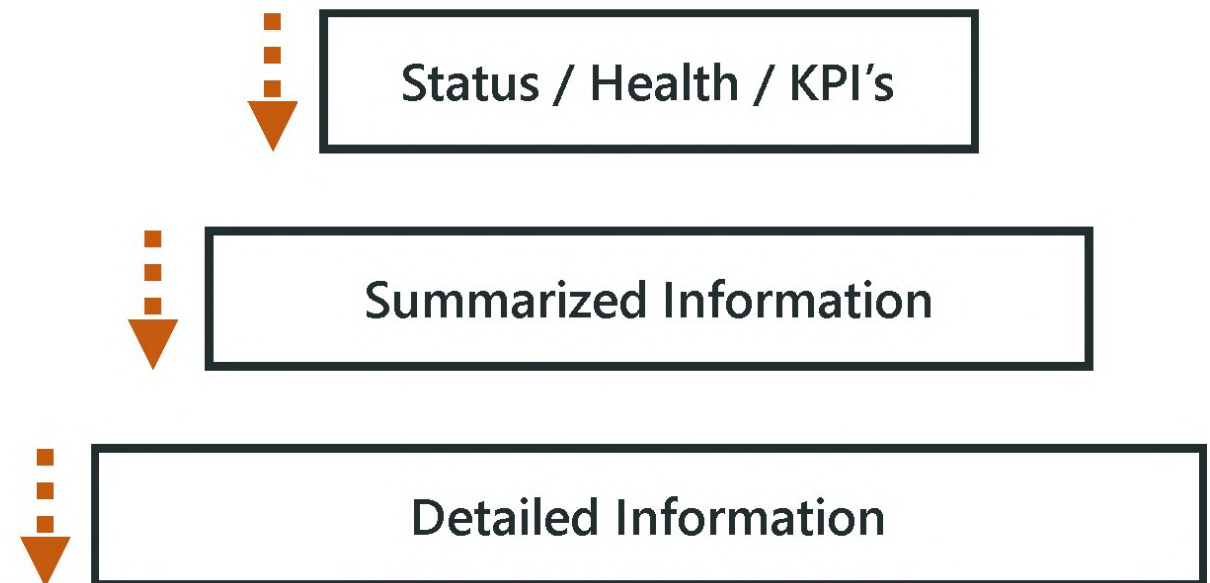


Design Principles

Information Processing

How we process information

- ⇒ Information is read left to right
 - Most people are accustomed to read in the direction of **left to right**
- ⇩ Data is analyzed from the top down
 - People typically look at summarized data **first**, before seeking further information
- 🎯 Application of Principles
 - Leveraging these two principles in report design will create more **effective reports**

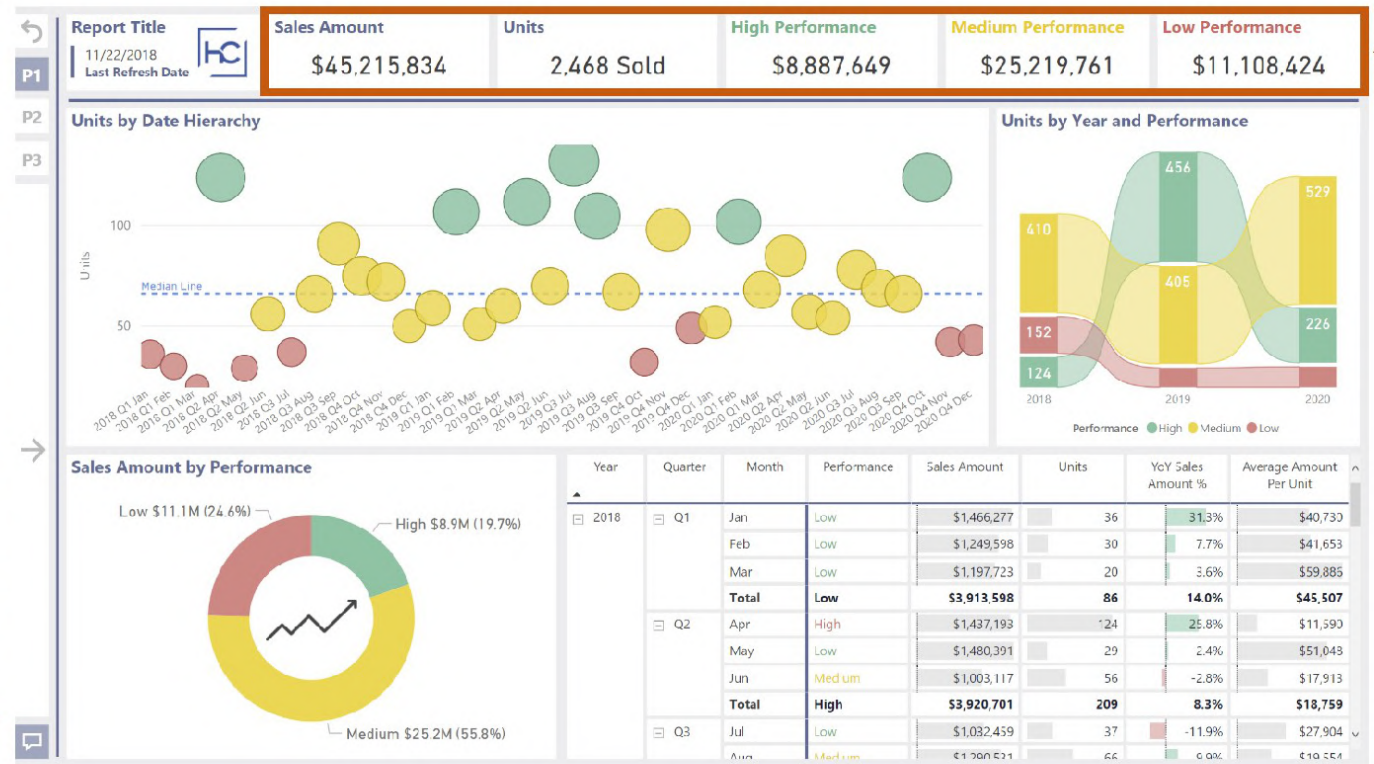


Design Principles

Information Processing ► Effective Report Organization

The data processing flow

1. Key Performance Indicators (KPI's)
 - Information pertaining to the **status**, **performance**, or **health** of the organization

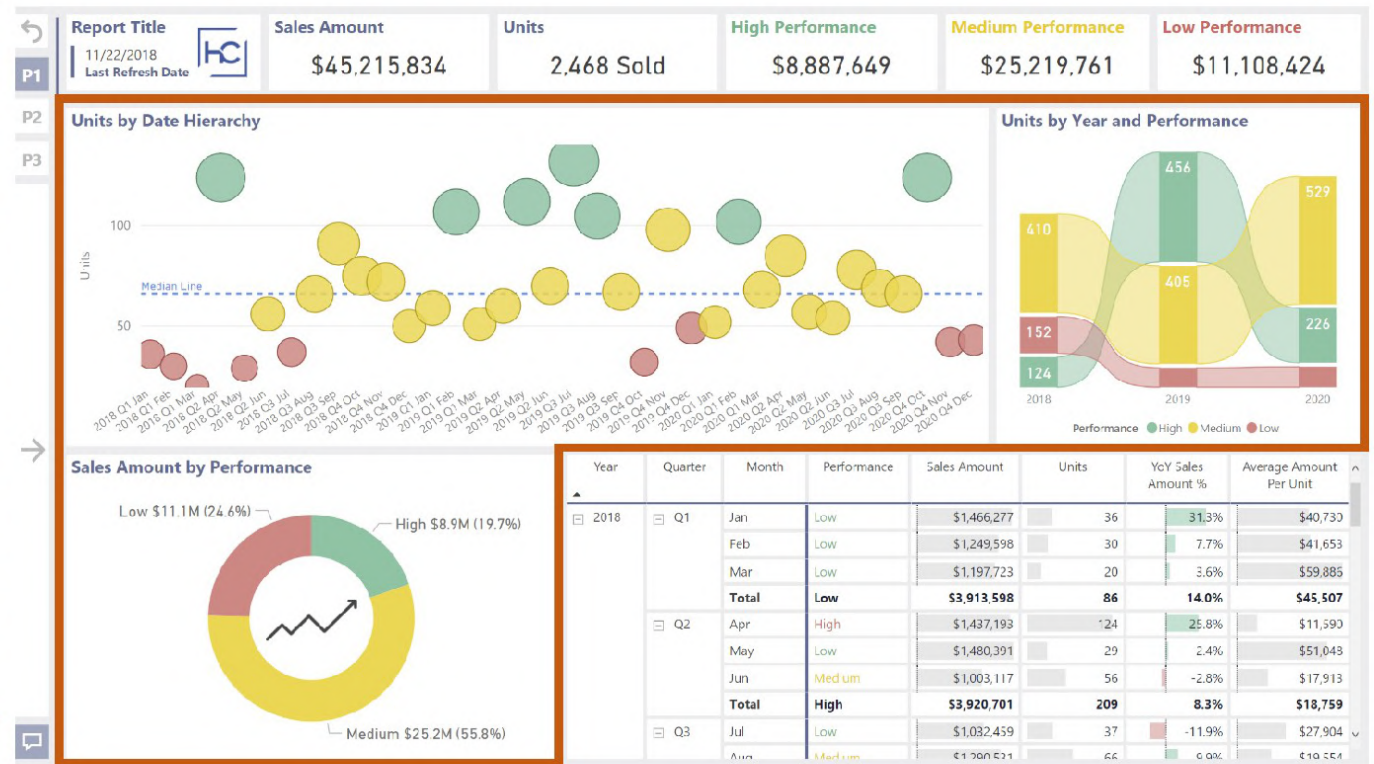


Design Principles

Information Processing ► Effective Report Organization

The data processing flow

1. Key Performance Indicators (KPI's)
 - Information pertaining to the **status**, **performance**, or **health** of the organization
2. Summarized Information
 - Visuals displaying **patterns** or **trends** in the data. Allowing additional insights to the KPI's

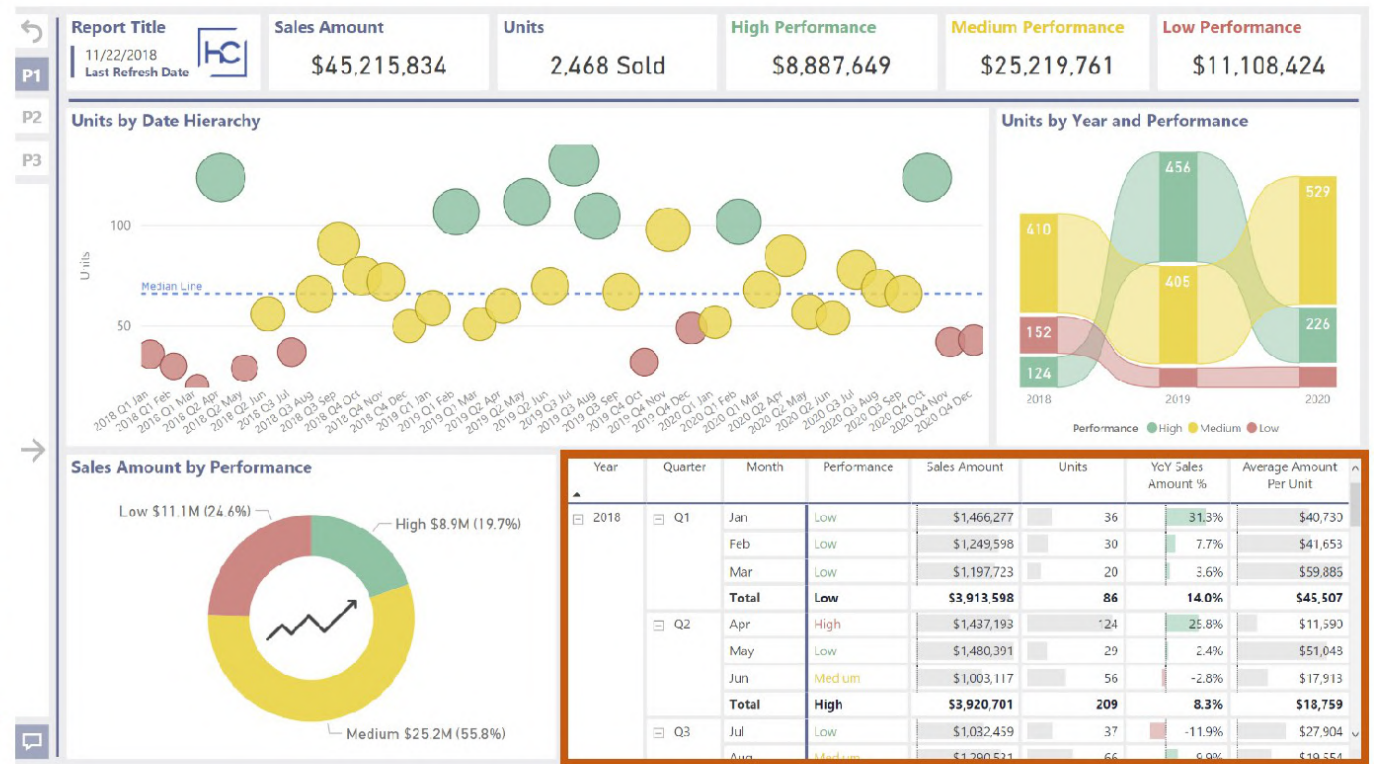


Design Principles

Information Processing ► Effective Report Organization

The data processing flow

1. **Key Performance Indicators (KPI's)**
 - Information pertaining to the **status**, **performance**, or **health** of the organization
2. **Summarized Information**
 - Visuals displaying **patterns** or **trends** in the data. Allowing additional insights to the KPI's
3. **Detailed Information**
 - Tables containing **specific detail** about the patterns or trends. Providing **explanation** to variances in the data




Design Principles

The S.C.R.A.P Methodology



Spacing

Contrast

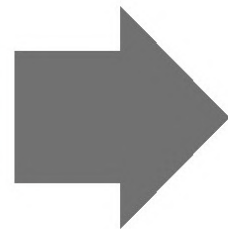



Repetition

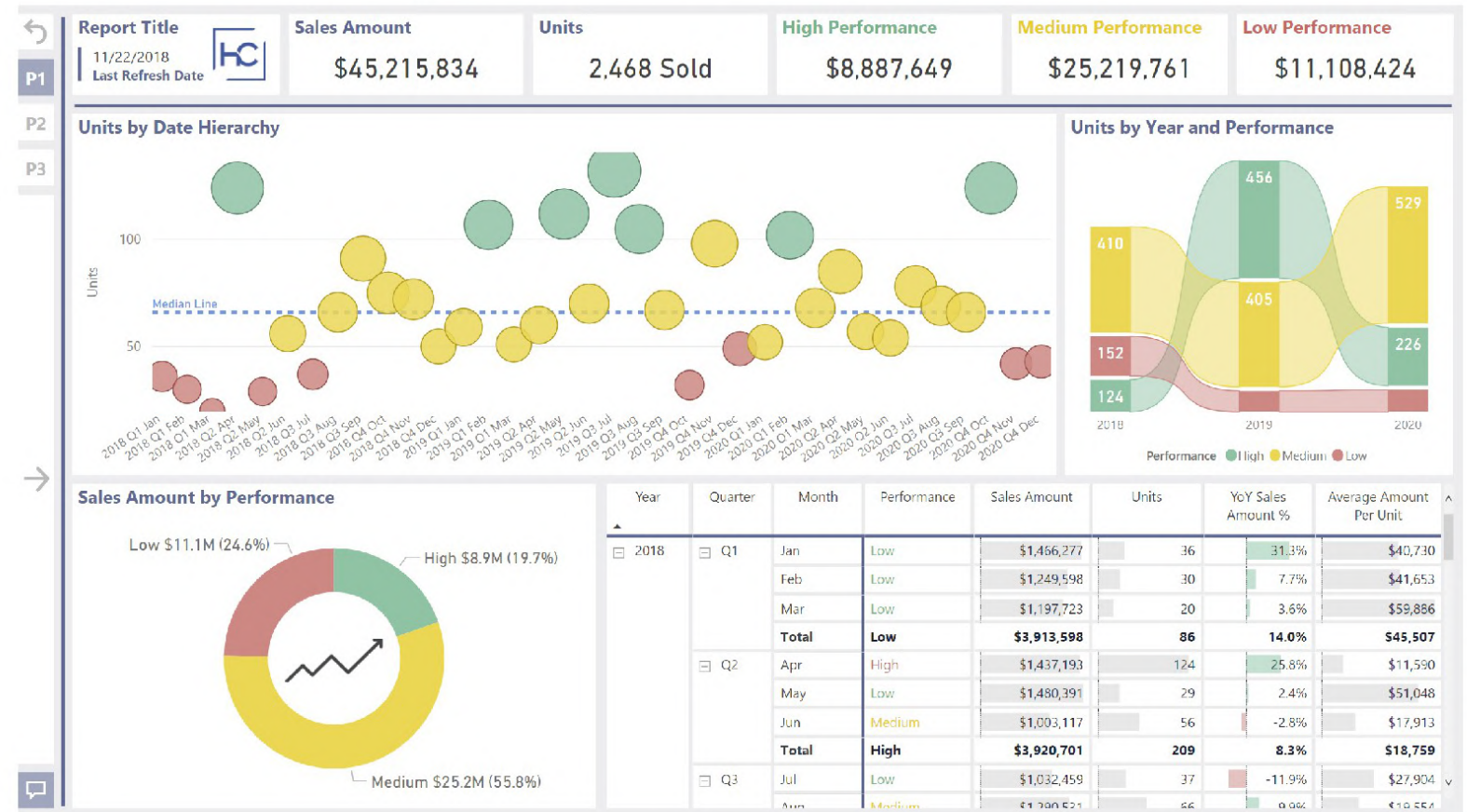
Alignment




Proximity

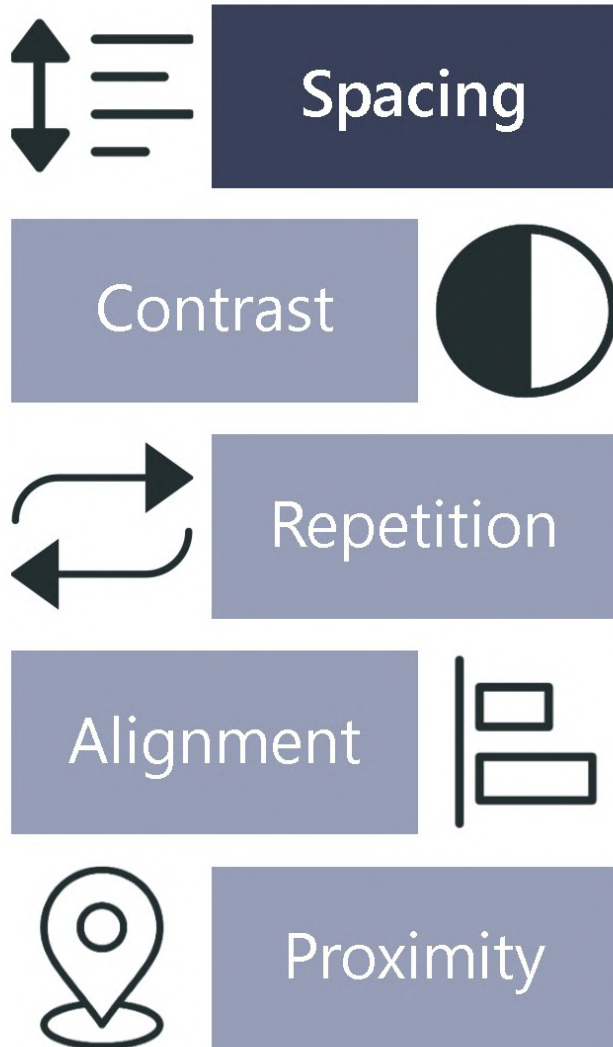


Report with applied methodologies



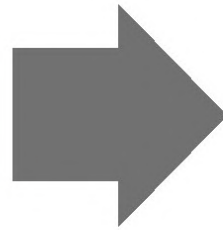
Design Principles

The S.C.R.A.P Methodology ▶ Spacing

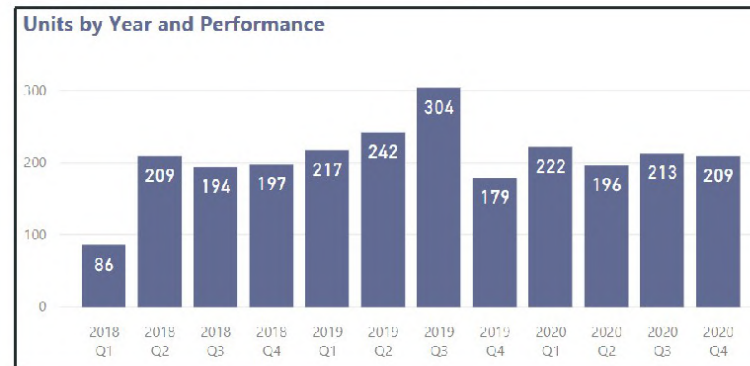


General concept

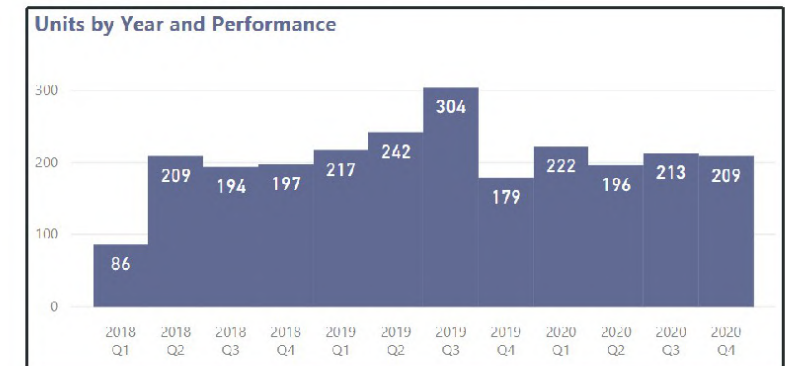
- **Space surrounding** or **between** the objects. Also known as **negative space**
- **Increases readability** by showing boundaries within objects



Spacing

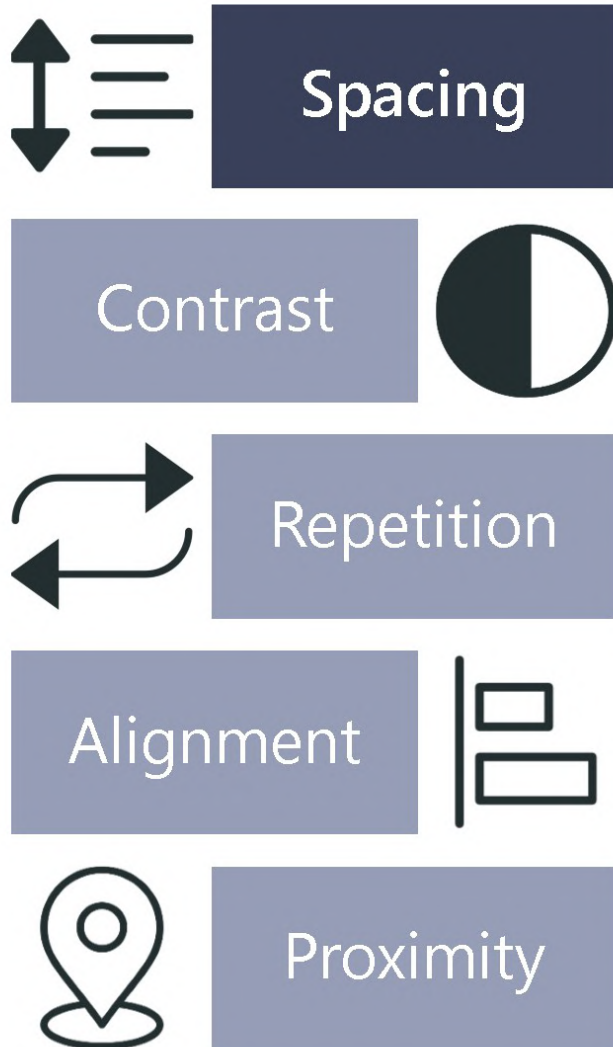


No Spacing



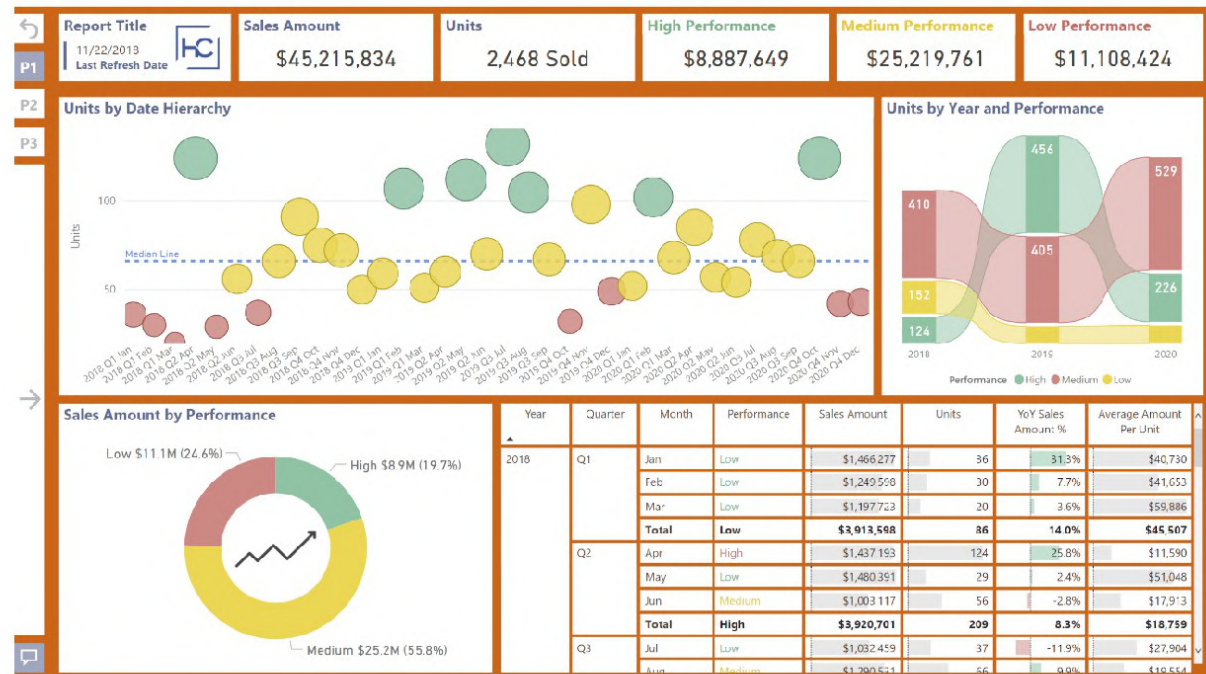
Design Principles

The S.C.R.A.P Methodology ▶ Spacing



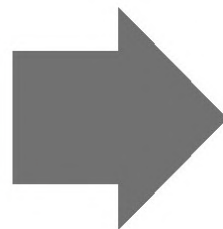
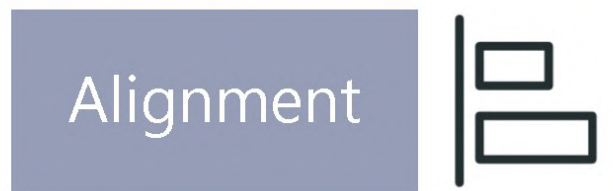
General concept

- **Space surrounding** or **between** the objects. Also known as **negative space**
- **Increases readability** by showing boundaries within objects
- Creates **clear boundaries** between objects



Design Principles

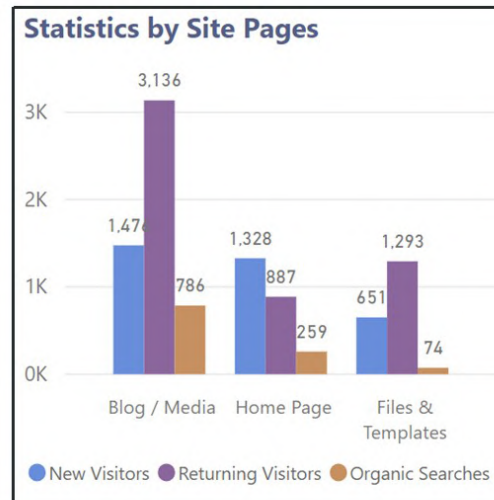
The S.C.R.A.P Methodology ▶ Contrast



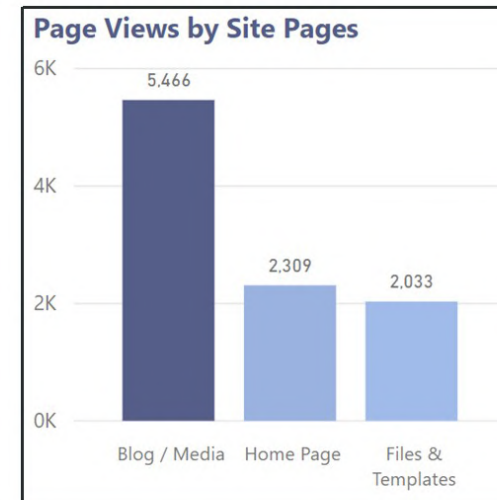
General concept

- Distinguishes elements to help **identify categories** or emphasize **key findings**

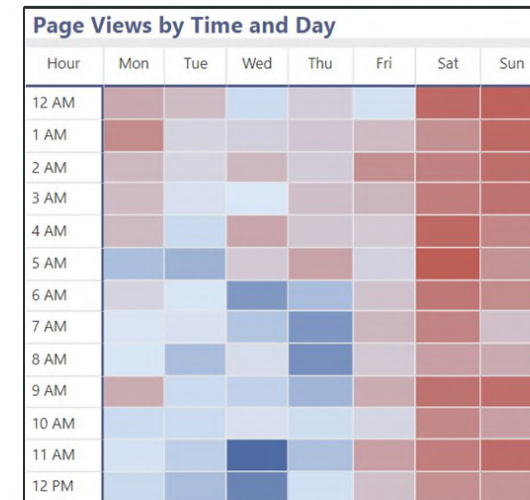
Categorical Colors



Sequential Colors

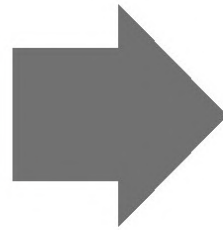


Diverging Colors



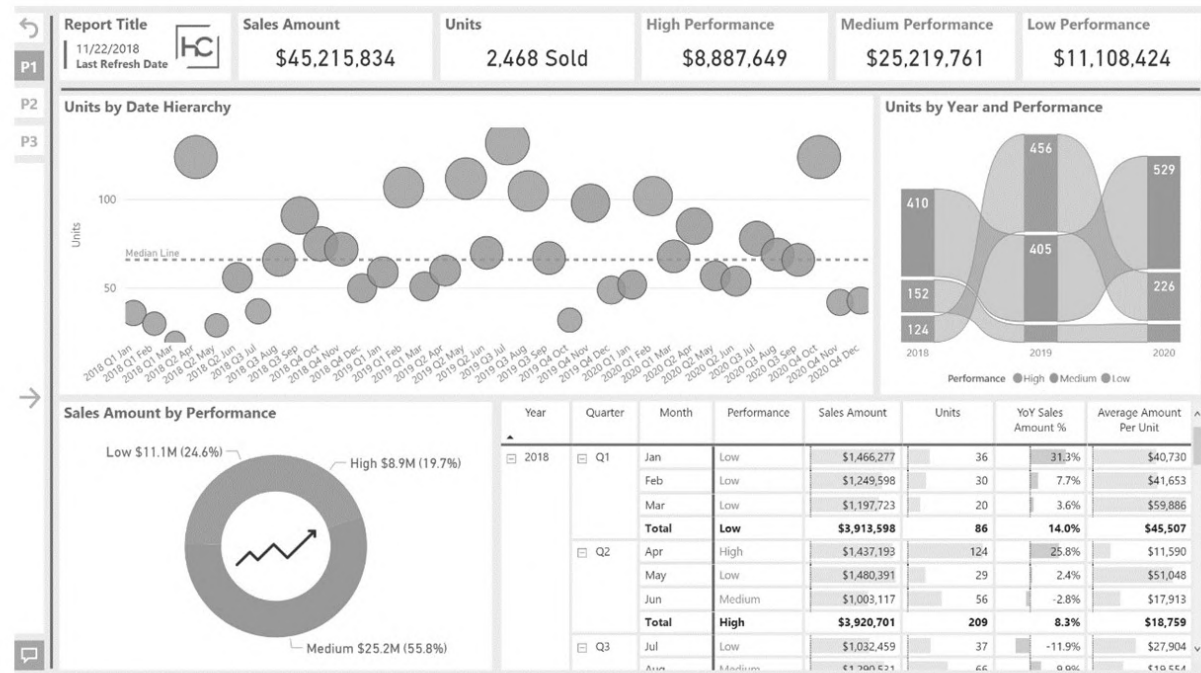
Design Principles

The S.C.R.A.P Methodology ▶ Contrast



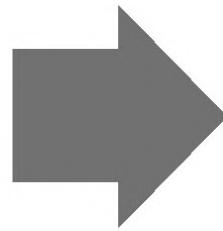
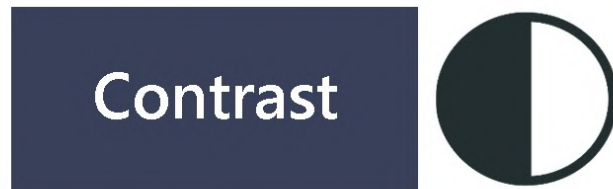
General concept

- Distinguishes elements to help **identify categories** or emphasize **key findings**
- **Color** is one of the most common forms of contrast



Design Principles

The S.C.R.A.P Methodology ► Contrast



General concept

- Distinguishes elements to help **identify categories** or emphasize **key findings**
- **Color** is one of the most common forms of contrast
- Contributes to the **squint test** requirements



Design Principles

The S.C.R.A.P Methodology ▶ Repetition



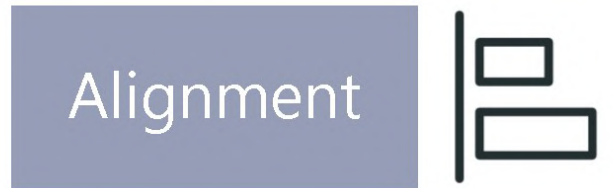
Spacing



Contrast



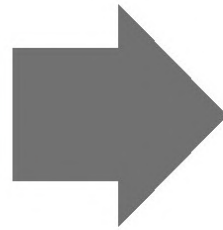
Repetition



Alignment



Proximity



General concept

- Applying a **consistent pattern** or elements throughout the report design

Repetition



Repetition

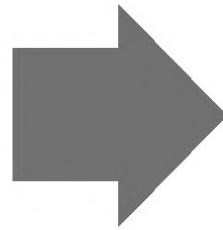
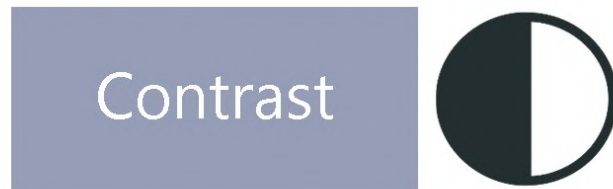


No Repetition



Design Principles

The S.C.R.A.P Methodology ▶ Repetition



General concept

- Applying a **consistent pattern** or elements throughout the report design

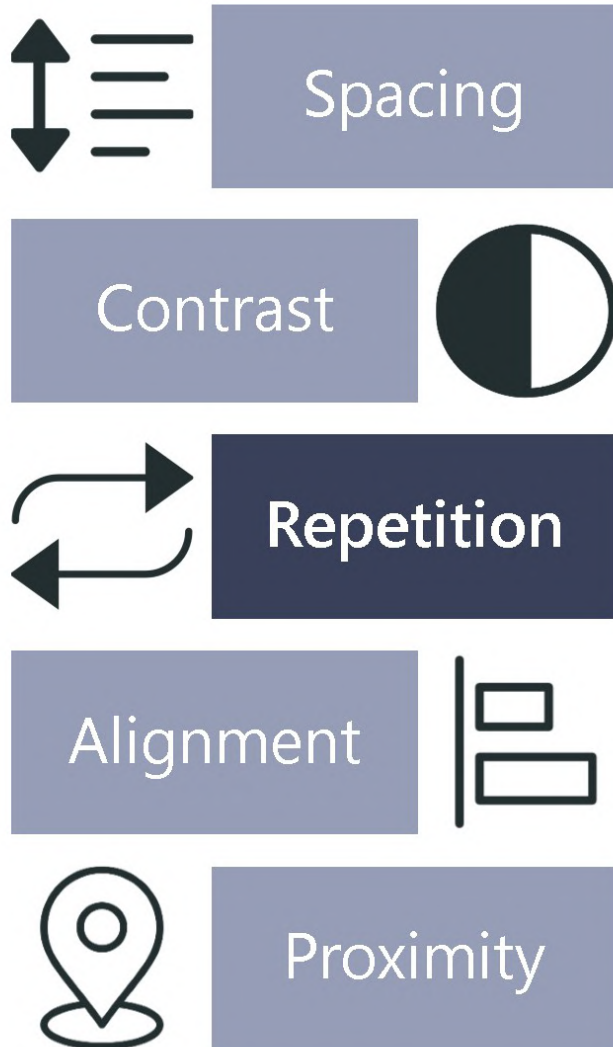
No Repetition



| Site Pages | Page Views | Unique Views | Searches | New Visitors | Returning Visitors |
|---------------------|---------------|---------------|----------------|--------------|--------------------|
| Blog / Media | 5,466 | 4,550 | 786.0 | 1,476 | 3,136 |
| Home Page | 2,309 | 1,932 | 259.0 | 1,328 | 887 |
| Files & Templates | 2,033 | 1,644 | 74.0 | 651 | 1,293 |
| Power BI Vs. Excel | 1,658 | 1,535 | 1,123.0 | 1,193 | 434 |
| About Us | 786 | 673 | 324.0 | 358 | 404 |
| What Is Power BI? | 501 | 412 | 129.0 | 178 | 300 |
| Consulting Services | 313 | 267 | 10.0 | 25 | 275 |
| Contact & Support | 210 | 187 | 2.0 | 18 | 184 |
| Online Courses | 129 | 120 | 1.0 | 13 | 116 |
| Total | 13,405 | 11,320 | 2,708.0 | 5,240 | 7,029 |

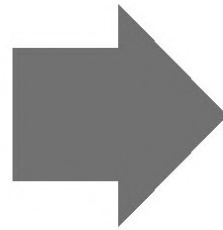
Design Principles

The S.C.R.A.P Methodology ▶ Repetition



General concept

- Applying a **consistent pattern** or elements throughout the report design
- Repetition can also **increase readability** by applying a specific pattern to groups, categories, or areas of a report



Repetition

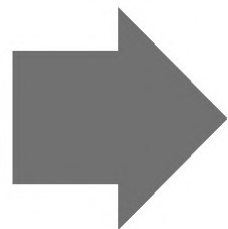
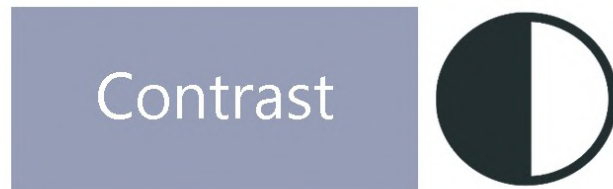
| | |
|----------------|--------------|
| Year All | State All |
| Quarter All | City All |

No Repetition

| | |
|----------------|--------------|
| Year All | State All |
| Quarter All | City All |

Design Principles

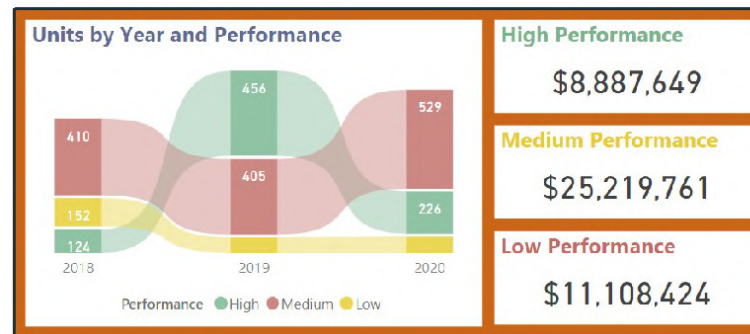
The S.C.R.A.P Methodology ▶ Alignment



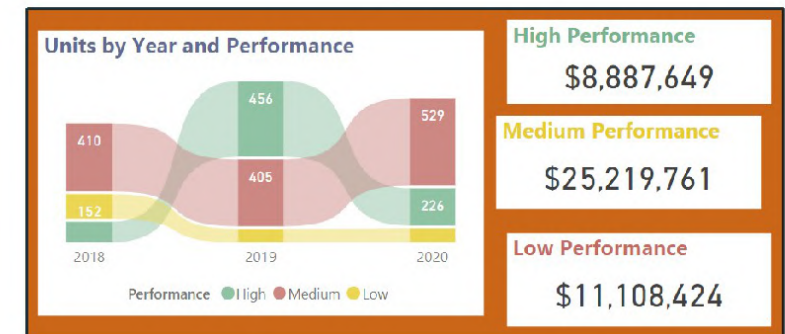
General concept

- **Edges of objects** are aligned with the edges of other objects
- Creates the perception that every object is **connected via an invisible line**, and that nothing is placed at random

Alignment

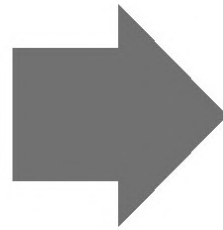
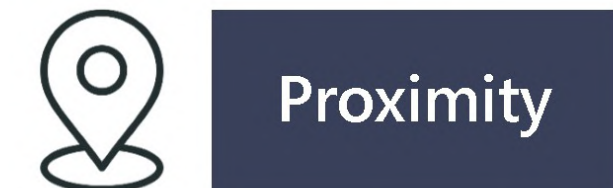
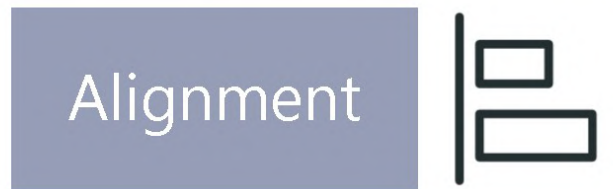
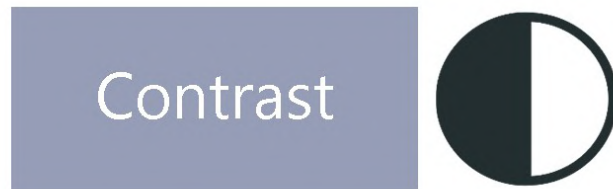


No Alignment



Design Principles

The S.C.R.A.P Methodology ▶ Proximity



General concept

- **Group related objects** together to show a relationship
- Applicable to **objects within a report**

Proximity

| | | | |
|--|---|--|---|
| New Site Visitors 5,268  | Returning Visitors 7,317  | Total Visitors 12,585  | Organic Searches 2,712  |
|--|---|--|---|



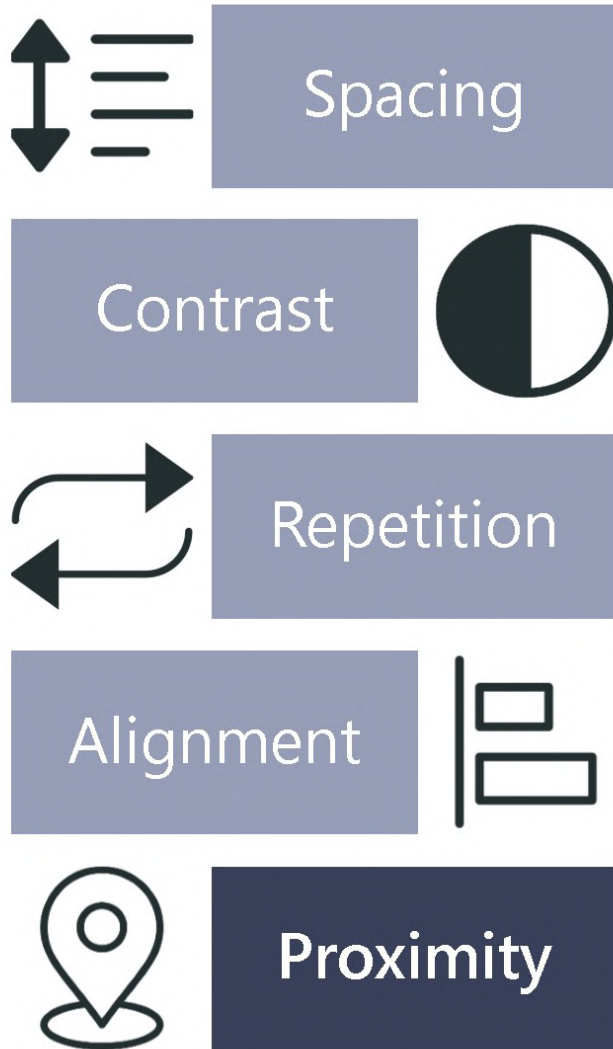
No Proximity

| | | | |
|--|---|---|--|
| New Site Visitors 5,268  | Returning Visitors 7,317  | Organic Searches 2,712  | Total Visitors 12,585  |
|--|---|---|--|



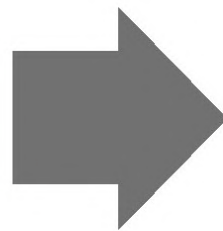
Design Principles

The S.C.R.A.P Methodology ▶ Proximity

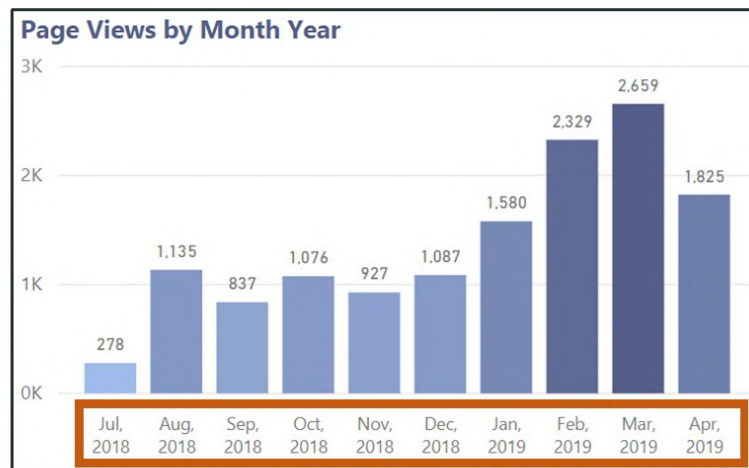


General concept

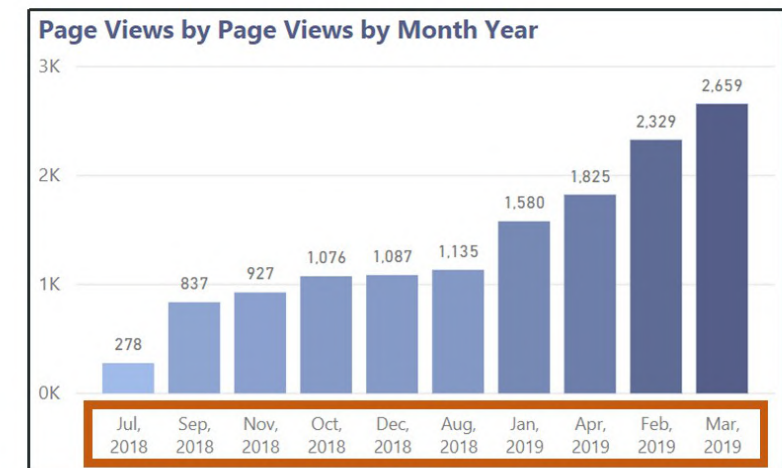
- **Group related objects** together to show a relationship
- Applicable to **objects within a report**
- Applicable to **elements within an object**



Proximity



No Proximity



Design Principles

Color Theory

Color wheel definition

- Visual representation of **color hues** arranged according to their **chromatic relationship**

The color wheel



Design Principles

Color Theory

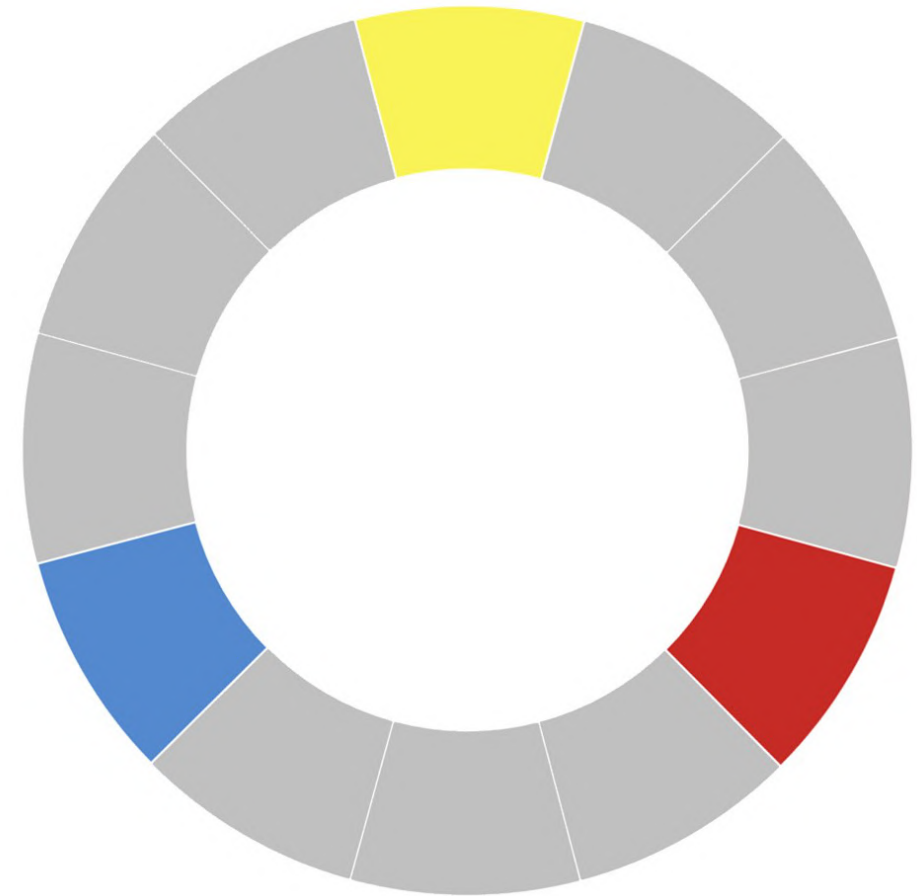
Color wheel definition

- Visual representation of **color hues** arranged according to their **chromatic relationship**

Primary vs. secondary colors

- Primary colors
 - **Cannot be created** by combining two or more colors together
 - All other colors are derived from these hues

The color wheel



Design Principles

Color Theory

Color wheel definition

- Visual representation of **color hues** arranged according to their **chromatic relationship**

Primary vs. secondary colors

- Primary colors
 - **Cannot be created** by combining two or more colors together
 - All other colors are derived from these hues
- Secondary colors
 - Colors that are formed by **combining** the primary colors

The color wheel



Design Principles

Color Theory ► Color Harmony

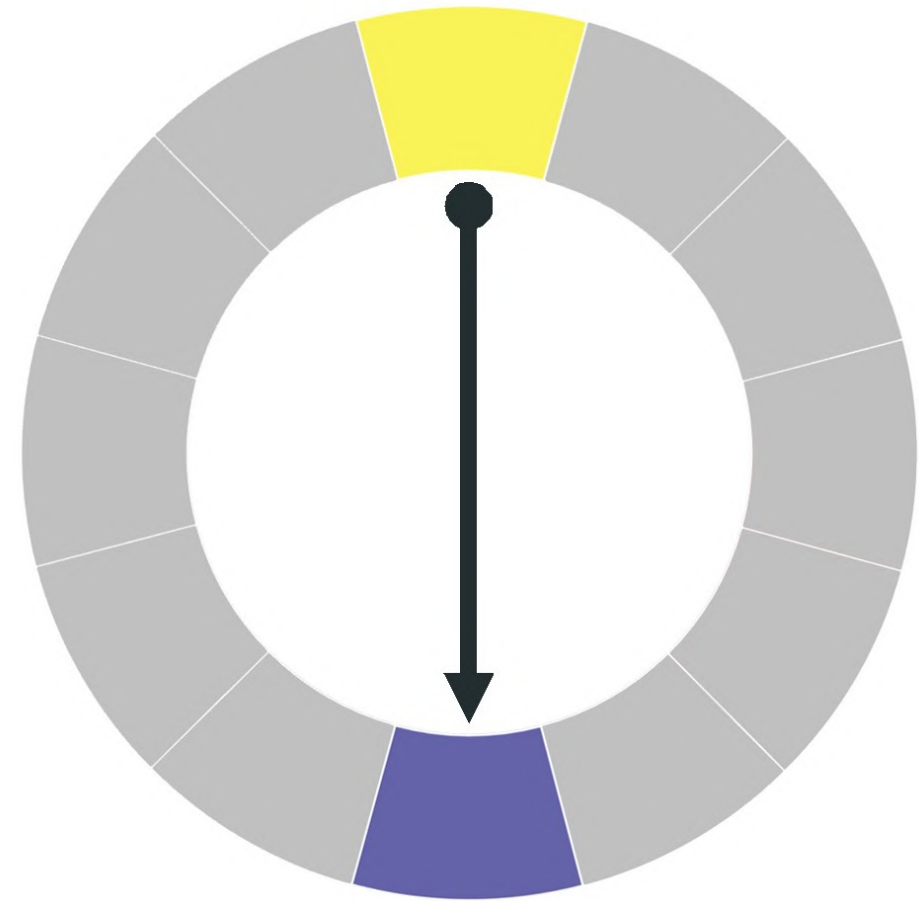
Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- Complementary
 - Most basic type of harmony. It is the **opposite point** of the key color on the wheel.
 - Most other harmonies are **variations of this harmony** (apart from the analogous harmony)

The color wheel



Design Principles

Color Theory ► Color Harmony

Color harmony definition

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The color wheel



Design Principles

Color Theory ► Color Harmony

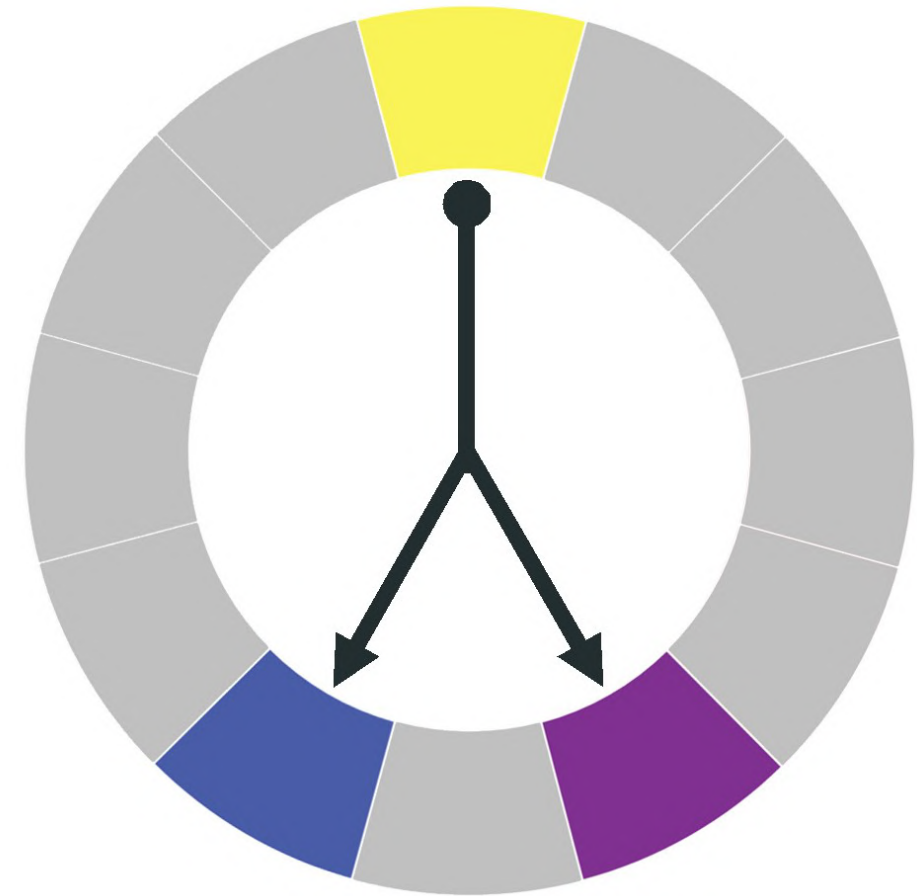
Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- Split complementary
 - Uses the colors **one space away** from the key color.
 - Allows for a **broader range of colors**, while maintaining the basic harmony between the complementary colors

The color wheel



Design Principles

Color Theory ► Color Harmony

Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- **Split complementary**
 - Uses the colors **one space away** from the key color.
 - Allows for a **broader range of colors**, while maintaining the basic harmony between the complementary colors

The color wheel



Design Principles

Color Theory ► Color Harmony

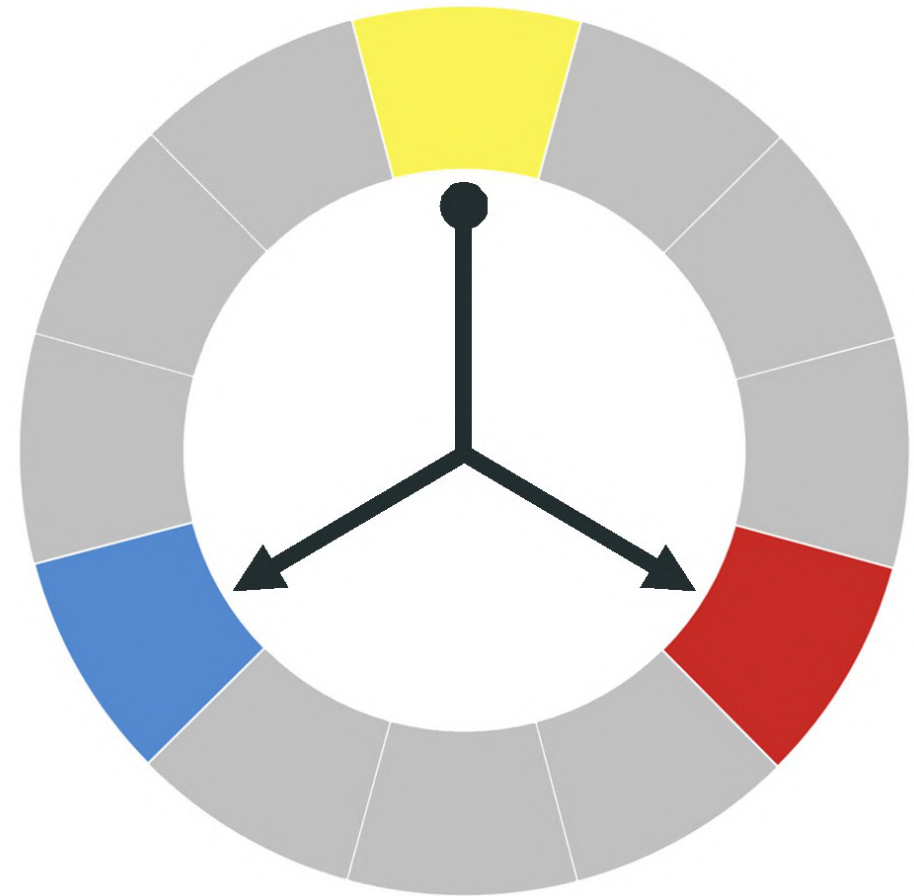
Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- Triadic
 - Uses the colors **two spaces** away from the key color
 - Essentially allows the use of **three equidistant colors** on the wheel
 - Further apart, and therefore **less harmonious**

The color wheel



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Design Principles

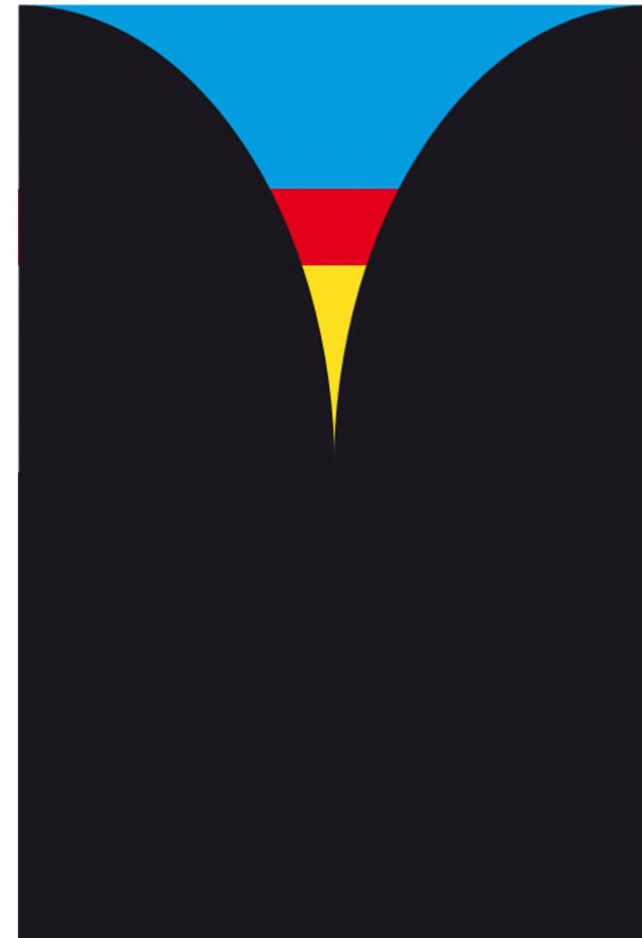
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Design Principles

Color Theory ► Color Harmony

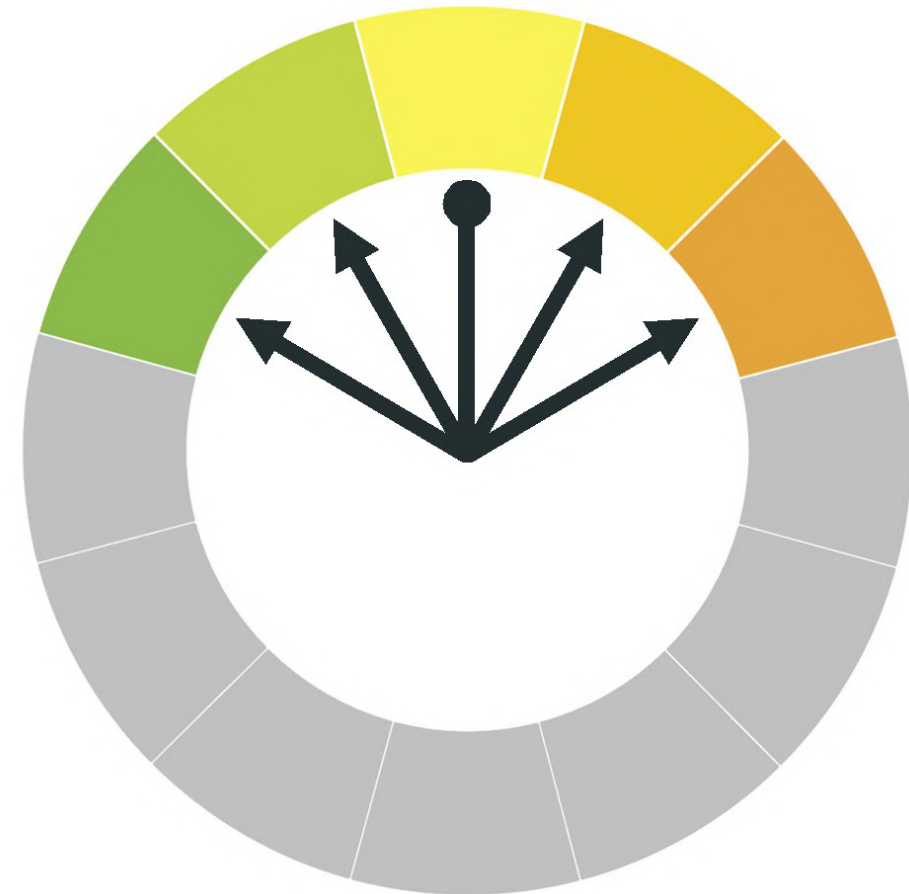
Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- Analogous
 - Colors that are **directly** to the **left or right** of the key color
 - Also known as **related colors**
 - Closest together, with the **least color variation**

The color wheel



Design Principles

Color Theory ► Color Harmony

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Design Principles

Color Theory ► Color Harmony

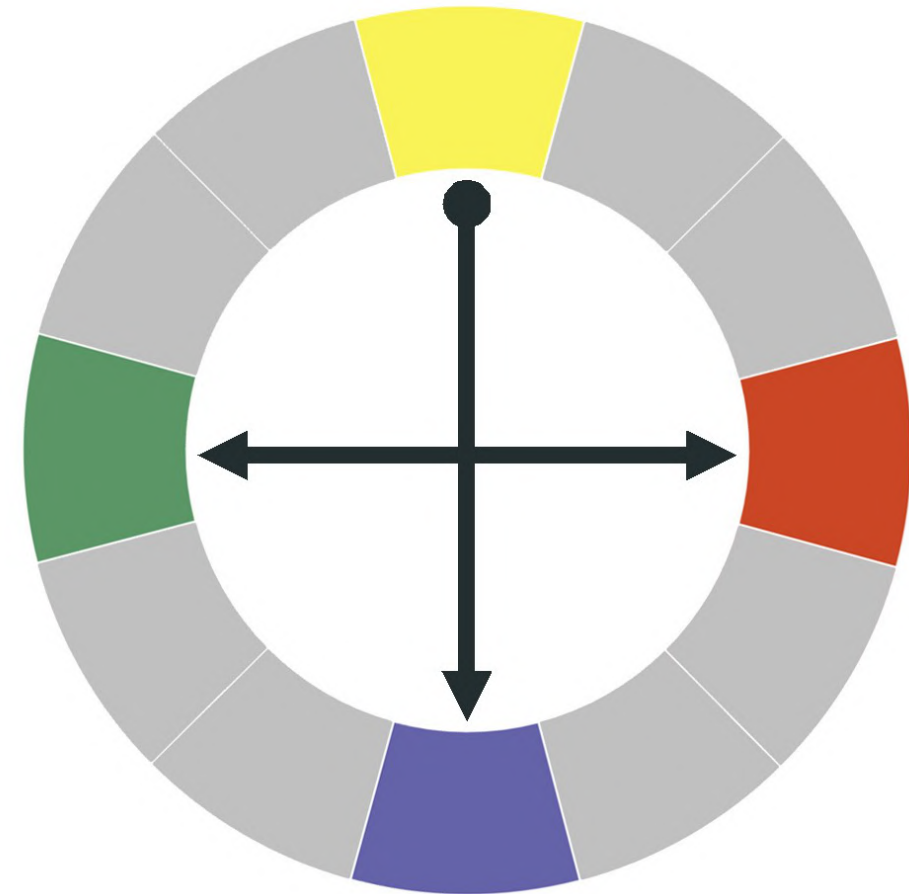
Color harmony definition

- Using a **combination of colors** that is **harmonious** to the human eye

Types of color harmony

- Tetradic
 - Similar to **triadic**, but with **four** colors all **equidistant** on the wheel
 - Essentially is using **two sets** of complementary colors
 - Greatest amount of **color variation**

The color wheel



Design Principles

Color Theory ► Color Harmony

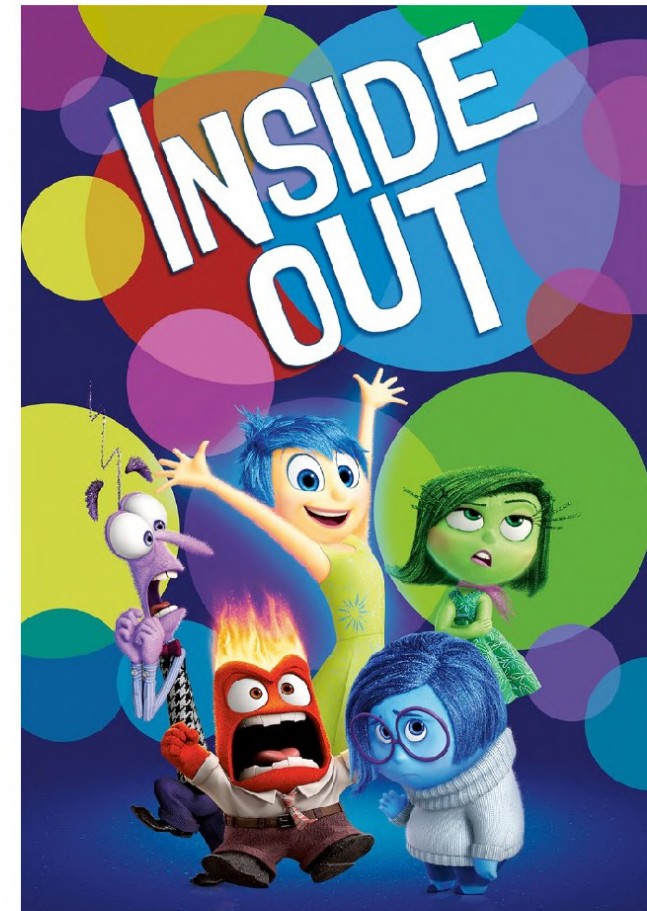
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The color wheel



Design Principles

How do we **process** information?

Left to Right

Top to Bottom



What does **S.C.R.A.P** stand for?



Spacing

Contrast



Repetition

Alignment



Proximity



Knowledge Check

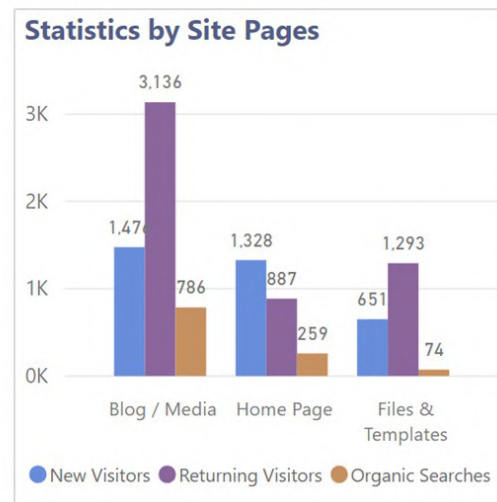
S.C.R.A.P Methodology

What are the **three types** of **color contrast** that can be used to distinguish elements?

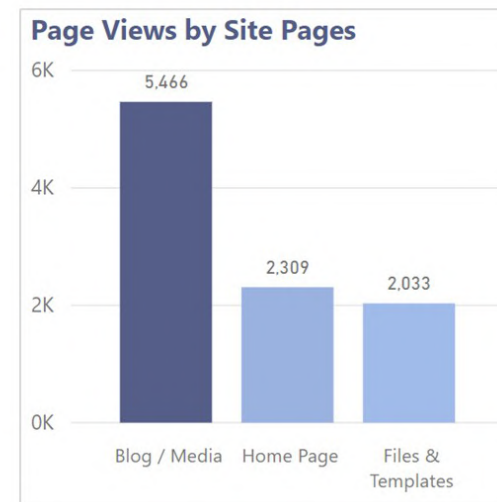


Knowledge Check

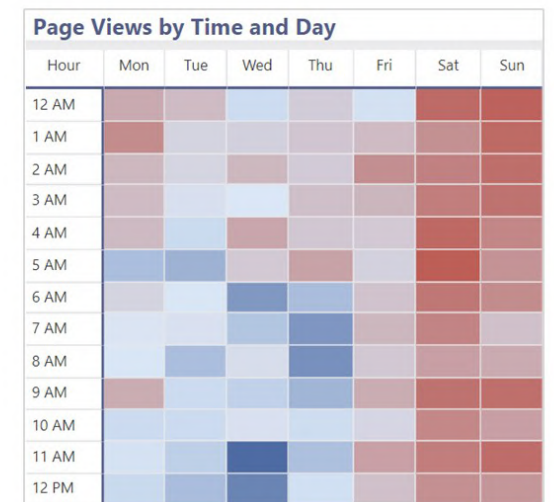
Categorical



Sequential



Diverging



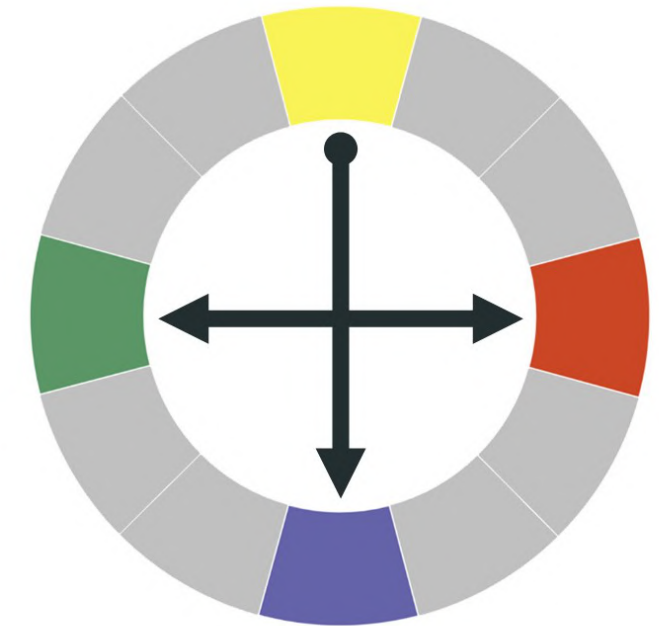
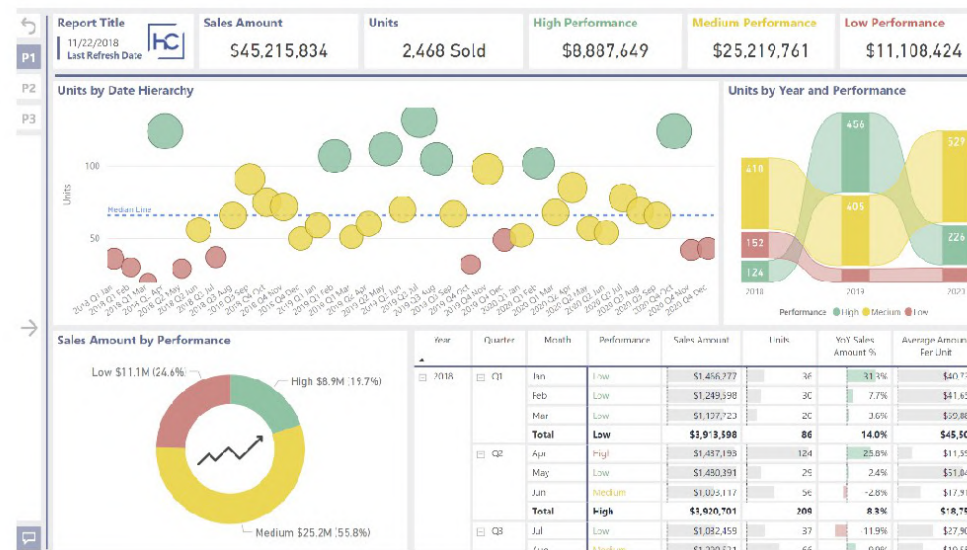
Design Principles

What type of **color harmony** is implemented in this report?



Knowledge Check

Tetratic





Questions?



Data Visualization

- Methodologies for creating impactful visualizations

Design Principles

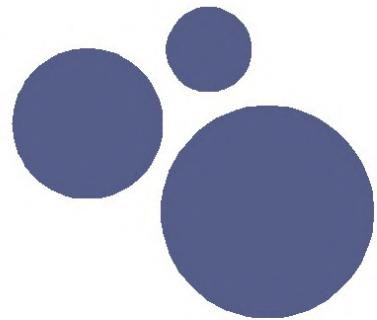
Visual Cues

General methodology

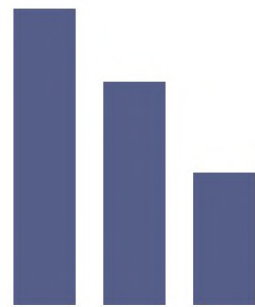
- Visualizations **translate** variances in data by utilizing different visual cues
- Each visual cue is **interpreted** differently by the human brain



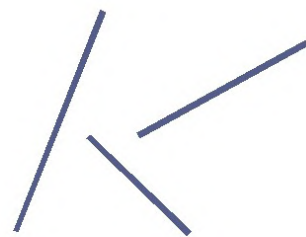
Types of visual cues



Area



Length



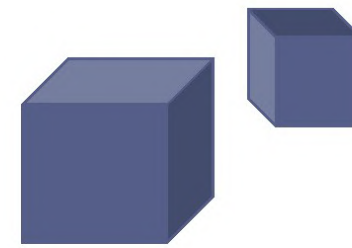
Slope



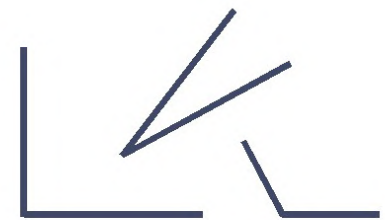
Color
Hue



Color
Intensity



Volume



Angle

VISUAL CUES ARE NOT CREATED EQUAL

Design Principles

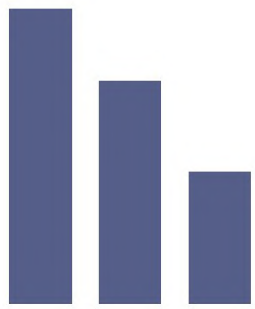
Visual Cues ▶ Ranked

General methodology

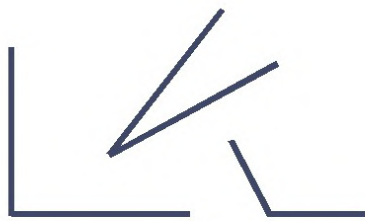
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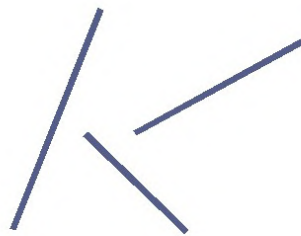
Visual cues ranked by accuracy



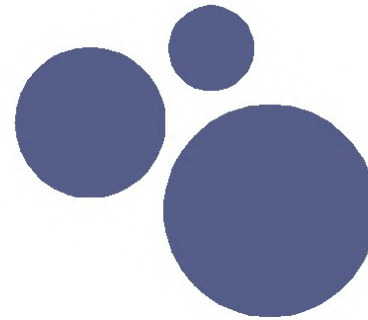
Length



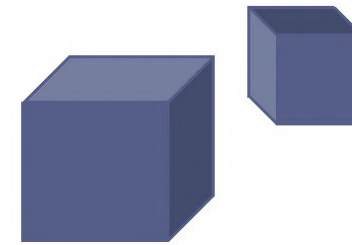
Angle



Slope



Area



Volume



Color Intensity



Color Hue

More Accurate

Less Accurate

Design Principles

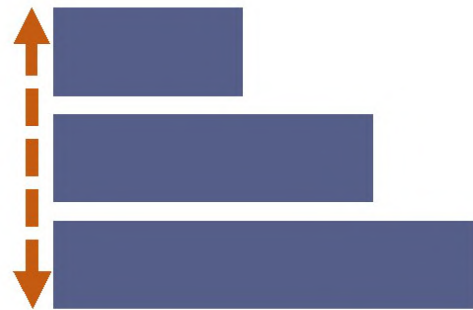
Visual Cues ► Accuracy Influencers

What influences accuracy?

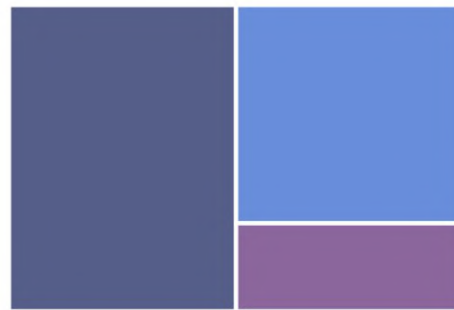


Alignment

- Objects on an **aligned scale** increase accuracy when comparing values
- Studies show length aligned on a single axis is the most accurate representation of data



Length
(Aligned)

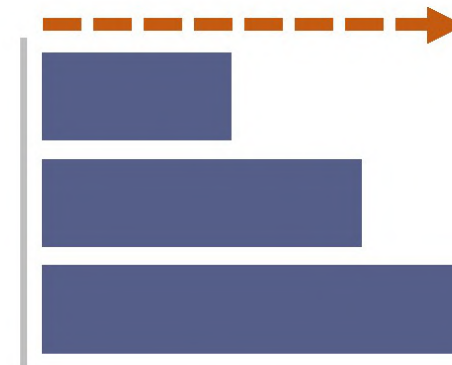


Tree Map

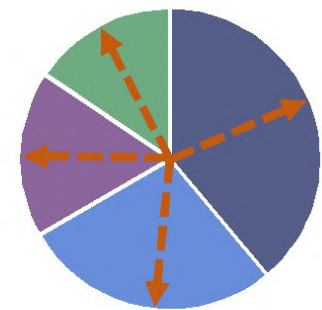


Direction

- Objects on an axis that follow a **single direction** also increase accuracy, when comparing values



Bar
Chart



Pie
Chart

Design Principles

Visual Categories



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SEP. 2018
<http://sql.bi/visual-reference>

PART-TO-WHOLE

Display the parts of a measure

| | | | | |
|------------------------|-------------------------------|-------------------------|-----------------------------|----------------------|
| Clustered bar chart | Clustered column chart | 100% Stacked bar chart | 100% Stacked column chart | Stacked bar chart |
| Stacked column chart | Line & clustered column chart | Drill-down column chart | KPI Column by MAQ | KPI Chart by Akvelon |
| Rotating Chart by MAQ | Horizontal bar chart | Table Sorter | Line & stacked column chart | Ribbon chart |
| Waterfall chart | Stacked area chart | Treemap | Pie chart | Donut chart |
| Sunburst chart | Aster Plot | Ring Chart by MAQ | Drill-down donut chart | Brick Chart by MAQ |
| Enlighten Waffle Chart | Waffle Chart | | | |

DISTRIBUTION

Display the distribution of a measure

| | | | |
|------------------------------|-----------------|--------------------|----------------------------|
| Clustered column chart | Line chart | Histogram Chart | Box & Whisker chart by MAQ |
| Candlestick by OKViz | Dot Plot by MAQ | Outliers Detection | Box and Whisker chart |
| Histogram with points by MAQ | Tornado chart | | |

CORRELATION

Display relations between measures

| | | | |
|-----------------------------|--------------------------|-------------------------------|----------------------------|
| Scatter chart | Enhanced Scatter | Line & clustered column chart | Quadrant Chart by MAQ |
| Venn Diagram by MAQ | Impact Bubble Chart | Correlation plot | Clustering |
| Clustering With Outliers | Funnel plot | Spline chart | KPI Chart by Akvelon |
| KPI Column by MAQ | Scatter Chart by Akvelon | Hexbin Scatterplot | Clustering using OPTICS... |
| Line & stacked column chart | Cluster Map | | |

SINGLE

Display single values

| | | | |
|---------------------------|------------------------|-------------------|-----------------------|
| Card with Status by OKViz | Card | KPI | Multi-row card |
| Table | Matrix | KPI Ticker by MAQ | Scroller |
| User List by CloudScope | Timeline by CloudScope | Multi KPI | Collage by CloudScope |
| Count Down Timer | KPI Indicator | Advance Card | Rotation Tile by MAQ |
| Acterys Matrix Light | Data Insights by MAQ | Gauge | Tachometer |
| Dial Gauge | Circle KPI Gauge | | |

FILTER

Control report filters

| | | | |
|----------------------------|---------------------------|-----------------------------|----------------------------|
| Slicer | Smart Filter Pro by OKViz | Smart Filter by OKViz | Chiclet Slicer |
| Timeline Slicer | Time Brush Slicer | Attribute Slicer | Facet Key |
| Play Axis (Dynamic Slicer) | Hierarchy Slicer | Enlighten World Flag Slicer | Text Filter |
| Enlighten Slicer | Image Grid | Image by CloudScope | Filter by List by Devscope |
| Pivot Slicer | | | |

NARRATIVE

Tell a story with data

| | | | |
|-------------------------------|-----------------------|----------------------------|--------------|
| Narrative for Business Int... | Timeline Storyteller | Add Natural Language Su... | DataText Box |
| ChartAccent BarChart | ChartAccent LineChart | Strippets Browser | Card Browser |
| Overview by CloudScope | Enlighten Data Story | | |

MISCELLANEOUS

| | | | |
|---------------------|----------------------|-------------|------------------------|
| PowerApps (Preview) | D3.js Visual | HTML Viewer | Dynamic Tooltip by MAQ |
| Text Wrapper by MAQ | Text Enhancer by MAQ | | |



There is a better alternative

Don't use in the category

Built-in visual

Certified visual

R required



Design Principles

Visual Categories



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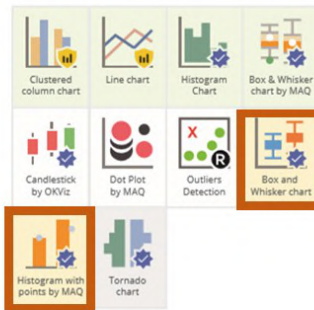
PART-TO-WHOLE

Display the parts of a measure



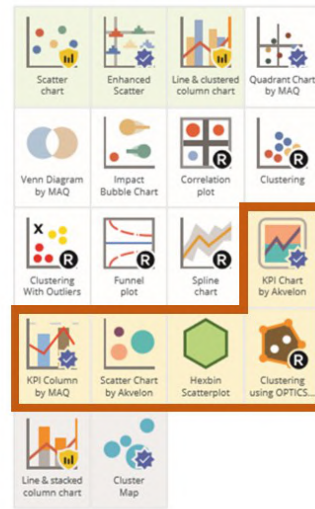
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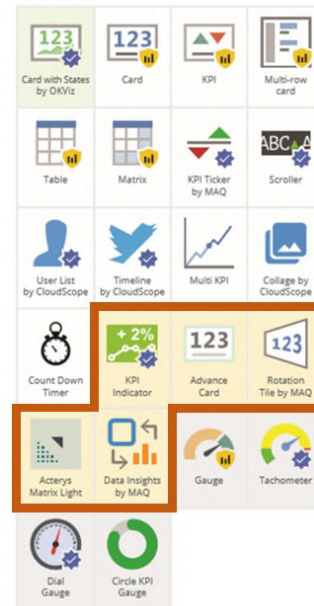
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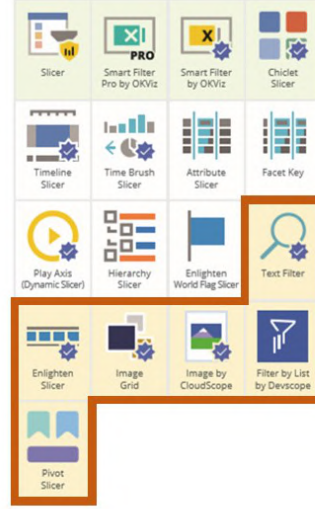
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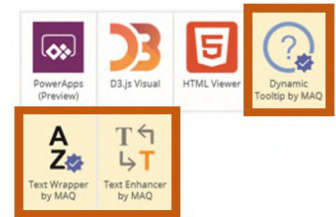


NARRATIVE

Tell a story with data



MISCELLANEOUS



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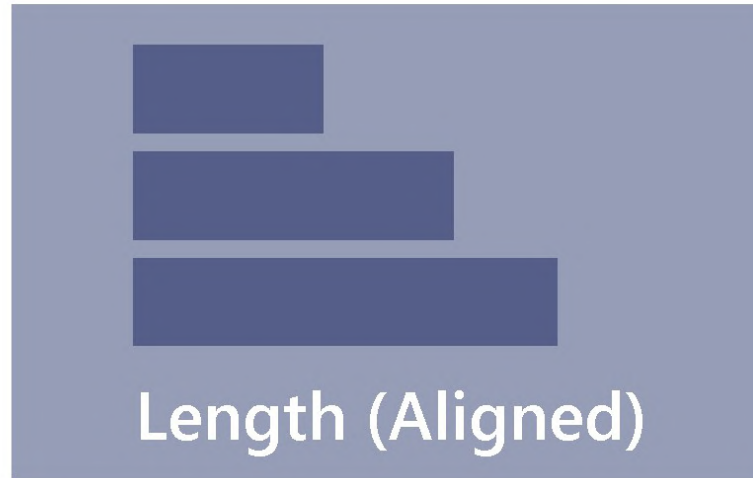
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 ■ Certified visual
 R R required

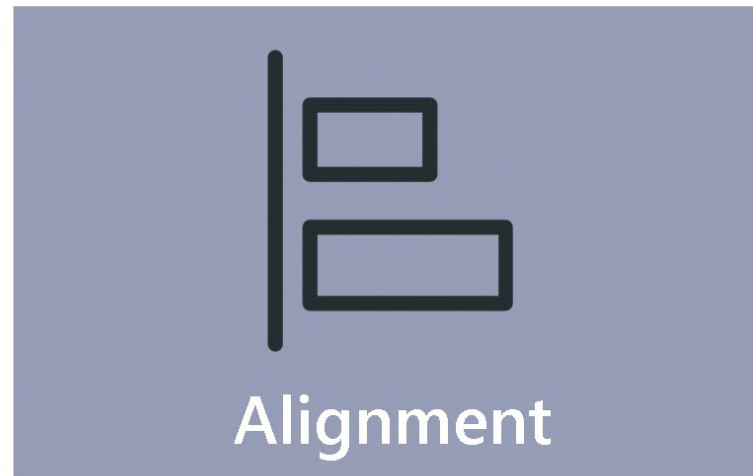


Visual Cues

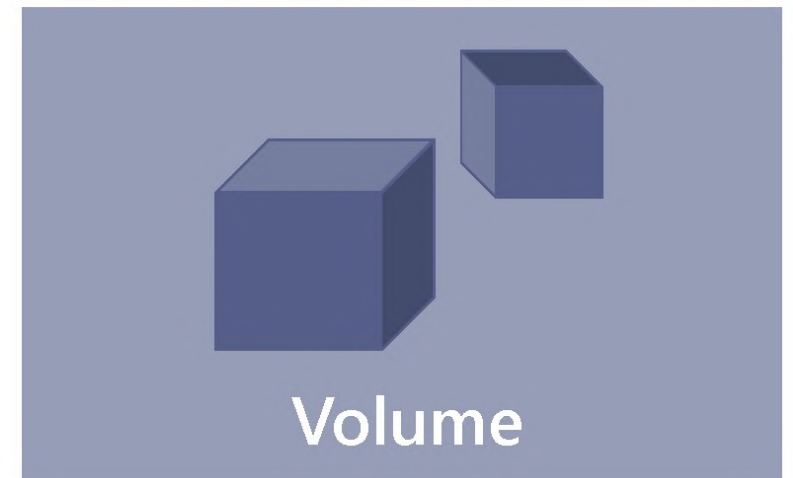
Easiest visual cue to process?



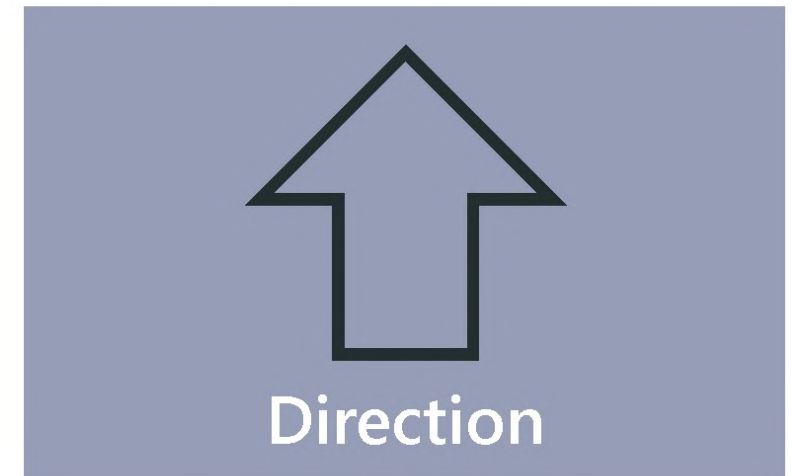
What influences **accuracy**?



Hardest visual cue to process?



What influences **accuracy**?



Knowledge Check



Questions?



Demonstration

Applying Report Design Principles

- Exercise 1 – Background Color
- Exercise 2 – Alignment and Spacing
- Exercise 3 – Removing Object Elements
- Exercise 4 – Selecting Visual Types



Recommended Practices

- **Design principle practices:**

- Commonly, people look at the *upper-left of report* pages first – consider carefully what to place there as that is the first thing users will see
- Develop reports from a *blank canvas perspective* – start with nothing and add one element at a time until requirements are met
 - This will help minimize unnecessary elements and prevent the report from becoming “noisy”
- Consider using a *light page background* and *white backgrounds for objects* – this creates soft borders between page elements
- Choose carefully the type of color contrast (*categorical, sequential, diverging*) applied to visuals – as each one tells a different story with the data
- Repetition (*e.g. font, color, location, naming, etc.*) can be used to indicate relationships or *lack thereof* – so choose carefully when to apply



Recommended Practices

- **Design principle practices:**

- Apply alignment to *every object* – no exceptions
 - Borders between objects should be able to follow a *natural line* throughout the report page
 - *Enabling Gridlines* in Power BI Desktop will help create consistent borders between visuals
- Have feedback sessions with users to determine *logical proximity* of report objects and the “flow” of the report page
- Reports should be built to *minimize eye and mouse travel* on the screen



Recommended Practices

- **Data visualization practices:**

- Have feedback sessions with users to determine what type of story needs to be told for each visualization – and make a visual type selection based on this
 - E.g. Part-to-whole, correlation, distribution, etc.
- *Forced variation* between visual types does not always add value – choose carefully the type of visual if *data accuracy* is important



References

- Power BI Visualization Best Practices
 - <https://docs.microsoft.com/en-us/power-bi/visuals/power-bi-visualization-best-practices>
- Design Concepts for Better Power BI Reports
 - <https://datasavvy.me/design-concepts-for-better-power-bi-reports>
- Adobe Color Wheel
 - <https://color.adobe.com>
- Color Blindness Resources
 - <https://www.color-blindness.com/>
- Visuals Reference
 - <https://www.sqlbi.com/ref/power-bi-visuals-reference>

Online Resources



Presentation PDF

- <http://www.havensconsulting.net/speaking-events>



Consulting Services

- <http://www.havensconsulting.net/consulting-services>



Files & Templates

- <http://www.havensconsulting.net/files-and-templates>



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