

Design Power BI reports

1. Introduction

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/1-introduction>

Introduction

Completed

You can design Microsoft Power BI reports in Power BI Desktop or the online Power BI service. Power BI mobile apps don't support report design; they support only the report consumer experience.

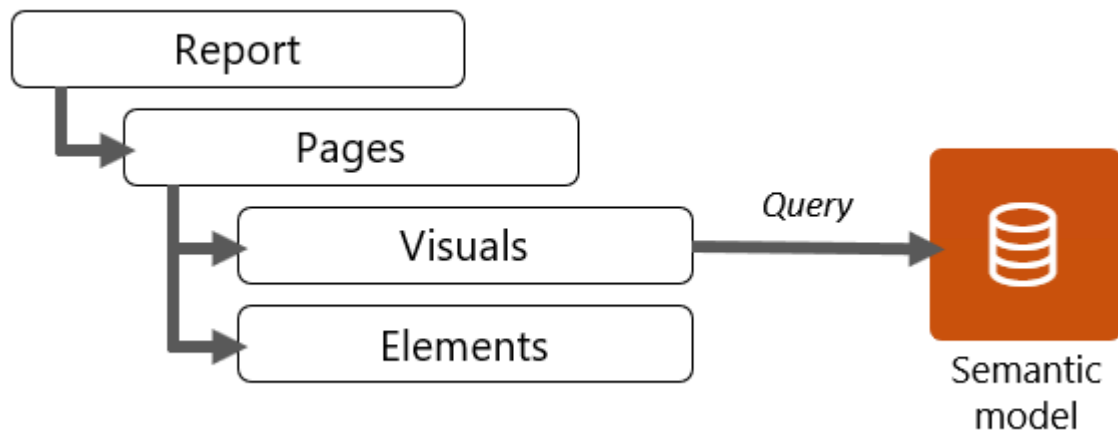
Note

Power BI Desktop is only supported on Windows operating systems. As a design tool, it also supports the development of reports and semantic models. In this module, the focus is only on report design.

Report structure

Structurally, a Power BI report connects to a single semantic model, and it has at least one report page. However, reports commonly have multiple pages. On each page, *report objects* are laid out. Report objects include:

- **Visuals** - Visualizations of semantic model data.
- **Elements** - Provide visual interest but don't use semantic model data. Elements include text boxes, buttons, shapes, and images.



Report pages

Similar to Microsoft Excel worksheets, you can add, rename, reorder, hide, duplicate, or delete Power BI report pages.

Tip

Duplicating pages can help expedite report development, especially when you're copying a completed and polished report page. However, take care that you don't over complicate the report design if you can accomplish a duplicated page by filtering a single page. For example, instead of creating one page for each customer, you could use a slicer on a single page to filter by customer.

Report consumers navigate to a visible page by selecting a page tab (in Power BI Desktop) or by selecting the page in the **Pages** pane (in the Fabric portal).

The decision to create more pages depends on your report requirements. Strive for a report design that expresses the data in a logical flow on the page and between pages. A well-designed report often provides a high-level summary on the first page with supporting detail on the following pages.

Occasionally, it might make sense to have a single report with many pages. Other times, it could make sense to separate pages into different reports. This scenario is especially true when you design those pages for a different audience or when you need to secure, share, or distribute them differently. You might do separate pages into different reports because report pages can't be secured or published independently of the report.

You can hide pages when they're not yet ready for use; they're a *work in progress*. However, you might hide them because you want to control how they're accessed. You can provide report page navigation with buttons or by drilling through from a visual. It's also possible to design a page as a tooltip, which is revealed when a report consumer hovers over a visual.

You can configure various page-level settings, which can be set in the **Format** options. Commonly applied settings include page information, page size, and page background.

2. Design the analytical report layout

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/2-design-layout>

Design the analytical report layout

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When report consumers look at a report, an automatic and unconscious process occurs when they comprehend what they see. Therefore, you should adhere to basic report design principles to support this process to help effectively communicate meaning from data.

Tip

Report design is a blend of science and art, and many possible report designs are available that help achieve the audience and interface requirements. What matters most is that the report design effectively communicates the data to meet requirements.

An analytical report can consist of one or more pages, and pages comprise report objects. Report objects can be data visuals, which represent query results, or decorations like images, background shapes, or text. You can begin to design a report layout by determining the number, sequence, and purpose of the pages. Make sure that you avoid combining subjects or opposing objectives on the same page. Then, design each page layout with specific report objects that are relevant to the requirements.

Additionally, good report design layouts should consider design principles of placement, balance, contrast, proximity, and repetition.

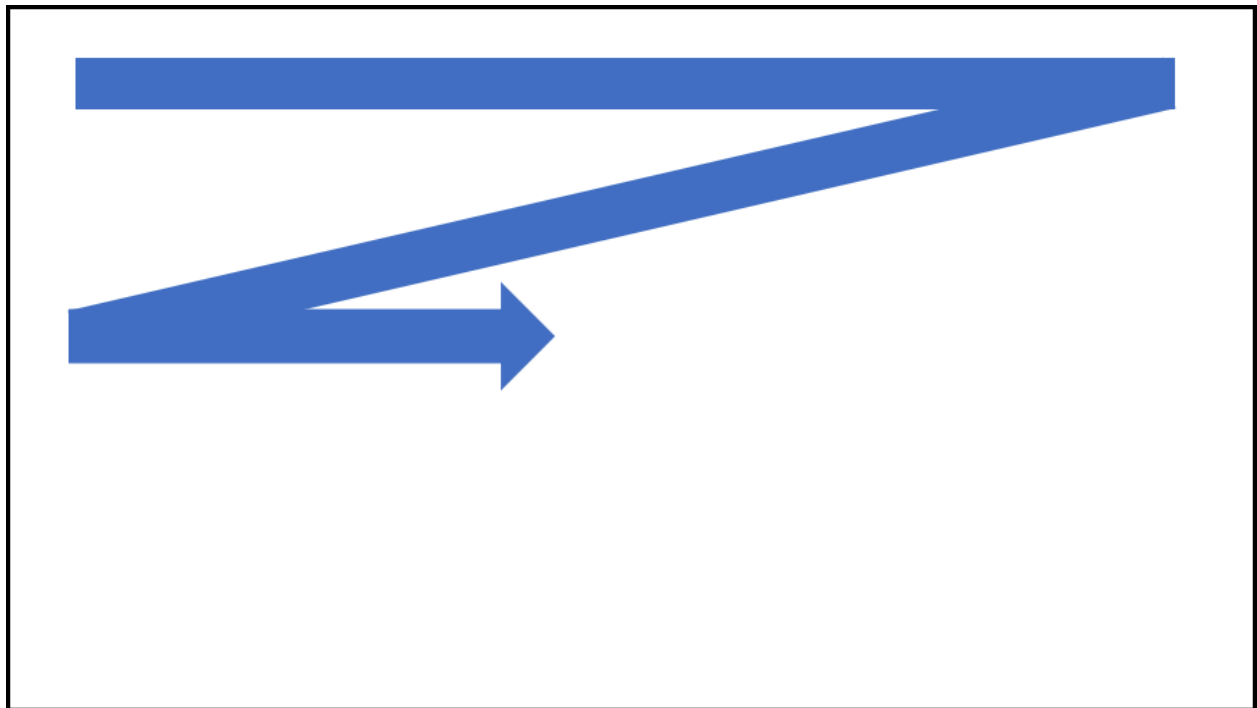
Tip

Always keep in mind that the *less is more* adage applies; simplicity and clarity lead to good design.

Placement

Good placement of report objects contributes to an ordered report design. Generally, you should place the most important information in the upper-left corner of the page and arrange the report

elements from left to right and top to bottom.

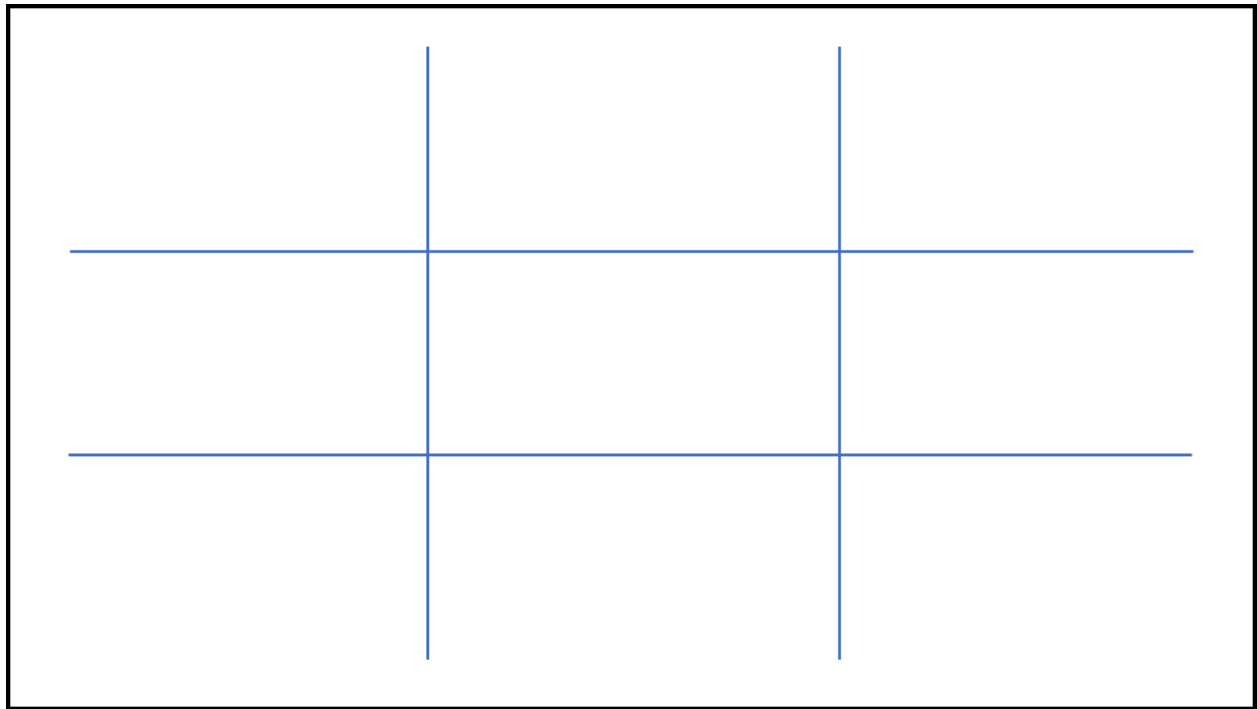


Note

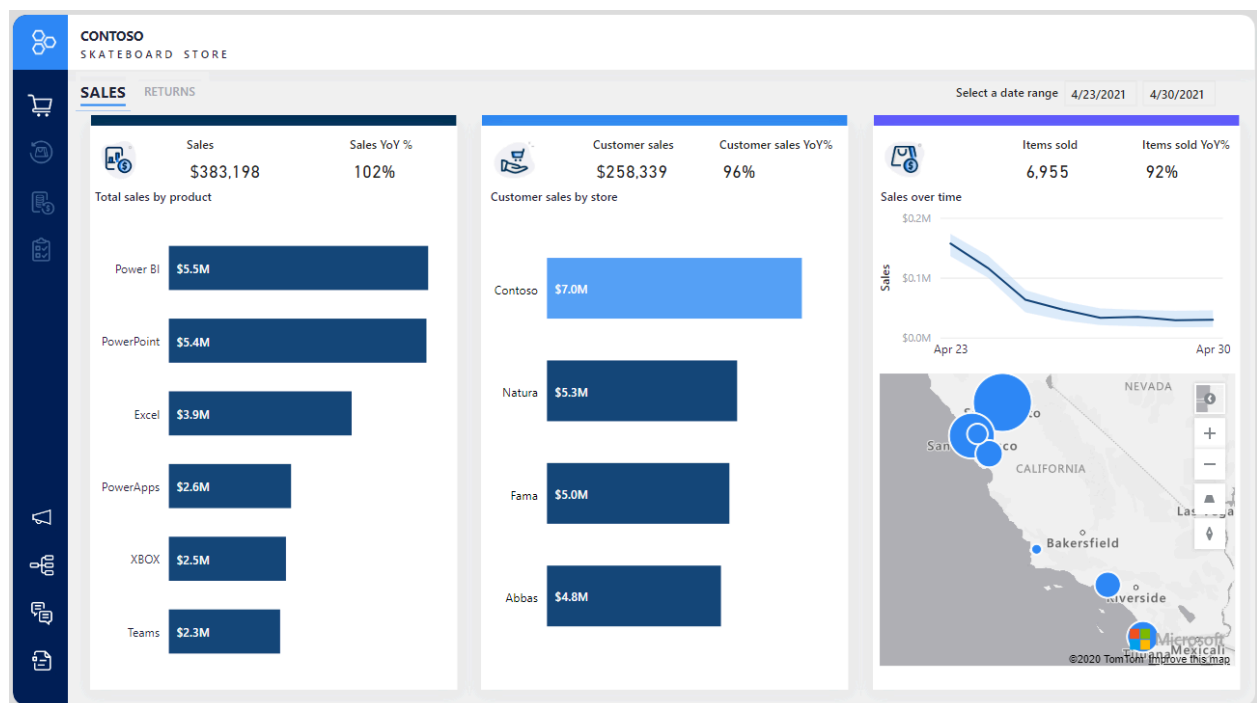
This placement applies to audiences who predominantly read left to right (LTR). When your audience reads right to left (RTL), as is the case with some written languages such as Arabic and Hebrew, place the most important information in the *upper-right* corner and arrange the report elements from *right to left*.

Arrange report objects so that the vertical and horizontal edges align because it looks ordered and is pleasing to the eye. Organize related report objects into logical groups. An ordered report layout creates a connection between visual elements and avoids clutter that can result from a seemingly random placement of report objects.

Additionally, aligning report objects in a visually pleasing layout can convey more energy and interest than simply centering or randomly placing report objects. Consider applying the *rule of thirds*, which is a visual arts rule that can be applied to report object placements in an analytical report. The rule proposes that a page layout should be divided into an invisible grid of nine equal parts. The grid is two equally spaced horizontal lines and two equally spaced vertical lines. Then, report objects can be placed within the cells of the grid.



At the Contoso Skateboard Store, a proposed report design for analyzing sales presents three equally sized vertical regions. The first region shows sales broken down by product, the second region shows sales broken down by customer store, and the third region shows sold items.



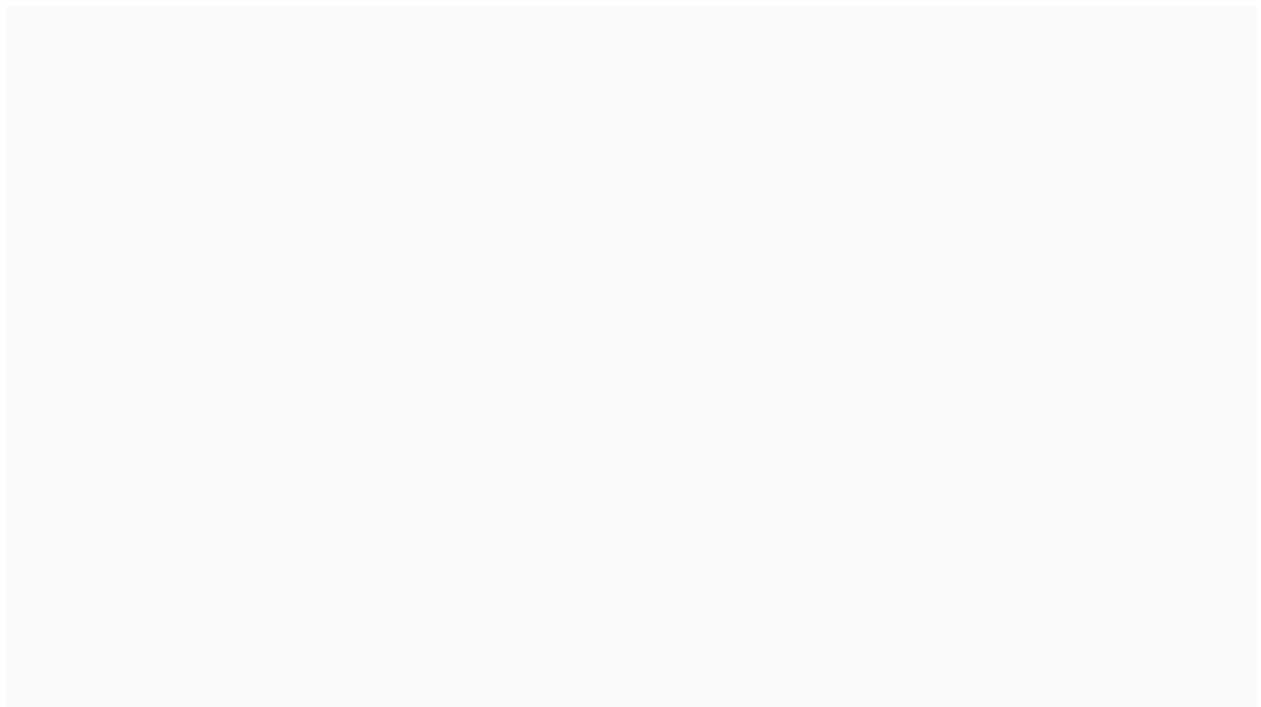
Balance

Another important consideration when you lay out report objects is *balance*. Balance is concerned with stability and structure in design. Balance in a report layout means how the weight of objects is spread across the page, whether they're the same size or different sizes.

Balance can be either *symmetrical* or *asymmetrical*. Symmetrical balance is achieved by distributing the weight evenly on both halves of the page. Asymmetrical balance is achieved through contrast.

Consider using the *golden ratio* as a guide to produce asymmetrical balance. The ratio is based on the Fibonacci Sequence, where two quantities are in the golden ratio if their ratio is the same as the ratio of their sum to the larger of the two quantities. For centuries, the golden ratio influenced art and architecture to produce works that are harmonious and balanced. When applied to report design, the golden ratio aligns a page to have one large visual to draw initial attention and supported by smaller visuals that provide context.

In the following animated image, notice how the report layout initially draws your eye to the larger charts. After you understand the larger charts, observe that your eye is likely drawn to the bar chart and then to the values in the cards.



Proximity

In a report layout, proximity is concerned with the nearness of report objects. When a report page consists of multiple groups of related objects, you should use space to visually separate them.

In the following report design, notice the top-left section labeled key metrics. Related visuals are placed near one another. They're also purposefully and consistently aligned forming a clear section.



Contrast

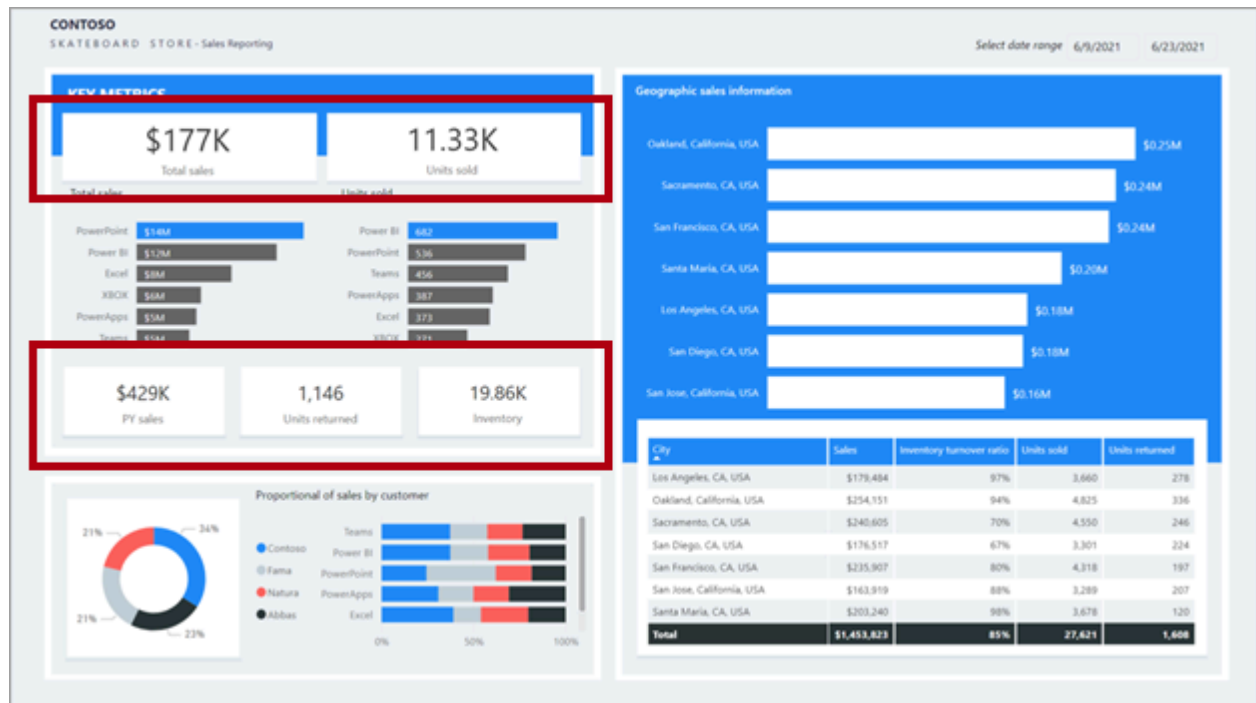
Contrast can be used to combine two opposing objects. The use of contrasting colors, fonts, font properties, or lines can emphasize important objects of the report design. Use this principle to direct report consumers to where they should look or which data visual they should interact with first.



Repetition

Repetition in a report design creates association and consistency. Good use of repetition can help strengthen a report layout by tying related report objects together.

In the following report design, notice the top-left section labeled *Key metrics*. Many key metrics are presented in single-value cards. This repetitious design allows report consumers to quickly understand and interpret the metrics.



3. Design visually appealing reports

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/3-design-reports>

Design visually appealing reports

Completed

Having the correct data and selecting appropriate visuals is important. Equally as important is ensuring that the report is visually appealing. A well-designed report should guide the report consumer to quickly find and understand the answers to their questions.

While you strive to produce an appealing report, bear in mind that the report should be user-friendly. Moreover, it might be possible to add more visuals to a well-designed report page without it appearing cluttered.

Space

Space is essential for an effective report design because it helps reduce clutter and increase readability. Spacing applies to the report page margins and the spacing between report objects.

Margins

Margins include the border area, or edge, around each page. Having a consistently spaced border area frames the report objects.

Because there isn't a report page property to set margins, it's up to you to lay out objects in way that results in a consistent border area. Margin sizes should be equal on both sides, with possible variation on the top and bottom. Space across the top or bottom can show branding, titles, slicers, or other information that needs to be separated from the visuals.

The following report shows the consistent spacing (highlighted with dashed lines) around the border area of the page.



Object spacing

Ensure that you provide sufficient space surrounding, or within, report objects.

Note

When visual headers are enabled, be sure to test that they don't overlap with nearby objects. Overlapping objects can make interacting with visual header icons difficult. Adequate spacing between visuals helps you avoid this problem.

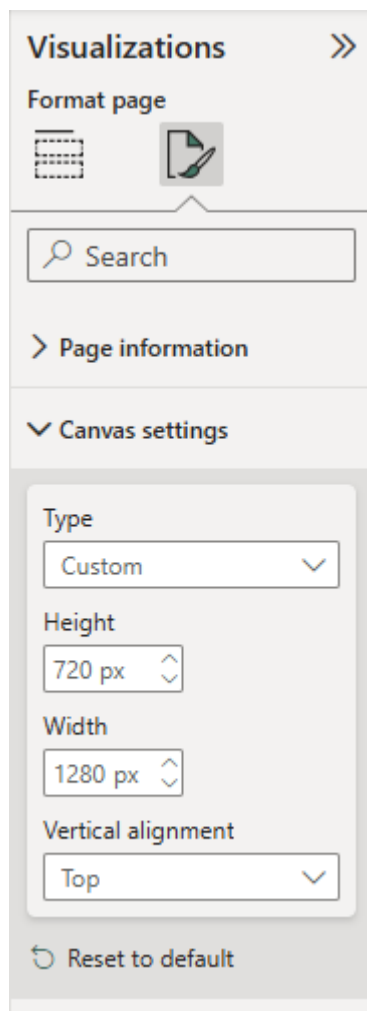
Consider using different space depth to visually separate sections of related objects. However, keep in mind that too much space can result in an unbalanced report layout and could draw the attention of the report consumer away from what matters. Moderation is key: Always strive to produce an evenly spaced and balanced report.

Size

Size can relate to page size and visual size.

Page size

You can set the page size to predefined or custom dimensions. Additionally, you can set custom dimensions that are larger than the available screen size so that the report consumer needs to interact with scrollbars to view the entire page.



However, a large page size that is filled with visuals might take time to render, and visuals might not render in a top-to-bottom order.

Visual size

Generally, the more important the visual, the larger its size. Report consumers quickly focus on larger visuals. When similar visuals are on the page, such as a series of card visuals, they should be equally sized.

Many visuals are responsive to size, so the visual looks appealing in either a small or large size. However, consider that a line chart visual might appear like a sparkline when small in size. In this case, only a few axis and data labels might appear. When the line chart visual is sized larger, more detail is revealed, including many more axis and data labels.

While report consumers can use focus mode to enlarge a single visual, the visual should still clearly communicate its data when viewed at actual size on the report page. Focus mode can help consumers better interpret the data or more easily interact with the visual, such as expanding into levels of a matrix or decomposition tree visual.

Alignment

When multiple visuals are on the report page, ensure that they're properly aligned, meaning that the edges of visuals should be in alignment and the spacings between visuals are consistent.

Alignment also relates to format options. For example, the alignment of titles and legends *within* visuals should be consistent.

Consider laying out the report page with different sections and aligning visuals appropriately within the sections. Sections can be *implied* or *explicit*.

Implied sections

An *implied section* aligns groups of visuals in close proximity. The following example shows how spacing separates the visuals. This example demonstrates how well-applied spacing (highlighted with dashed lines) can convey association, and guide the attention of the report consumer while providing balance and structure to the report page.



Explicit sections

An *explicit section* uses colored shapes and overlays aligned visuals on those shapes. The following example shows how the colored background shapes and spacing (highlighted with shading) separate the visuals into three sections.



Tip

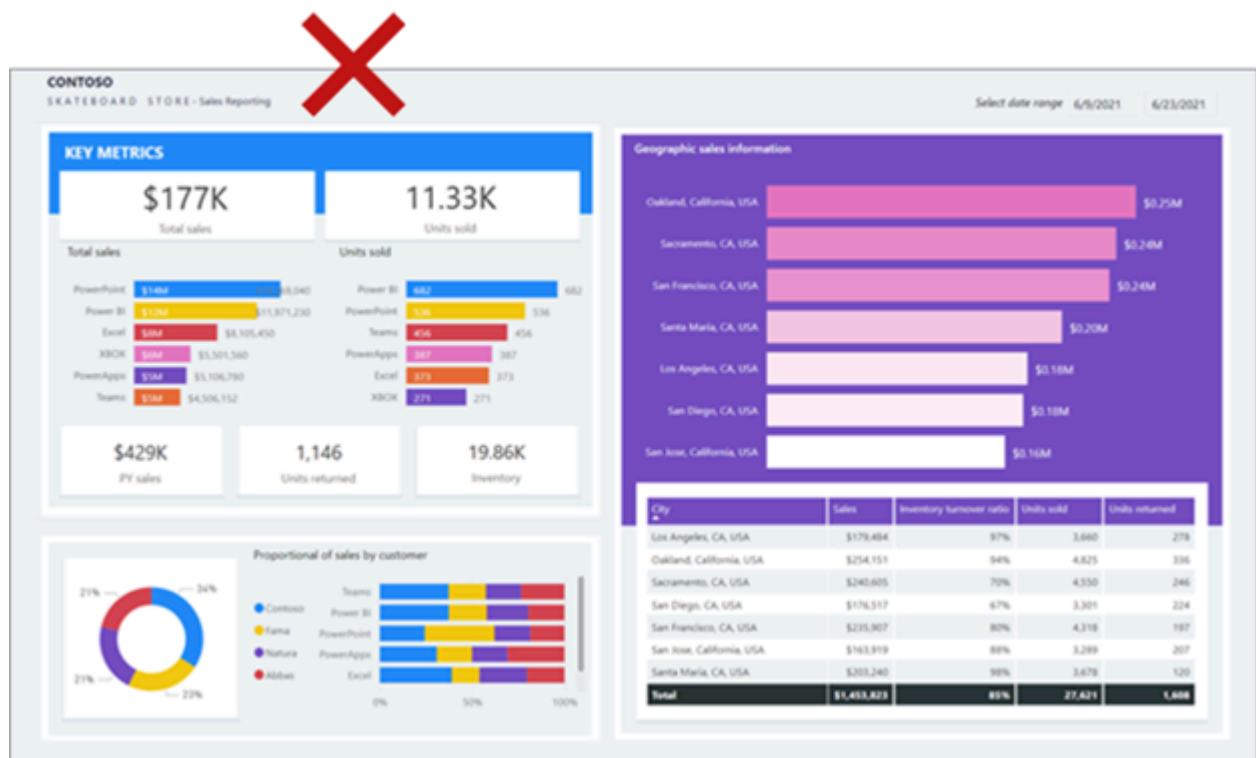
Use the alignment commands found on the **Format** ribbon, which can help you quickly and accurately align visuals.

Color

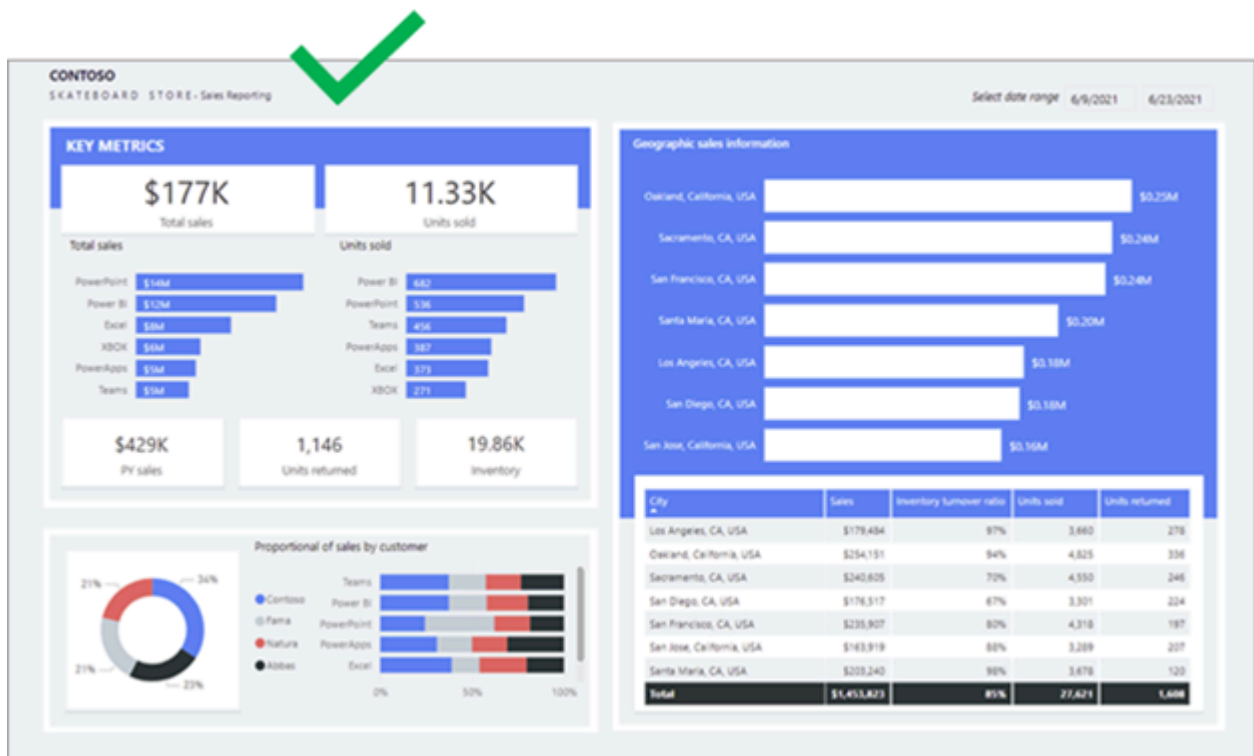
Use color sparingly and meaningfully because overuse can be distracting. Stick to a few softer colors as a base, possibly aligned with corporate colors. Softer colors ensure that the data is the focus in your report. Reserve the use of bolder colors to highlight exceptions.

Ensure that colors are sufficiently contrasting. Color contrast is especially important to create accessible reports for report consumers who have low vision.

The following example shows several issues that are related to color. The colors that are applied on the left side of the page are different from colors that are applied on the right side. Also, the colors are bright and possibly distract the report consumer. Some colors, such as yellow, don't provide sufficient contrast with the white data labels.



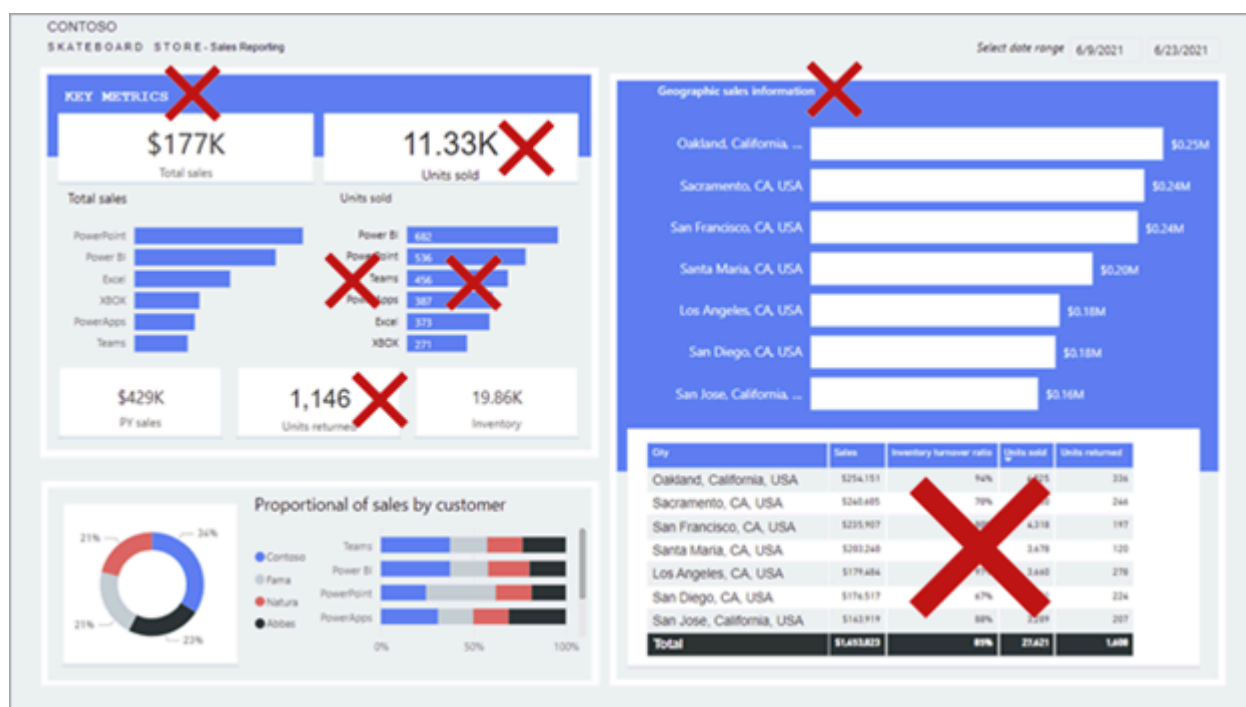
In the following image, the report layout is improved thanks to the use of better colors. The colors are now consistent and provide suitable contrast with the white data labels.



Consistency

Strive for consistency when you lay out and configure report objects. Consistency should apply to everything in your report design, including spacing, margins, size, alignment, and especially to object format options. Format options include the selection of font, font size, font weight, colors, and many other styling options. Format options also include the enabling of visual features like axis labels and data labels.

The following example shows many inconsistencies, including mixed fonts, different font sizes, and inconsistent titles. At first glance, the report appears unbalanced.



The quickest way to enforce consistency is to use a *report theme*. A report theme applies format settings to your entire report, ensuring consistent application of colors, fonts, pages, and visual format options, including the style of the **Filters** pane.

Consider using one of the many built-in themes from the theme gallery. You can use one as a starting point and then customize it to better meet your requirements. Alternatively, you can create a new theme, which can be considerable work initially, but provide you with granular control.

Note

Theme is overridden when you explicitly configure a format option. For example, you can explicitly set a color by entering a HEX value instead of selecting a color from the palette. Try to limit overriding the report theme to an exception basis because if you switch themes, overridden properties aren't updated.

Be sure to export the report theme, which is a JSON file, and then apply it to other reports to ensure consistency across all your reports.

Tip

You can use an external site like powerbi.tips to generate a theme. The site guides you through building a color palette and setting property values for all core visual types.

For more information, see [Use report themes in Power BI Desktop](#).

4. Use report objects

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/4-report-objects>

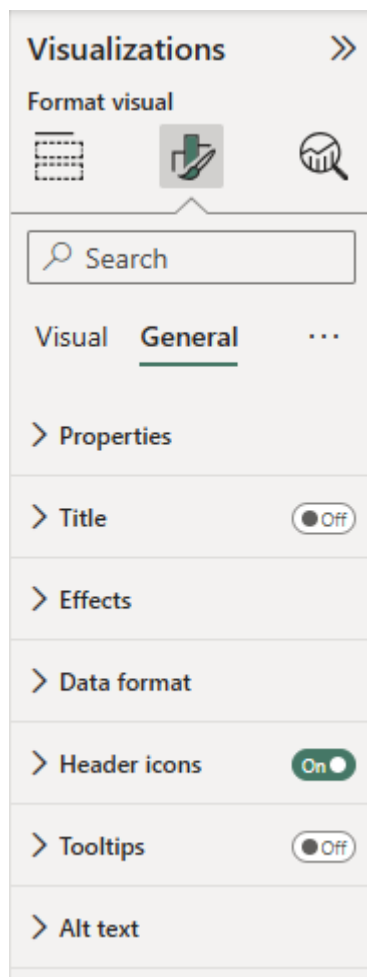
Use report objects

Completed

Report objects are laid out on each report page and include:

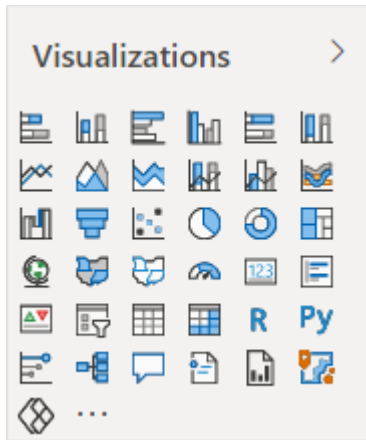
- **Visuals** - Visualizations of semantic model data.
- **Elements** - Provide visual interest but don't use semantic model data. Elements include text boxes, buttons, shapes, and images.

All report objects have some properties in common, which can be set in various sections of the **Format** options. Commonly applied settings include general properties (location, size, and alt text), title, and effects (background, border, shadow, and more).



Visuals

Visuals are visualizations of semantic model data. Power BI includes over 30 *core visuals*, which are built in and available to all reports. You can access the core visuals in the first section of the **Visualizations** pane.



Tip

To learn what a visual icon in the **Visualizations** pane represents, hover the cursor over it to reveal the visual type in a tooltip.

You can also extend the core visuals with *custom visuals*. Custom visuals are sourced from Microsoft AppSource (an app store for business applications such as Microsoft Office 365, Microsoft Dynamics 365, Power BI, or separate Microsoft Azure web apps) or uploaded as a PBIVIZ file.

You can use the following general methodology to add and configure a visual:

1. Select the visual type in the **Visualizations** pane and then position and size it on the page.
2. Map semantic model fields to populate the visual. Each visual has one or more *wells*. The number and type of wells differ between visuals. Some visuals, like the slicer, have a single well, but others have more.
3. Optionally, apply visual-level filters.
4. Modify field mappings, possibly renaming fields, modifying summarization behavior (or restricting summarization), or enabling the *Show items with no data* option.
5. Optionally, modify the sort field and the sort direction (in ascending or descending order).
6. Optionally, apply format options to produce the desired result and style.
7. Optionally (and when supported), use the **Analytics** options to overlay supporting data, like minimum or maximum lines, or Artificial Intelligence (AI) results, like anomaly detection and forecasts.

Note

Steps 2-4 define the analytic query, which is concerned with filtering, grouping, and summarizing semantic model data.

To gain a better understanding of this general methodology, watch the following video, which demonstrates how to configure a report visual.

This module doesn't intend to describe each visual in detail. In the next unit, visuals are grouped into visualization requirements together with guidance on when to and when not to use them.

Tip

For a complete list and explanation of the core visuals, see [Visualization types in Power BI](#).

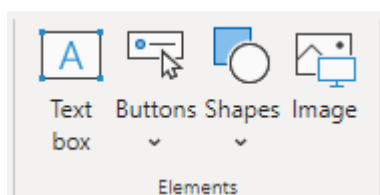
Additionally, this module doesn't intend to describe each visual format or analytic option.

Tip

A great way to learn how to format a Power BI visual is by experimentation. The **Format** options include a search box that you can use to help narrow down and locate a particular setting. To learn what a setting does, configure it and then observe the result. If it doesn't produce the expected result, press the **Ctrl+Z** keyboard shortcut to revert to the original setting.

Elements

Elements provide visual interest but don't use semantic model data (with one exception, which is described later).



The four types of elements are:

- **Text box** - Add rich text, such as the title, to the report page. You can selectively apply font type and font size and then set the color, styling (bold, italics, or underline), and paragraph alignment (right, center, or left). You can insert hyperlinks, too.
- **Buttons** - Add buttons so that report consumers can interact with the report as they would an app. Buttons can perform different actions, such as return to the previous page, navigate to a specific page, drill through to a page, select a bookmark, open Q&A, or open a web URL in the default web browser.
- **Shapes** - Add a shape to the report as decoration or to behave like a button to perform an action. Almost any conceivable shape is possible, from basic shapes to arrows and even hearts. Shapes can include text and can be formatted and styled in many different ways.
- **Image** - Upload an image, such as your company logo, to the report page. Supported image types include BMP, JPEG, GIF, TIFF, and PNG. Similar to the **Shapes** element, images can behave like buttons to perform an action.

The text box deserves a special mention because it's capable of embedding *dynamic values* that are retrieved from the semantic model and embedded in paragraphs of text. When the page is filtered, dynamic values are filtered. Technically, the text box isn't a visual. However, in this instance, it behaves like one. It's also available as the Smart narrative visual, which automatically summarizes data by using text descriptions and insights.

A

B

/

U

+ Value

Review

Create a dynamic value that updates with your data

How would you calculate this value

Ask a question about your data

Result

\$%

General

\$ %

Auto

Name your value

Value

Save

Cancel

At design time, you can start with a text box, or you can add the Smart narrative visual from the **Visualizations** pane. However you start, the end result is the same. Then, you can add a dynamic value by using Q&A to ask a question. Additionally, you can format the values.

5. Select report visuals

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/5-report-visuals>

Select report visuals

Completed

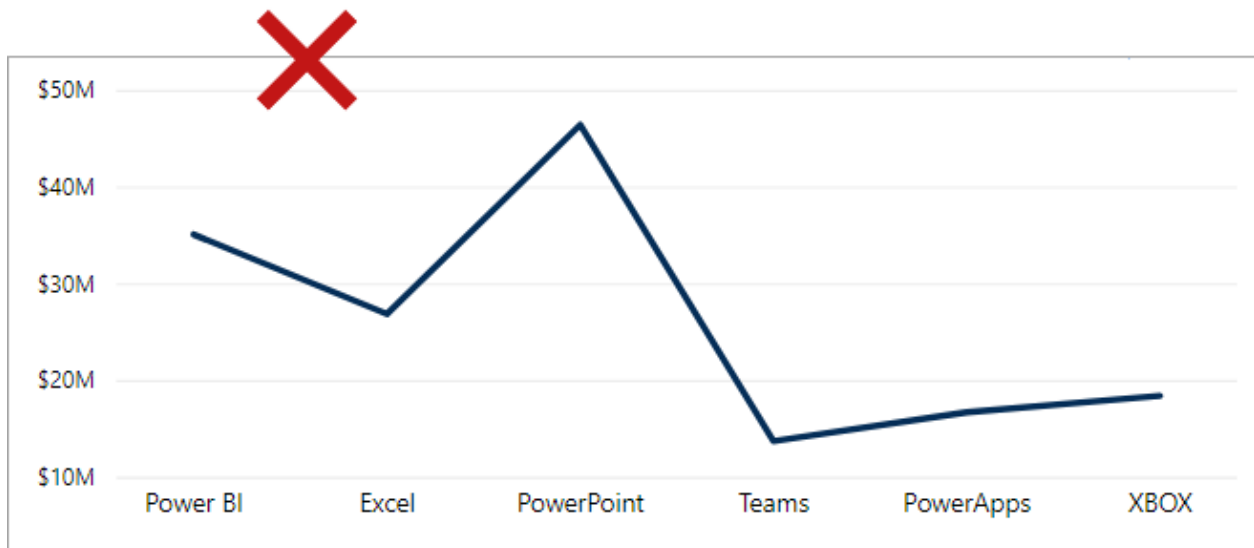
The primary goal of data visualization is to communicate information clearly and effectively to report consumers. Selecting the most effective visual type and layout to meet requirements is critical. Selecting the wrong visual type could make it difficult for report consumers to understand the data, or worse, it could result in the misrepresentation of the data.

Visual selection can be challenging because you have so many visuals to choose from. To help you select an appropriate visual, the following sections provide tips and guidance to help you meet specific visualization requirements.

Categorical visuals

Often, bar or column charts are good choices when you need to show data across multiple categories. Selecting which type depends on the number of categories and the kind of information that you want to visualize. For example, if many category values are available, you should avoid selecting a visual where color is used to split the data, such as a stacked bar chart with a category legend. Instead, use the category dimension on the axis of a bar chart.

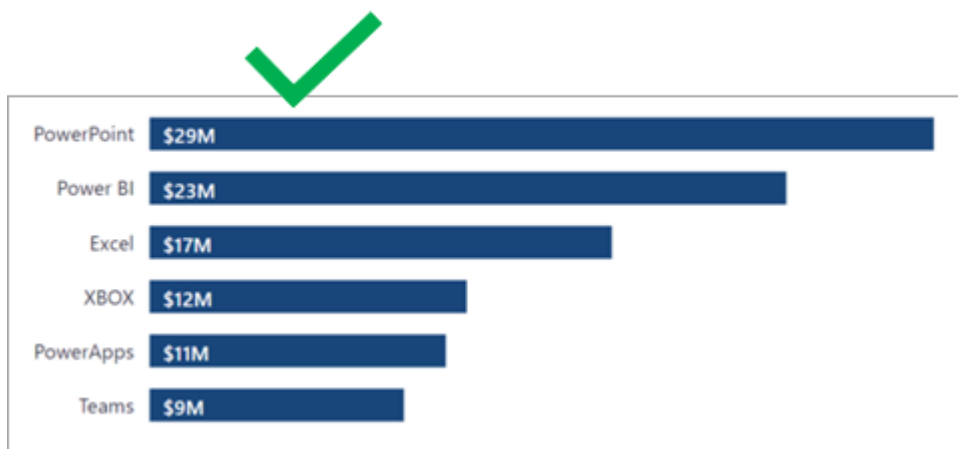
Additionally, you should avoid a line chart with a categorical X-axis because the line implies a relationship between elements that might not exist. In the following example, notice that the line chart visual implies a relationship between the product categories on the X-axis.



In the next example, a bar chart shows sales by product category. Notice that the visual is sorted by sales values in descending order. Mostly, you should sort categorical charts by value rather than in alphabetical category order. Make sure that you determine the sort order (ascending or descending) by what you want to first draw attention to so that it provides the report consumer with an intuitive visual organized to produce a natural flow.

Note

You should sort by category when an established sequence is in place, such as steps in a process that should be displayed in that order.



Time series visuals

Always use a line or column chart to show values over time. The X-axis should present time, sorted from earliest to latest periods (left to right).

Note

This placement applies to audiences who predominantly read left to right (LTR). When your audience reads right to left (RTL), as is the case with some written languages, sort the X-axis from right to left.

In the following example, a line chart shows historical sales. The line chart shows the natural flow of a timeline from left to right, eliminating the time needed to interpret the X-axis.



You can take the line chart to the next level by adding an analytics option. In this case, it [applies a forecast](#) to extend historical sales with projected sales.



Line charts work well with a consistent flow of data, such as when sales are recorded for every period. If no sales are recorded for some periods, the line chart visual will fill such gaps with a straight line that connects the values of the previous and next periods. If missing values are a possibility, a column chart might be a better visual choice because it helps to avoid the interpretation of a nonexistent trend.



Other Power BI core visuals that you can use for time series data include:

- Stacked column chart
- Area chart
- Line and stacked column chart
- Ribbon chart, which has the added benefit of showing rank changes over time

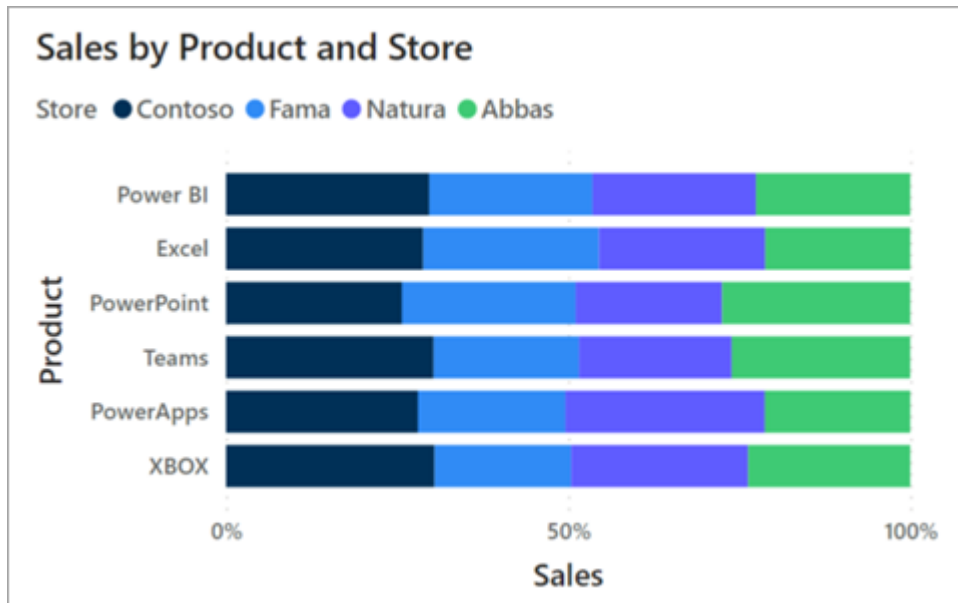
Proportional visuals

Proportional visuals show data as part of a whole. They effectively communicate how a value is distributed across a dimension. Column and bar chart visuals work well for visualizing proportions across multiple dimensions.

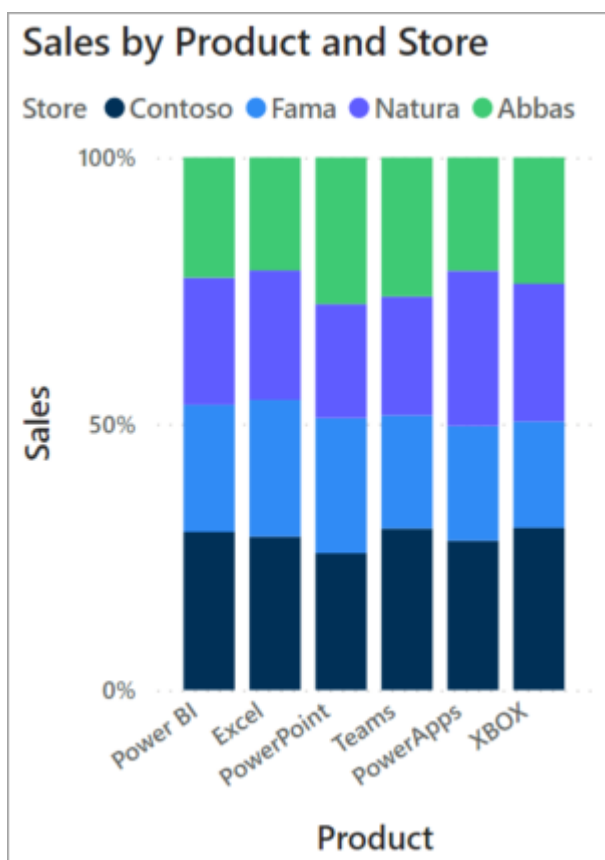
Note

Proportional visuals can't plot a mix of positive and negative values. They should be used when all values are positive or all values are negative.

In the following example, a 100% Stacked Bar chart visual shows proportional sales across four stores. It lets you compare each store across the six product categories. Notice that the actual sales value isn't shown. Instead, the proportion of sales is shown, allowing report consumers to determine which one is higher. (If necessary, you can reveal the actual values in a tooltip.)



In the next example, notice that the same information can be expressed vertically as a 100% Stacked Column chart. It yields an equivalent result.



Other Power BI core visuals that you can use for proportional visualization include:

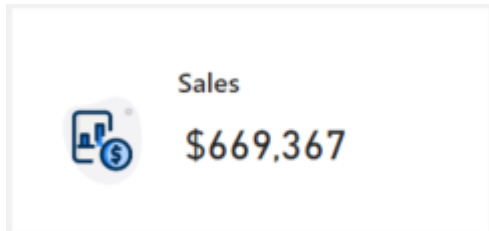
- 100% Stacked Column chart
- Funnel chart
- Treemap
- Pie chart

- Doughnut chart

Numeric visuals

Numeric values show high-level callouts that demand immediate attention and can be represented with card visuals. They can be powerful in dashboard and analytical reports because they communicate important data quickly.

In the following example, a card visual shows a single value that's quick and simple to read.



You can also use a multi-row card to display multiple values in a single visual.

Grid visuals

Tables and matrices are often overlooked, yet can effectively convey detailed information. Tables have a fixed number of columns, and each column can express grouped or summarized data. Matrices can have groups on columns and rows. Conditional formatting options, such as background colors, font colors, or icons, can enhance values with visual indicators. This extra context supports simple report consumption and can bring balance to a report page.

Additionally, matrices provide one of the best experiences for hierarchical navigation. They allow users to drill down, on the columns or rows, to discover detailed data points of interest.

The table and matrix **Format** options provide fine-grained control to format and style grid values.

In the following example, a table visual shows sales and units sold by product. Showing these metrics together in a single visual can be a challenge because the scale of values for sales and units is different. But by applying conditional formatting, data bars help report consumers quickly understand the distribution of values. Notice that the products are sorted by sales values in descending order, drawing attention to the product with the highest sales.

Product	Sales	Units sold
Power BI	\$244,885	2,881
PowerPoint	\$172,320	2,154
Excel	\$102,250	2,045
Teams	\$88,144	3,148
PowerApps	\$80,496	2,236
XBOX	\$74,400	1,860
Total	\$762,495	14,324

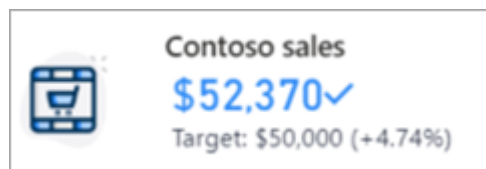
In the next example, a matrix visual displays inventory by product and by store. It uses conditional formatting to show indicators, which provide visual cues to understanding the data.

Inventory on hand breakdown			
City	On hand	Inventory turnover ratio	Days sales of inventory
Los Angeles, CA, USA	32	100% ★	✓
Power BI	2 ○	100% ★	✓
Excel	0 ○	100% ★	!
PowerPoint	0 ○	100% ★	!
Teams	30 ○	99% ★	✓
PowerApps	0 ○	100% ★	!
Total	1,706	97% ★	✓

Performance visuals

Communicating performance involves describing a value and its comparison to a target. Any difference between the value and target is its variance, which can be favorable or unfavorable. Colors or icons can convey status. For example, when the variance is unfavorable, you can display a red color or an exclamation mark (!) icon.

Here's an example of a Key Performance Indicator (KPI) visual that displays total sales compared to target, including variance.



The KPI visual is also a good choice when you want to show progress toward a specific goal over time. To configure a KPI, you need three pieces of information:

- A unit of measurement that you want to track, for instance total sales, number of employee hires, number of loans serviced, or number of students enrolled.
- A goal for the measurement so that you can compare your progress with that goal.
- A time series, for instance daily, monthly, or yearly.

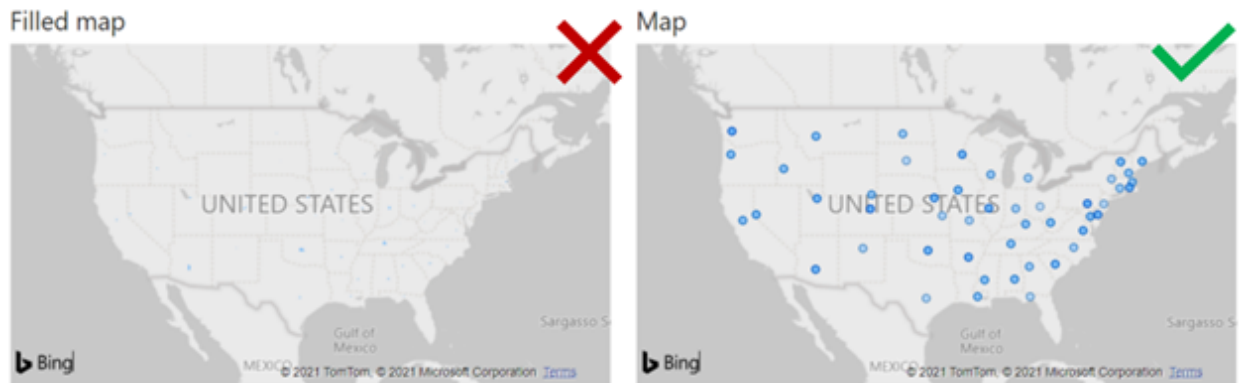
Other Power BI core visuals that you can use to show performance include:

- Gauge
- Table, with conditional formatting
- Matrix, with conditional formatting

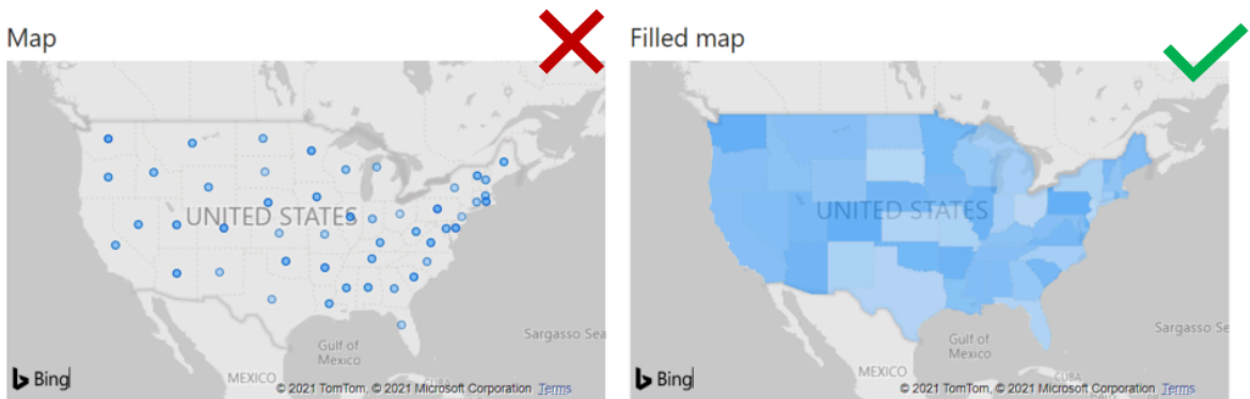
Geospatial visuals

When a semantic model stores geospatial information, it can be conveyed by using map visuals. Power BI includes several core map visuals. Each visual offers various formatting options that, when appropriately applied, can help highlight geospatial data.

In the following example, sales by city are displayed by using a Map visual and a Filled map visual. In this instance, the granularity of the data is at the city level and the perspective is the entire United States. Because a high dispersion is between plot points, the Map visual (which shows a bubble for each city) produces a helpful result. However, the Filled map visual of the United States can't sufficiently convey city sales.



If you raise the granularity to state level, the Filled map visual produces a better result than the Map visual. In this case, the report consumer can determine relative sales by interpreting the color graduations.



Note

Either of the map visuals can occupy considerable space on the report page. Also, geospatial data doesn't always need to be shown in maps. If location isn't highly relevant to the requirements, consider using a categorical visual instead.

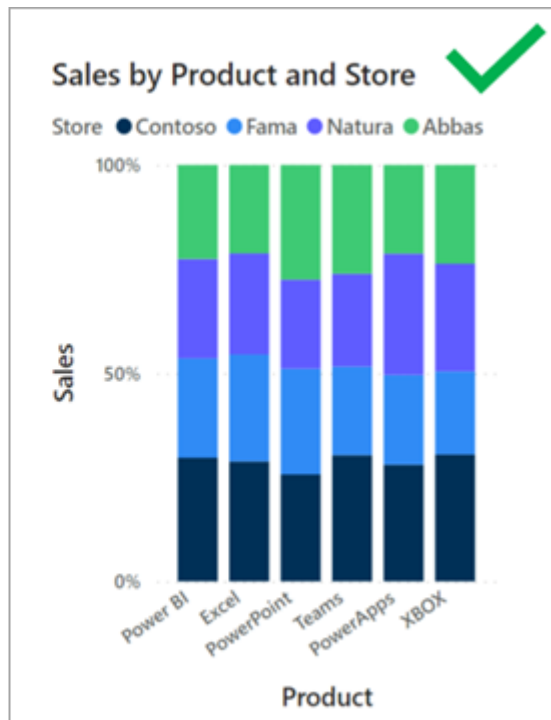
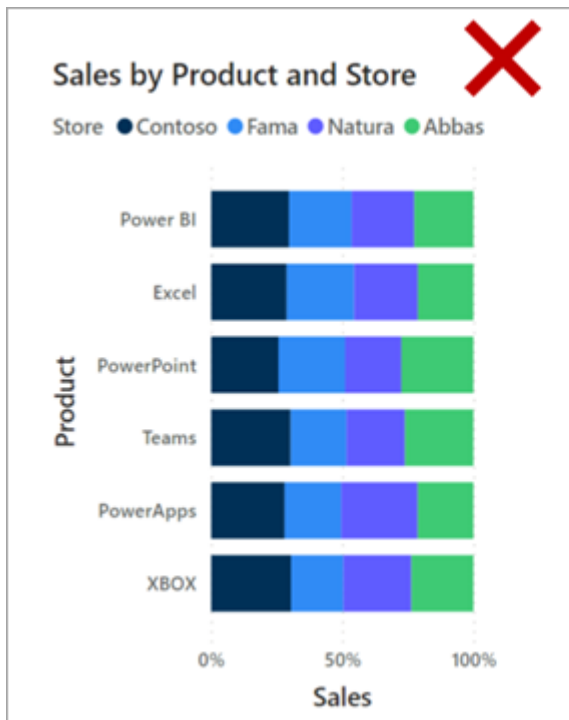
Visual layout

Often, you can choose between multiple visual types to meet design requirements. To narrow down the selection, you might also consider the visual that best fits the available space on the report page. Use a visual that is aesthetically pleasing while maximizing the use of the available page space.

The following examples show two visuals side by side: a 100% Stacked Bar chart visual and a 100% Stacked Column chart visual. Each visual shows the same data and occupies the same space on the page. One visual is easier to read. In this instance, the 100% Stacked Bar chart visual helps make it easier for you to determine relative values. The reason is because the visuals occupy a wide yet short area: The lengths of the *long* bars are easier to interpret than the heights of the *short* columns.



This situation isn't always the case. When the visual needs to fill a narrow yet tall space, the 100% Stacked Column chart is more effective. The heights of the *tall* columns are easier to interpret than the lengths of the *short* bars.



6. Apply filters and slicers to reports

Apply filters and slicers to reports

Completed

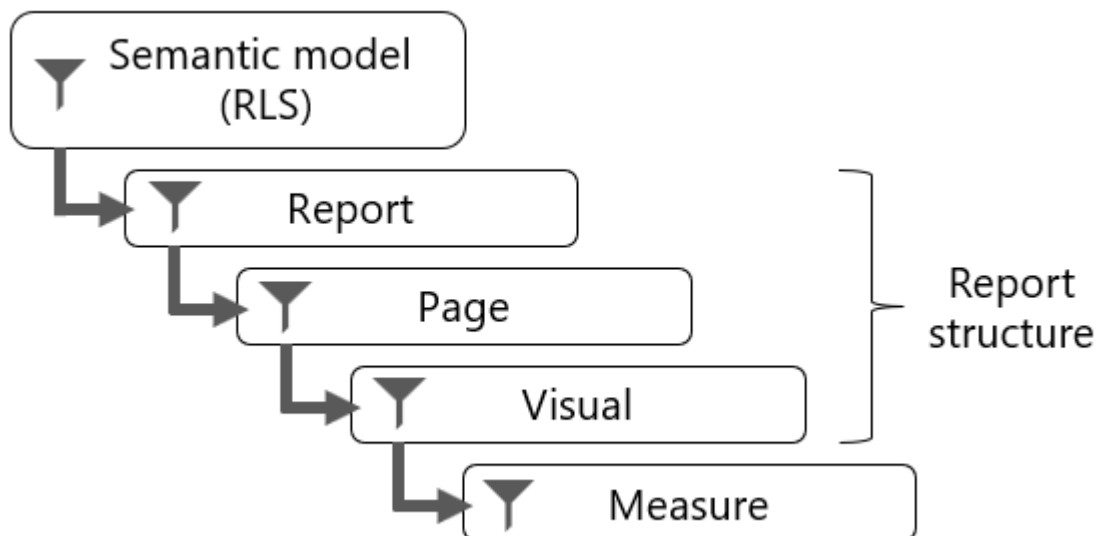
Report filtering is a complex topic because many techniques are available for filtering a report. However, with complexity comes control, allowing you to design reports that meet requirements and expectations. This unit introduces filtering capabilities and describes the techniques you can apply to your report at design time.

Introduction to report filtering

Filtering can occur at five different levels of a report:

- Semantic model, with row-level security (RLS)
- Report
- Page
- Visual
- Measure

Report, page, and visual level filters apply to the structure of the report.



Semantic model

Every report queries a single semantic model, which must be a semantic model. The semantic model can enforce [row-level security \(RLS\)](#) to restrict access to a subset of data, and different users see

different data. A report can't determine whether the semantic model enforces RLS, and it can't override RLS.

Important

When you filter RLS-filtered tables, take care to avoid situations where some report consumers see no data (BLANK) in the report. For example, consider a model that enforces RLS to restrict data visibility to specific countries/regions. If you have permission to see Australian data and filter the report by Australia, a report consumer with permission to see only United States data doesn't see any data.

Report structure

The structure of a report is hierarchical. The structure of the report is as follows:

- The top level is the report.
- The second level comprises its pages.
- The third level comprises report objects, which consist of visuals and elements.

In the **Filters** pane, you can add a filter to any of these levels.

Measure

Measures are calculations created to summarize data in the semantic model. Measure formulas, which are written in Data Analysis Expressions (DAX), can modify filter context by using the `CALCULATE` or `CALCULATETABLE` function. These functions are powerful and provide you with the flexibility to add, remove, or modify filters and relationships. A set of DAX functions, known as time intelligence functions, also modify filter context. These functions can override any filters that are applied to the report structure.

At report design time (only in Power BI Desktop), you can create measures. These measures belong to the report, and so they're called *report-level measures*.

A good example of a measure that overrides report filters is a three-month moving average calculation. To compute the result for March, the filter context for month must expand to encompass January, February, and March. The `CALCULATE` function or a time intelligence function can modify the filter context to produce the desired result.

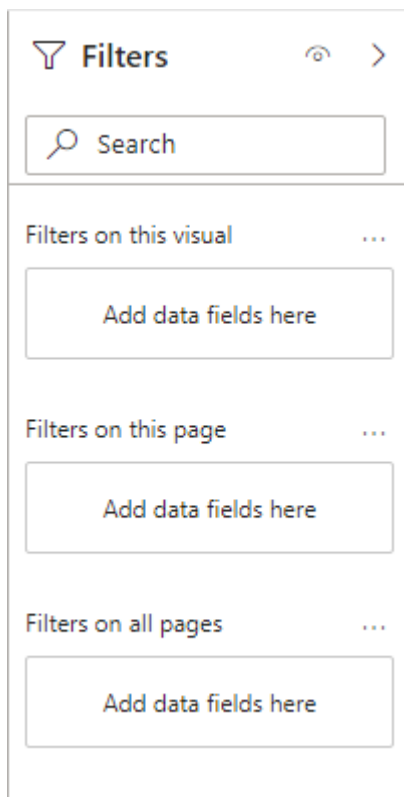
To gain a better understanding of report filtering, watch the following video that describes filter techniques at design time and consumption time.

Note

The video mentions datasets, which are now known as *semantic models*.

Apply filters to the report structure

At report design time, use the **Filters** pane to apply filters to the report structure.



The **Filters** pane has three sections:

- Filters on all pages
- Filters on this page
- Filters on this visual

The *Filters on all pages* section defines report-level filters, which apply to all report pages and visuals. Consider that report-level filters are global filters.

The *Filters on this page* section defines page-level filters, which apply to all visuals on a specific page, adding to any existing report-level filters. For example, if a report-level filter restricts data to the country/region of United States, and a page-level filter restricts data to the state of Washington, then both filters are in effect: Country/region is United States and State-Province is Washington.

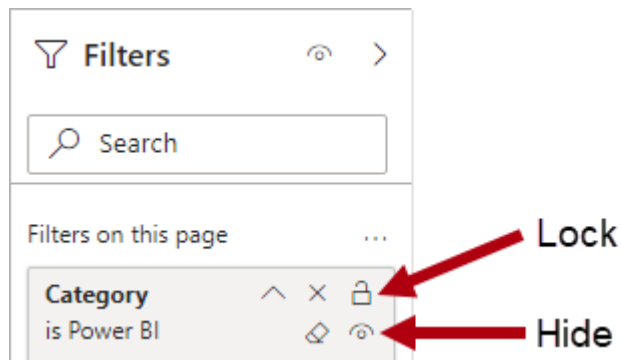
The *Filters on this visual* section defines visual-level filters. This section is only visible when one visual is in focus because visual-level filters apply only to a single visual; they add to any existing report-level and page-level filters. Continuing the previous example, if a visual-level filter restricts data to the city of Seattle, then three filters are in effect: Country/region is United States, State-Province is Washington, and City is Seattle.

Unlike report and page-level filters, a visual-level filter can filter by using a measure. When a measure filters a visual, it's used to eliminate groups. For example, consider a column chart visual that groups by store. A measure filter could eliminate groups (stores) where the total store sales are less than a certain amount.

Filters apply to a single field and use one of following filter types:

- Basic
- Advanced, which allows you to create more complex conditions by using data type-specific operators
- Top N
- Relative date and Relative time

You can lock filters to ensure that report consumers can't remove or modify them. It's a good idea to lock filters that are critical to the design of the report, page, or visual. Additionally, you can hide filters. A hidden filter isn't visible to report consumers. Consider hiding a filter when the report consumer doesn't need to know about it, such as when filters are cleaning up the data, perhaps by removing BLANKs.



You can hide the entire **Filters** pane to ensure that report consumers can't open it.



Apply filters with slicers

The Slicer is a core visual with one purpose: *filter other visuals*. It's one of the most common visuals that you add to a report page because it presents an intuitive way for report consumers to filter data.

As a report author, you have considerable control over how the visual is laid out and formatted and how it functions.

By default, slicers filter all other visuals on the page. However, you can edit visual interactions to restrict filtering between two visuals. We cover visual interactions later in this module. [Sync slicers](#) can also extend to filter visuals on other pages.

Important

It might be tempting to think that slicers apply page-level filters because that's the default result. However, it's important to understand that a slicer is a visual that propagates filters to other visuals on the same page or (when synced) across other pages.

You can configure a slicer by using one or more fields from the same table or a hierarchy. When configured to use multiple fields or a hierarchy, the slicer presents an expandable tree structure of items.

The slicer layout is responsive to the data type of the field. Field data types are either text, numeric, or date. By default, a text field produces a list slicer, a numeric field produces a numeric range "between" filter, and a date field produces a date range "between" filter, allowing value selection with calendar controls.

At design time, you can modify the slicer layout so that lists become dropdown lists. Dropdown lists use much less space on the report page. Numeric and date ranges offer more layouts, allowing you to select a single value that acts as the lower or upper boundary of the filter. The reason why numeric and date slicers have other layouts is because these data types represent continuous values. Therefore, the slicer layouts allow filtering by ranges of continuous values.

Note

To change the slicer style, select Format your visual > Slicer settings > Visual > Options > Style.

A slicer based on a date field offers other layouts to filter by *relative date or time*. Relative filters allow the report consumer to filter by past, present, or future time periods based on the current date and time. For example, a relative date slicer could filter by the current date (today).

Tip

Dropdown slicer layouts are common; they help minimize the size of the slicer to provide more room on the page for other visuals. Another benefit when using dropdown slicers that might not be immediately apparent is that they only query the semantic model when expanded open. Therefore, they can also help expedite report page rendering.

List and dropdown slicers support format options to control the selection of items. When you enable the *Single select* option, the slicer allows only a single item selection. That approach makes sense for a slicer like scenario, where the options are Actual, Budget, or Forecast. In this case, it only makes sense to filter by one scenario at a time.

7. Understand filtering techniques and considerations

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/7-filter-techniques>

Understand filtering techniques and considerations

Completed

Some report filtering techniques apply at design time, while others are relevant at report consumption time (in reading view). This unit describes filtering techniques that allow report consumers to intuitively narrow down to the data points that interest them.

Other filtering techniques

Beyond filters and slicers, report authors can employ other filtering techniques, such as:

- Visual interactions
- Drillthrough
- Report tooltip
- Bookmarks
- Report options
- Query reduction options

Visual interactions

By default, when report consumers interact with visuals, filters are propagated to other visuals on the report page. This way, visuals behave like slicers. For example, a report consumer can select a column of a column chart visual to filter other visuals on the page. To remove the cross filters, they can either select the column again or select a different visual.

Tip

While cross filtering, you can introduce more cross filters, even from other visuals, by pressing the **Ctrl** key.

Cross filtering (and cross highlighting) works between any two visuals. However, at design time, you can edit visual interactions between any pair of visuals and in either direction. Additionally, you can disable cross filtering or modify the interaction to use cross highlighting instead.

To gain a better understanding of visual interactions, watch the following video that describes a use case and shows how to configure it.

Drillthrough

Add [drillthrough pages](#) to allow report consumers to drill from visuals. By default, the drillthrough action propagates all filters that apply to the visual to the drillthrough page.

Report tooltip

Add [report tooltips](#) that will appear when report consumers hover the cursor over visuals. By default, the report tooltip receives all filters that apply to the visual.

Bookmarks

Bookmarks capture a specific view of a report, including filters, slicers, the page selection, and the state of visuals. Report authors and report consumers can create them.

Note

Report consumers can also create bookmarks known as *personal bookmarks*.

Because bookmarks can capture filter state and when invoked they apply that filter state. You can invoke bookmarks directly from the **Bookmarks** pane, or you can invoke them indirectly by selecting a button, image, or shape.

You can create a bookmark to capture the default state of slicers. A button on the report page could have the text **Reset slicers**, and when invoked, it uses the bookmark.

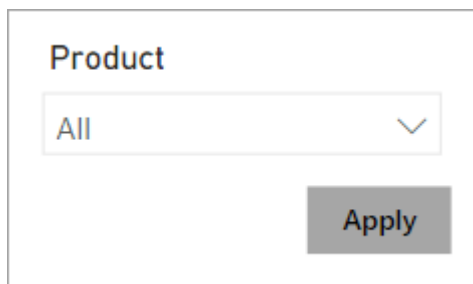
Other techniques

Report authors can configure report or visual settings to control filter options and behavior.

With report options, you can:

- Disable persistent filters. (Persistent filters are covered in Unit 5.)
- Hide visual headers for all visuals or for a specific visual. When the visual header is hidden, report consumers can't hover the cursor over the Filter icon to determine the filters that are applied to the visual. (The **Filter** icon is covered in Unit 5.)
- Hide the **Filter** icon for a specific visual.
- Restrict report consumers from changing filter types (for example, basic to advanced) in the **Filters** pane.
- Remove the search box in the **Filters** pane.

Report authors can also configure report settings to reduce the number of queries that are sent to the semantic model. Fewer queries result in better responsiveness as report consumers update filters or slicers or cross filter report pages.



Select report filter techniques

Filters and slicers are two different techniques that can achieve the same outcome.

Typically, the decision to use a filter or slicer is a tradeoff between performance and design. Consider that the **Filters** pane performs better (because Power BI doesn't need to render slicer visuals), and it doesn't take up space on the report page. However, you should also consider that slicers have the formatting flexibility to seamlessly integrate into the report page, creating the most refined experience possible for report consumption. Many ways are available for you to format a slicer, and the most important consideration is to ensure that it fits into the report design with an intuitive placement and user experience that meets requirements.

Here are the advantages associated with using the **Filters** pane:

- The **Filters** pane is consistently located on the right side of the report.
- It allows you to configure advanced filter types, like *Top N*, or allows you to use more complex expressions, like "contains," "doesn't contain," "is blank," and others.
- The search box and sort functions (to order filters within the sections) are powerful tools to use when many filters exist.
- Filters result in faster report rendering because no visual rendering is required.

- You can lock and/or hide filters.
- When the *Apply* button is enabled, you can submit all filter updates at once, resulting in fewer queries.
- You can filter by using measures (only at visual level).

Here are the disadvantages associated with using the **Filters** pane:

- The **Filters** pane offers less design flexibility, though you can style it by using specific fonts and colors.
- Careful consideration should be made to hide certain filters to avoid confusing report consumers.
- It can be easy to lose track of applied visual-level filters.

Here are the advantages associated with using slicers:

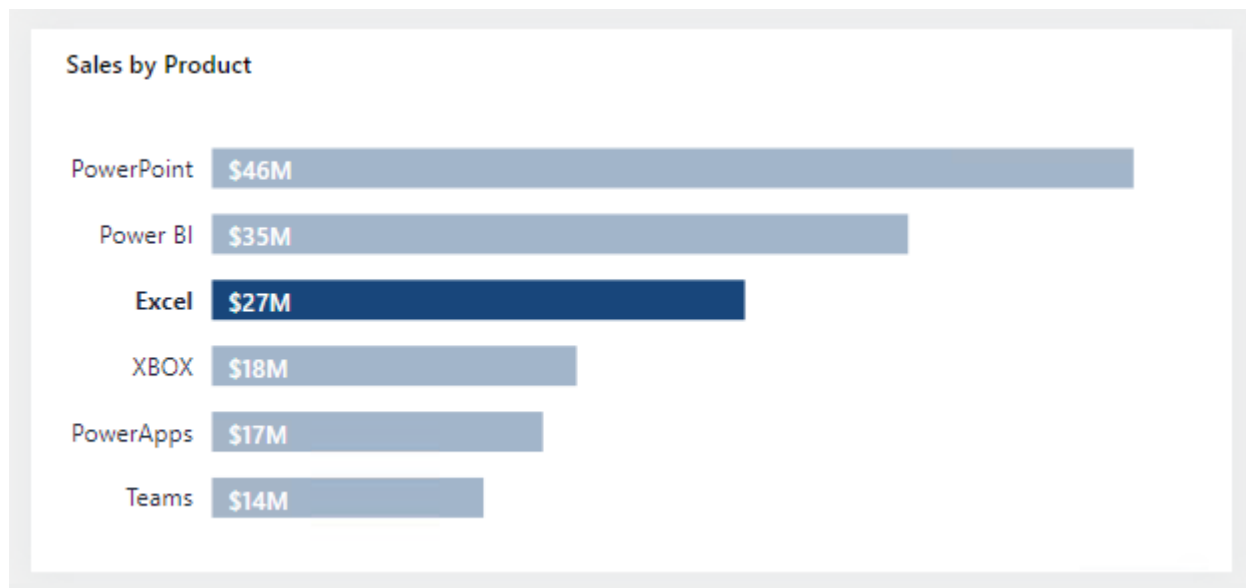
- You can place slicers anywhere on the report page to produce an intuitive layout.
- Slicers are highly configurable to achieve the required functionality and style.
- You can configure hierarchical slicers (based on a hierarchy or by using multiple fields that are sourced from the same table).
- They can display their selection (filter context) directly on the report page.
- They can display images when you're using a field that is categorized as an image URL.
- They can filter only certain visuals by editing visual interactions.
- You can filter slicers as you would any visual. For example, you can apply a filter to a slicer to remove the BLANK item.
- You can sort slicer items.
- Synced slicers can filter other pages in the report.

Here are the disadvantages associated with using slicers:

- Slicers can affect the report render performance due to the visual render time.
- They occupy space on the page instead of other data visuals.
- Slicer filtering options are less complex than the advanced filter options that are possible in the **Filters** pane. For example, you can't configure a *Top N* slicer.

Bear in mind that you can enable filtering by using visuals. For example, a sales by product bar chart can behave like a slicer when report consumers select a single or multiple bars. However, a downside to this approach is that some report consumers might not know that visuals can cross filter other visuals.

In the following bar chart, the report page is filtered by the product Excel.



Filtering tips

Here are some filtering tips to help you produce successful report designs:

- Use either filters or slicers. Avoid using both filter techniques because it can create confusion.
- In the **Filters** pane, consider locking or hiding visual-level filters to avoid confusing report consumers. (Often, report consumer shouldn't modify or see visual-level filters.)
- Create a bookmark to reset all slicers to default values. Then, add a button to the page to invoke the bookmark. For example, the button could be captioned as *Reset slicers*.
- When a requirement is in place to lay out many slicers, consider creating a page that is dedicated to showing all slicers. For example, the page could be named *Slicers*. Sync the slicers to other pages and then set the slicers as hidden on those pages. This design technique requires that report consumers should always go to the *Slicers* page to modify slicer settings. To help them, you can add a page navigation button at a consistent location on each page so that they can easily return to the *Slicers* page.
- Consider using other visuals in place of slicers. Be sure to show report consumers how to cross filter by using these visuals.

8. Case study - Configure report filters based on feedback

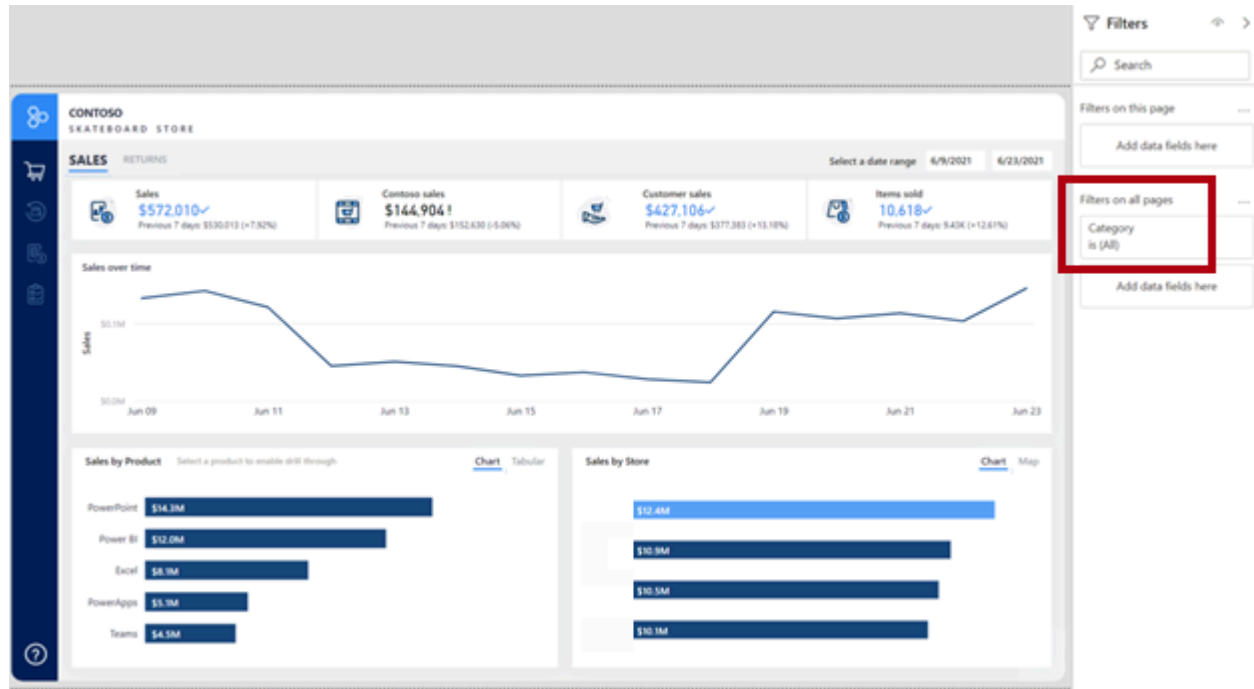
<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/8-report-filters-case-study>

Case study - Configure report filters based on feedback

Completed

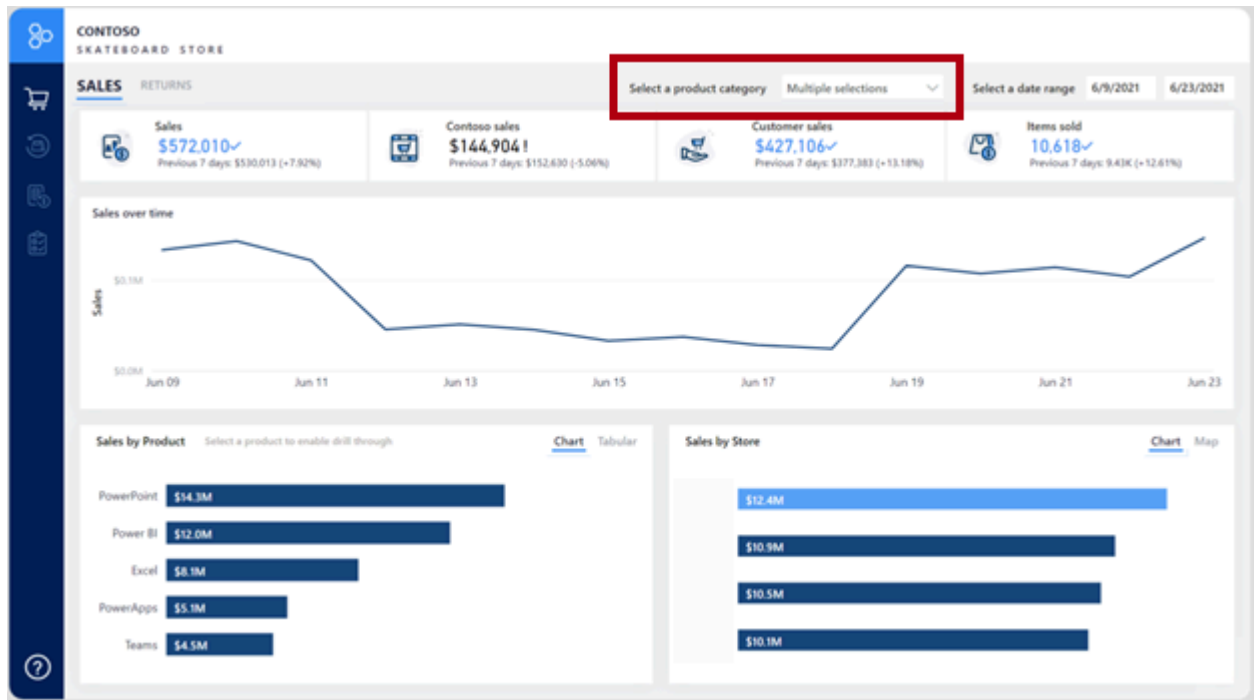
At the Contoso Skateboard Company, the sales director requested an update to the *Sales* analytic report. Specifically, the main report page, which focuses on sales for a specific date range, should also allow filtering by one or more product categories.

The first attempt added the **Category** field to the *Filters on all pages* section of the **Data** pane. The report author decided that it was a quick and easy update to make.



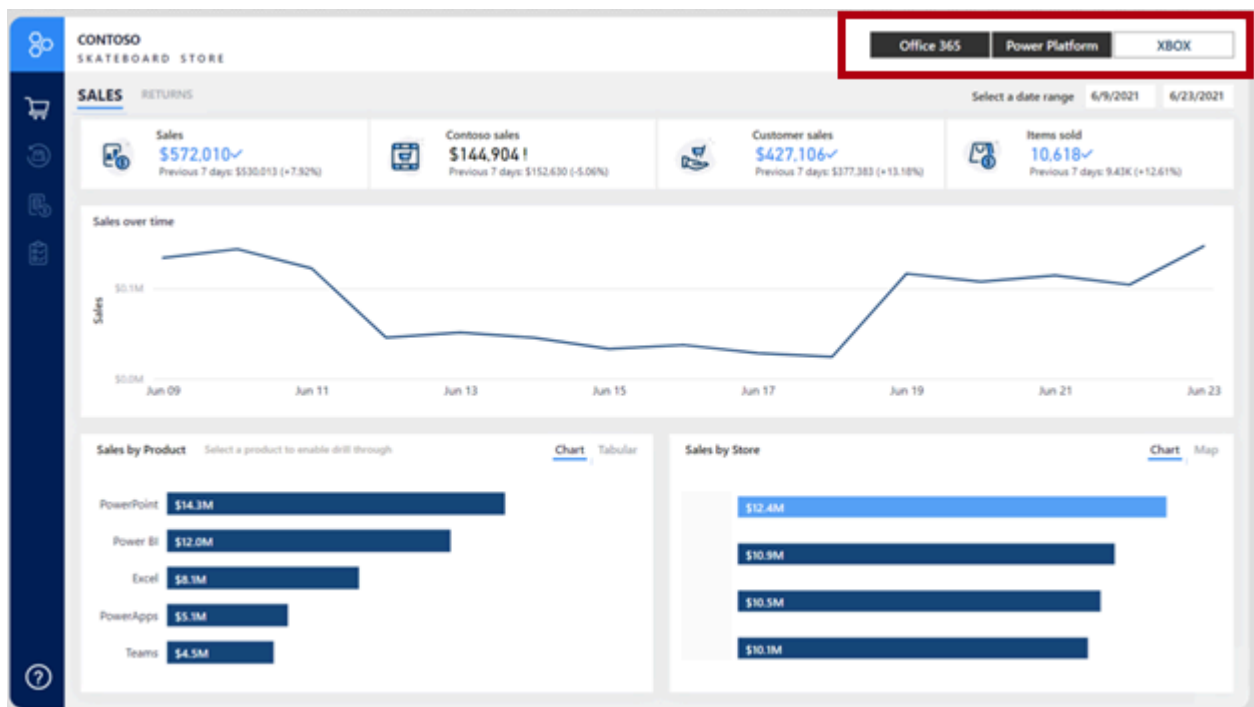
However, feedback from the sales director and salespeople wasn't positive. Some report consumers couldn't easily locate the filter. Others were frustrated that the filter wasn't visible on the report page so that they could see and understand the filter selection.

A second attempt resulted in the removal of the **Category** page-level filter. A dropdown list slicer was then added across the top of the report page.



Nevertheless, feedback from the sales director and salespeople still wasn't positive. They complained that when they filtered the page by multiple category items, the dropdown slicer read *Multiple selections*, meaning that they needed to expand the dropdown slicer to determine the filtered categories.

A third (and final) attempt resulted in repositioning the product category slicer to the upper-right corner of the page and then changing the orientation to horizontal. This way, the slicer always shows the three different categories and the selected items.



Tip

Take care not to use horizontal orientation when many distinct values are present. Often, report consumers don't notice the scrollbar that allows navigation to the following items, and might think that the value they're looking for doesn't exist.



This case study describing the evolution of a particular report design serves as a good reminder that many techniques are available for filtering a report. What matters is that your report design allows report consumers to intuitively and quickly narrow down to the data points that interest them.

9. Exercise - Design Power BI reports

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/9-lab>

Exercise - Design Power BI reports

Completed

In this exercise, you learn how to:

- Design a report.
- Configure visual fields and format properties.

This lab takes approximately **45** minutes to complete.

Note

A virtual machine containing the client tools you need is provided, along with the exercise instructions. Use the "Launch lab" button to launch the virtual machine.

A limited number of concurrent sessions are available. If the hosted environment is unavailable, please try again later.

Alternatively, you can [open the instructions in a separate window](#).

Access your environment

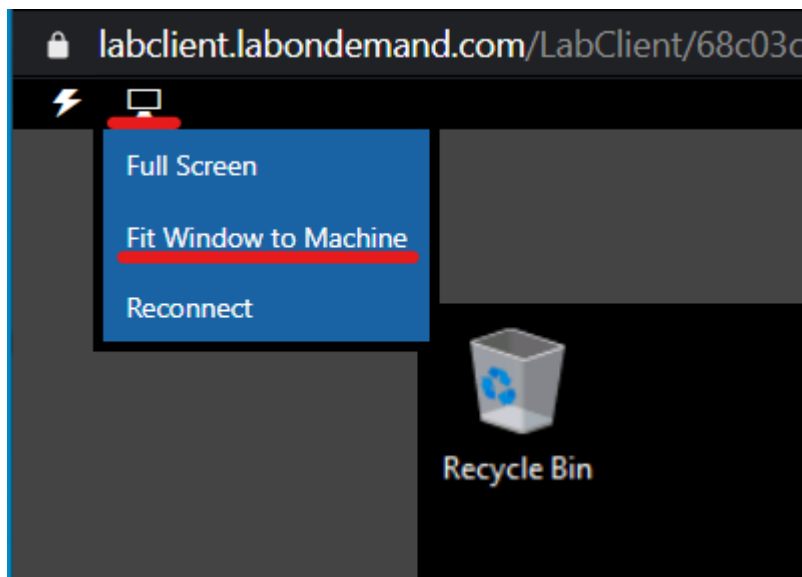
Before you start this lab (unless you are continuing from a previous lab), select **Launch lab** above.

You are automatically logged in to your lab environment as data-ai\student.

You can now begin your work on this lab.

Tip

To dock the lab environment so that it fills the window, select the PC icon at the top and then select **Fit Window to Machine**.



10. Check your knowledge

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/10-check>

Check your knowledge

Completed

11. Summary

Summary

Completed

Designing a Power BI report involves laying out objects over one or more report pages. While you have a great deal of flexibility in how you do that, what matters most is that you meet requirements by clearly communicating the data to report consumers. Chances of success are higher when you select the correct visual types. Beyond the correct visual types, you then can consider overlaying analytics options, ordering the visual elements in an intuitive way, and applying suitable format and styling options.