

Domain 4: Design effective reports in Power BI

Scope report design requirements

1. Introduction

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

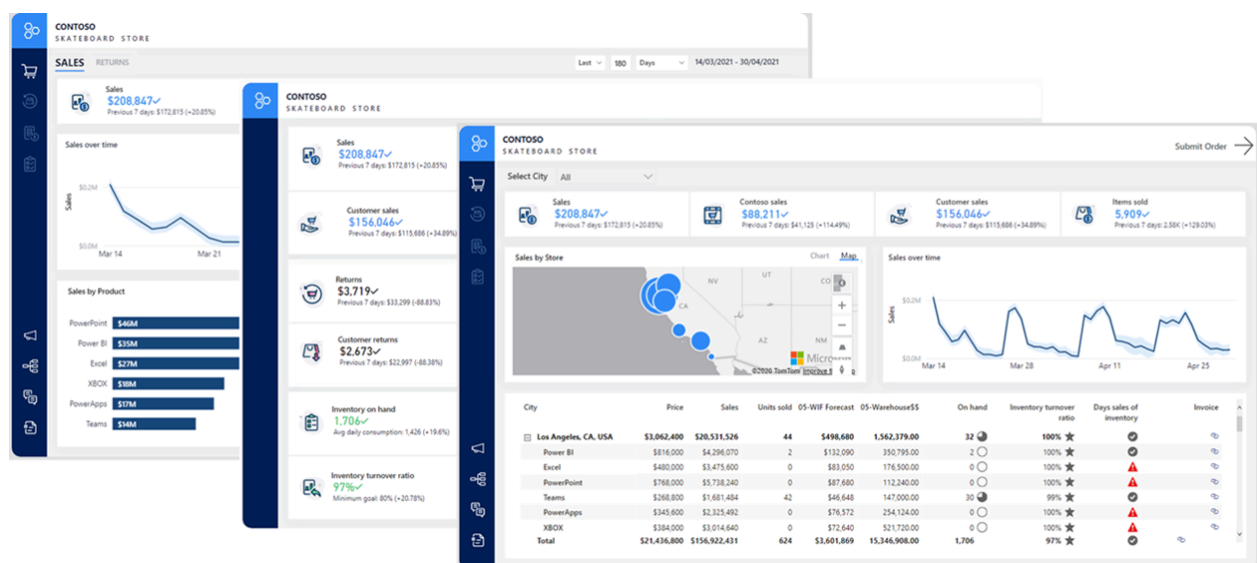
Introduction

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As with any project, a good starting point when designing reports is to define clear goals. In your reporting project, those goals should strive to help you determine the:

- Audiences of your reports.
- Report types.
- User interface requirements.
- User experience requirements.

This module provides examples based on a scenario of the Contoso Skateboard Store company, which specializes in direct-to-consumer skateboard sales. To modernize their workflow and gain a deeper understanding of their product sales and inventory management, the company needs to create a set of reports to deliver data to their employees.



Currently, the finance and supply chain divisions operate in vertical silos. These divisions use data differently, which resulted in many inconsistencies in how they interpret the data when making decisions. These inconsistencies often led to disagreements and misalignment at the executive level because the numbers don't match.

Also, the company currently consumes this information by using formats that aren't optimized for a modern workforce. To this end, employees commonly spend many hours creating reports on demand by using disparate data sources. These reports answer simple questions like "What were our sales in the Los Angeles area last month?" These reports contributed to a duplication of effort, resulting in an overlapping of reports that might occasionally use different calculation logic over the same data.

The company is committed to developing a new suite of reports to meet the following business requirements:

- Promote a standard view of their data and business logic that is a *single source of truth* across all divisions.
- Ensure reports deliver up-to-date data that's no older than 24 hours for sales and one hour for inventory.
- Create modern sales and inventory reports accessible at any time by their employees, whether they're in the office, working from home, or on the road. Reports used by finance managers, supply chain managers, and data analysts.
- Design reports that feel natural and are user-friendly.
- Publish reports that have sufficient depth of detail and enable report consumers to discover new insights.
- Apply consistent corporate brand standards.

2. Identify the audience

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/2-identify>

Identify the audience

Completed

Identifying the audience is one of the most important steps in the report design process. It enables the report author to create a final result that can be efficiently used and meet the needs of the report consumer.

There are three broad report consumer audiences:

- Executive
- Analyst
- Information worker

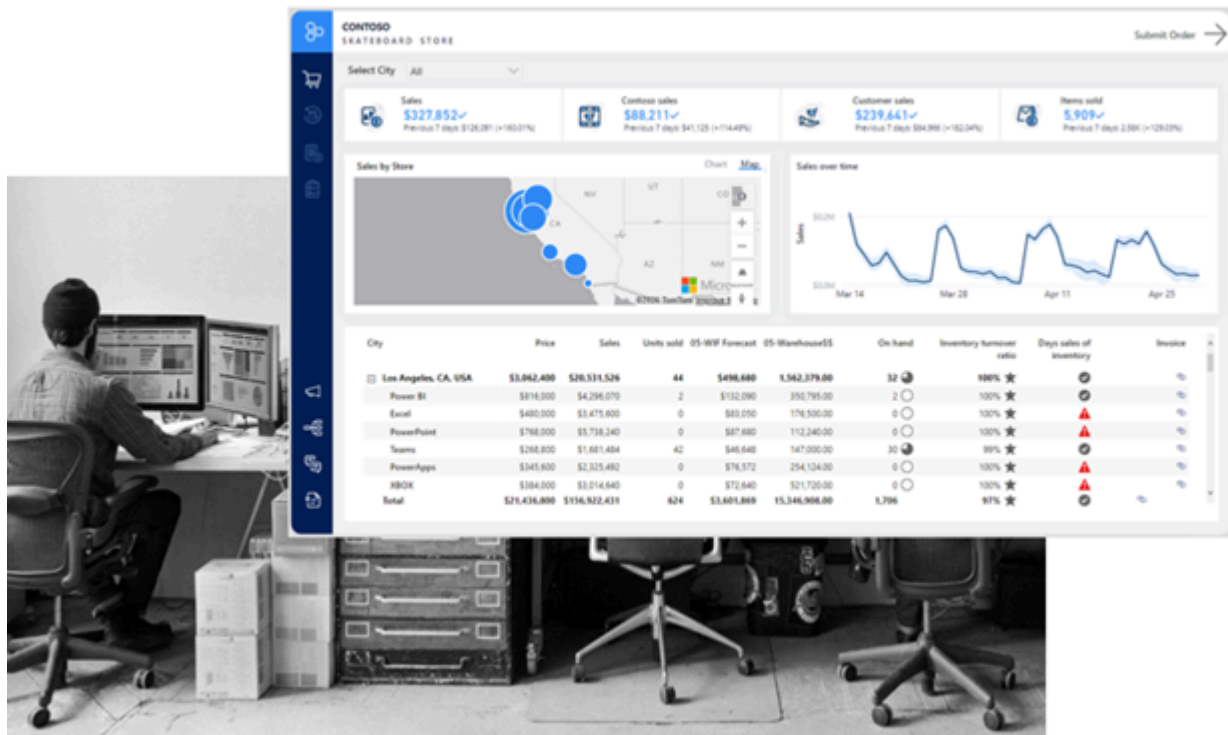
An *Executive* is a person responsible for making plans and decisions that typically involve a medium or long-term focus. Executives are responsible for making the business run smoothly. For example, the C-level executives at the Contoso Skateboard Store are an executive audience.



An *Analyst* is a person who provides guidance to the organization. Analysts can be responsible for a range of tasks, often with goals of determining the effectiveness of business strategies, developing or improving processes, or implementing change. A business analyst (or data analyst) in the sales division of the Contoso Skateboard Store is an example of an analyst audience.



An *Information worker* is someone who uses data to help make decisions or take actions. Often, these decisions and actions are operational in that they're done on a daily basis and are aligned to processes. The inventory manager at the Contoso Skateboard Store, who needs up-to-date information about stock levels, is an example of an information worker audience.



3. Determine report types

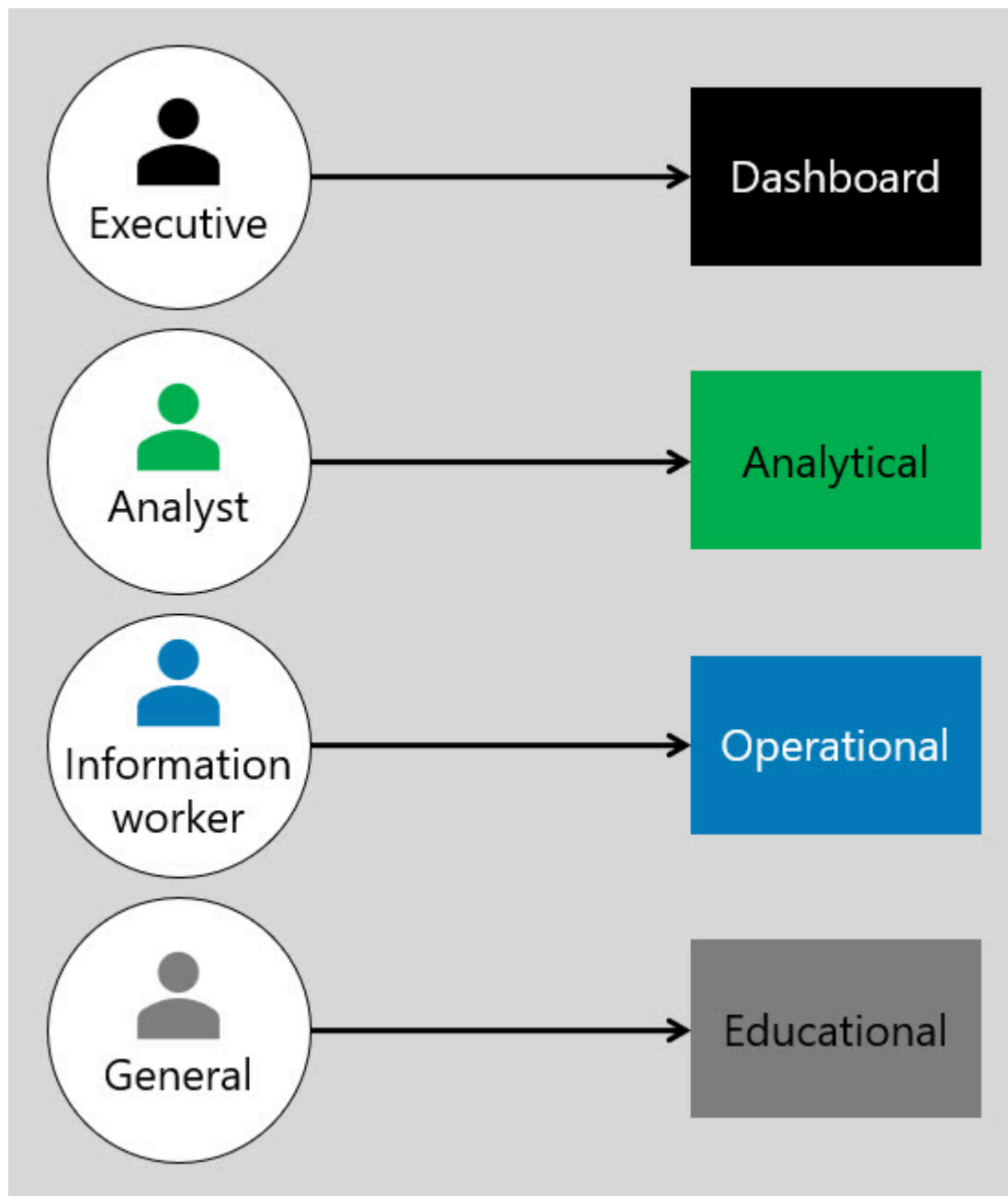
Determine report types

Completed

Generally, report design is classified by report type. Often, a direct mapping between the report audience and the report type exists. Meet audience needs through one, or possibly a combination, of four report types:

- Dashboard
- Analytical
- Operational
- Educational

Commonly, executives work with dashboards, analysts work with analytical reports, and information workers work with operational reports. General audiences might work with educational reports.



Usually each report type requires you to adopt a different approach to the user interface (UI) and user experience (UX) requirements. These requirements are described in more detail later in this module.

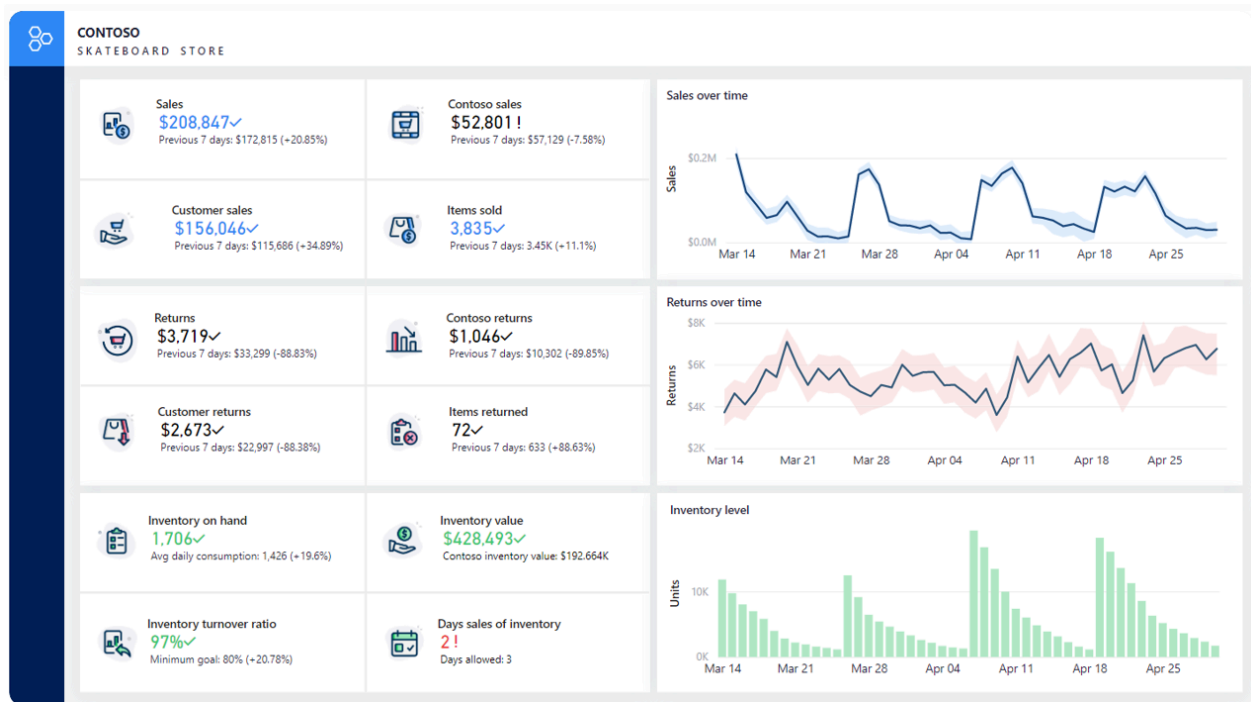
Dashboard

The primary goal of a *dashboard* is to monitor and interpret key facts as quickly as possible. User interactions are limited by insights that are highly curated toward the audience. Report visuals are focused, self-explanatory, and clearly labeled. A dashboard directly communicates the meaning behind the data to minimize misinterpretation or confusion.

A good example of a dashboard is an *executive dashboard*, which often presents high-level metrics that are displayed on a single page. Dashboards help answer performance-related questions such as

"How are we doing?" or "Are we there yet?"

At the Contoso Skateboard Store, a dashboard is a report that allows users to view several key performance indicator (KPI) values, targets, statuses, and trends.



Analytical report

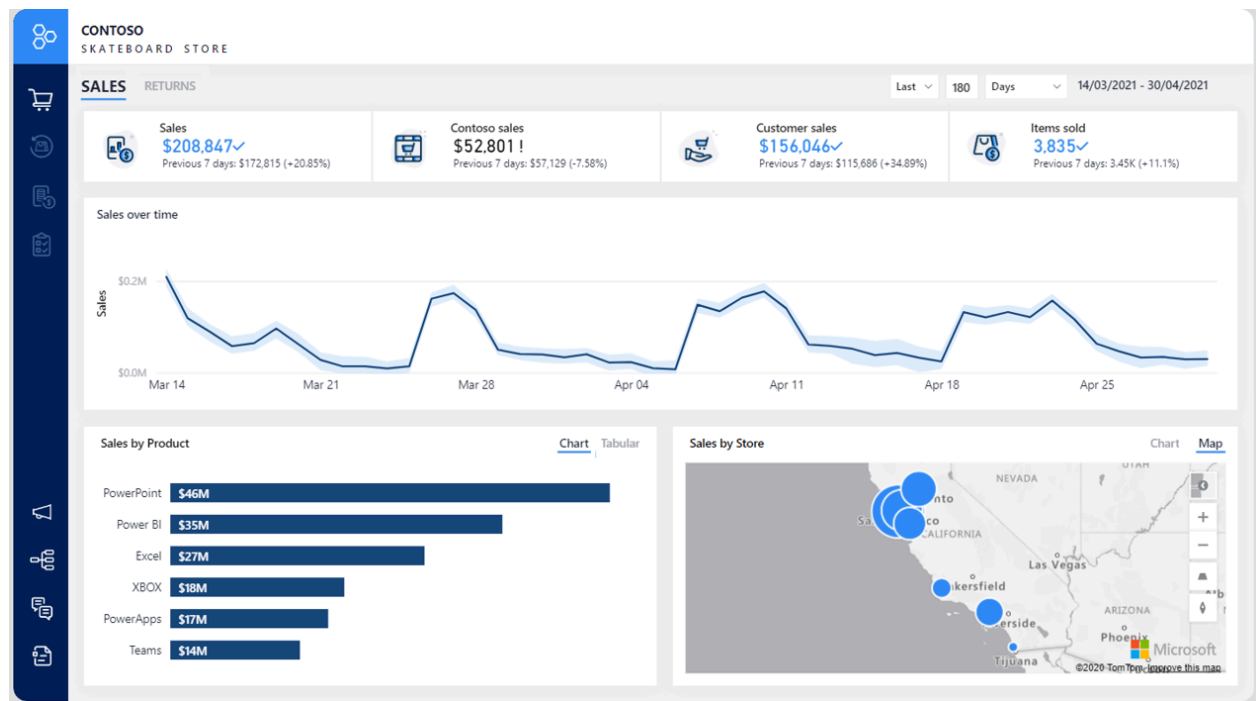
An *analytical report* is the most common type of report that can serve various report consumer use cases while providing a structured space for analysis.

The primary goal of an analytical report is to help report consumers discover answers to a broad array of questions by interacting with the report and its visuals. Analytical reports often have many slicers to filter report data, and they usually contain complex visuals that expose in-depth detail of the data.

Report pages are often expressly designed for interactivity with a focus on UX features. Multiple pathways are often provided for the report consumer to follow, which allows them to explore a topic of interest, share their findings, or return to where they started. Report consumers can remove layers and add context and detail by incorporating interactive features. Common interactive features include drill-down, drillthrough, and tooltips.

A good example of an analytical report is one that extends beyond the "How are we doing?" type of question to answer the "Why did that happen?" or "What might happen next?" types of question.

At the Contoso Skateboard Store, an example of an analytical report is their sales analysis report. It allows drilling into sales revenue from year, down to quarter, month, and day.



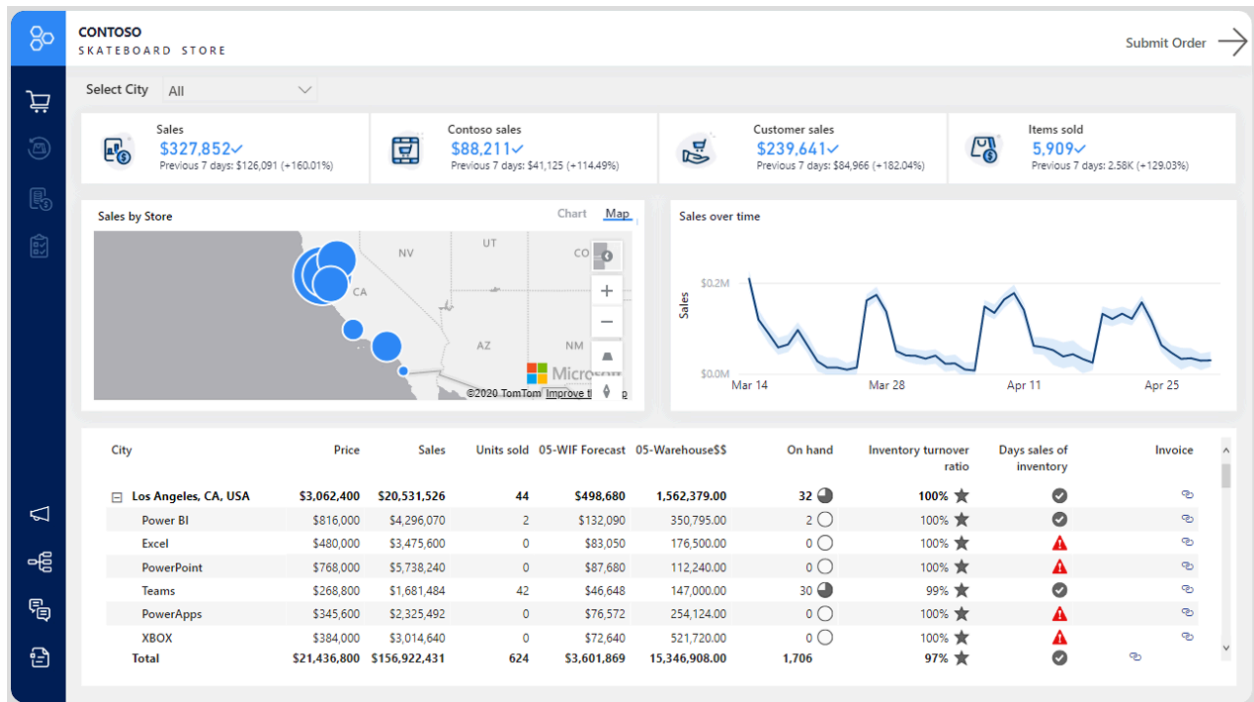
Operational report

An *operational report* is designed to give the report consumer the ability to monitor current or real-time data, make decisions, and act on those decisions. Operational reports can include buttons that allow the report consumer to navigate within the report and also beyond the report to perform actions in external systems. Frequently, operational reports serve as a hub for action that's used by report consumers as part of their daily activity and workload.

This type of report should minimize the number of analytical features to ensure that focus remains on the operation it's designed to serve. A streamlined user experience is the primary aim for this report type because excessive clicking or illogical flow can lead to high dissatisfaction and impede productivity.

A good example of an operational report is one that allows monitoring of a manufacturing production line. When an unexpected event arises, such as equipment malfunction, a button could allow workers to start a maintenance request.

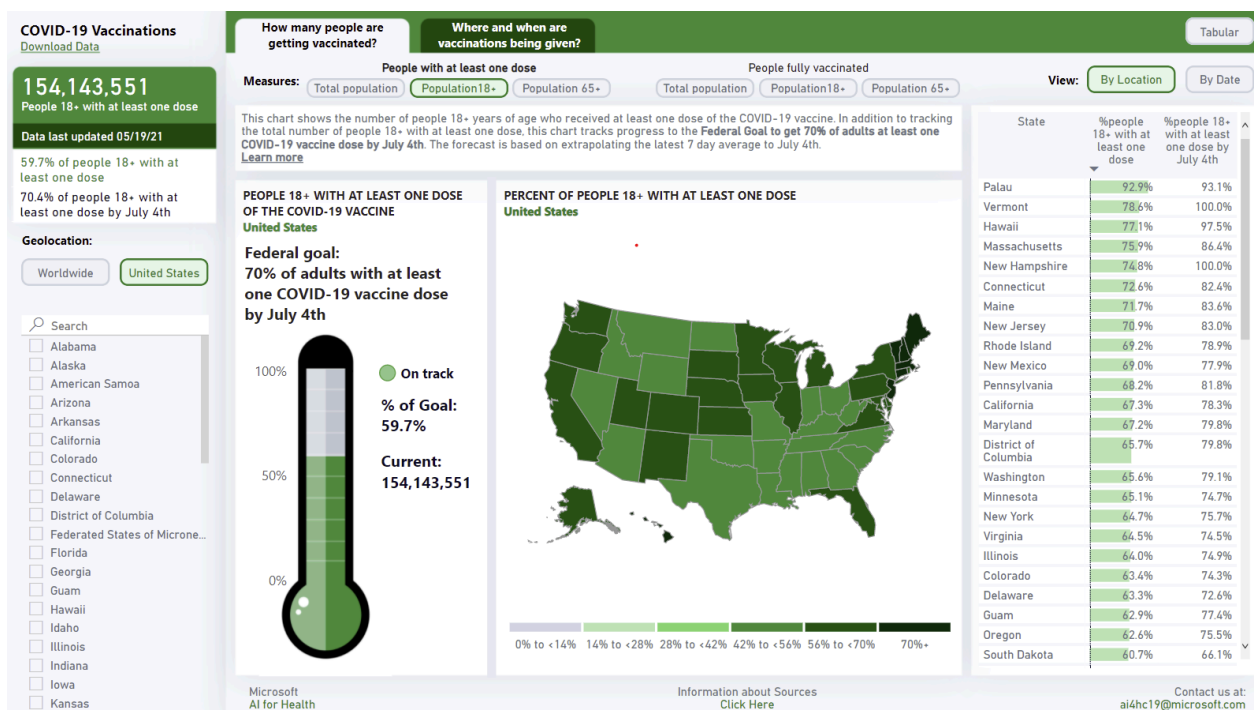
An example of an operational report at the Contoso Skateboard Store is their inventory report. It informs the report consumer of current stock levels and highlights low stock levels or back orders. It also includes a *Submit Order* button that allows users to create a purchase order.



Educational report

An *educational report* assumes that the report consumer is unfamiliar with the data or context. So it must provide clear narrative detail and guidance to help with understanding. This type of report is often used in journalism and by governments to disseminate information to large audiences that have varying levels of understanding of the subject.

A good example of an educational report is one that describes the rollout of COVID-19 vaccination progress and that can filter by the home geographic region of the report consumer.



4. Define user interface requirements

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/4-define-interface>

Define user interface requirements

Completed

UI requirements relate to how reports are consumed and to the appearance and behavior of reports. Aspects to consider include form factor, input method, style and theme, and accessibility.

Form factor

In the context of report design, form factor describes the size of the hardware that's used to open reports, and to page orientation (portrait or landscape).



Generally, today's computers are accompanied by large-sized monitors and multiple monitors. Large monitor screen sizes are ideal for viewing reports in web browsers, especially when they include several visuals or complex visuals by using landscape orientation.

Mobile devices, which are typically used when the report consumer is away from their desk, have a smaller form factor. Phones and tablets display content in portrait orientation by default. Smaller form factors demand a different design approach compared to reports that are designed for larger

form factors. Accordingly, when you design for a smaller form factor, strive for fewer and less complex visuals. Also, visuals should be large to help ease viewing and interactivity.

Some mobile devices can encompass augmented or mixed reality technologies, allowing head-mounted devices to display reports that are superimposed over the reality of the surroundings.



Occasionally, the design of a report that's intended for a large form factor can be refactored to create a mobile view. In this case, the mobile view might contain a subset of visuals from the full-sized report.

Input method

When you define UI requirements, also consider input methods that are supported by devices or applications.

While a computer has a keyboard and pointing device (mouse), mobile devices rely on common gestures, such as tap, double-tap, drag, pinch, spread, or press. Report consumers who use mobile devices can also use on-screen keyboards, voice control, or barcode and QR code readers. Augmented or mixed reality devices rely heavily on hand gestures or body movement.

Knowing how your report consumers interact with reports should influence your report designs. Consider the number of visuals that display together on the page, the complexity of visuals, spacing between visuals, and the use of interactive design elements such as tooltips, slicers, buttons, and filters.

When a report is embedded in an application, input can be received programmatically from the application. For example, when the application user opens a page to view history for a specific customer, a filter automatically passes to an embedded report to filter and display sales history for that customer.

Style and theme

UI requirements should also consider style and theme. Strive to design reports with a consistent and distinctive appearance that's determined by a deliberate theme.

The report theme should express your organizational branding or aim to complement it. At a minimum, the theme should include:

- A brand mark or logo symbol.
- A palette of colors that align to, or complement, organizational branding. The colors should also be sufficiently different so that, when applied to visuals, they provide appropriate contrast when they appear side by side.
- Text settings, including font selection, sizes, and color.

To manage style and theme changes effectively and efficiently, design reports that use images and themes that are stored in a central repository. This approach improves change management: Changes that are applied to the repository will automatically cascade through to reports.

Accessibility

UI requirements should also factor in accessibility. Reports need to communicate to the broadest audience possible. So you should consider how report consumers with no-to-low vision or other physical disabilities can fully experience the reports.

While you might not be aware of report users with accessibility issues today, it's a good idea to design for accessibility from the outset. Accessibility requirements can influence your report designs in terms of form factor, input method, and style and theme.

To support people with low or no vision, consider using:

- Clear and large-sized fonts.
- Well-spaced and large visuals.
- Clear and distinctive contrasting colors.
- Intuitive report navigation that can be understood by keyboard and screen readers.

Some physical disabilities can inhibit or prevent report consumers from fully interacting with reports in the way that you intend. When possible, ensure that you offer alternative paths for consumers to follow so they can achieve the interactive design outcomes. For example, add alt text to visuals for screen reader support, and set tab order of report elements for keyboard navigation.

5. Define user experience requirements

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/5-define-experience>

Define user experience requirements

Completed

UX requirements help ensure your Power BI reports meet the needs of your audience. Focusing on user experience makes your reports easier to use, more accessible, and more valuable for decision-making. Consider these key areas when designing your reports.

Enable interactive exploration

Interactivity lets users engage with your report and discover insights on their own. Features like drilling, navigation, and filtering empower users to answer their own questions and find the information most relevant to them. These options make your reports more dynamic and accessible to a wider audience.

- Drill up, drill down, and drill through to details.
- Navigation within the report or to other reports.
- Filters and slicers for visuals, pages, or the whole report.

Add drillthrough buttons so users can select a sales region and see detailed transactions for that area. Drillthrough helps users with different needs find the level of detail they want, improving accessibility for everyone.

Provide flexible data access

Flexible data access empowers users to engage with your reports in ways that suit their needs and abilities. Make your reports more inclusive and valuable to a broader audience by supporting different methods of exploring and retrieving information.

- Export data as Excel or CSV files.
- Ask questions using natural language (Q&A visual).
- Set up data alerts for key values (in Power BI service dashboards).
- Link to open webpages.
- Configure actions to open applications, write back data entry values, or start workflows.

The Q&A visual lets users use natural language like, "*Show me total sales by product,*" and instantly see a chart. This makes data accessible to users who might not be familiar with the report layout.

Support scenario analysis and customization

Scenario analysis and customization features let users test different situations and personalize their view of the data. What-if analysis and flexible layouts help users understand the effect of changes and make informed decisions. These features also make your reports more adaptable and accessible.

- What-if analysis with adjustable parameters.
- Page layouts that work across multiple pages and print well.
- Printing the report to a physical printer or as a PDF document.

Consider a what-if parameter for sales growth, which allows users to adjust the slider to see how changes in demand affect revenue, making the report more interactive and accessible for planning.

Automate delivery and encourage collaboration

Subscriptions and in-report conversations help users stay up to date and work together more effectively. These features support ongoing engagement and make your reports more valuable over time.

- Subscribing to the report so that it can be automatically delivered as a document on a scheduled basis.
- Collaboration capabilities that allow adding comments, feedback, or engaging in a conversation about the report.

As an example, report subscriptions so team members receive updated reports by email every Monday. Enable comments so users can discuss findings directly in the report, supporting accessible, collaborative decision-making.

6. Explore designs in a Power BI report

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/6-explore-designs>

Explore designs in a Power BI report

Completed

The following report allows you to explore different report design outcomes for the Contoso Skateboard Store. The report shows the three factors that you should consider: audience, form factor, and other requirements.

Select an option for each factor, and then select *Go!* to reveal a recommended report design.

Possible design recommendations that you can explore include:

- Executive > Browser > None
- Executive > Browser > Print-friendly
- Executive > Phone > None
- Executive > Tablet > None, and others

Tip

You can open the report in full-screen mode by selecting the double-headed arrow located in the lower-right corner. When you're ready to return to the module, select *Escape*.



7. Check your knowledge

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/7-check>

Check your knowledge

Completed

8. Summary

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-requirements/8-summary>

Summary

Completed

Scoping your report design requirements is imperative. A clear understanding of the business goals and your report audiences is essential in delivering an effective reporting solution. Other design aspects that you should consider include selecting the most fitting report type and factoring in user interface requirements.

Design Power BI reports

1. Introduction

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

Introduction

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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.

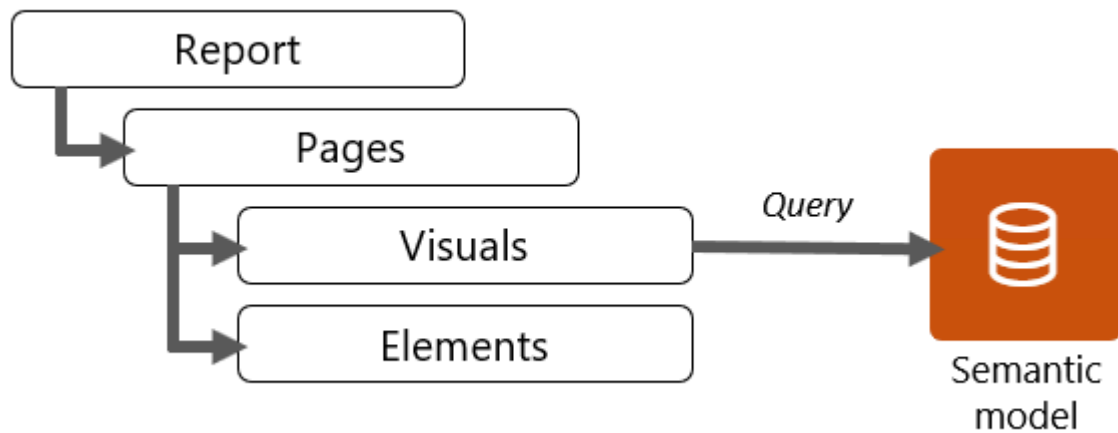
Note

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

Completed

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.

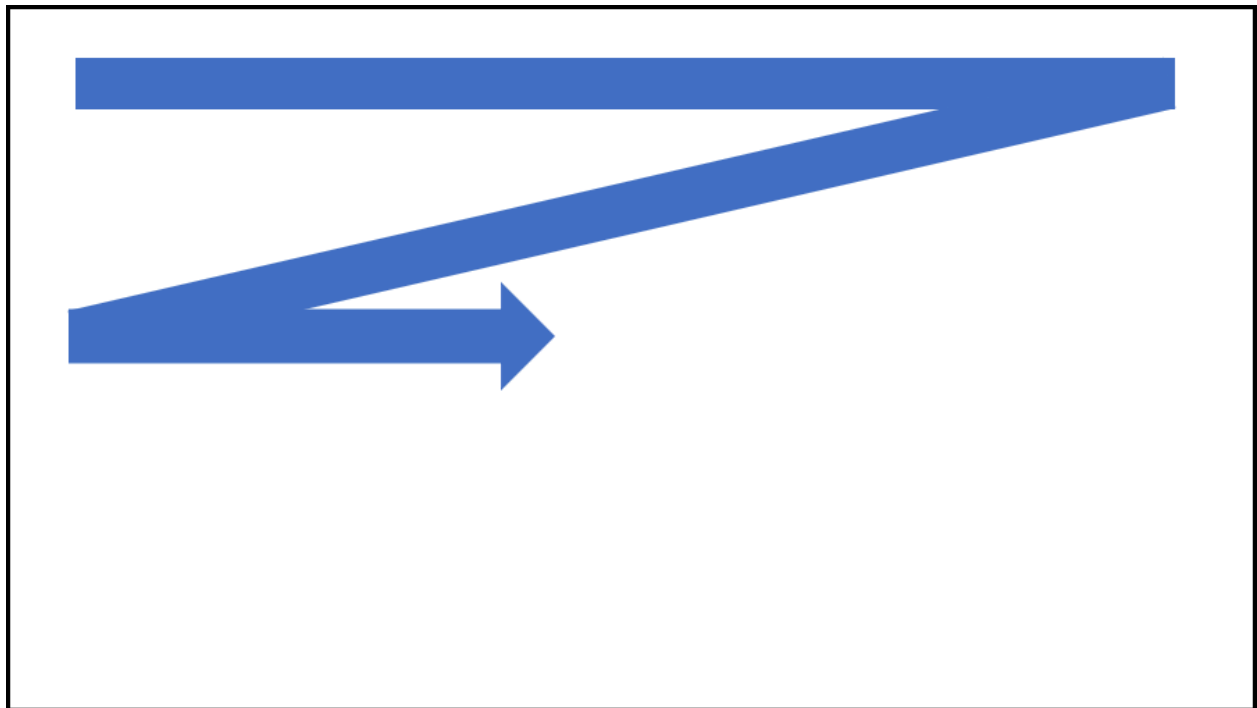
Tip

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.

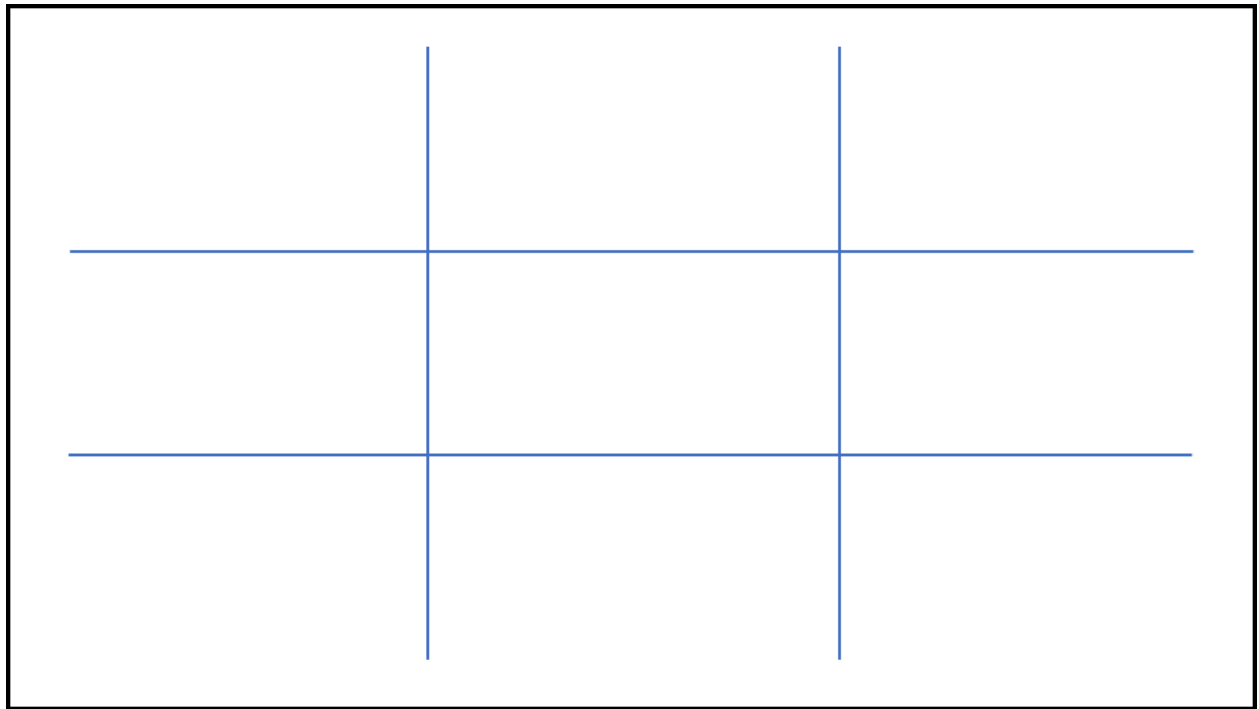


Note

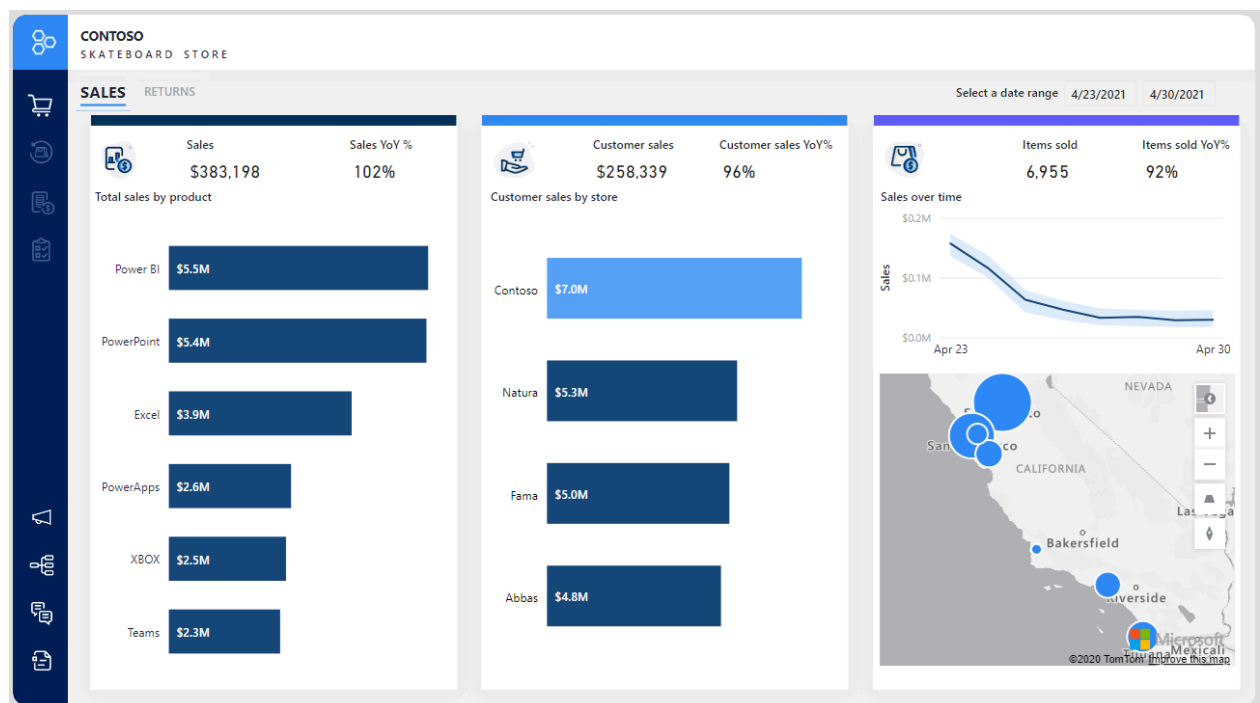
This placement applies to audiences who predominantly read left to right (LTR). When your audience reads right to left (RTL), as is the case with some written languages such as Arabic and Hebrew, place the most important information in the *upper-right* corner and arrange the report elements from *right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



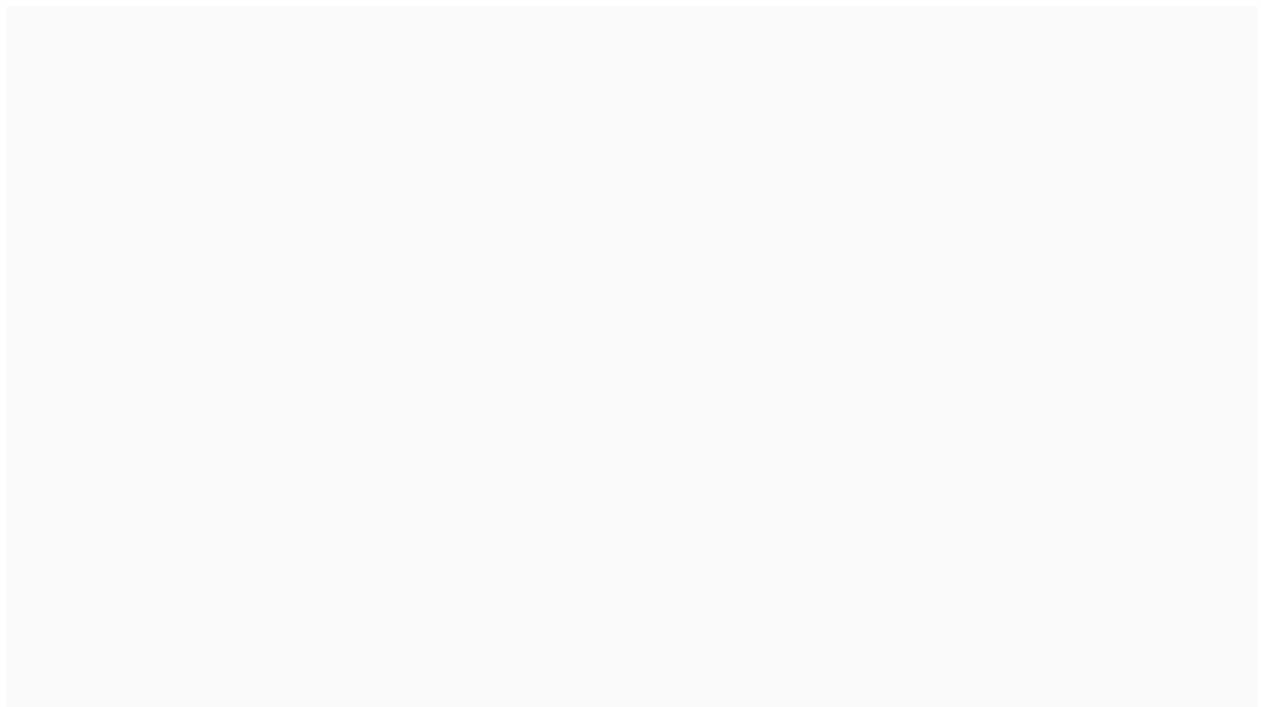
Balance

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

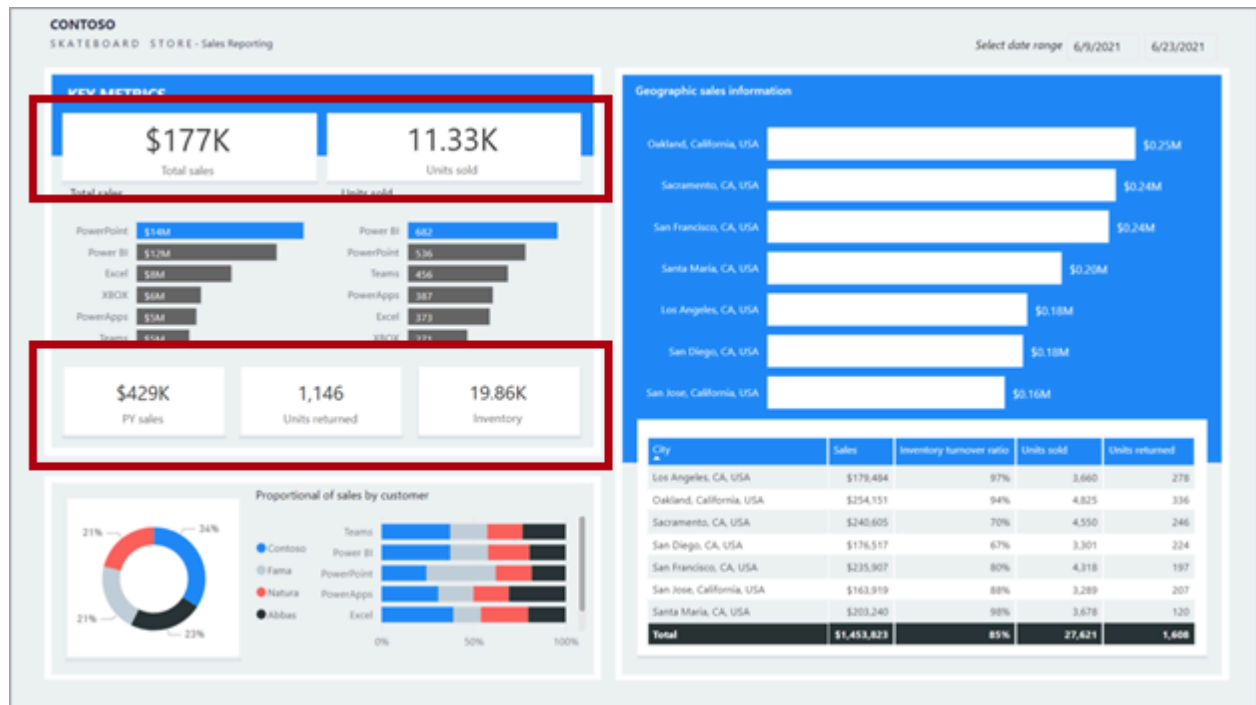
Contrast can be used to combine two opposing objects. The use of contrasting colors, fonts, font properties, or lines can emphasize important objects of the report design. Use this principle to direct report consumers to where they should look or which data visual they should interact with first.



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.

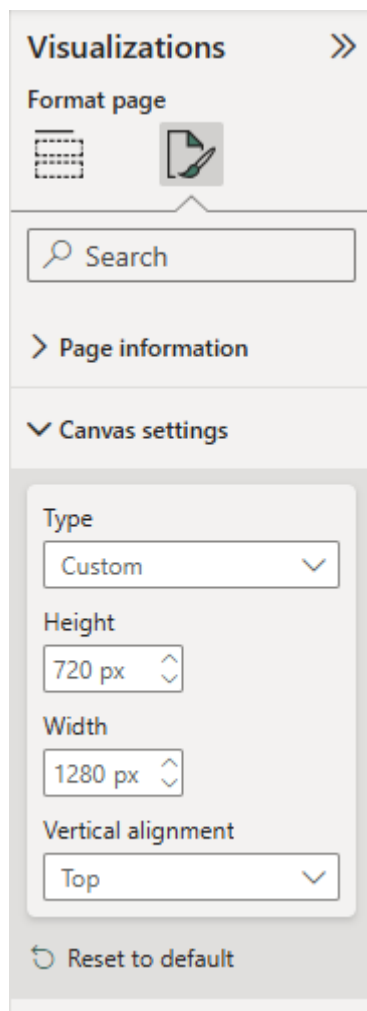
Consider using different space depth to visually separate sections of related objects. However, keep in mind that too much space can result in an unbalanced report layout and could draw the attention of the report consumer away from what matters. Moderation is key: Always strive to produce an evenly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

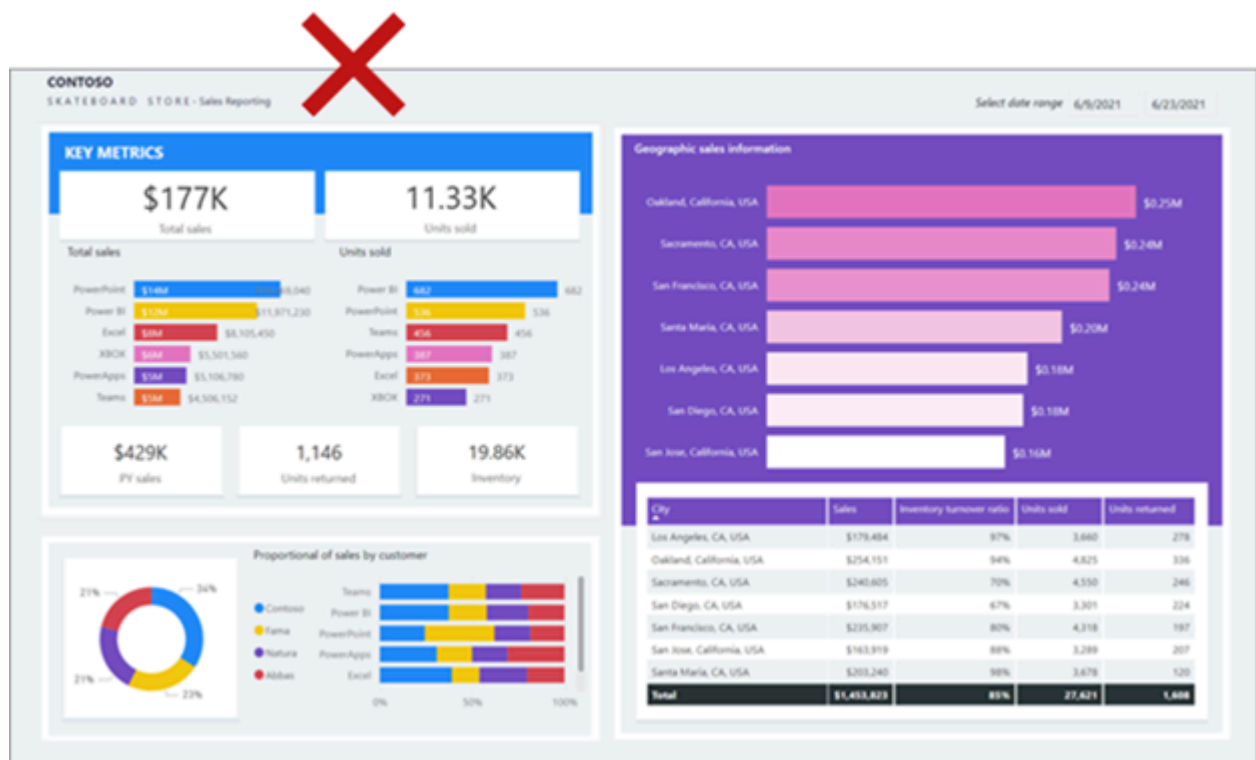
Use the alignment commands found on the **Format** ribbon, which can help you quickly and accurately align visuals.

Color

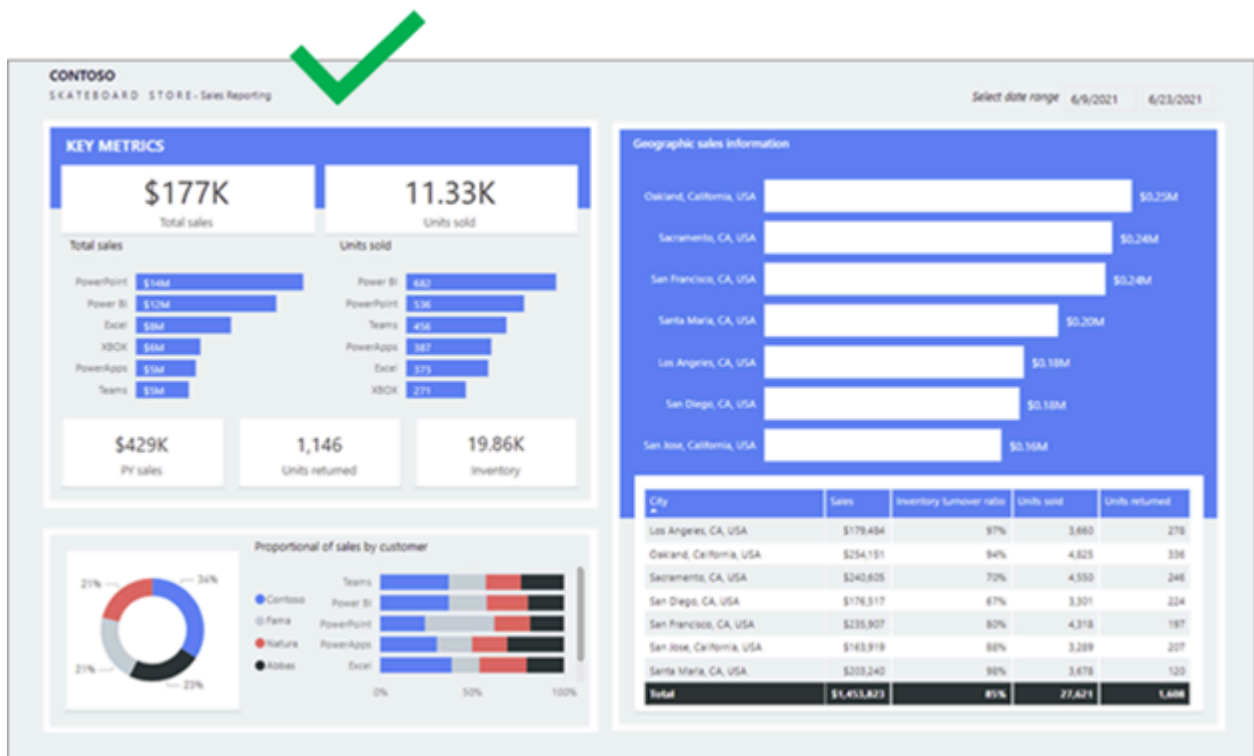
Use color sparingly and meaningfully because overuse can be distracting. Stick to a few softer colors as a base, possibly aligned with corporate colors. Softer colors ensure that the data is the focus in your report. Reserve the use of bolder colors to highlight exceptions.

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.



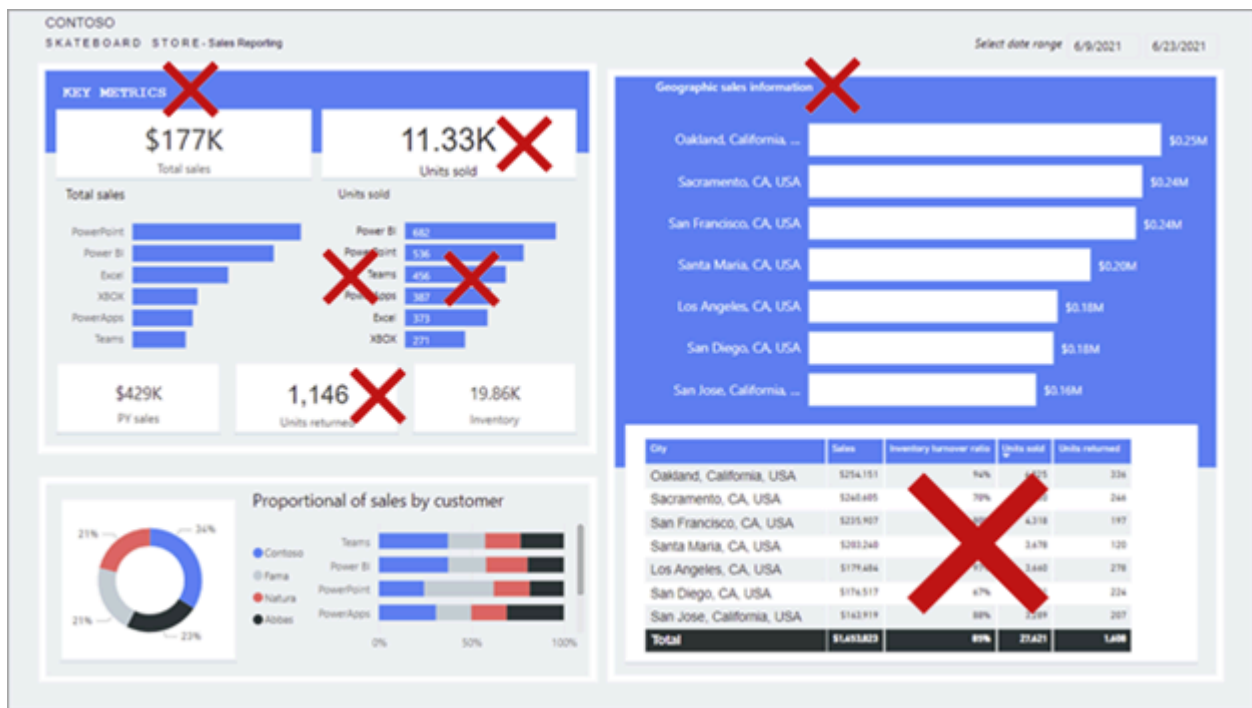
In the following image, the report layout is improved thanks to the use of better colors. The colors are now consistent and provide suitable contrast with the white data labels.



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>

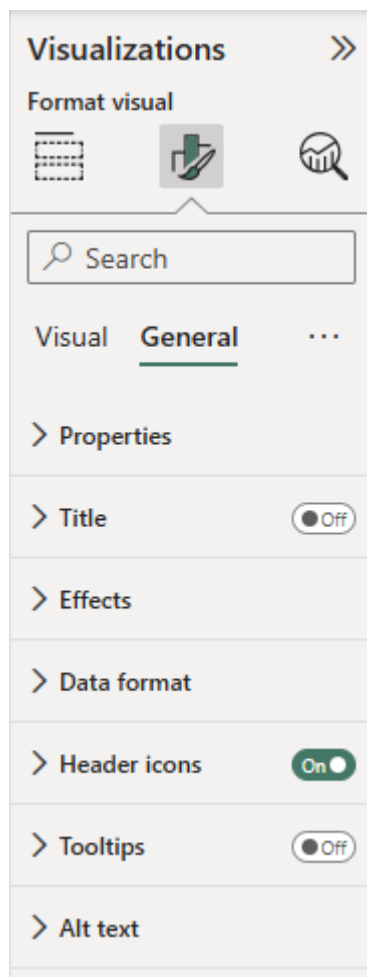
Use report objects

Completed

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

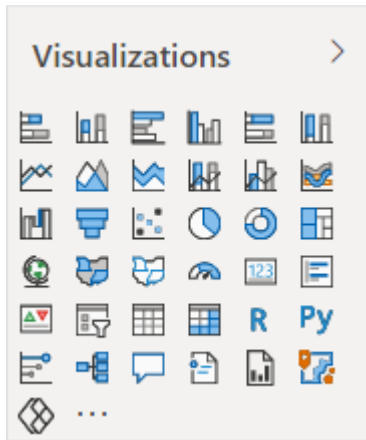
- **Visuals** - Visualizations of semantic model data.
- **Elements** - Provide visual interest but don't use semantic model data. Elements include text boxes, buttons, shapes, and images.

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](#).

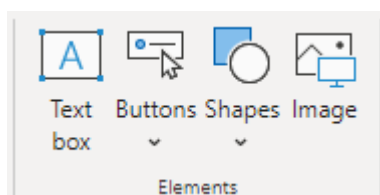
Additionally, this module doesn't intend to describe each visual format or analytic option.

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

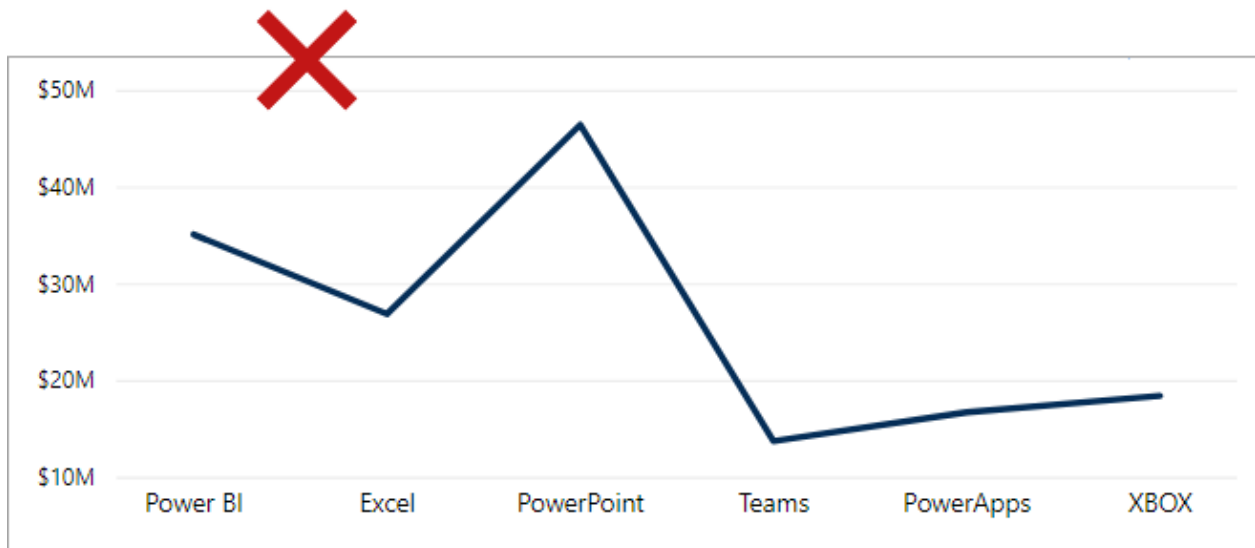
The primary goal of data visualization is to communicate information clearly and effectively to report consumers. Selecting the most effective visual type and layout to meet requirements is critical. Selecting the wrong visual type could make it difficult for report consumers to understand the data,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

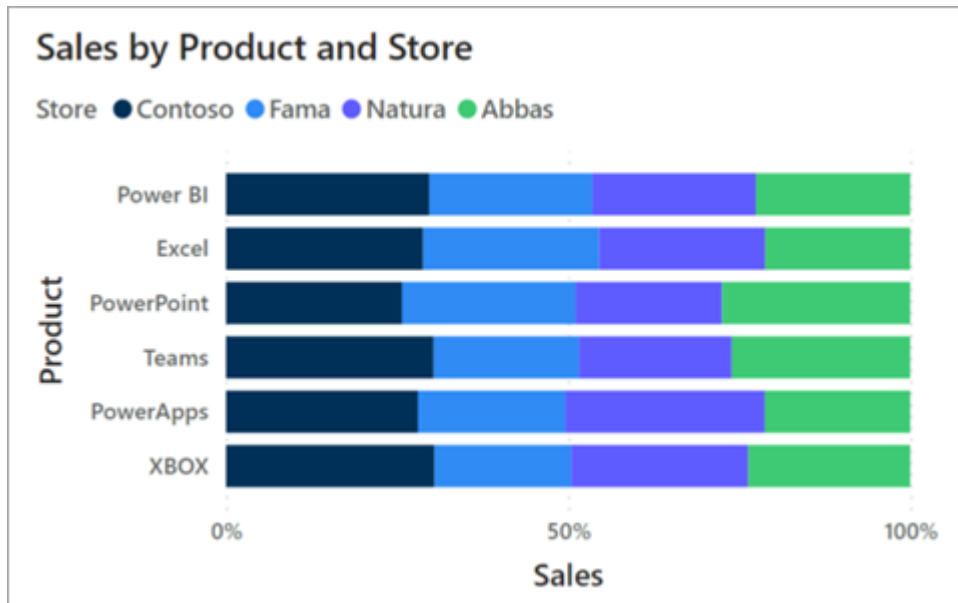
Proportional visuals

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.

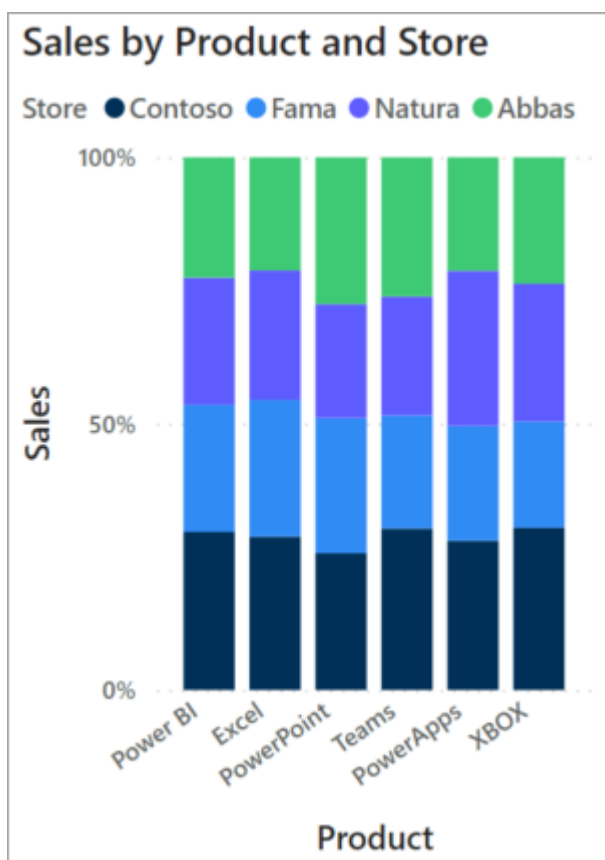
Note

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:

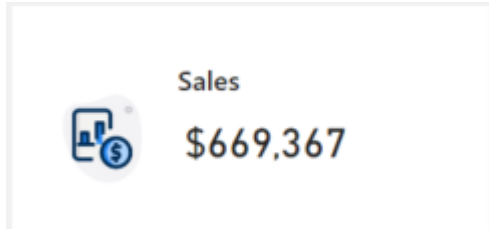
- 100% Stacked Column chart
- Funnel chart
- Treemap
- Pie chart

- 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

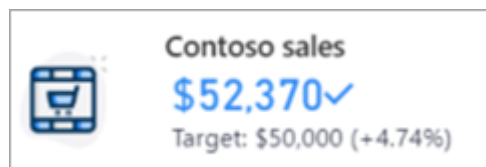
In the next example, a matrix visual displays inventory by product and by store. It uses conditional formatting to show indicators, which provide visual cues to understanding the data.

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.

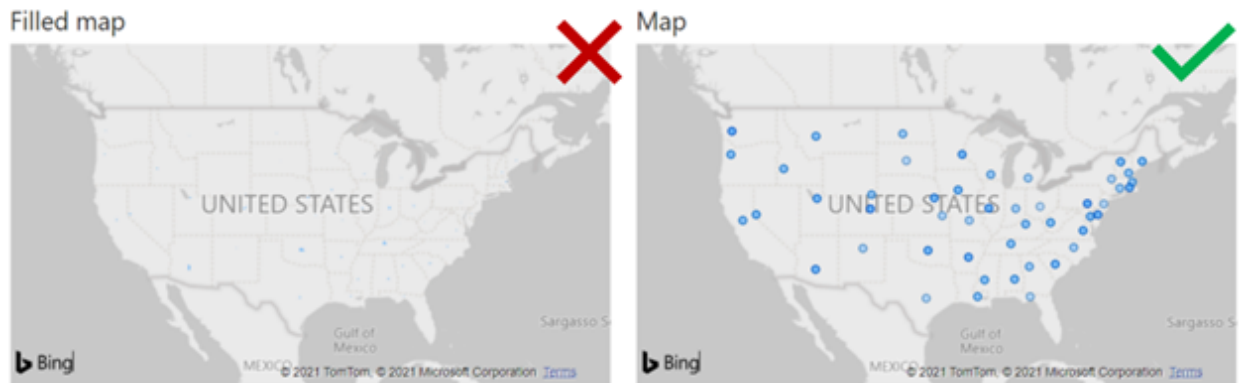
Other Power BI core visuals that you can use to show performance include:

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

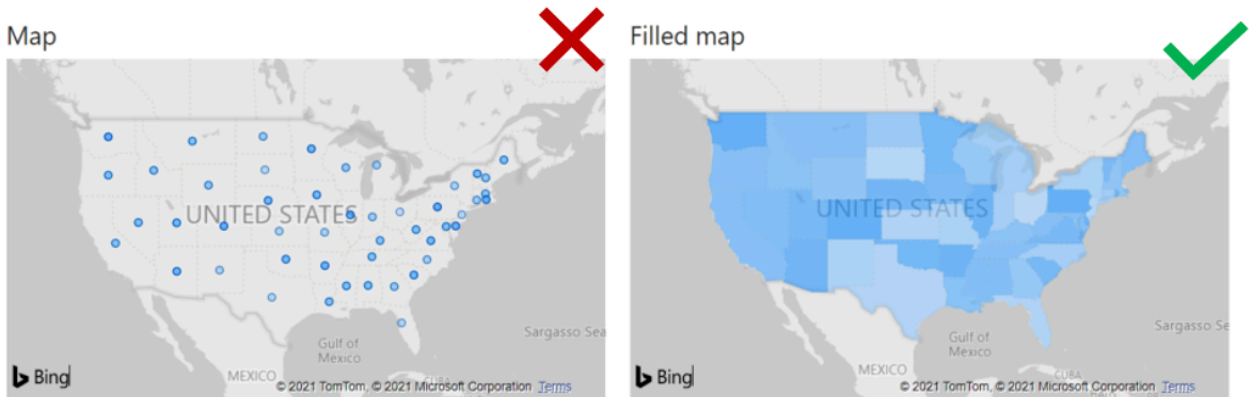
Geospatial visuals

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.

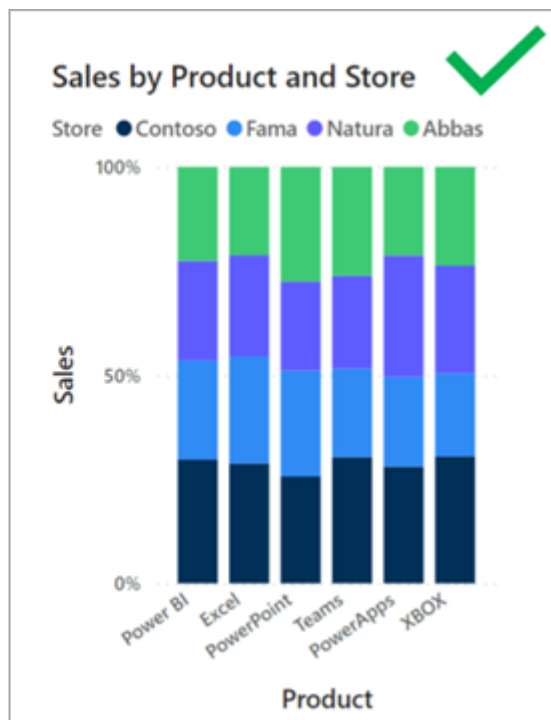
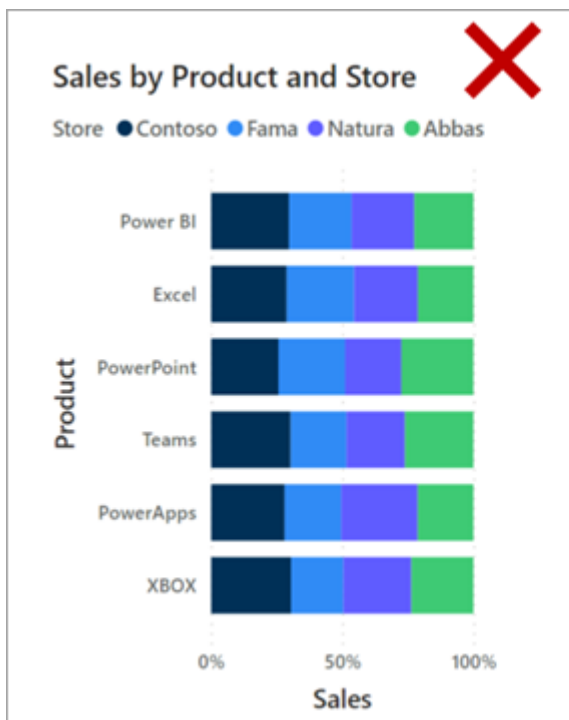
Visual layout

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

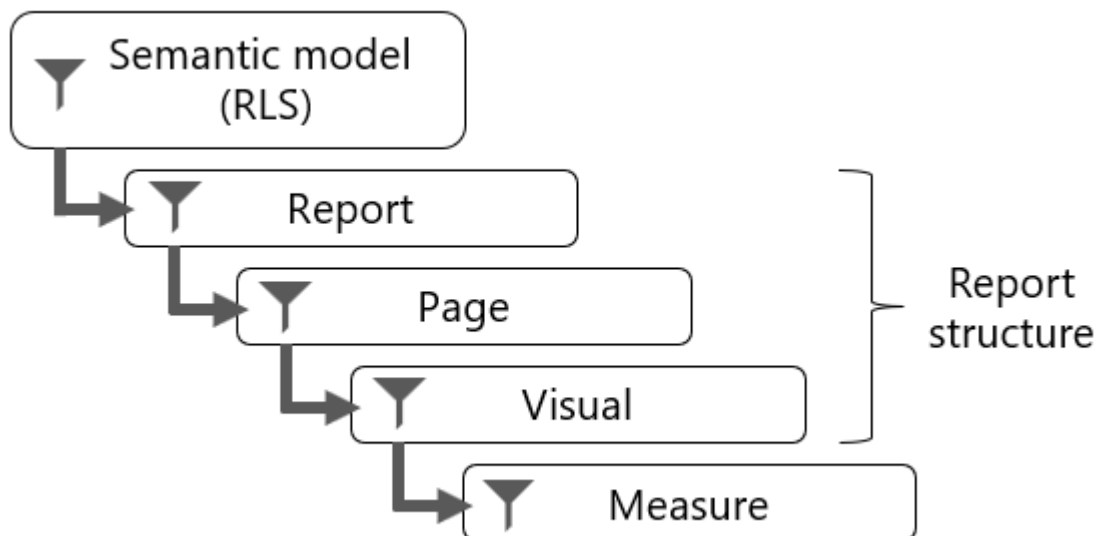
Report filtering is a complex topic because many techniques are available for filtering a report. However, with complexity comes control, allowing you to design reports that meet requirements and expectations. This unit introduces filtering capabilities and describes the techniques you can apply to your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

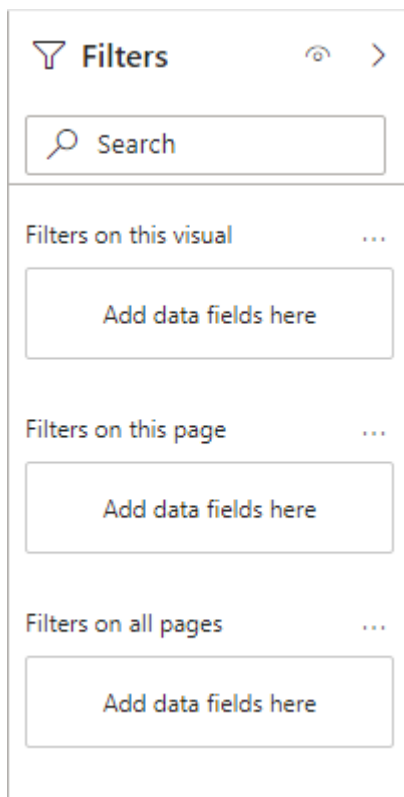
To gain a better understanding of report filtering, watch the following video that describes filter techniques at design time and consumption time.

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.

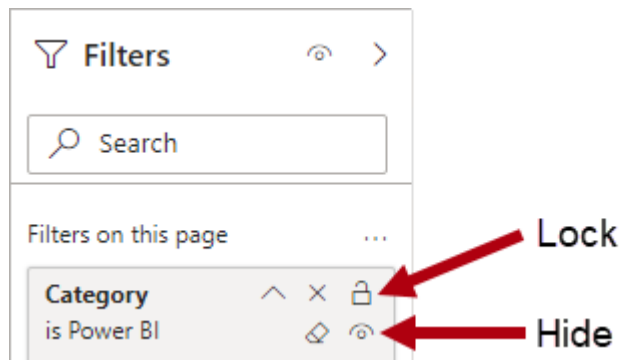
The *Filters on this visual* section defines visual-level filters. This section is only visible when one visual is in focus because visual-level filters apply only to a single visual; they add to any existing report-level and page-level filters. Continuing the previous example, if a visual-level filter 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.

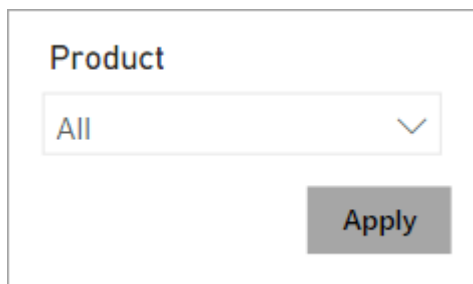
Other techniques

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:

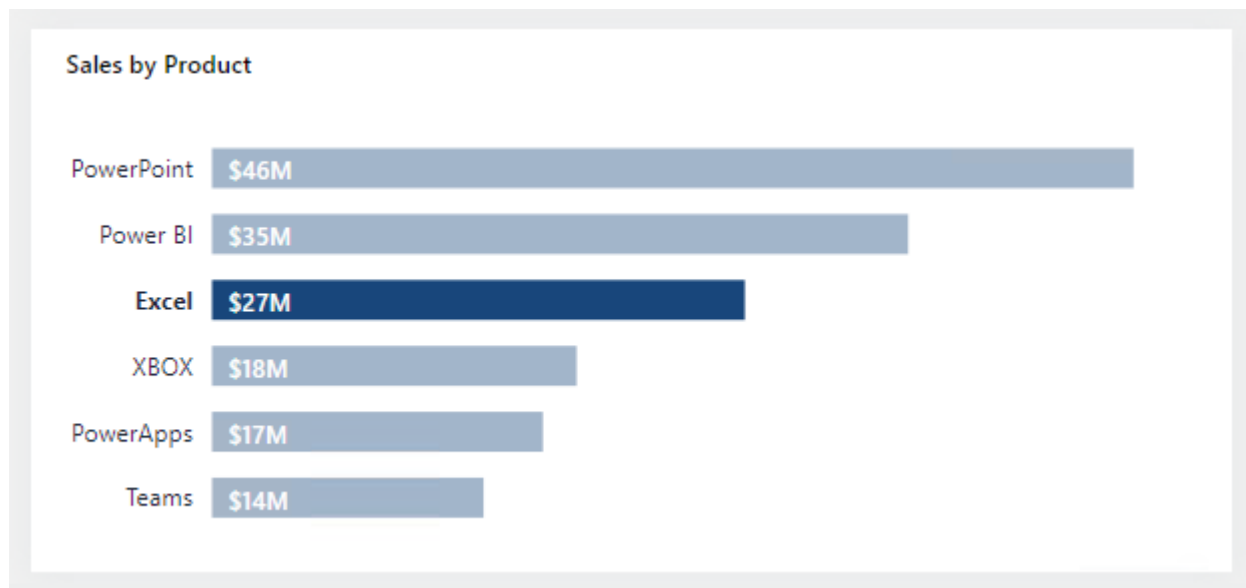
- You can place slicers anywhere on the report page to produce an intuitive layout.
- Slicers are highly configurable to achieve the required functionality and style.
- You can configure hierarchical slicers (based on a hierarchy or by using multiple fields that are sourced from the same table).
- They 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

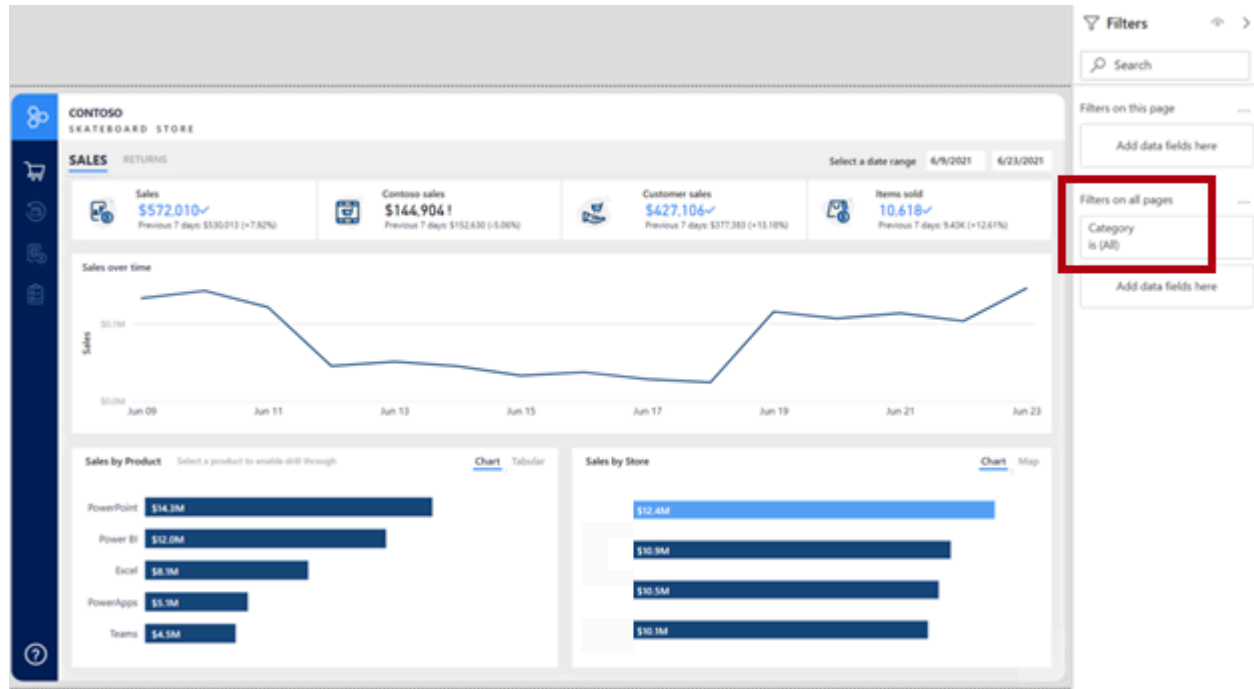
<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-reports/8-report-filters-case-study>

Case study - Configure report filters based on feedback

Completed

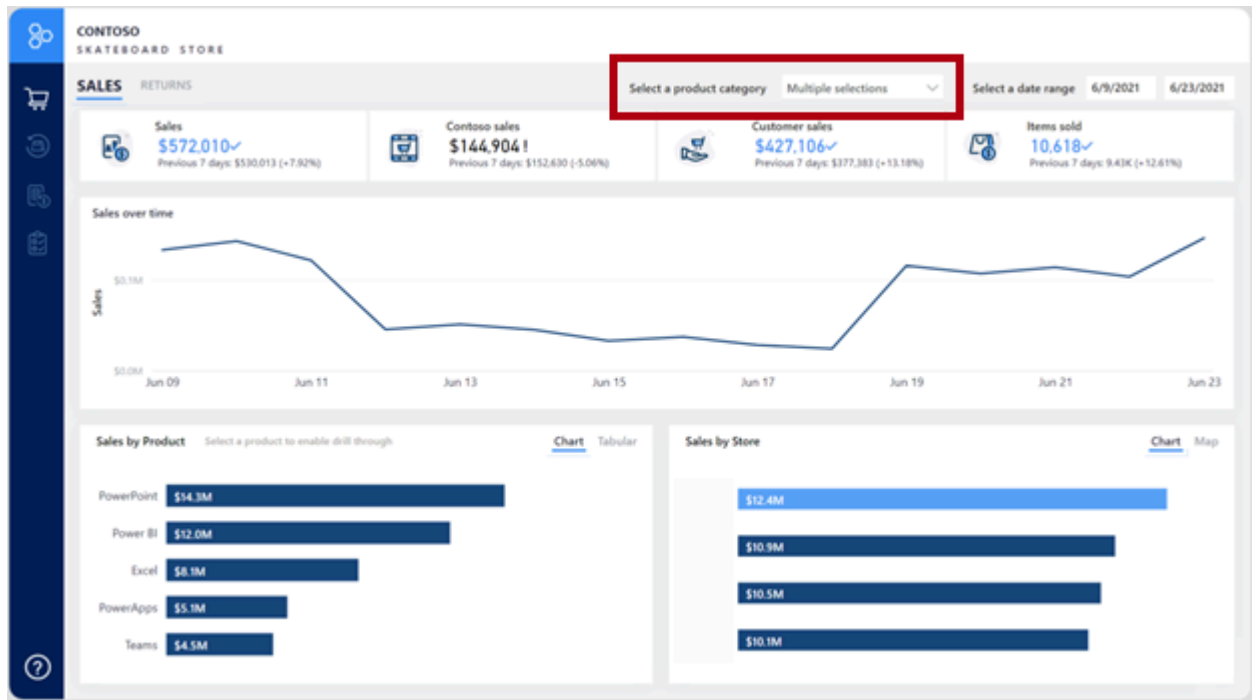
At the Contoso Skateboard Company, the sales director requested an update to the *Sales* analytic report. Specifically, the main report page, which focuses on sales for a specific date range, should also allow filtering by one or more product categories.

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.



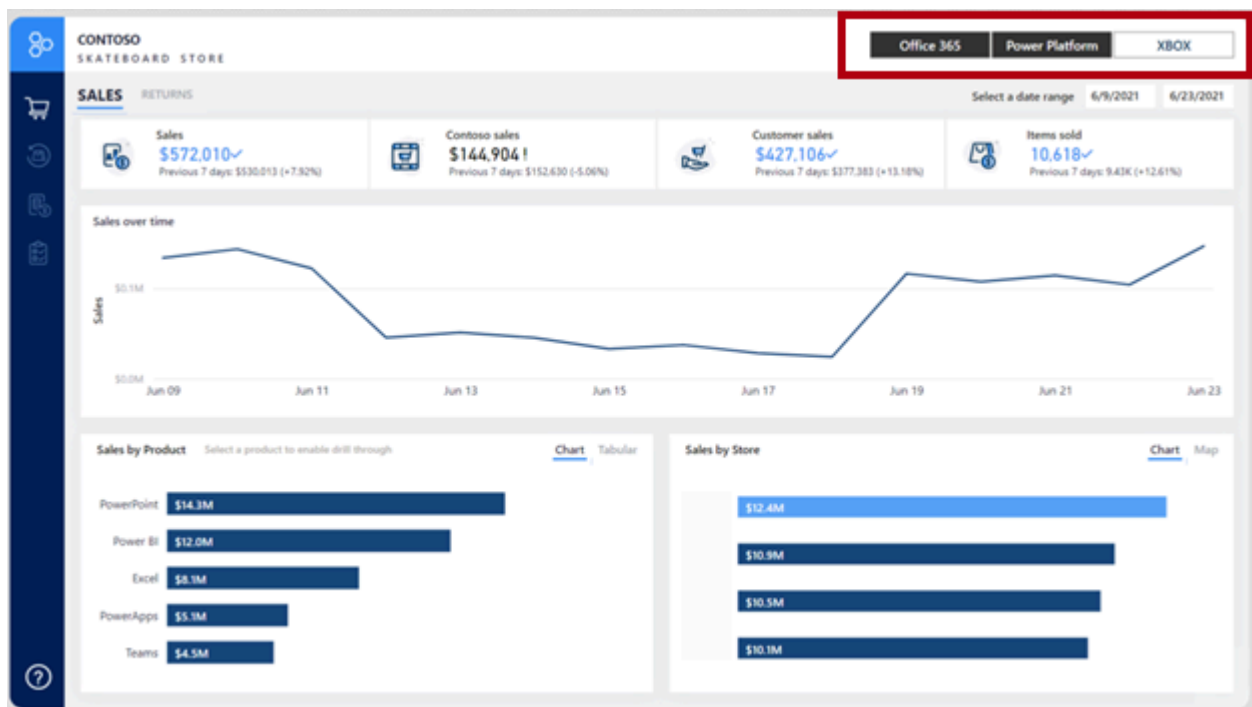
However, feedback from the sales director and salespeople wasn't positive. Some report consumers couldn't easily locate the filter. Others were frustrated that the filter wasn't visible on the report page so that they could see and understand the filter selection.

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

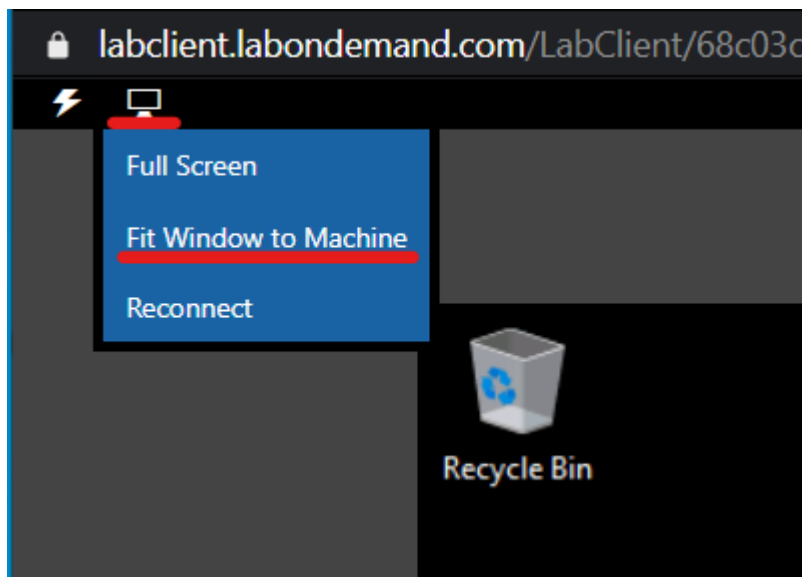
Before you start this lab (unless you are continuing from a previous lab), select **Launch lab** above.

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.

Enhance Power BI report designs for the user experience

1. Introduction

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

Introduction

Completed

Power BI reports support many features and capabilities that enable you to design compelling user experiences.

This module covers many topics. It begins by describing how to design reports that integrate a guided analytical experience, and how to apply techniques to highlight values. You'll then learn how to use buttons and bookmarks to create reports that behave like apps. Then, you learn how to add navigation capabilities to your report, and how and why to use visuals headers.

By the end of the module, you'll know how to polish your report designs with built-in assistance, how to troubleshoot and tune your reports should you encounter performance issues, and techniques to present an alternative report layout optimized for mobile access in portrait orientation.

All in, this module informs you of what's possible, and it shares concepts and tips to help you take your report designs to the next level.

2. Design reports to show details

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/1a-design-reports-show-details>

Design reports to show details

Completed

An analytical report layout can integrate a guided analytical experience. That way, the report design is aligned to the automatic and unconscious processes that take place when the report consumer looks at the report.

The guided analytical experience allows navigation between three levels:

- High-level metrics
- Supporting visuals
- Details, when required

You can show details by using four different techniques:

- Use drillable visuals
- Add tooltips
- Add drillthrough
- Embed paginated reports

For a demonstration of the four different techniques, watch the following video.

Use drillable visuals

The simplest way to show details is to use drillable visuals. The matrix visual is an excellent choice because it allows drilling on rows and/or columns. Therefore, by assigning hierarchies or multiple fields, report consumers can drill to the level of detail that they want. For example, the matrix rows could show years, and the report consumer could drill down to quarter, month, and date levels.

Current sales vs 'What if' analysis

City	Sales
Los Angeles, CA, USA	\$179,484
Power BI	\$45,050
Excel	\$35,850
PowerPoint	\$21,920
Teams	\$12,488
PowerApps	\$31,896
Total	\$1,453,823

Tip

Ensure that the visual size is sufficient for consumers to view drill-down details, or you can teach your report consumers how to use focus mode to enlarge the visual. Also, you can add buttons to provide a quick way for report consumers to drill to specific levels. This scenario is covered in Unit 4.

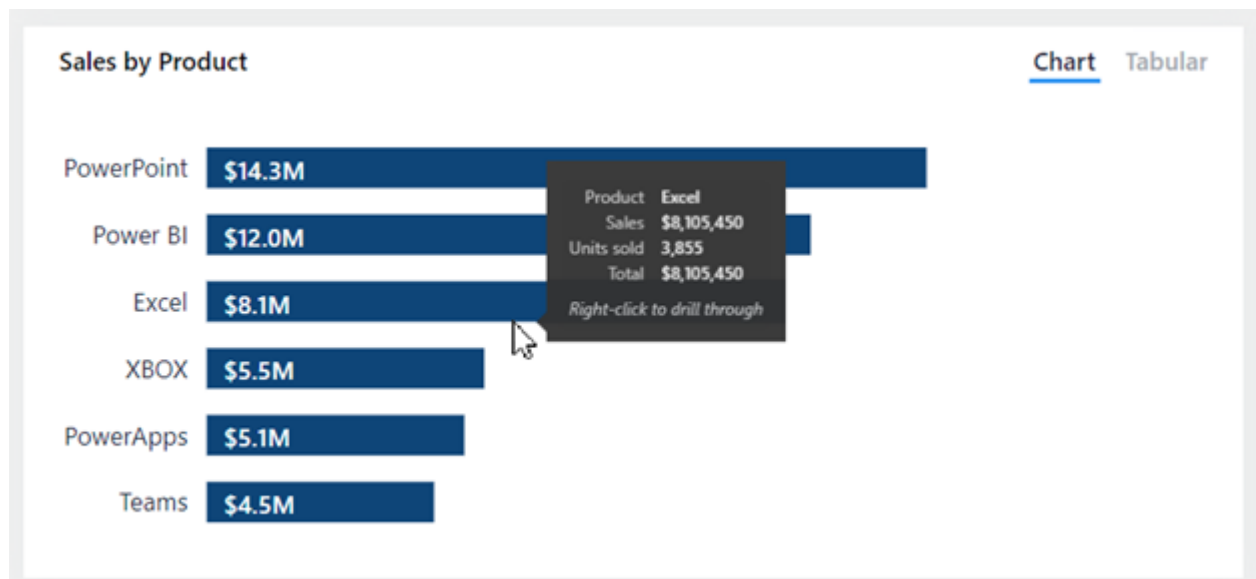
Add tooltips

Adding tooltips is a simple way to reveal details or provide supporting metrics. In Power BI service, tooltips appear when the report consumer hovers the cursor over an element of a report object. An element could be a column of a column chart or a bubble or region in a map. In a mobile app, tooltips appear when consumers are using the tap-and-hold gesture.

Power BI reports support two types of tooltips: visual and page.

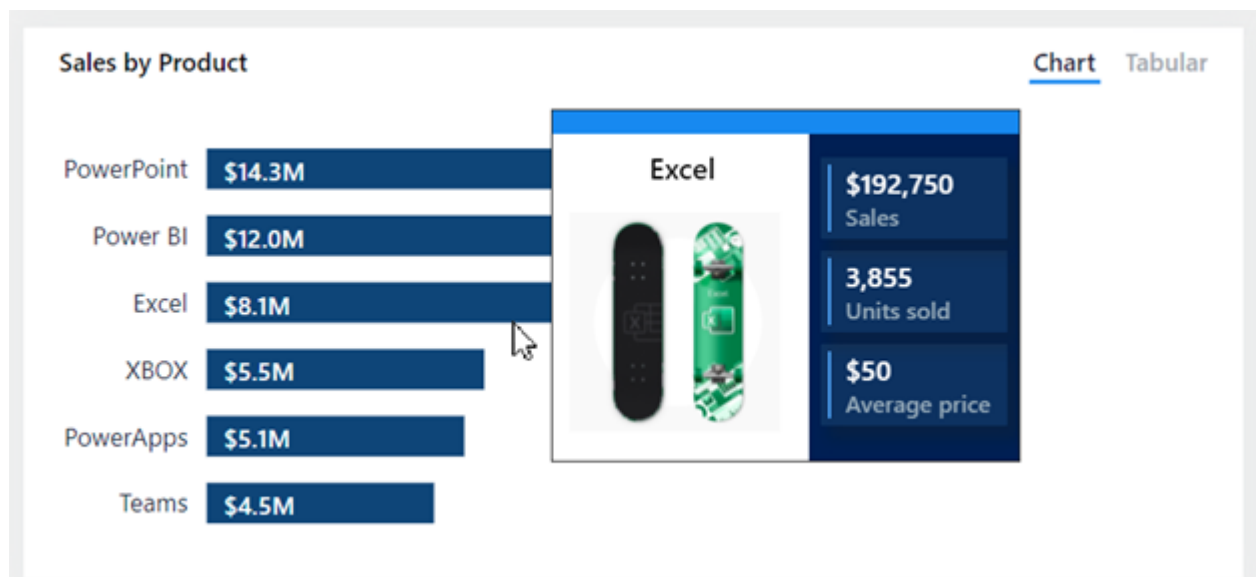
Visual tooltips

Many Power BI visuals include a **Tooltips** well. Fields that are added to this well are summarized in a tooltip. For example, a column chart visual that shows sales revenue by month could include order quantity as a tooltip. While the height of the column reveals the monthly revenue amount, when a report consumer hovers over the column, a tooltip describes the order quantity for that month.



Page tooltips

Page tooltips allow your report consumers to gain deeper insights quickly and efficiently from visuals. As its name suggests, a page tooltip is a report page that receives the filter context of the source element. In this way, they're closely related to drillthrough pages, with the difference being that the page tooltip overlays a small page of visuals.



You can associate page tooltips with different report objects, such as:

- **Visuals** - On a visual-by-visual basis, you can configure which visuals reveal your page tooltip. For each visual, you can have the visual reveal no tooltip, default to the visual tooltips (which is configured in a field well found in the **Visualizations** pane), or use a specific page tooltip.
- **Visual headers** - You can configure specific visuals to display a page tooltip. Your report users can reveal the page tooltip when they hover the cursor over the visual header icon. Make sure that you educate your users about this icon.

Note

Page tooltips don't support interactivity. If you want your report consumers to interact with the visuals, create a drillthrough page instead.

For more information, see [Extend visuals with report page tooltips](#).

Add drillthrough

Drillthrough navigates the report consumer to a different page, possibly in a different report, and it can show details. The main benefit of drillthrough is that you don't need to clutter a report page with details. Instead, the details are available when required.

A common use case for drillthrough is to allow report consumers to achieve the following flow:

1. View a report page.
2. Identify a visual element to analyze in depth.
3. Right-click the visual element to drill through.
4. Perform complimentary analysis.
5. Return to the source report page.

To enable drillthrough, you can create a report page that provides details. This design approach allows consumers to view supporting transactions and only when needed.

Note

Report consumers might not know if a visual supports drillthrough. To promote visibility, you can add a button that performs drillthrough.

For more information, see [Set up drillthrough in Power BI reports](#).

Embed paginated reports

Use the **Paginated report** visual to embed a Power BI paginated report in your report. Paginated reports can connect directly to source databases, providing you with the ability to present transaction-level detail that isn't stored in the Power BI semantic model.

You can map fields from your Power BI semantic model to report parameter values of your paginated report visual, allowing report consumers to cross filter the paginated report. This way, it can behave like a drillthrough page.

Tip

In the visual format options, you can enable the toolbar so that report consumers can use the export command. This command can export the paginated report in many different formats,

including Microsoft Excel, PDF, Accessible PDF, CSV, PowerPoint, Microsoft Word, MHTML, and XML. Also, unlike the 150,000-row limitation imposed for Power BI reports, paginated reports can export up to 1,000,000 rows to Excel while retaining all formatting of the paginated report.

For more information, see [When to use paginated reports in Power BI](#).

For more information, see [Create and use the paginated report visual](#).

3. Design reports to highlight values

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

Design reports to highlight values

Completed

Highlighting values in reports helps to quickly communicate important and relevant facts about data. Power BI supports several techniques to highlight values:

- Conditional formatting
- Overlaid analytics
- Anomaly detection
- Specialized visuals

Conditional formatting

You can use conditional formatting to format table and matrix visuals. With this approach, you can apply rules to highlight specific cells by using:

- Background color
- Font color
- Data bars
- Icons

The following image shows an example of a matrix visual with icons. The icons highlight the **On hand** values.

Inventory on hand breakdown

City	Units sold	On hand
 Los Angeles, CA, USA	394	850 
 Oakland, California, USA	226	459 
 Sacramento, CA, USA	527	2,780 
 San Diego, CA, USA	412	1,550 
 San Francisco, CA, USA	733	1,697 
 San Jose, California, USA	324	1,056 
Total	2705	8,536

Note

Consider that report consumers might have blindness or have low vision. Take care not to highlight by using only color. Instead, consider using icons that use shape and color to communicate status.

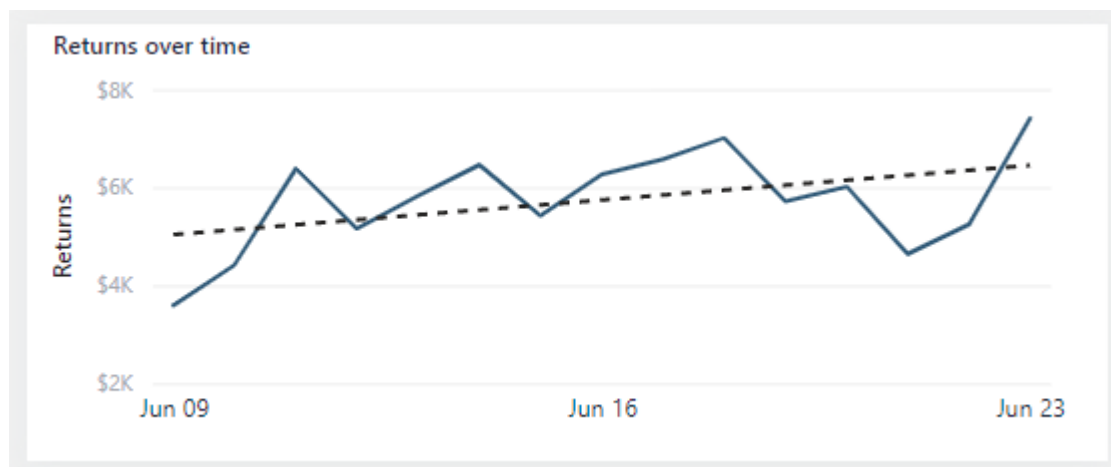
For more information, see [Use conditional formatting in tables](#).

Overlaid analytics

You can also overlay analytics to highlight values. Certain visuals, like the line chart visual, allow you to add analytic options. Options include trend lines, constant lines, minimum or maximum lines, and many others.



The following image is an example of a trend line. The upward gradient of the trend line clearly indicates that returns are increasing over time.

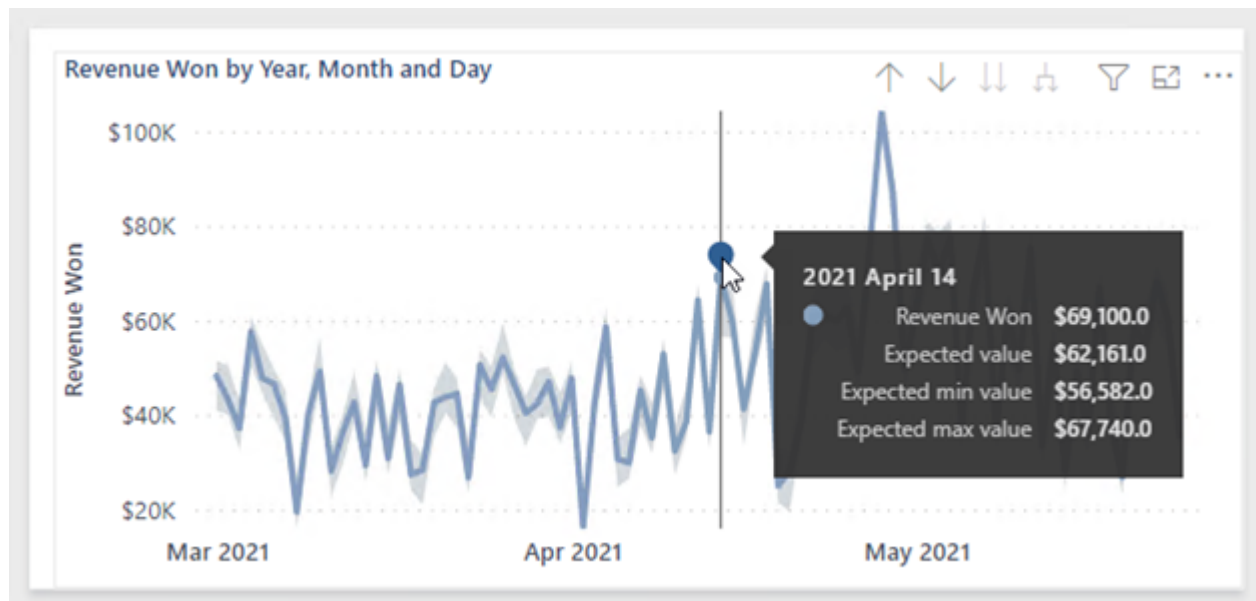


For more information, see [Use the Analytics pane in Power BI Desktop](#).

Anomaly detection

When a time series (date field) is on the X-axis, two other analytic options are available. These options use AI to produce a forecast or find anomalies. The anomaly detection feature can help you highlight exceptional values.

The following example shows a line chart visual. Power BI detected an anomaly on a particular date and marked it with a shape. When the report consumer hovers the cursor over the shape, a tooltip appears that describes expected values.



Select the anomaly shape to open the **Anomalies** pane, which lists a series of visuals that provide further possible explanations.

For more information, see [Anomaly detection](#).

Specialized visuals

Some specialized visuals can help to highlight values in your reports; specifically, the **Key influencers** visual and the **Decomposition Tree** visual.

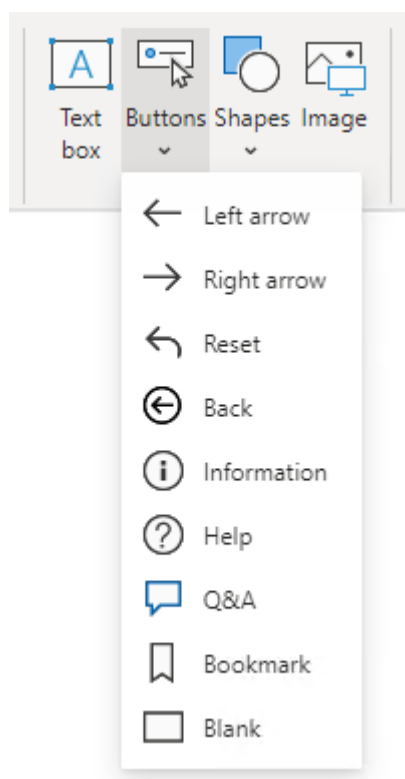
4. Design reports that behave like apps

Design reports that behave like apps

Completed

The button element can take your Power BI reports to the next level by making them behave like an app. Buttons support six different actions that take effect when the button is selected.

When you're inserting a button, many preconfigured buttons are available for you to choose from. Preconfigured buttons include icons and preconfigured actions, such as the Back button, Q&A button, and Bookmark button.



Note

You can assign any type of action to images and shapes so that these elements can behave like buttons.

The **Back** action navigates to the previous page. It's useful in drillthrough scenarios, allowing the report consumer to quickly return to where they drilled from.

The **Bookmark** action activates a selected bookmark. Bookmarks can turn a Power BI report into a guided analytical experience, maximize available page real estate, and provide user-friendly

interactions. Bookmarks are covered in the next unit.

The **Drillthrough** action is assigned a target drillthrough destination page. The button remains disabled until drillthrough becomes a valid action, which is the case when you're interacting with a visual that can navigate to the drillthrough page. When the Drillthrough action is selected, Power BI navigates to the drillthrough page, propagating appropriate filters.

The **Page navigation** action directs the report consumer to a specific report page. The page can be a specific page that is assigned at design time or a measure that returns the page name. Using a measure allows Power BI to dynamically determine the page based on the filter context.

Note

A measure is a model object that summarizes data. When assigned to the **Page navigation** action, measure formulas, which are written in Data Analysis Expressions (DAX), must return a text value that represents the page name.

The **Q&A** action opens a pop-up window that allows the report consumer to explore data by using intuitive, natural language capabilities and receive answers as data visualizations.

For more information, see [Q&A for Power BI business users](#).

Tip

Unlike the **Q&A** visual, a button that's assigned the **Q&A** action doesn't occupy significant space on the report page.

The **Web URL** action opens the URL by using the default web browser. Like the **Page navigation** action, this action can be a specific URL or one that is returned by a measure. The measure can produce a URL that appends filter context to the query string. For example, if the report consumer filters the page by a single customer, the measure can return a URL to an external system that includes the Customer Key in the query string.

Tip

Consider using the **Web URL** action to create a bridge to resources that are commonly referenced in tandem. **Web URL** actions can be highly effective in prompting direct action or workflows in external systems.

5. Work with bookmarks

Work with bookmarks

Completed

Bookmarks are a powerful way to turn a Power BI report into a guided analytical experience. Bookmarks can also help maximize available page space and provide user-friendly interactions. The possibilities are nearly endless, spanning from simple outcomes, such as resetting filters, to more complex behaviors that swap visuals or navigate visual depth.

Commonly, you add buttons to a report design and configure their actions to apply a bookmark. Shapes and images can also apply bookmarks.

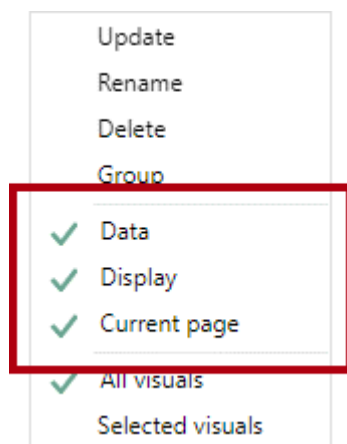
To understand what you can achieve with bookmarks, you need to know how to configure them. You can configure the state that they capture and the scope of visuals that they affect.

Tip

To ensure that all actions produce the intended result, be as prescriptive as possible when deciding on the enabled states and scope.

Bookmark state

Bookmarks capture different state, relating to data, display, and the current page. By default, a new bookmark captures all state types, but you can decide to disable any of them.



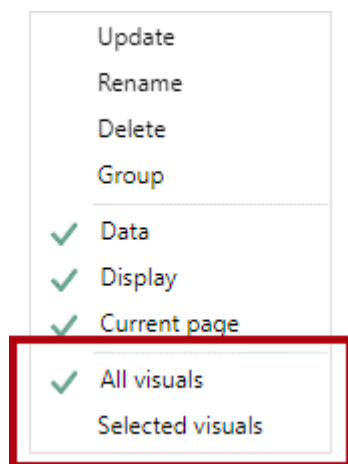
The **Data** state captures anything that impacts the queries that Power BI sends to the semantic model. For example, if a slicer is included in the scope of the bookmark, the **Data** state retains the applied slicer items when the bookmark was created (or last updated). It also captures sort order and the drill depth of a visual because the query is impacted.

The **Display** state is related to the visibility of a report object. Objects consist of visuals and also elements like text boxes, buttons, shapes, and images. By using the **Selection** pane, you can hide or unhide objects and groups of objects. Additionally, you can swap visuals on a report page by creating bookmarks that capture hidden and unhidden objects.

The **Current page** state determines whether the bookmark directs the report consumer to the bookmarked page or apply the current page. Disabling the **Current page** state is rare, but you should consider some creative use cases. For example, on a page tooltip, a bookmark can change the visuals without navigating from the page that the report consumer selected.

Bookmark scope

Bookmarks can apply to all page visuals or specific visuals that you select.



The **All visuals** scope is turned on by default, meaning that the bookmark applies to all report objects, even if hidden.

The **Selected visuals** scope targets only those visuals that are selected when the bookmark was updated.

Tip

Press the **Ctrl** key to select multiple visuals. The simplest way to select multiple visuals is to use the **Selection** pane. Also, when you're creating a selected visuals bookmark that shows/hides several objects, create a group of those objects and configure visibility for the group. That way, you can add or remove objects from the group without the need to update the bookmark.

Setting **Bookmark** scope is best described with an example. For a demonstration on the use of the **Selected visuals** scope, watch the following video.

Bookmark examples

By combining different bookmark states and scopes, you can create intuitive experiences.

Note

Make sure you include bookmark requirements in all design decisions. For optimal experiences, you should create bookmarks at the end of report development after you've added all report elements. This approach helps you avoid the complex and time-consuming updating of bookmarks when you're adding new elements.

The following sections highlight common use cases for bookmarks.

Reset slicers

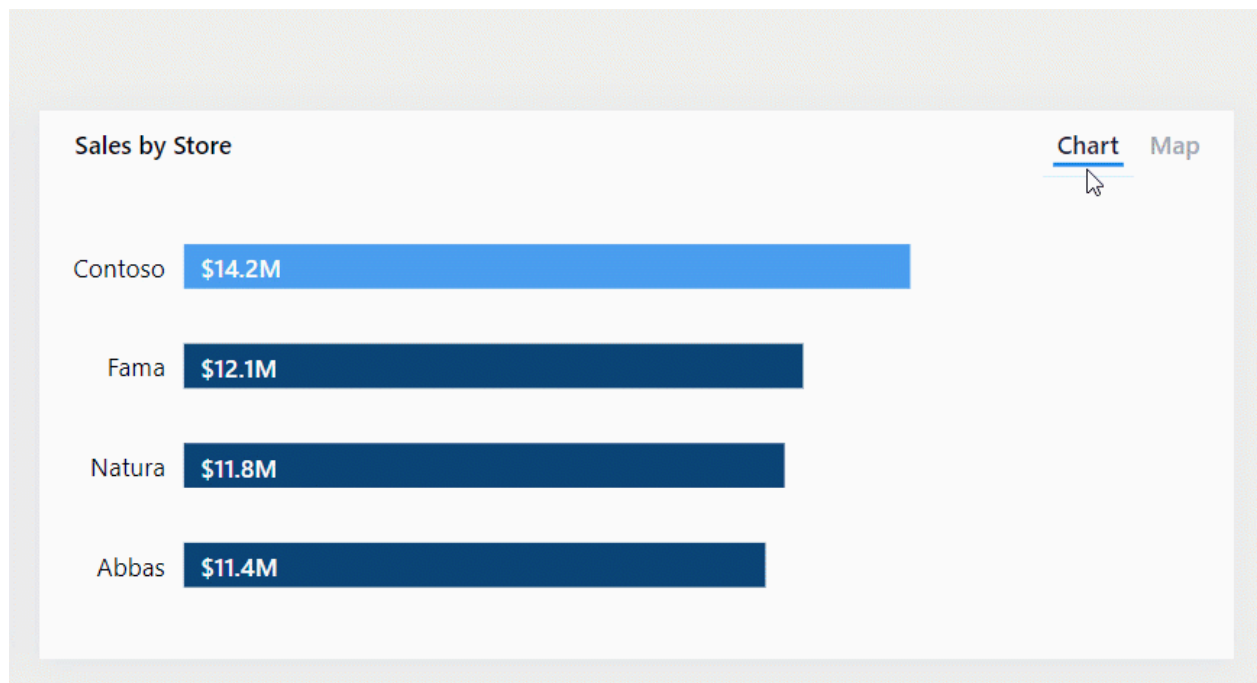
You can provide a simple way for report consumers to quickly reset slicers to a default state by following these steps:

1. Configure the bookmark to capture the **Data** state.
2. Configure the bookmark to use the **Selected visuals** scope, targeting the slicers that you want to reset. The **Selected visuals** scope is key because you don't want to affect other slicers or visuals. For example, if a drillable visual is on the page, the bookmark shouldn't overwrite the drill state when it resets the slicers.
3. Set the slicers to the default values.
4. Update the bookmark.
5. Assign the bookmark to a button action.

Swap visuals

Swapping a visual means replacing it with another visual. For example, your report can allow the report consumer to select the type of visual, perhaps a chart or a table. Alternatively, you might allow the report user to determine the unit system, whether it's metric or imperial.

In the following example, buttons allow the report consumer to swap a bar chart visual for a map visual.



Swapping a visual requires two bookmarks, and you can do so by following these steps:

1. Configure each bookmark to capture the **Display** state but not the **Data** state. These settings preserve any sorting or other filtering.
2. Configure each bookmark to use the **Selected visuals** scope, targeting the initially visible visual and the hidden visual.
3. Update the first bookmark, with one visual as visible and the other as hidden.
4. Update the second bookmark by using the inverse visibility state.
5. Assign the bookmarks to button actions.

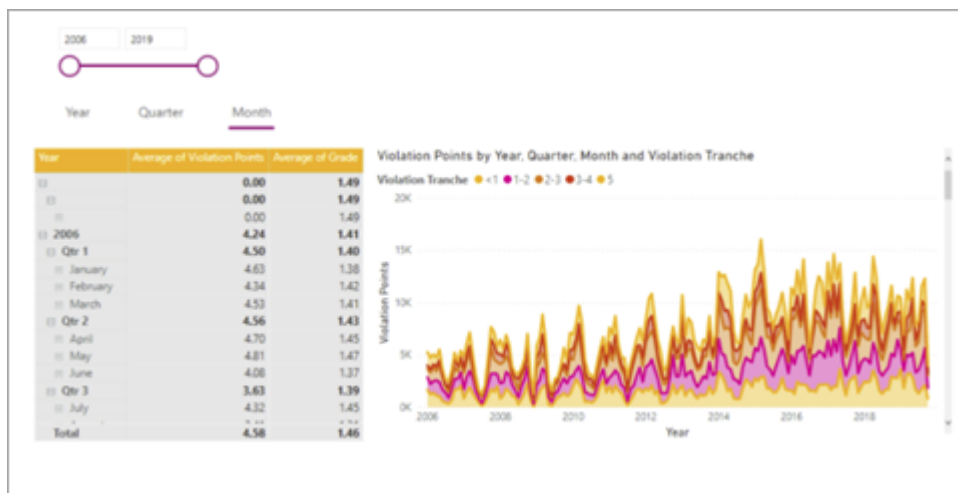
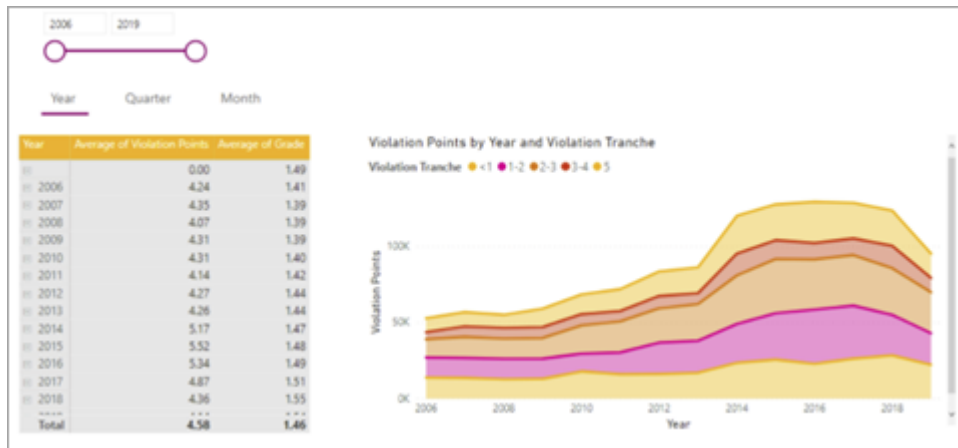
Note

Performance isn't impacted by having hidden visuals on a page because hidden visuals don't run queries. Swapping visuals provide flexible consumption options to the report consumer while retaining optimal performance and making the most out of the report page space.

Drill down multiple visuals and direct depth navigation

When visuals have many levels of drill depth, buttons and bookmarks can provide report consumers with a quick and simple way to arrive at the required depth.

In the following example, bookmarks navigate the matrix visual and the area chart visual across year and month.



You can create a bookmark for each required drill depth with the following steps:

1. Configure each bookmark to capture the **Data** state, which preserves the drill state of visuals.
2. Configure each bookmark to use the **Selected visuals** scope, targeting the visuals to update.
3. In the visuals, drill down to the required level, and then update the corresponding bookmark.
4. Assign the bookmarks to button actions.

Tip

In the **Bookmark** scope, consider including a shape or alternate button that appears as highlighted. That way, report consumers are aware of the selected drill level.

Pop-up overlays

Use buttons and bookmarks to overlay an image, shape, or text box. A good example of a pop-up overlay is one that provides built-in assistance. Designing reports with built-in assistance is covered in Unit 7.

In the following example, when the report consumer selects the **Help** button in the lower-left corner of the page, a full-page image becomes visible. The image includes many coach marks, which point

to the targeted objects on the report page. Also, the image uses transparency so that the underlying report design remains partially visible. When the report consumer selects anywhere on the page, the image becomes hidden (due to an action on the image that uses a bookmark).



Two bookmarks are required for creating a pop-up overlay:

1. Configure the first bookmark to capture the **Display** state.
2. Ensure that the overlay object is visible, and then update the bookmark.
3. Assign the bookmark to a **Help** button action.
4. Configure the second bookmark to capture the **Display** state.
5. Ensure that the overlay object is hidden, and then update the bookmark.
6. Assign the bookmark to the overlay object.

6. Design reports for navigation

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/5-design-navigation-reports>

Design reports for navigation

Completed

Many different button actions are available to help you configure report navigation experiences. While buttons enable navigation, the report and button layout is critical to ensure that report

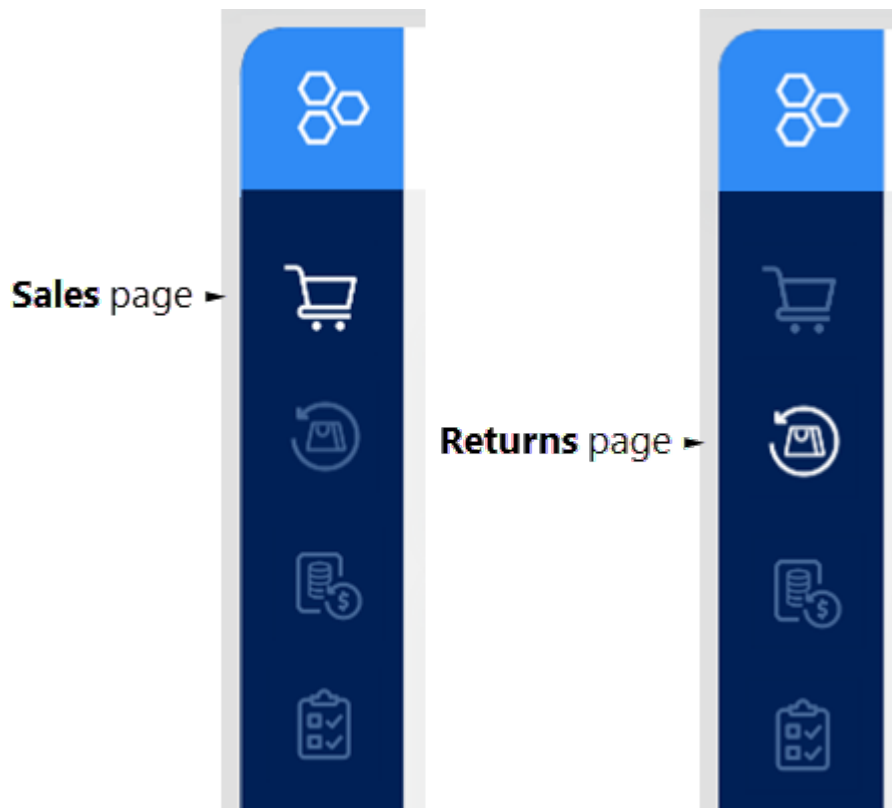
consumers can efficiently navigate within the report.

Tip

To ensure seamless integration into your report design, these UX components should be considered early in the design process. Retrofitting buttons and actions to a report design can lead to an unintuitive and disjointed experience for report consumers.

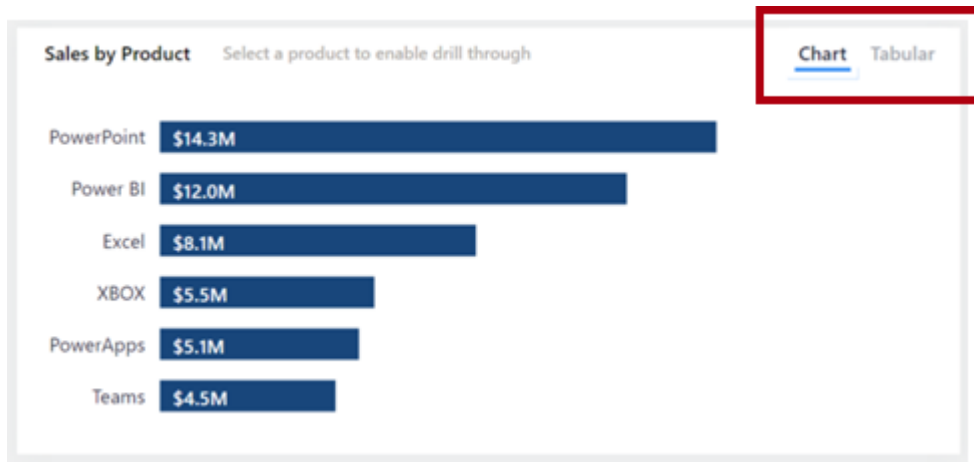
Buttons should be placed in relevant and consistent locations. A button is only valuable if it's easy to find. To promote ease of discovery, ensure buttons are placed in a relevant and consistent location on the report page.

In the following example, buttons that are located along the left side of the report page allow report consumers to navigate between pages. Most importantly, they're placed in the same location and in the same order on all report pages. The button that represents the current page is formatted in a way to highlight the icon.



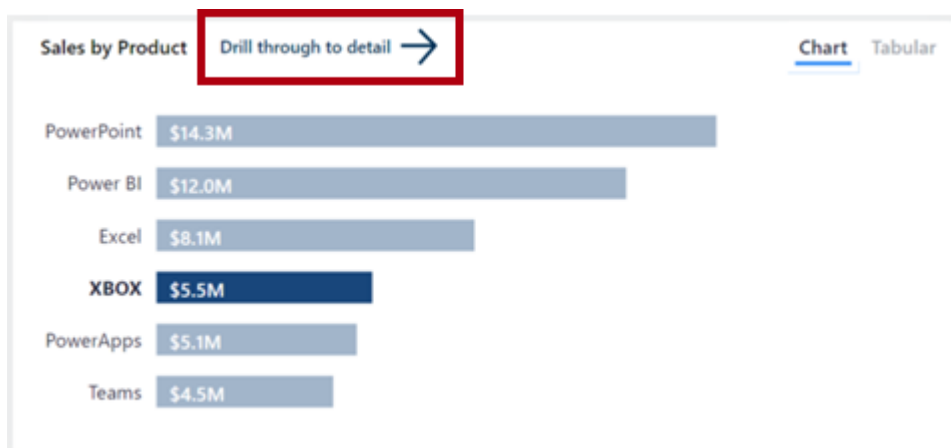
When a button only impacts one section of a report, you can place it within that section so that it's clear to report consumers that the action applies only to that section.

In the following image, two buttons are located in the upper-right corner of a section that allows the report consumer to switch between visual types.



Similarly, if a button action drills through to a page, place it as close as possible to the visual that activates it.

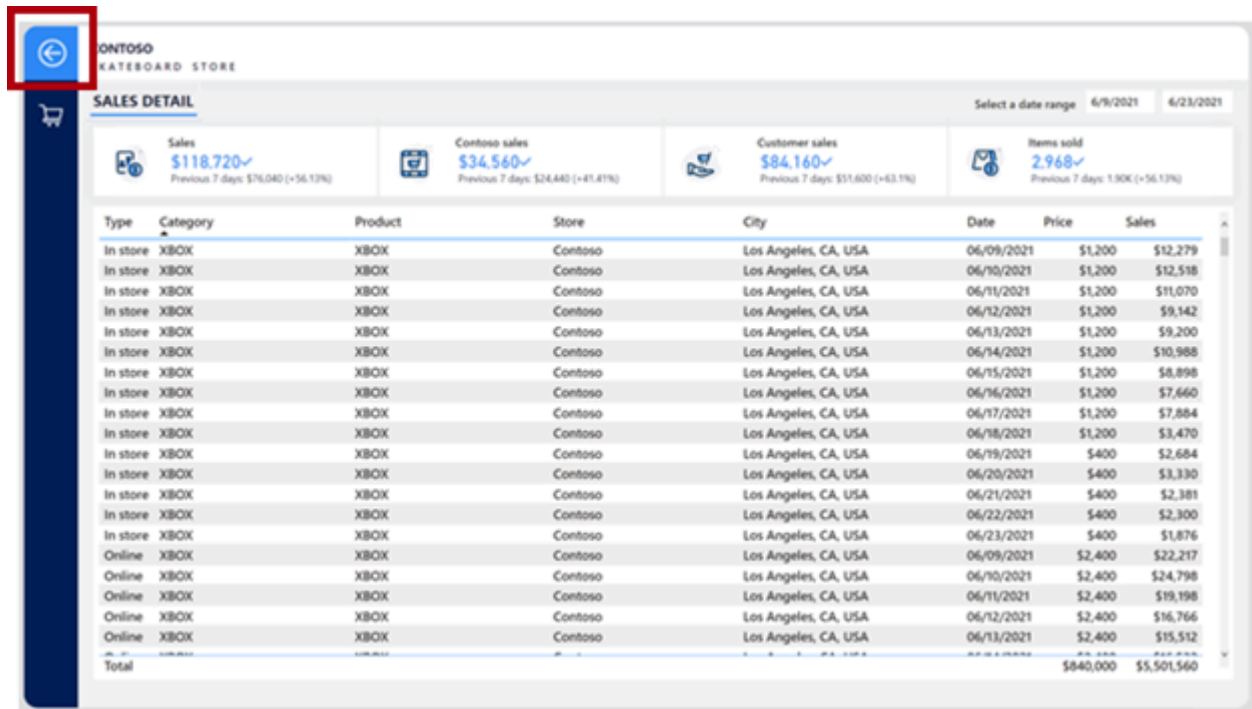
In the following image, the **Drill through to detail** button is located above the visual that activates it.



On the drillthrough page, ensure that a back button provides a simple way for the report consumer to return to where they drilled from. An established convention is to use a left-pointing arrow icon for the button.

Note

Power BI automatically adds a back button, which it places in the upper-left corner of the page. The button icon is a left-pointing arrow.



CONTOSO KATEBOARD STORE

SALES DETAIL

Select a date range: 6/9/2021 to 6/23/2021

Sales \$118,720 ✓
Previous 7 days: \$76,040 (+56.13%)

Contoso sales \$34,560 ✓
Previous 7 days: \$24,440 (+41.81%)

Customer sales \$84,160 ✓
Previous 7 days: \$51,600 (+63.1%)

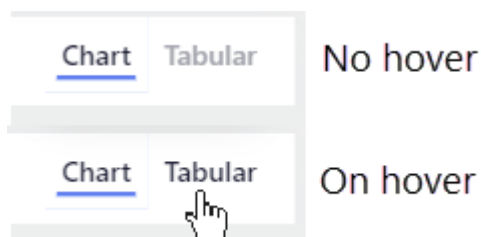
Items sold 2,968 ✓
Previous 7 days: 1,900 (+56.13%)

Type	Category	Product	Store	City	Date	Price	Sales
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/09/2021	\$1,200	\$12,279
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/10/2021	\$1,200	\$12,518
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/11/2021	\$1,200	\$11,070
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/12/2021	\$1,200	\$9,142
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/13/2021	\$1,200	\$9,200
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/14/2021	\$1,200	\$10,988
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/15/2021	\$1,200	\$8,898
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/16/2021	\$1,200	\$7,660
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/17/2021	\$1,200	\$7,884
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/18/2021	\$1,200	\$3,470
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/19/2021	\$400	\$2,684
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/20/2021	\$400	\$3,330
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/21/2021	\$400	\$2,381
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/22/2021	\$400	\$2,300
In store	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/23/2021	\$400	\$1,876
Online	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/09/2021	\$2,400	\$22,217
Online	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/10/2021	\$2,400	\$24,798
Online	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/11/2021	\$2,400	\$19,198
Online	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/12/2021	\$2,400	\$16,766
Online	XBOX	XBOX	Contoso	Los Angeles, CA, USA	06/13/2021	\$2,400	\$15,512
Total						\$840,000	\$5,501,560

Buttons need to be clearly interactive. If a button doesn't appear to be interactive, the report consumer might not notice it. To help in their discovery, you can apply two formatting options: on-hover formatting and descriptive tooltips.

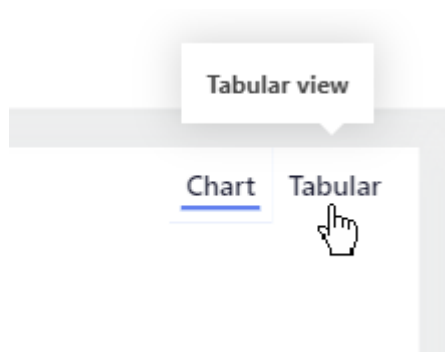
On-hover formatting

You can configure buttons to change their state when a hover over is available. When the report consumer hovers the cursor over a button, the cursor icon changes to a pointing finger, which indicates that the button is selectable. In this example, the **Tabular** button text is light gray by default, but when they hover the cursor over, it darkens to black.



Descriptive tooltips

In addition to on-hover formatting, you can configure tooltips to concisely communicate what the button does.



Note

Enable and enter the tooltip text in the **Action** section for the button.

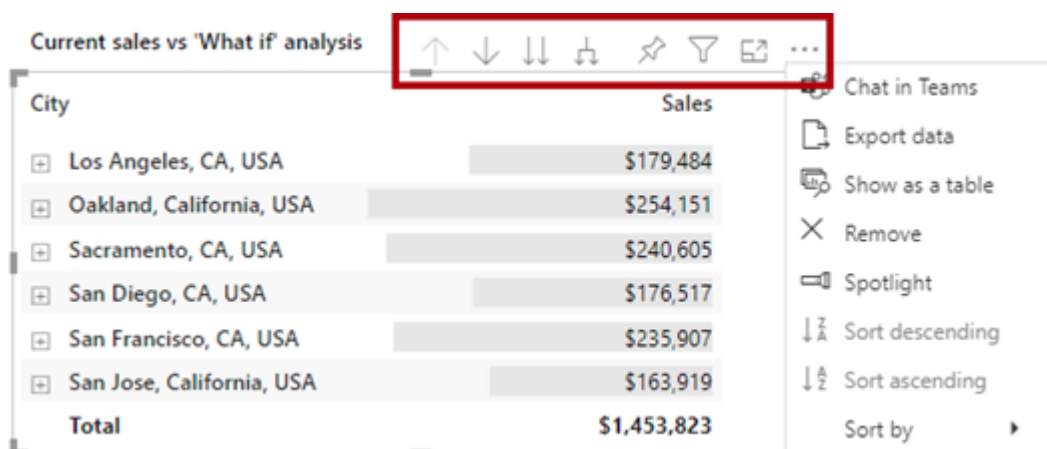
7. Work with visual headers

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/6-visual-headers>

Work with visual headers

Completed

Visual headers make many interactions available to report authors and consumers. All report objects, including visuals and elements (like buttons), have a visual header. The visual header appears when you hover the cursor over the report object, and they can launch actions like focus mode, drill up, or drill down. You can also access the **More options** menu by selecting the ellipsis (...) button. The menu includes sorting options, export, spotlight, and many others. By default, visual headers are enabled for all report objects.



Visual headers might appear in the upper or lower part of the object. Power BI attempts to show visual headers in the upper right of the object when sufficient space is available between the upper part of the object and the edge of the page. When no space is available in the upper part, Power BI places the visual headers in the lower-right corner of the visual. If no space is available in either location, it places the headers inside the visual in the upper right.

Tip

Always leave sufficient space for the visual headers to appear in the upper-right section of objects. This approach ensures a consistent experience for report consumers. Also, take care not to overlap objects because superimposed visual headers make it difficult for consumers to see or select icons.

A report setting is available for you as the report author to disable all visual headers. When visual headers are disabled they will still be visible when editing the report, but they will be hidden for report consumers (in reading view). However, situations might occur where enabling this option is a good idea because it limits most interactions. It might make sense to disable visual interactions when you are delivering a Power BI report to an audience that's unfamiliar with Power BI or when you don't expect them to interact with the report.

Visual headers can be turned off for a single object. A good report design turns off visual headers for objects that don't need them. Therefore, consider turning off visual headers for slicers and buttons and any other object that won't be used to launch actions. Fewer visual headers will produce a cleaner and less distracting final result.

For those objects that have visual headers, consider disabling functionality that's not appropriate or useful. You can disable all visual header icons, including the **More options** (...) menu.

Note

At design time, the icons will still appear to help you create the report. However, when the report opens in reading view, the icons won't appear.

By enabling the visual header tooltip icon, you can enter a text value or reference a page tooltip. This topic is covered in the next unit.

For more information, see [Using improved visual headers in Power BI reports](#).

8. Design reports with built-in assistance

Design reports with built-in assistance

Completed

Training report consumers on how to use and navigate your reports can be difficult because every report that you create is different. Features and functionality that are present in one report might not be present in another. Creating intuitive and simple-to-navigate reports is important. When approaching a report design project, you should always aim to provide "no training required" experiences. Strive to add built-in assistance whenever possible.

Several design techniques that can provide built-in assistance include:

- Information page
- Visual header tooltip icon
- Button with overlay

Tip

Every report consumer approaches a report with a different expectation of how to interact with it. Therefore, to avoid handling support requests, take extra initial effort to ensure that the functionality is as discoverable as possible.

Information page

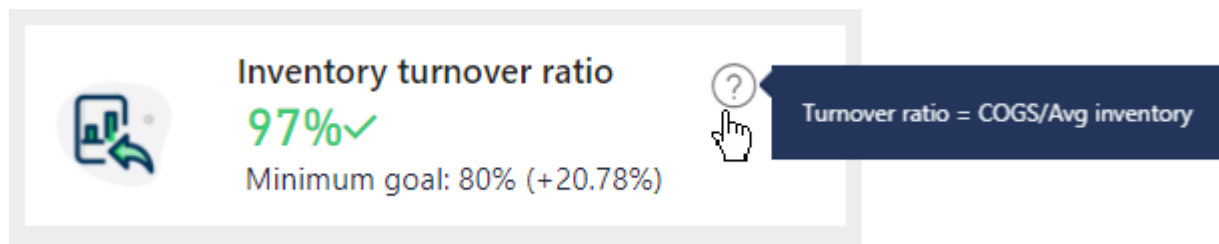
Adding an **information page** is the most simplistic technique. Dedicate an entire report page that includes instructions and definitions.

Tip

Consider adding a back button to the page. Then, add a button in a consistent location to each page that navigates to the information page. Configure these buttons to use the **Information** or **Help** icon.

Visual header tooltip icon

Within the visual header options, you can enable the visual header tooltip. It adds the **Help (?)** icon to the visual header. Then, you can assign a page tooltip or text. This technique is beneficial for providing visual-specific guidance, such as more detail that describes definitions, calculation logic, or the source of data.



Button with overlay

You can use buttons and bookmarks to overlay an image, shape, or text box that provides built-in assistance. Unit 4 of this module provides an explanation of how to create the bookmarks to support this scenario.



9. Tune report performance

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/8-tune-reports>

Tune report performance

Completed

When you've finished creating your report, you should give consideration to its performance. Performance relates to how quickly visualizations on the report page can load. You should test your report in the Power BI service to see how it works from the perspective of the user. If you experience

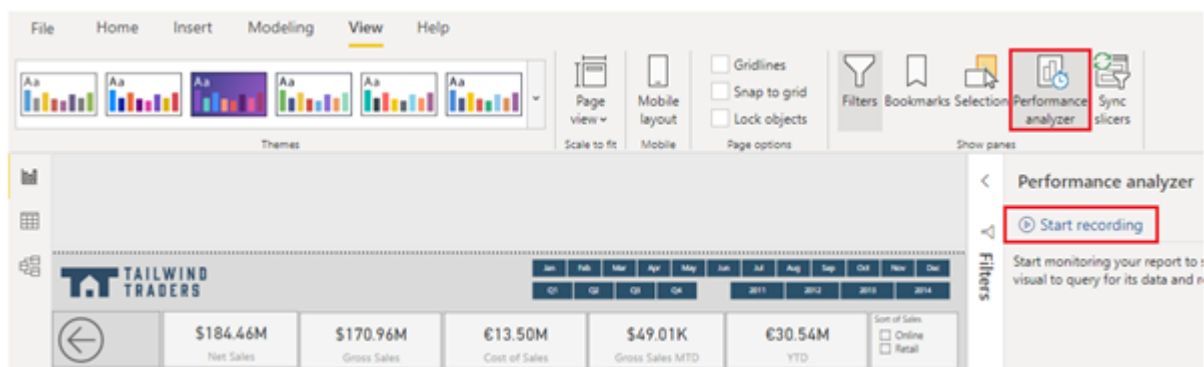
poor performance, or if report users have reported issues, you should investigate the cause of those issues and take steps to tune the report for more optimized performance.

Analyze performance

To investigate the cause of poor performance, your first step is to use *Performance Analyzer*. Performance Analyzer is built-in to Power BI Desktop. It allows you to examine how each of your report elements, such as visuals and DAX formulas, perform. It provides you with logs that measure (in time duration) how each of your report elements performs when users interact with them. By examining the durations in the logs, you can identify which report elements are the most (or least) resource intensive. You might also discover where bottlenecks exist, which is a good starting point for making design improvements.

Before you run Performance Analyzer, ensure that you clear the visual cache and data engine cache; otherwise, the results might not be accurate. Also, you should set up the report so that it opens on an empty page.

When you've cleared the cache and opened the report, go to the **View** ribbon tab, select **Performance analyzer**, and then in the **Performance analyzer** pane, select **Start recording**.



Interact with your report as you would expect a user to. The results of your interactions will display in the **Performance analyzer** pane as you work. When you're finished, select the **Stop** button. Then, it's time to analyze the results. The performance results of each element displays in milliseconds in the **Duration** column.

The following image shows that all elements on the report take less than two seconds to load, which in this instance is considered acceptable. You can expand any element in the list to view more detailed information and to identify the exact cause of an issue, such as the DAX query, the visual display, or something else.

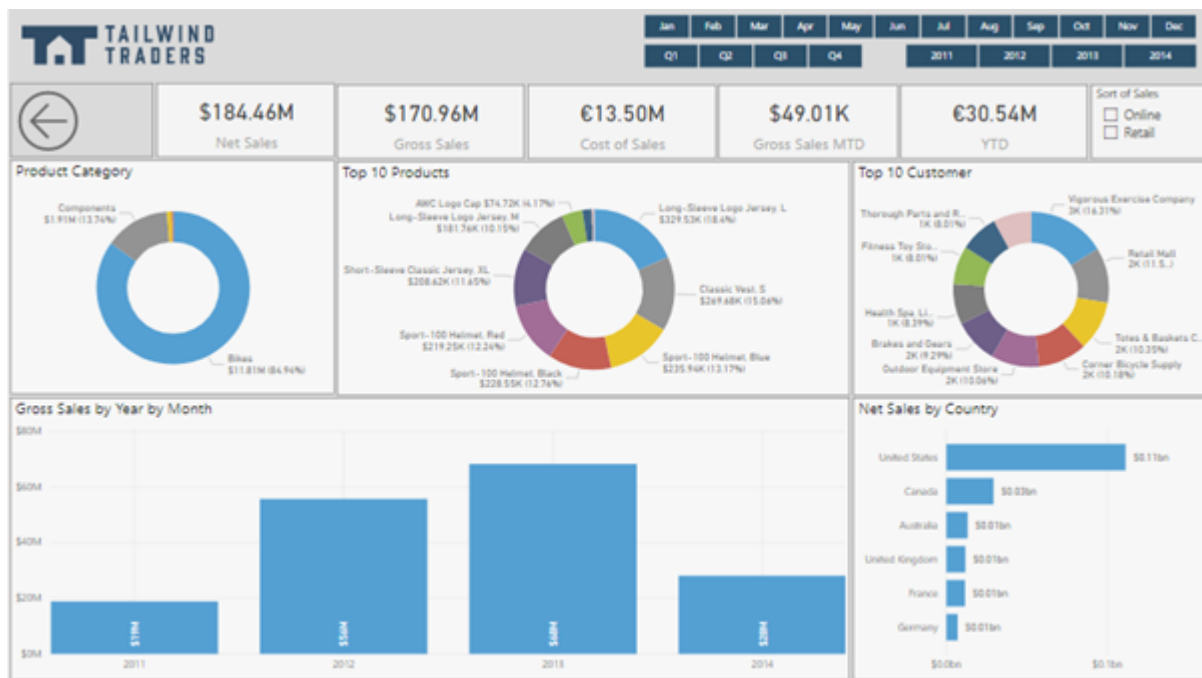
Performance analyzer ×	
▶ Start recording ↻ Refresh visuals ⏹ Stop	
🗑 Clear 📄 Export	
Name	Duration (ms) ↓
🕒 Recording started (16/06/2020 00:13:52)	-
📄 Changed page	-
⊕ Net Sales	1435
⊖ MTD card	1491
DAX query	46
Visual display	31
Other	1414
📄 Copy query	
⊕ YTD card	1983
⊕ Cost of Sales	1550
⊕ Cross Sales	1655
⊕ Gross Sales by Year by Month	1312
⊕ Net Sales by Country	1831
⊕ Top 10 Products	1355
⊕ Top 10 Customer	1587
⊕ Product Category	2023
⊕ Sort of Sales	1034
⊕ Slicer	1726
⊕ Slicer	1190
⊕ Slicer	1896
⊕ Image	305
⊕ Button	115

If you want to examine a particular DAX query, select **Copy query** and then paste it into a tool like DAX Studio to conduct further analysis. DAX Studio is a free, open-source tool that you can download and install on your computer.

Tune performance

The results of your analysis can inform you of areas for improvement and highlight items that you need to optimize.

A common reason for poor performance is that there too many visuals on the page. The following image shows an example of a busy page that possibly contains too many visuals.



If you identify that visuals are a bottleneck, consider taking the following steps to tune the report:

- Reduce the number of visuals on the report page because fewer visuals means better load performance. If a visual isn't necessary and doesn't add value to the user, you should remove it. Rather than using multiple visuals on the page, consider other ways to show details, like drillthrough pages and tooltips.
- Reduce the number of fields in visuals. Identify fields that aren't valuable and then remove them.

If you find that the visuals aren't the reason for performance issues, you should investigate whether the DAX queries are the cause of poor performance. For example, you might need to investigate the design of the semantic model, or the DAX logic contained in measures.

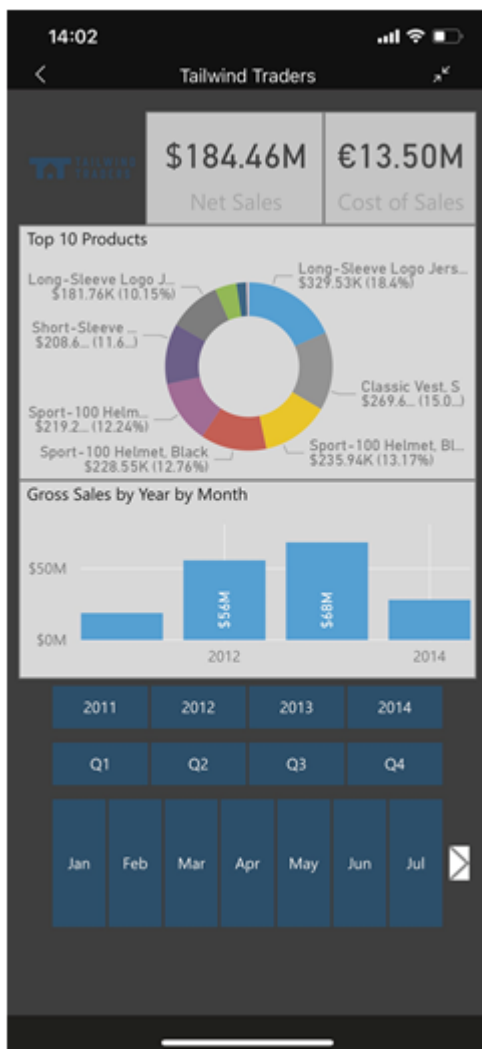
In circumstances where you've made necessary changes to tune report performance and have established that the report is performing well, yet some users still experience poor performance, external factors might be affecting performance. External factors can include network bandwidth, server, firewall, and other external, uncontrollable factors. You might also need to meet with your IT department to determine whether they can explain why users are experiencing poor performance when using your reports.

10. Optimize reports for mobile use

Optimize reports for mobile use

Completed

Some of your report users might want to view your reports on their mobile phone or tablet. While they can view any Power BI report page in landscape orientation, you might want to create another view that is optimized for mobile devices and displays in portrait orientation. Power BI gives you the power to use visuals that make sense for mobile users and rearrange those visuals in the most effective way.



When you have finished creating your report for the regular web view, you can then create a version of the report that's optimized for use on phones and tablets.

To create a mobile-optimized version of your report, you can:

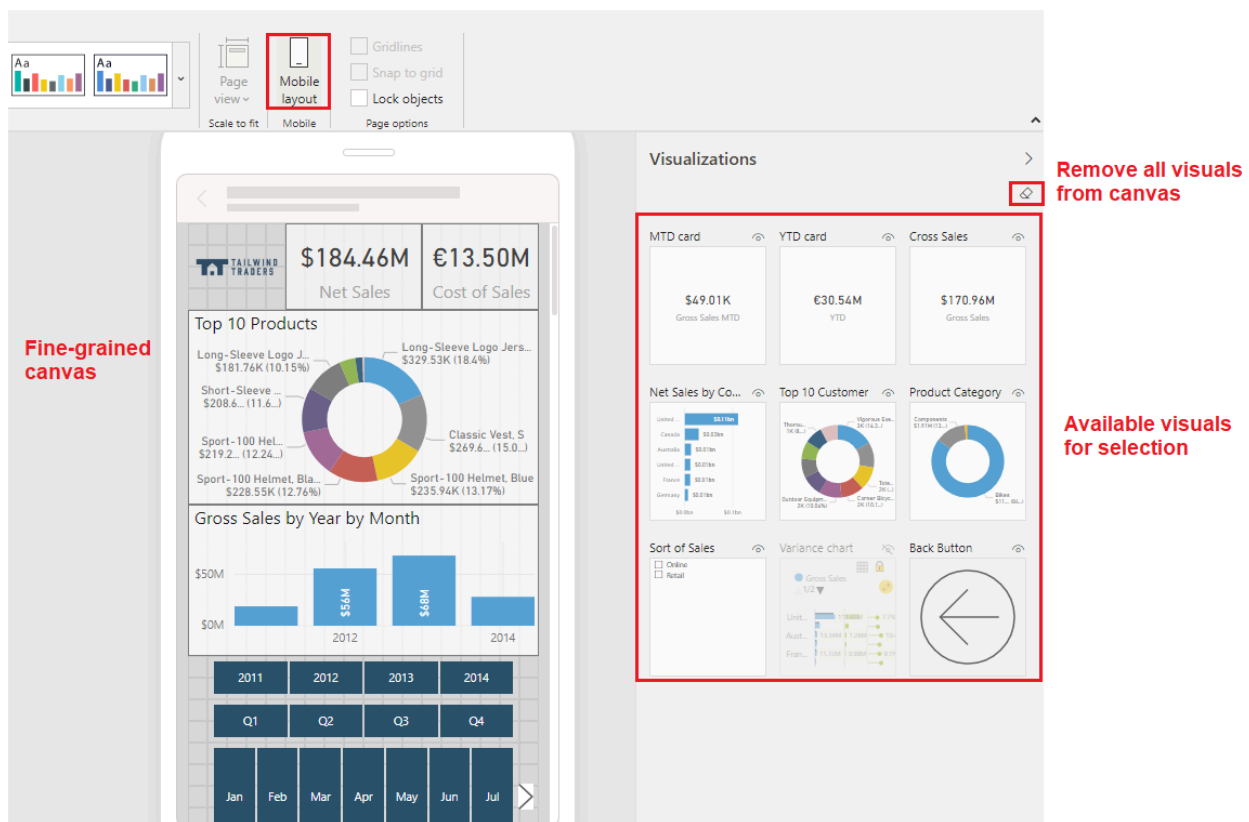
- Design a mobile layout view, where you can drag and drop certain visuals onto a phone emulator canvas.
- Use visuals and slicers that are suitable for use on small, mobile screens.

To publish a mobile-optimized version of your report, you simply publish the report as you did previously. The web and mobile versions are published together at the same time.

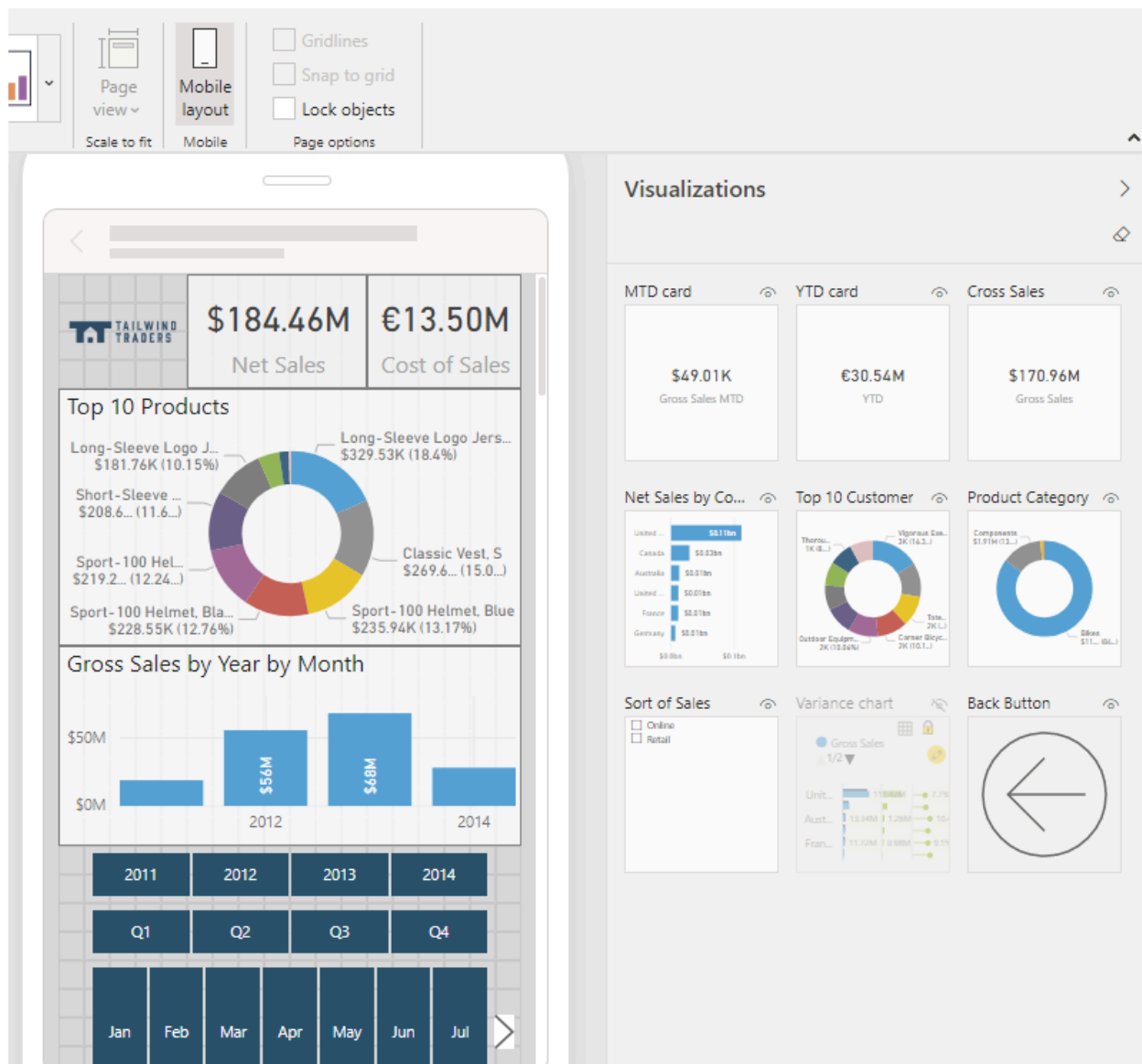
Design a mobile report layout

To design the mobile-optimized view of a report page, start by opening the mobile layout view for that page. In Power BI Desktop, open the specific report page, select the **View** tab, and then select **Mobile layout**.

This selection results in showing a scrollable canvas shaped like a phone and a **Visualizations** pane that lists all visuals on the original report page. Each visual appears with its name (for easy identification) and a visibility indicator that's useful when you're working with bookmarks. The visibility indicator of a visual changes depending on the visibility status of the visual in the current state of the web report view.



To add a visual to the mobile layout canvas, drag the visual from the **Visualizations** pane to the phone canvas, or double-click the visual in the **Visualization** pane. You can then resize and reposition the visual in the same way that you would a report page. Repeat these steps to add other visuals to the mobile layout canvas.



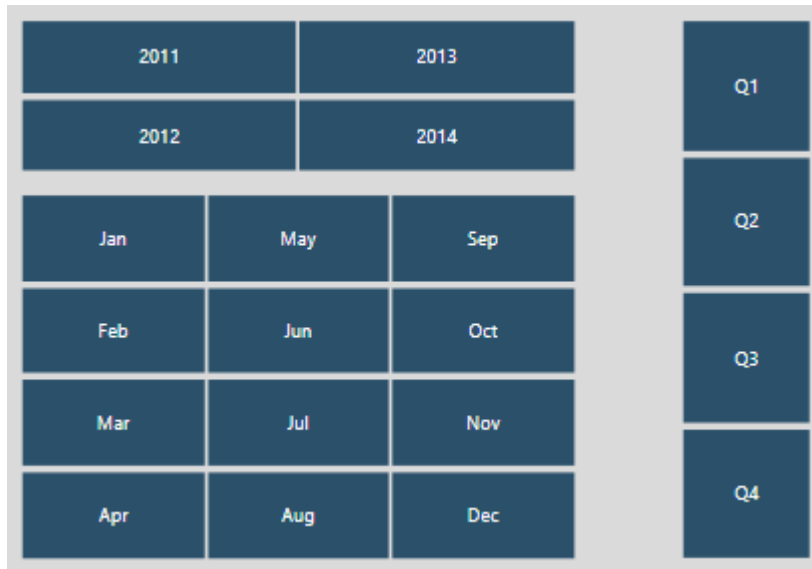
Configure visuals and slicers for use in mobile reports

By default, many visuals in Power BI are responsive, which means they change dynamically to display the maximum amount of data and insight—regardless of the screen size. As a visual changes size, Power BI gives priority to the data and makes small changes, such as removing padding or repositioning the legend, so that the data remains visible. When it comes to configuring visuals for mobile reports, Power BI does all the hard work for you. However, if you want to turn off this default responsiveness, you can do so in the **General** section of the format settings for the visual.

Regarding slicers, which offer on-canvas filtering of report data, you might want to modify some settings to optimize them for mobile use. Return to the regular report authoring mode to edit the slicer settings, and then consider the following points:

- Determine whether you want to allow report readers to select only one item or multiple items.
- Decide on the orientation of the slicer, whether it should be vertical, horizontal, or responsive (responsive slicers must be horizontal). If you make the slicer responsive, as you change its size

and shape, it shows more or fewer options. If you make the slicer small enough, it becomes a filter icon on the report page.



11. Exercise - Enhance Power BI reports

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/10-lab>

Exercise - Enhance Power BI reports

Completed

In this exercise, you learn how to:

- Sync slicers.
- Create a drill through page.
- Apply conditional formatting.
- Create and use bookmarks & buttons.

This lab will take approximately **45** minutes to complete.

Note

A virtual machine containing the client tools you need is provided, along with the exercise instructions. Use the button above 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](#).

Tip

You need access to the Power BI service to complete this exercise in your own environment. Work with your IT organization or create a free [Microsoft 365 Developer account](#).

12. Check your knowledge

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/11-check>

Check your knowledge

Completed

13. Summary

<https://learn.microsoft.com/en-us/training/modules/power-bi-effective-user-experience/12-summary>

Summary

Completed

Enhancing report designs with rich and compelling features is about delivering report requirements while taking the user experience to the next level. Keep in mind that your report consumers might not know how to work with all user experiences. As you publish a report, consider providing instructions or video recordings to show how you intend the consumers to interact with it. Also, consider surveying your report consumers to understand what works and what doesn't, and ask for suggestions.

Perform analytics in Power BI

1. Introduction to analytics

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

Introduction to analytics

Completed

Big data analytics, machine learning, and artificial intelligence (AI) focus on predictive capabilities to solve business problems. These advanced analytics methods enable organizations to make data-driven decisions and uncover new opportunities.

Analytics can transform raw data into an extensive collection of information that categorizes data to identify and analyze behavioral data and patterns. Organizations can use this information to analyze the current state of their operations and to predict future behavior and trends by asking "what-if" questions. Additionally, analytics can help with fraud detection, image recognition, sentiment analysis, overall general employee productivity, and it also often replaces cumbersome manual processes.

Consider a scenario where you ask an employee to determine the cause of a recent spike in sales. The employee might have to painstakingly inspect each sale, interview customers, talk to sales people, and examine market trends. Instead, you can use the **Key Influencers** visual, which uses advanced analytics, to get a faster explanation. The visual is only as good as the data that you give it, meaning you still have to collect the data and organize it. The actual analytics, however, can be done for you or at least give you an excellent start.

By reducing manual work, advanced analytics is ultimately able to help organizations make better business decisions and create actionable and meaningful results.

Traditionally, data analysis was a complex task that performed by data engineers. Today, data analysis is more accessible to, and understood by, many people within organizations and across all teams. Power BI is an exceptional tool for quickly pulling actionable insights from data. It allows you to build visuals and metrics for your data in reports and dashboards so that you and your users can analyze data insights. They can start by analyzing at a high level and drill down into those insights for more detailed information, when necessary.

In this module's scenario, you work for Tailwind Traders as a data analyst. Your task is to create reports and dashboards that support key business decisions by showing high-level insights and visuals using advanced analytics. Each team requires unique reports and dashboards:

- The Product team wants to know if specific products aren't selling as well as others.
- The Sales team is focused on sales forecasts for the coming year.
- The Warehouse team is interested in a general breakdown of how the warehousing and shipping locations are performing worldwide.

This module outlines the built-in functionality to help you accomplish your tasks with Power BI. By the end of this module, you'll use advanced analytics to identify trends, track data changes, and create predictive models. These features can help your organization make better business decisions, plans, and forecasts.

2. Explore statistical summary

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/2-statistical-summary>

Explore statistical summary

Completed

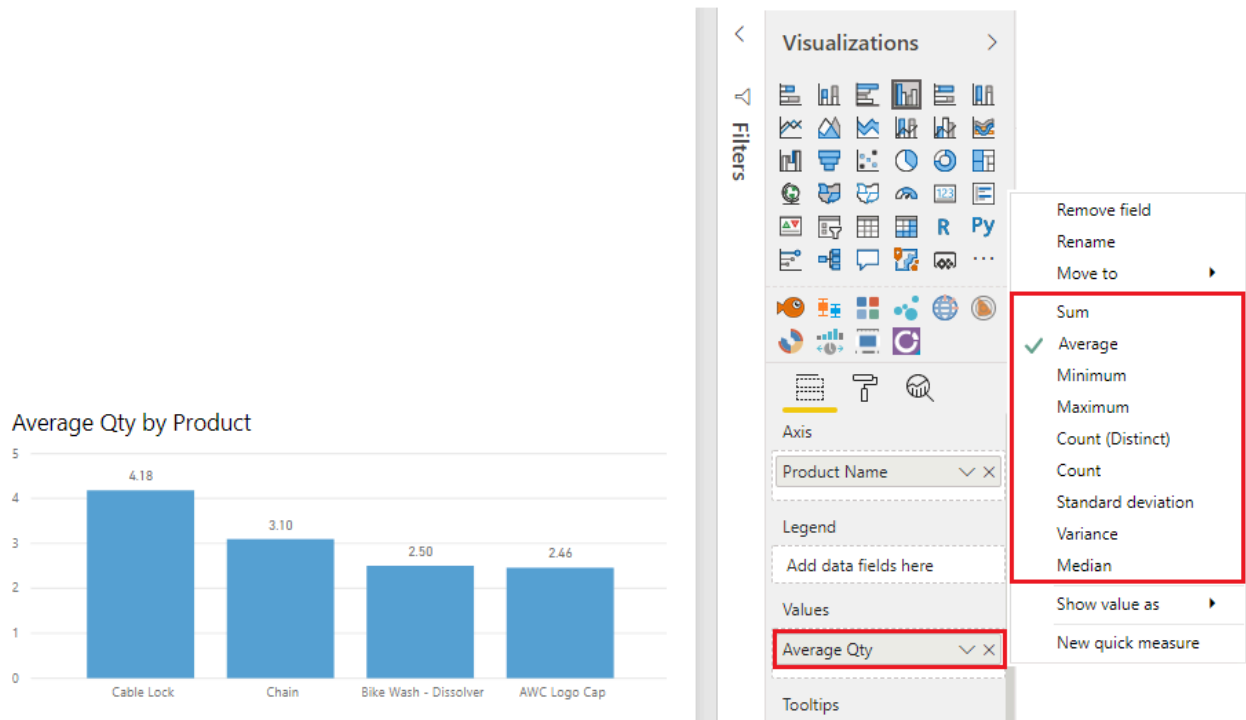
Data is often intertwined with statistics because statistics are one way in which you can explore your data. Statistics can show you the distribution of your data, help you to identify key takeaways and trends, and determine whether outliers exist.

A statistical summary provides a quick and simple description of your data. Power BI has many features that help you conduct a statistical analysis. Exploring the statistical summary gives the user a high-level view of the available data, where they can see clusters, patterns on behavioral data, data averages, and more. They can gain insights about their data that help drive business decisions.

For example, the Supply Chain team asks you to create a report that shows the frequency of orders for certain products and what the top 10 products are in terms of sales.

Statistical functions

Power BI supports many Data Analytics Expressions (DAX) functions that you can use to get quick statistics based on your data. You can access these quick functions by right-clicking a summarizable field assigned to the well of a visual in the **Visualizations** pane, as illustrated in the following image.

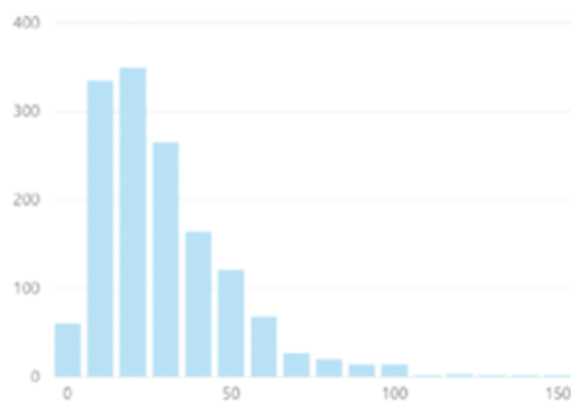


However, to avoid performance issues, it's better to create the statistical measures yourself by using an expression written in DAX. For example, to analyze the average order quantity for each product, you could create the following measure:

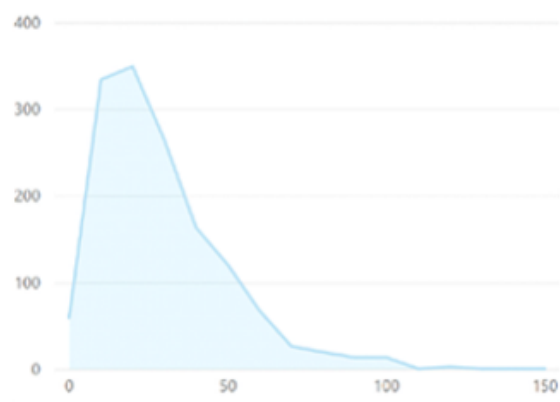
```
Average Qty =  
AVERAGE ( Sales[Order Qty] )
```

Histogram

Histograms and bell curves are a common way to display statistics about your semantic models. In Power BI terms, you can represent a histogram with a bar or column chart visual and represent a bell curve with an area chart visual, as illustrated in the following image. You can also use the Q&A visual to ask a direct question about the top or bottom items in a list.



Bar Chart



Area Chart

A typical bar or column chart visual in Power BI relates two data points: a measure and a dimension. A histogram differs slightly from a standard bar chart in that it only visualizes a single data point.

In this example, you can use the clustered column chart visual to present a histogram that determines the order quantities by order sizes.

You start by selecting the clustered column chart icon on the **Visualization** pane. Next, create a new grouping for the X-axis. We cover grouping and binning later in this module, but for now understand that they're useful in this context also.

To create the group, in the **Data** pane, right-click the data field that you want to analyze and then select **New Group**. In this case, you use the **OrderQty** field. In the **Groups** window, configure the bin group as follows:

1. Rename the group as *Order Bins (Buckets)*.
2. Set the **Group type** option to *Bin* and the **Bin Type** option to *Number of bins*.
3. Set the **Bin count** to 5, the **Min value** to 1, and the **Max value** to 44.

Groups

Name	Order Bins (Buckets)	Field	OrderQty
Group type	Bin	Min value	1
Bin Type	Number of bins	Max value	44

Binning splits numeric or date/time data by an amount you specify. The default bin count is calculated based on your data.

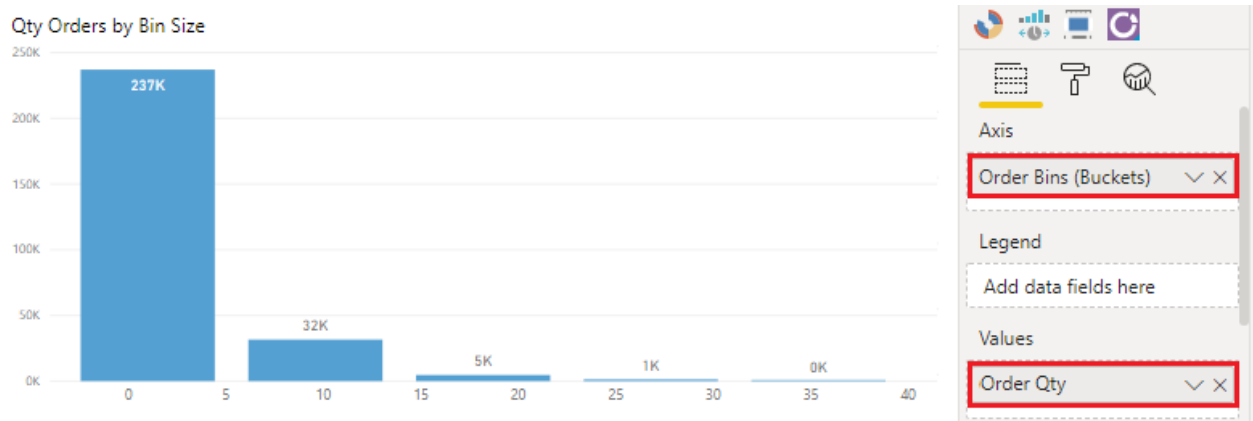
Bin count	5	Bin size	8.6
Reset to default			

OK

Cancel

Next, populate the visual as follows:

1. Drag the **OrderQty** field from the **Data** pane into the **Value** well in the **Visualizations** pane.
2. Drag the **Order Bins (Buckets)** field from the **Data** pane into the **Axis** well in the **Visualizations** pane.



The visual now shows that the data is grouped into buckets on the X-axis, with the order quantities of that variable on the Y-axis.

The histogram displays the order quantity by order size buckets for the Supply Chain team.

Top N analysis

The **TOPN** DAX function returns the top N rows of a specified table. Top N analysis is a common technique to present data that might be important, such as the top 10 selling products, top 10 performers in an organization, or top 10 customers. Alternatively, you can look at it from the other perspective and present the bottom N items in a list. In other words, the worst performers. Depending on the requirements, you might want to use one or both of these techniques.

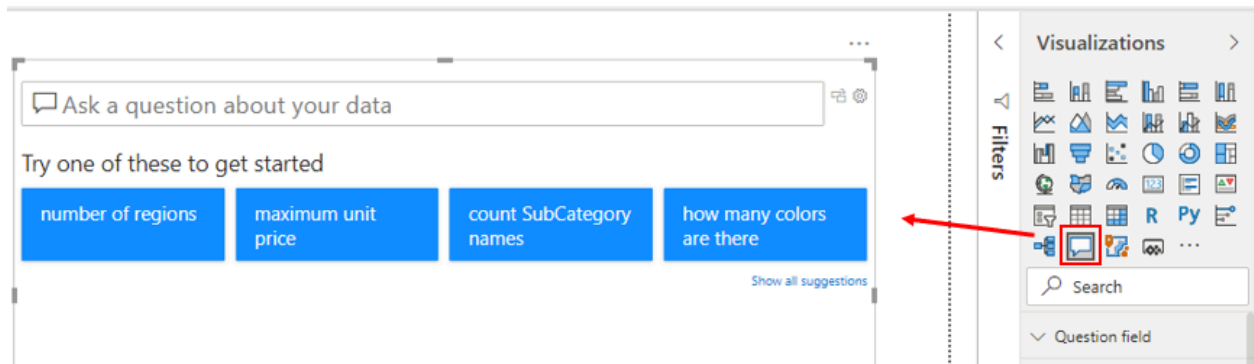
Consider a scenario where the Supply Chain team wants to know what the top 10 selling products are. You can accomplish this task by using a Q&A visual, a Top N filter, or creating a DAX measure.

Use the Q&A visual to find the top N

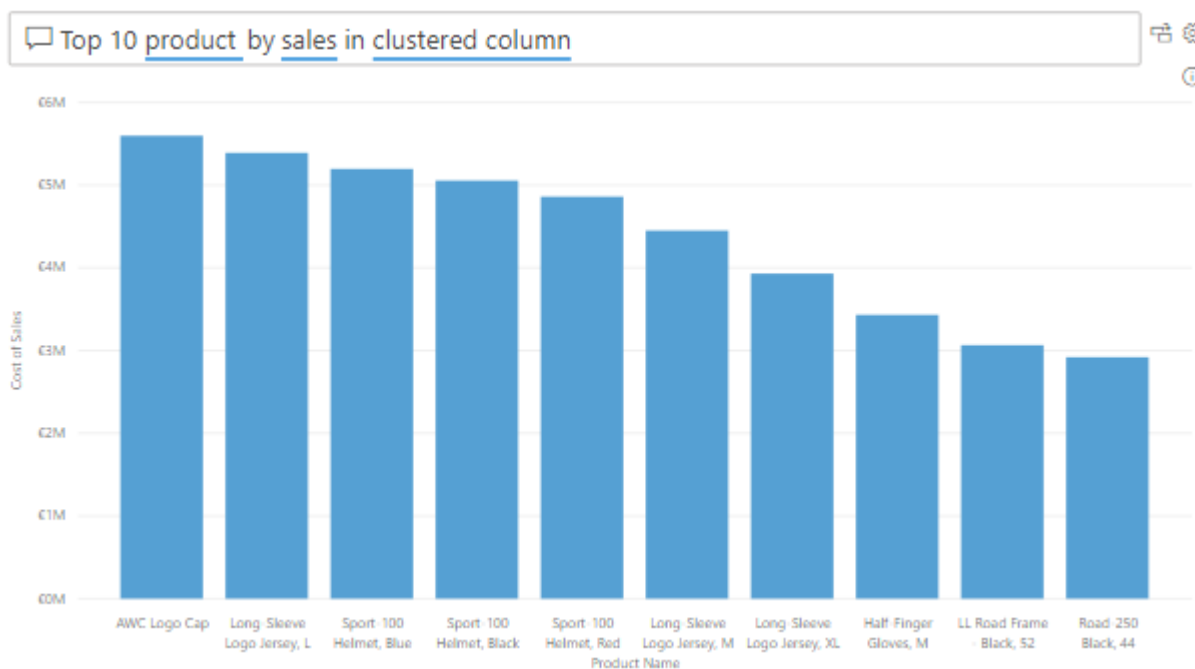
Assume you created a report for the Supply Chain team, and now the team members have questions about various other views or insights that they're interested in. Power BI has a built-in Q&A visual that allows users to ask their own questions and get answers. That means you don't have to address each individual question with a report visual.

The Q&A visual is an effective tool because it allows users to quickly and independently get answers about the data. That saves time for everyone involved. The Q&A visual is unique in that it doesn't require prior knowledge of Power BI; users can ask their question.

Add the **Q&A** visual to your report, and then reposition the visual and customize its formatting, as required.

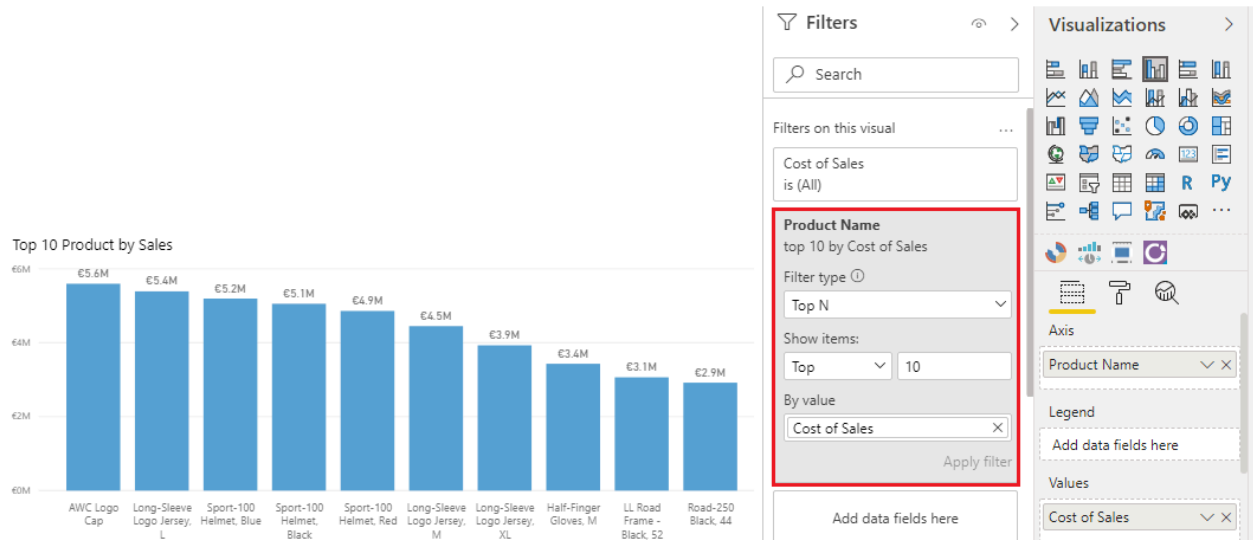


Now, you can use the visual to get answers. In this case, you want to know what the top 10 selling products are, so you enter a question such as, *What are my top 10 products by sales?* Power BI automatically displays the result for you.



Use a Top N filter

Top N is a filtering option that is available in the **Filters** pane. Select the field that you want to analyze on your report page (in this example, it's the **Product Name** field). In the **Filters** pane, expand the **Filter type** list and select *Top N*. In the **Show items** settings, select *Top* and *10*. Then, set the **Cost of Sales** field as the value that you want to filter by.



Use a TOPN function

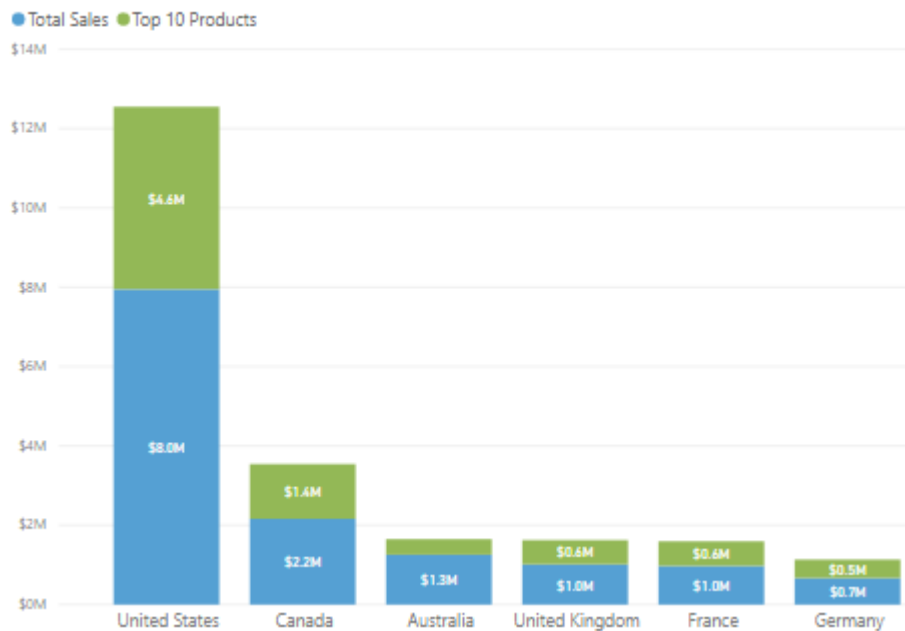
You can also calculate your top 10 products with DAX by using the `TOPN` function. This function can be used to present a top 10 list in a different context, such as how much of the top 10 best-selling products contributed toward the overall total sales.

Start by creating a measure named `Top 10 Products`. Then, use the `TOPN` function along with the `SUMX` function, to calculate the top 10 products by total sales, as follows:

```
Top 10 Products =
SUMX (
    TOPN (
        10,
        'Product',
        'Product'[Total Sales]
    ),
    [Total Sales]
)
```

The following image shows the top 10 products compared to total sales.

Top 10 Product Sales out of Total Sales by Country



You can adjust the DAX formula to present the same result in percentages.

For more information about the statistical capabilities of DAX, see [Statistical Functions](#).

3. Identify outliers with Power BI visuals

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/3-visuals>

Identify outliers with Power BI visuals

Completed

An outlier is a type of anomaly in your data. It's something that you don't expect or that surprises you, based on historical averages or results. You should identify outliers to isolate data points that significantly differ from other data points, and then take action to investigate the reasons for the differences. This analysis can make a significant effect on business decision making.

Consider a scenario where you're analyzing data for a shipping warehouse. You notice that the number of orders increased above average for a specific product category. You first want to identify the product category. Then, you want to ask several questions about the outlier, like:

- Did above average shipments happen that day?
- Did this anomaly occur in a specific warehouse?
- Did a single event cause the increase in orders for that specific category?
- Did this event occur on other days in the last month, quarter, year, or prior year?

Power BI allows you to identify outliers in your data, but you first need to determine the logic behind what constitutes an outlier. You can use trigger points, such as calculations, around what you would consider the outlier to be.

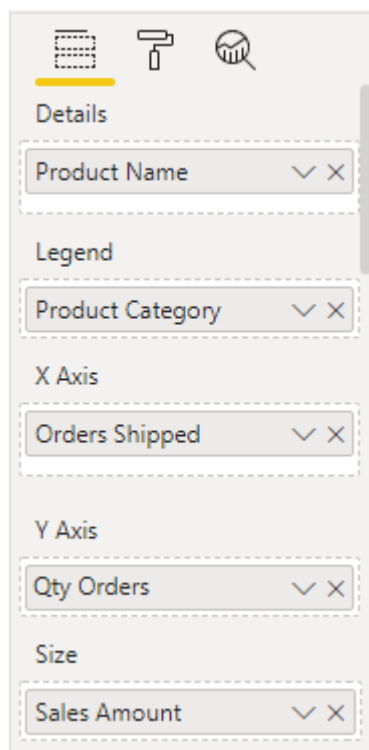
The process of identifying outliers involves segmenting your data into two groups: one group is the outlier data and the other group isn't. You could use calculated columns to identify outliers, but the results would be static until you refresh the data. A better way to identify outliers is to use a visualization or measures because these methods ensure that your results are dynamic.

When you identify outliers in your data, you can use slicers or filters to highlight those outliers. You can also add a legend to your visuals so that outliers can be identified among the other data. You can then drill in to the outlier data for more detailed analysis.

Use a visual to identify outliers

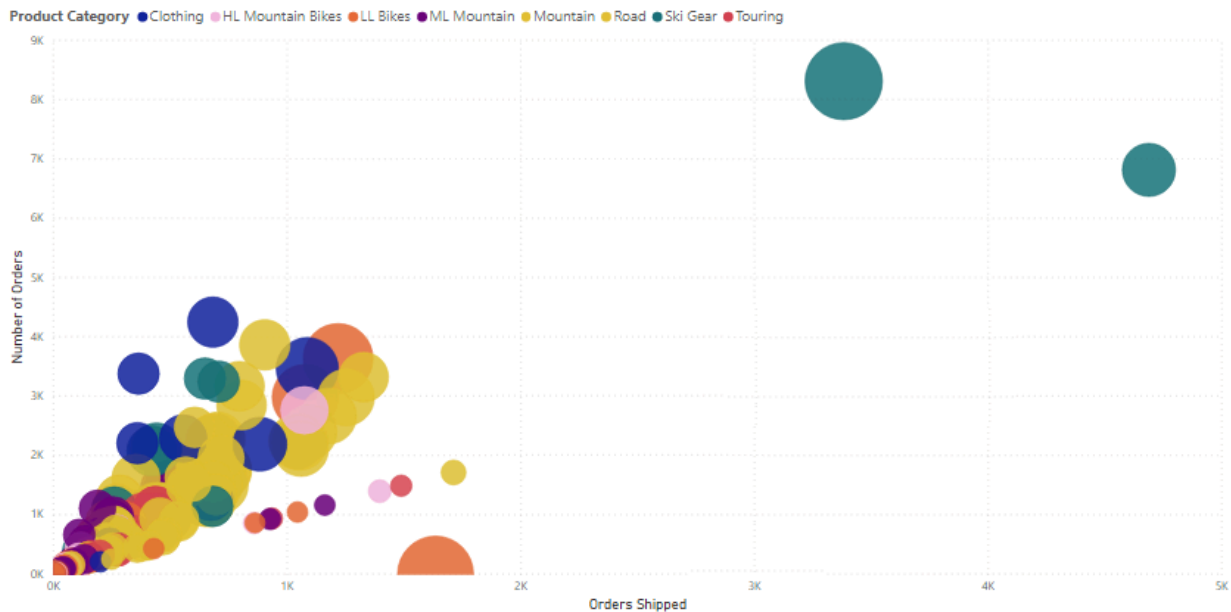
The best visual to use for identifying outliers is the scatter chart. It can show the relationship between two numerical values. Scatter charts display patterns in large sets of data and are, therefore, ideal for displaying outliers.

When you add a scatter chart to your report, put the fields of interest into the **X Axis** and **Y Axis** wells, respectively. In this case, the **Orders Shipped** field is on the X-axis, and the **Qty Orders** field is on the Y-axis.



The visual updates to show the data based on the selected fields, making it easy to spot outliers, which are the items separated from the main data points.

Number of Orders by Orders Shipped by Product Category



Now that you can identify outliers in your data, you can investigate the reasons for their existence and take corrective action.

Use measures to identify outliers

You can create a measure to identify outliers in your data based on specific values. In the following code, `Order Qty` is a measure in the `Sales` table, and `Min Qty` is a measure that determines the lowest order quantity in the `Sales` table.

```
Outliers =
CALCULATE (
    [Order Qty],
    FILTER (
        VALUES ( 'Product'[Product Name] ),
        COUNTROWS (
            FILTER (
                Sales,
                [Order Qty] >= [Min Qty]
            )
        ) > 0
    )
)
```

After you create the outlier measure, you can group products into categories and then add the measure to a **scatter chart** visual to analyze and act on outliers.

4. Group and bin data for analysis

Group and bin data for analysis

Completed

When you create visuals, Power BI filters, groups, and summarizes underlying data. You can refine how those groups are presented. You can also create new groups by grouping two or more data points in a visual or by putting values into equal-sized groups (binning).

Grouping is a technique for categorizing data. *Binning* is similar to grouping, but it's a technique for grouping continuous fields, such as numbers and dates.

You can use the grouping and binning features to display your data according to your preference. These features help you to clearly view, analyze, and explore the data and trends in your data. Additionally, can identify clusters, patterns of behavior, data averages, and more. The results of this analysis provide users with more specific insights on their data, which can help drive business decisions.

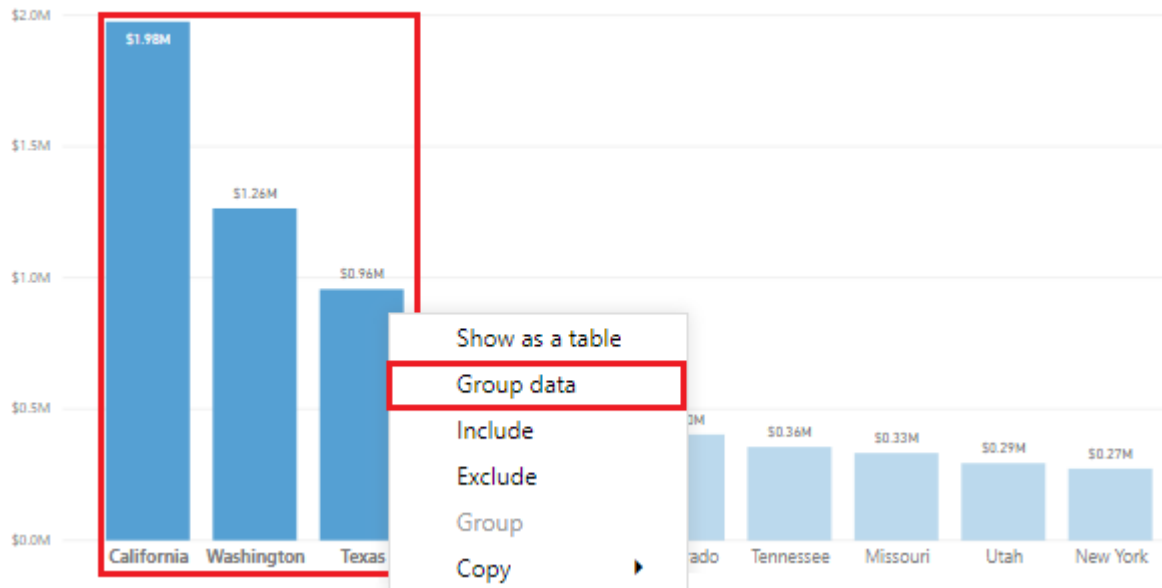
Consider a scenario where the Customer Service team now wants you to further analyze their help ticket data and asks whether you can segment the data into different groups and clusters. In particular, they want to identify the cities with the highest sales.

Create a group

The following image shows a bar chart where Power BI automatically segmented the data in the way that it found most useful: Total Sales by State. However, you want to group some of the bars (states) together so that you can view them as one category, which helps the Sales team identify the cities with the highest sales.

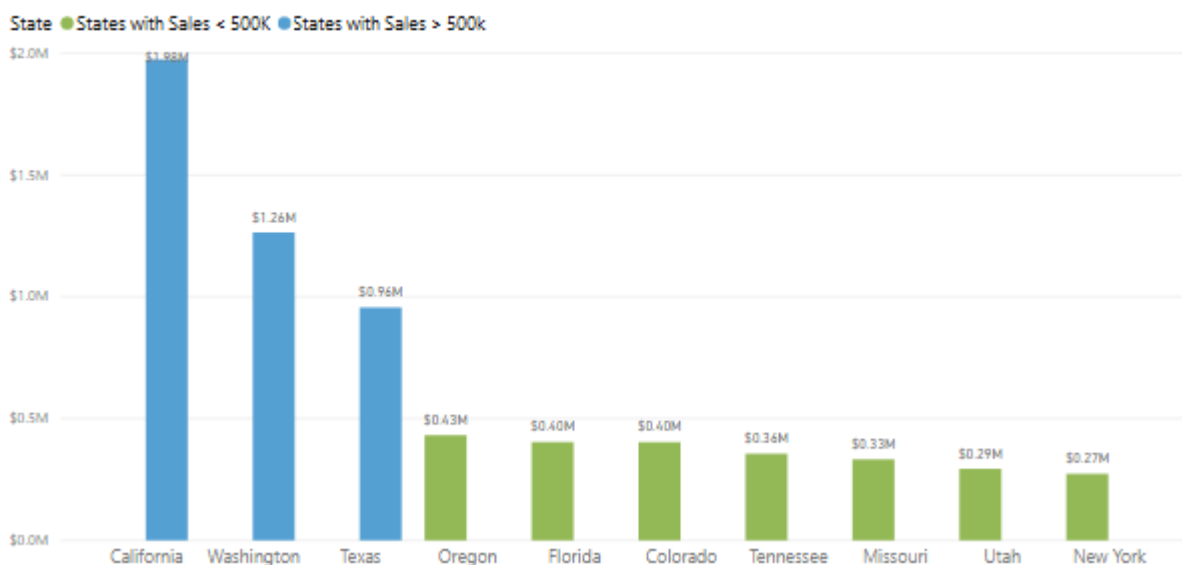
To create the group, use **Ctrl+Click** to multi-select the data points in the visual that you want to group. In this case, it's the states with sales greater than 500,000 dollars. Right-click one of those selected data points and then select **Group data**.

Total sales by State



When the group is created, notice that the visual updates to show the new group. The following image shows that the other states, which are the states with lower sales (less than 500,000 dollars), grouped together and highlighted in a different shade.

Total Sales by State



The new group field displays in the **Legend** well of the visual, and is also added to the data model and listed in the **Data** pane.

When you create a group, you can change the way that the data is displayed in the visual. For example, you might want to switch the values in each axis. You can also use the group in any of the other visuals in your report. To do so, drag the group field from the **Data** pane and then drop it into any visual.

Edit a group

Continuing with the previous example, you now want to edit the categories that make up your group. Right-click the group field in either the **Legend** well or the **Data** pane, and then select **Edit Groups**.

In the Groups window, you see a list of the groups and the different items within those groups. The following image shows the **States with Sales > 500k** group and its members, along with the **Other** group (**States with Sales < 500k**) that contains all other values that don't belong to the first group. If you refresh your data, new items appear in the ungrouped values list and go into the **Other** group.

Groups

Name

State (groups)

Field

City

Group type

List

Ungrouped values

Ain

Aisne

Alabama

Alaska

Alberta

Allier

Alpes (Haute)

Alpes-de-Haute Provence

Alpes-Maritimes

Ardèche

Groups and members

States with Sales > 500k

California

Washington

Texas

States with Sales < 500K (Other)

Contains all ungrouped values

Group

Ungroup

☒ Include Other group ⓘ

OK

Cancel

You can now make changes to the group. You can rename any group by double-clicking the group title in the **Groups and members** section and entering a new name. You can also add ungrouped values into an existing group, remove values from an existing group, or create a new group.

Create bin groups

The process of binning allows you to group your numerical and time field data into *bins* of equal size. This approach allows you to visualize and identify trends in your data in more meaningful ways. Binning allows you to right-size the data that Power BI displays.

In this example, you want to create bins (groups) for the **Order Qty** field. Start in the **Data** pane by right-clicking the **Order Qty** field that you want to create the bins for, and then select **New Group**. In the **Groups** window, set the **Bin size** to the size that you want, adjust other settings as required, and then select **OK**.

Groups

Name	Order Qty (Bins)	Field	OrderQty
Group type	Bin	Min value	1
Bin Type	Size of bins	Max value	44

Binning splits numeric or date/time data into equally sized groups. The default bin size is calculated based on your data.

Bin size	5
----------	--------------------------------

[Reset to default](#)

[OK](#)

[Cancel](#)

When you set up the bin group, you see a new field in the **Data** pane with *(bins)* appended to its name. You can then add that field to any visual.

5. Apply clustering techniques

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/5-clustering-techniques>

Apply clustering techniques

Completed

Clustering allows you to identify a segment (cluster) of data that's similar to each other but dissimilar to the rest of the data. The process of clustering is different to that of grouping, which you learned about in the previous unit.

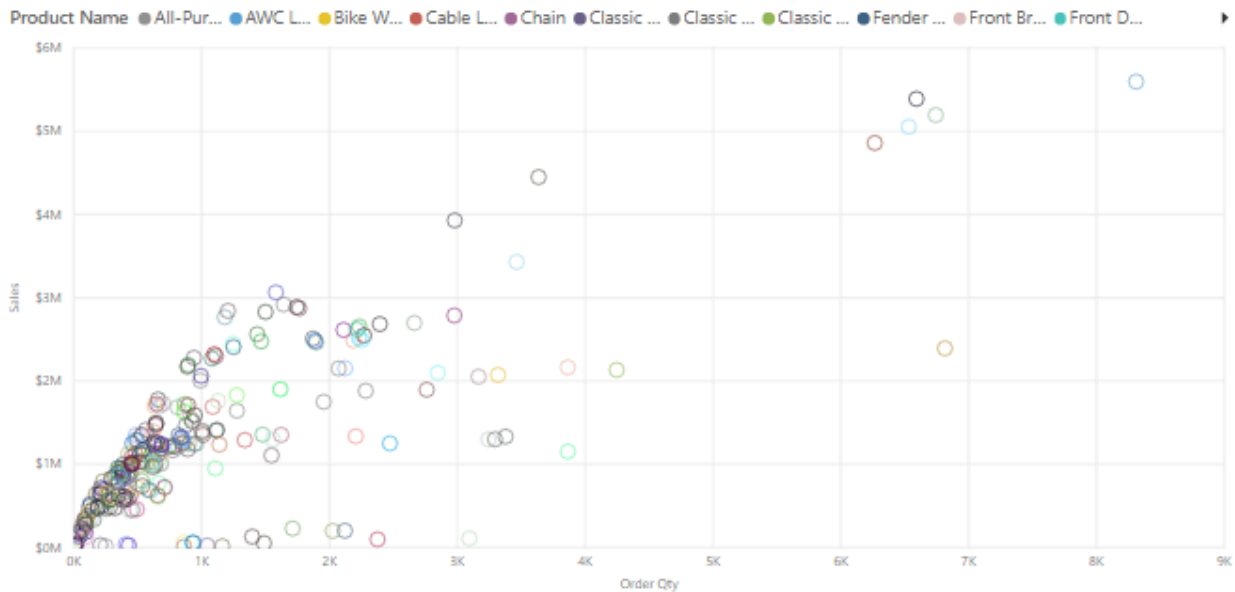
The Power BI clustering feature allows you to quickly find groups of similar data points in a subset of your data. It analyzes your semantic model to identify similarities and dissimilarities in the attribute values, and then it separates the data that has similarities into a subset of the data. These subsets of data are referred to as *clusters*.

For example, you might want to look for patterns in your sales data, such as the behavior of customers overall. You can segment customers into clusters according to their similarities, such as age or location.

Start by adding the scatter chart visualization to your report and then add the required fields to the visual. In this example, you add the **Order Qty** field to the A-axis, the **Sales** field to the Y-axis, and the **Unit Price** field to the Values.

The following image shows considerable data in the scatter chart, so it's difficult to discern any natural groups.

Product Clusters



To apply clustering to your scatter chart, select **More options (...)** in the upper-right corner of the visual, and then select **Automatically find clusters**.

In the **Clusters** window, you can edit the default name, field, and description, if necessary. However, for this example, you want to change the number of clusters. The following image shows that the **Number of clusters** box is blank by default, which means that Power BI automatically finds the number of clusters that it determines as making the most sense with your data.

Clusters

Name
Product Name (Clusters)

Field
Product Name

Description
Clusters for Product Name

Cluster1 (203 items)
Cluster2 (7 items)
Cluster3 (56 items)
(Blank) (29 items)

Number of clusters
Changing the number of clusters will rerun clustering and discard cluster names.

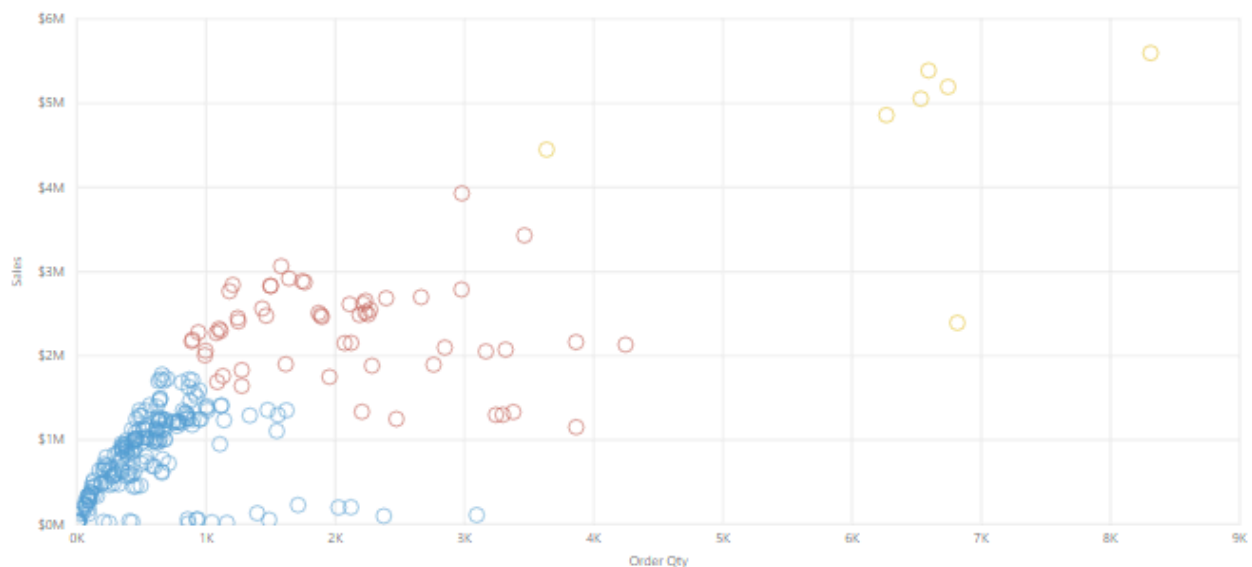
OK

Cancel

Enter the number of clusters that you want (3) into the box and then select **OK**. Power BI runs the clustering algorithm and creates a new categorical field that contains different cluster groups. Now, when you look at the visual, you can clearly see the clusters that are in your data and proceed to perform analysis on them.

Product Clusters

Product Name (Clusters) ● Cluster1 ● Cluster2 ● Cluster3



The new cluster field is added to your scatter chart's **Legend** well, which you can now use as a source of cross-highlighting like any other **Legend** field. The new cluster field is added to the data model, and you can find it in the **Data** pane.

If you want to edit the cluster, right-click the cluster field and select **Edit clusters**.

Clusters

Name

Product Name (Clusters)

Field

Product Name

Description

Clusters for Product Name

Cluster1 (40 items)
Cluster2 (1 items)
Cluster3 (10 items)
Cluster4 (7 items)
Cluster5 (81 items)
Cluster6 (28 items)
Cluster7 (67 items)
Cluster8 (4 items)
Cluster9 (3 items)
Cluster10 (25 items)

Number of clusters

Changing the number of clusters will rerun clustering and discard cluster names.

10

OK

Cancel

In the preceding example, when you applied clustering to the scatter chart, you could only use two measures. If you want to find clusters by using more than two measures, you can use a table visual

instead. In this case, add all the fields you want to use, and then run the clustering algorithm by using the same process.

6. Conduct time series analysis

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/6-time-series-analysis>

Conduct time series analysis

Completed

Time series analysis involves analyzing a series of data over time in order to identify meaningful information and trends and even make predictions. The result of time series analysis is the best data that you can use for forecasting activities.

In Power BI, you can use various visuals to observe how your data progresses over time and detect any major events that might have disrupted your data. For example, Gantt charts are useful for project planning, while stock movement semantic models help in tracking stock trends.

To conduct a time series analysis, use visualization types suited for displaying trends and changes over time, such as line charts, area charts, or scatter charts.

Use the Play Axis visual

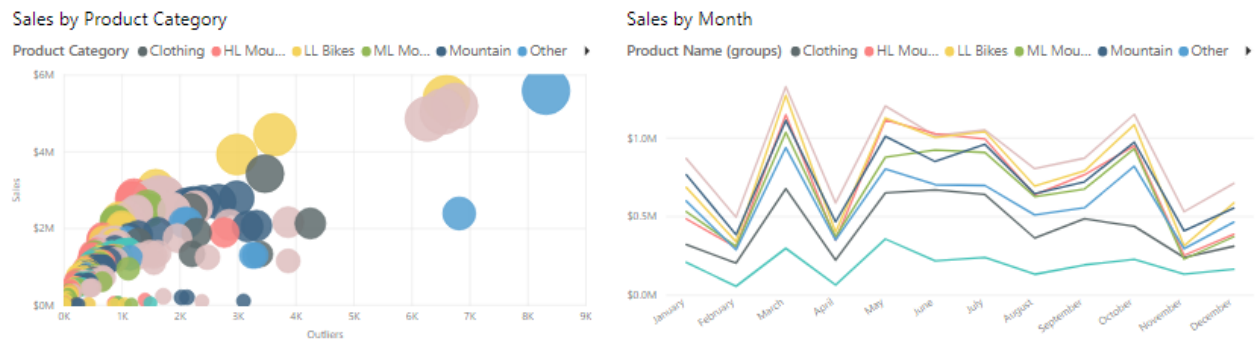
You can also import custom visuals from Microsoft AppSource, like the **Play Axis** animation visual, which acts as a dynamic slicer to compellingly display time trends and patterns without user interaction.

Note

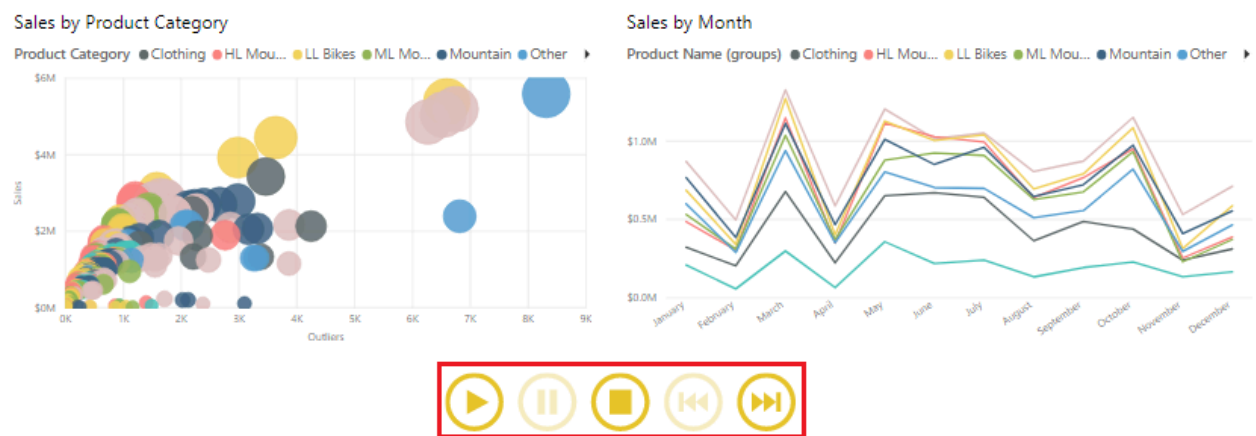
Some organizations prefer not to use custom visuals for security or other reasons. Before you import custom visuals, check with your organization to see whether they're allowed. If they're not allowed, you can use the scatter chart visual and its play axis instead.

Consider a scenario where you're developing a Sales report. The Sales team wants to study the quarterly sales trends and identify which models sell better, depending on the time of the season. You decide to use two visuals: a scatter chart and a line chart, for time series analysis. You then enhance those visuals with animation so the Sales team can learn how the sales data changes over time.

You start by adding your visuals to the report page to show the sales data and then importing the custom visual.

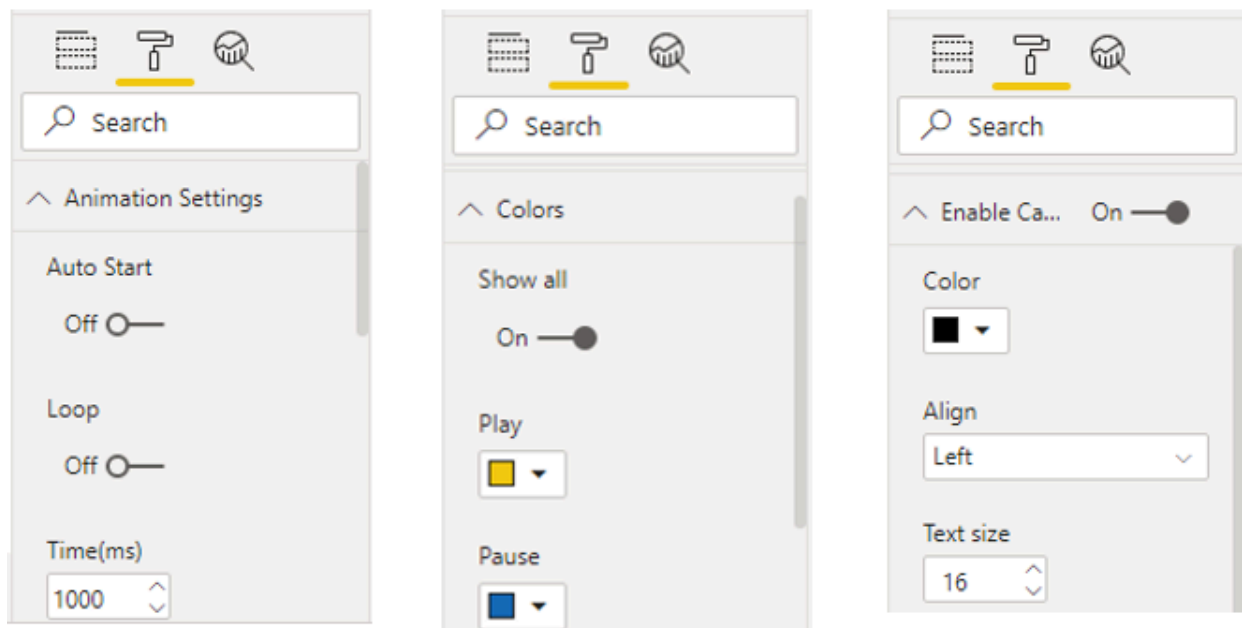


With the new visual selected, add the **Quarter** field to the **Play Axis** visual. Animation controls then become available on the visual.

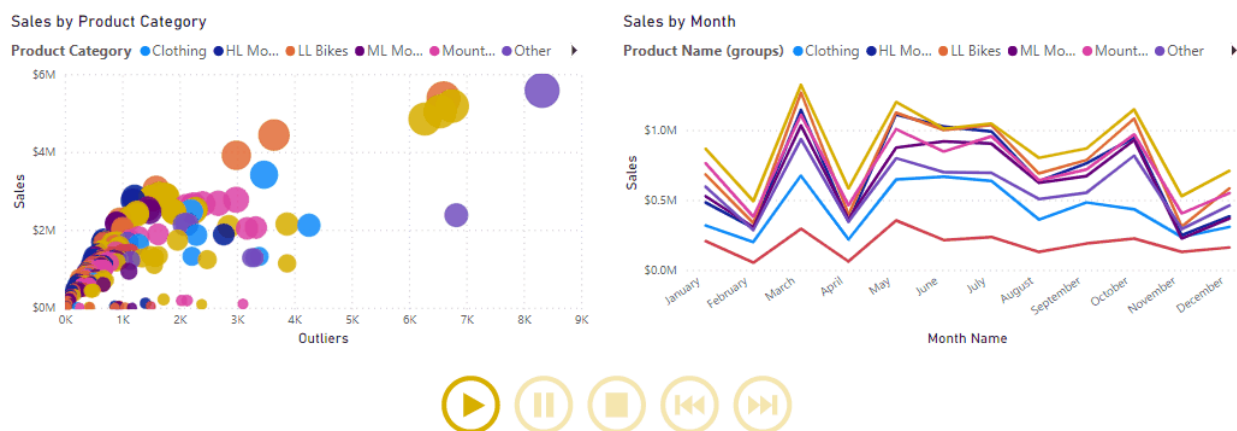


You can resize, reposition, and customize the visual's formatting to match the other visuals on the page. Key formatting options include:

- **Animation Settings:** Control play functionality, such as autostart, looping, and animation speed.
- **Colors:** Adjust overall color or individual control button colors.
- **Enable Caption On:** Toggle text display next to the visual and adjust its formatting.



After configuring the visual, select the **Play** button and watch how the data in each visual on the page evolves over the time. You can use the control buttons to pause the animation, restart it, and further analysis.



7. Use the Analyze feature

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/7-analyze-feature>

Use the Analyze feature

Completed

The **Analyze** feature provides you with further analysis that's generated by Power BI for a selected data point in a visual. You might use this feature to see if Power BI found something new or to gain new insights into your data. This feature is useful for analyzing why your data distribution looks the way that it does.

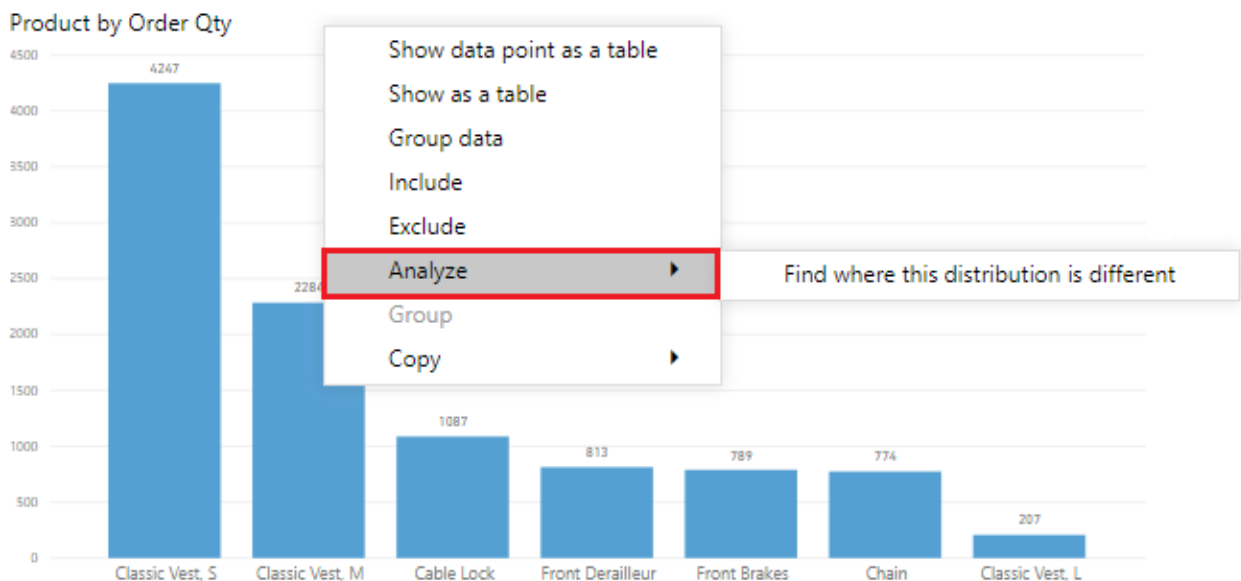
Note

This feature doesn't work if you have non-numeric filters applied to your visual and/or you have measure filters applied.

Consider a scenario where you're developing a report for the Customer Service team that deals with help tickets. They want to analyze the ticketing data created online when a customer asks a question.

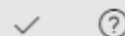
After creating a visual displaying tickets by location, you're curious about the distribution. Instead of exploring the data manually, you can use the **Analyze** feature to get fast, automated, insightful analysis of your data.

To use the **Analyze** feature, right-click a data point on the visual and then hover over the **Analyze** option to display two further options: **Explain the increase** and **Find where the distribution is different**. The options that are available depends on the data point that you selected.



In the following image, you select the **Explain the increase** option, and a window opens with a new visual.

Here are the filters that cause the distribution of OrderQty by Product Name to change the most

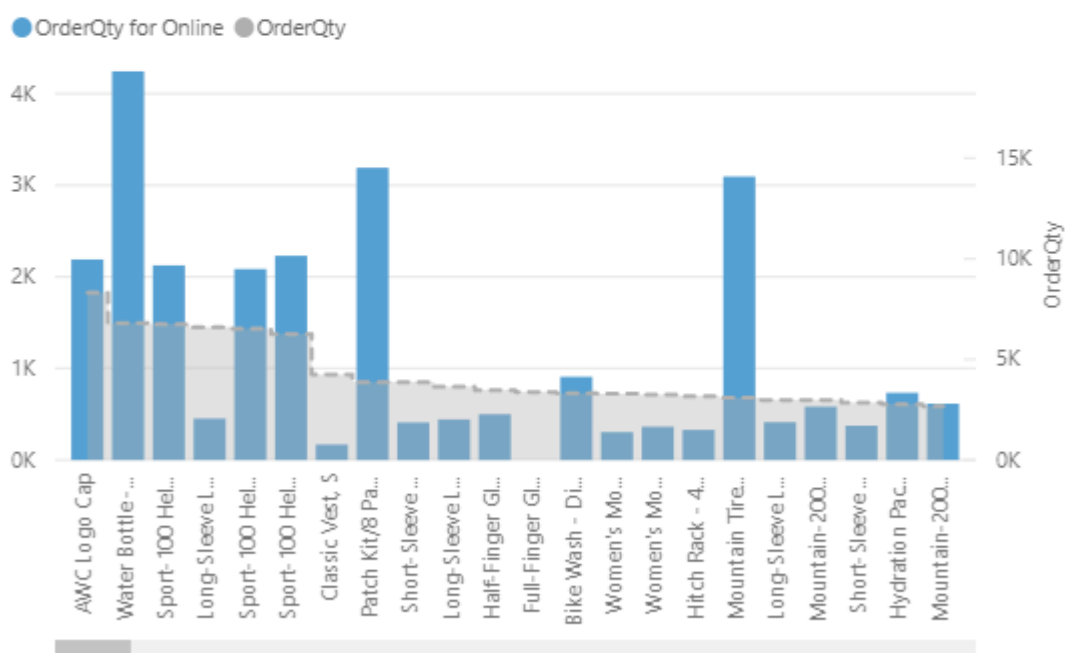


TYPECUSTOMER



'Online', with 49.8% of records and 'Retail', with 50.2% of records, most affect the distribution.

Online Retail



☒ Comparing proportions ⓘ

If you find this analysis useful, you can add any of the new visuals to the report so that other users can benefit from it. Select the plus (+) icon in the upper-right corner of the visual to add it to your report.

For more information about the Analyze feature, see [Apply insights in Power BI Desktop to discover where distributions vary \(preview\)](#).

8. Create what-if parameters

Create what-if parameters

Completed

You can use *what-if* parameters to run scenarios and scenario-type analysis on your data. What-if parameters are powerful additions to your Power BI semantic models and reports because they enable you to look at historical data to analyze potential outcomes should a different scenario occur. Additionally, what-if parameters can help you to predict or forecast what could happen in the future.

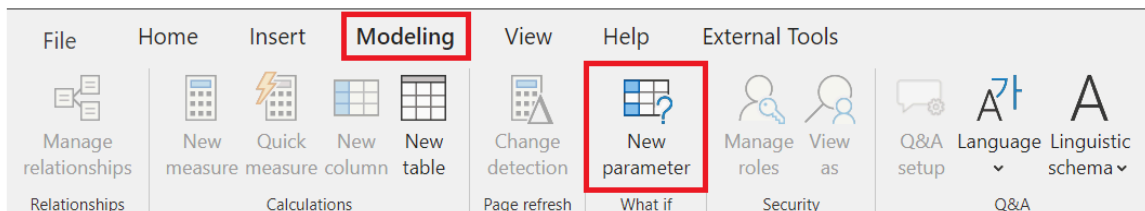
You can use what-if parameters in multiple situations. For instance, you can determine the effect of increased sales to deeper discounts, or let sales consultants see their compensation should they meet certain sales goals or percentages.

Consider a scenario where you want to find out how much growth the Sales team needs to make in order to earn 2 million dollars gross sales each month.

Create a what-if parameter

To create a what-if parameter, follow these steps:

1. On the **Modeling** ribbon tab, select **New Parameter**.



2. In the **What-if parameter** window, configure the new parameter.
3. For this example, change the parameter name to *Sales Forecast Percentage*.
4. Set the **Data type** to *Fixed decimal number* because you're using currency in your forecast.
5. Set the **Minimum** value to *1*, the **Maximum** value to *1.50*, and the **Increment** value to *0.05*, which is how much the parameter adjusts with report interactions.
6. Set the **Default** value to *1.00*.
7. Leave the **Add slicer to this page** checkbox selected so that Power BI automatically adds a slicer with your what-if parameter to the current report page.

×

What-if parameter

Name

Sales Forecast Percentage

Data type

Fixed decimal number ▼

Minimum

1

Maximum

1.5

Increment

0.05

Default

1

☒ Add slicer to this page

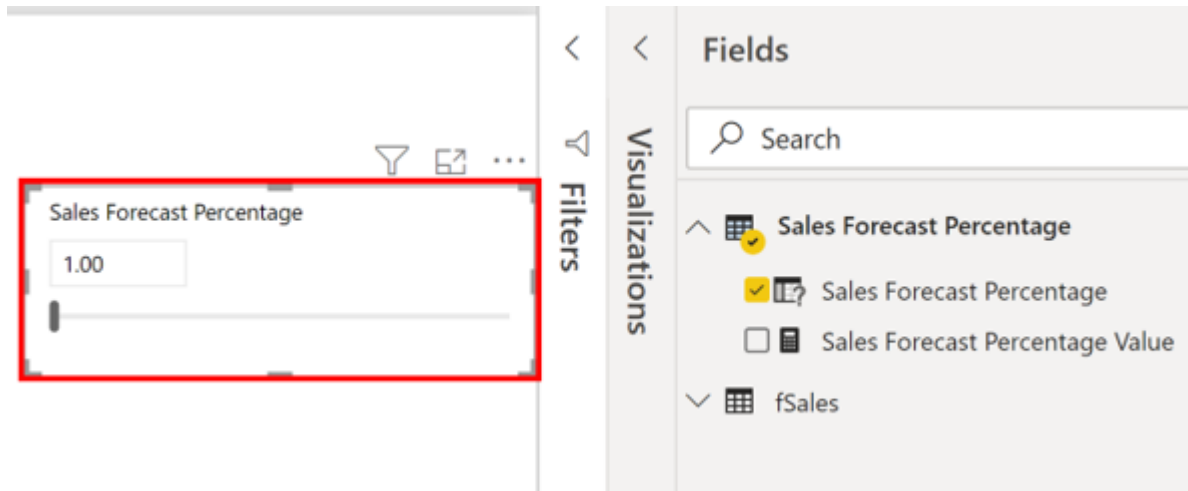
OK

Cancel

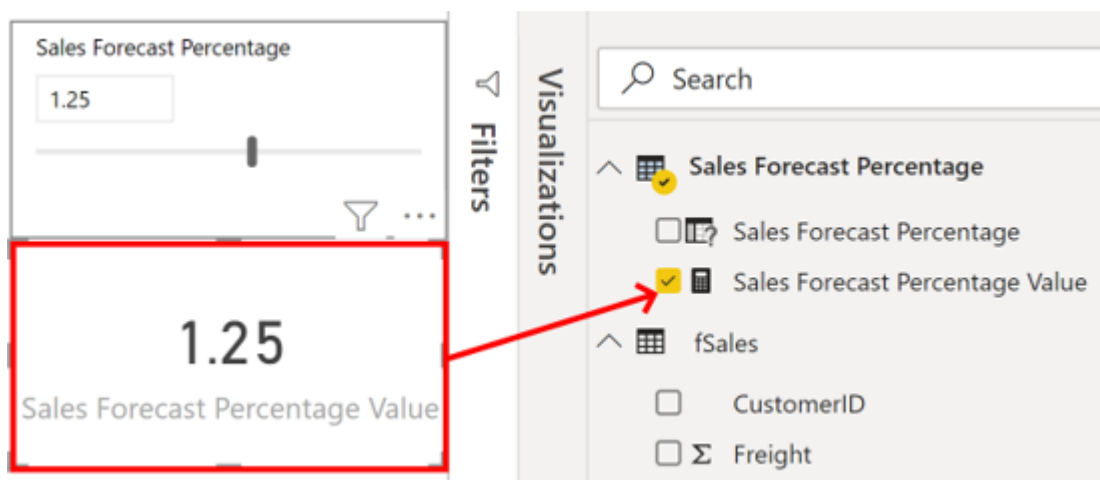
Note

For decimal numbers, make sure that you precede the value with a zero (as in *0.50* versus *.50*).

The new slicer visual appears on the current report page. You can move the slider to see the numbers increase according to the settings that you applied. You should also see a new field for the **Sales Forecast Percentage** table in the **Data** pane, and when you expand that field, the what-if parameter should be selected.



Similarly, you should see the measure that was also created. You can use this measure to visualize the current value of the what-if parameter.



After you create a what-if parameter, the parameter and the measure are parts of your data model. Therefore, they're available to the report and can be used on other report pages. Additionally, because the parameter and measure are part of the model, you can delete the slicer from the report page. If you want it back, you can drag the what-if parameter from the **Data** pane onto the canvas and then change the visual type to a slicer.

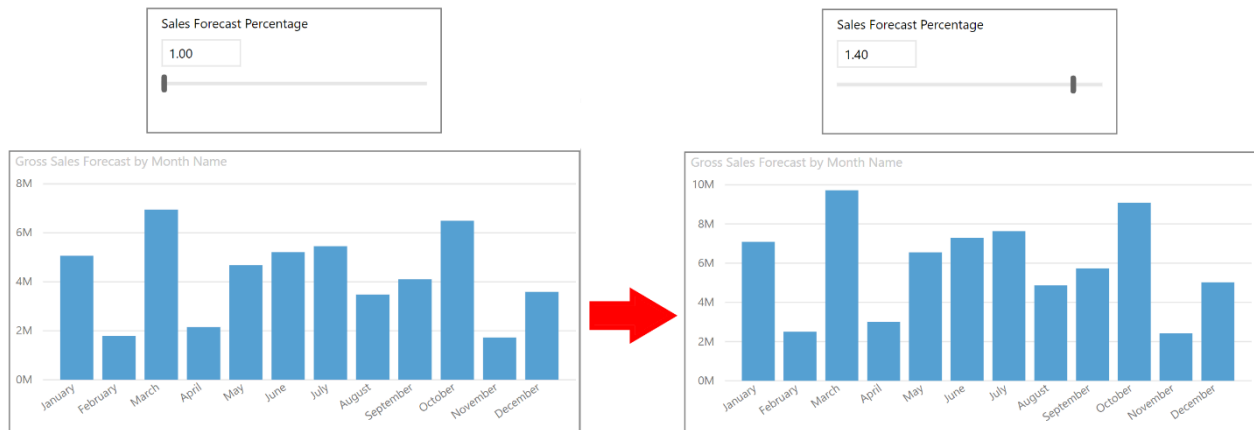
Use a what-if parameter

You need to create a new measure whose value adjusts with the slider to use the new parameter. You can create complex and unique measures that let your report users visualize the variable of your what-if parameter. However, to keep this example simple, the new measure is the total sales amount, with the forecast percentage applied, as show in the following measure expression.

```
Gross Sales Forecast =
[Gross Sales] * [Sales Forecast Percentage Value]
```

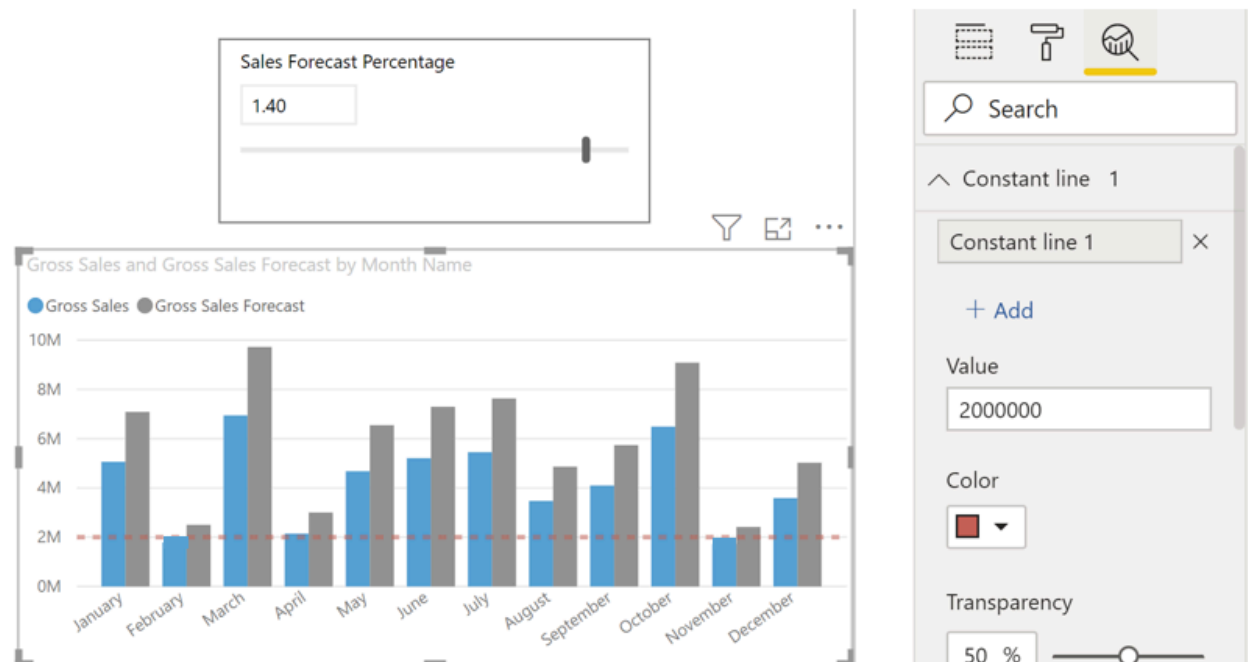
Next, you create a clustered column chart with the **MonthName** field on the axis and the **Gross Sales** and **Gross Sales Forecast** measures as its values.

Initially, the bars are similar; however, as you move the slider, notice that the **Gross Sales Forecast** column reflects the sales forecast percentage amount.



Add a constant line

To enhance the visual, you can add a constant line so that you can clearly see how the organization is performing against a particular threshold or target. In this example, we add a constant line with 2 million dollars as the threshold value. Then use the slider to find out by what percentage increase sales must grow to reach the threshold. In the following image, the gross sales need to increase by 1.40 percent to reach the two million dollar threshold.



9. Use specialized visuals

Use specialized visuals

Completed

Power BI includes several specialized visuals that provide considerable interactive experiences for report consumers. Often, these specialized visuals are called *AI visuals* because Power BI uses machine learning to discover insights from data. These visuals provide a simple way to deliver rich and interactive experiences to your report consumers.

The three main AI visuals are:

- Key influencers
- Decomposition tree
- Q&A

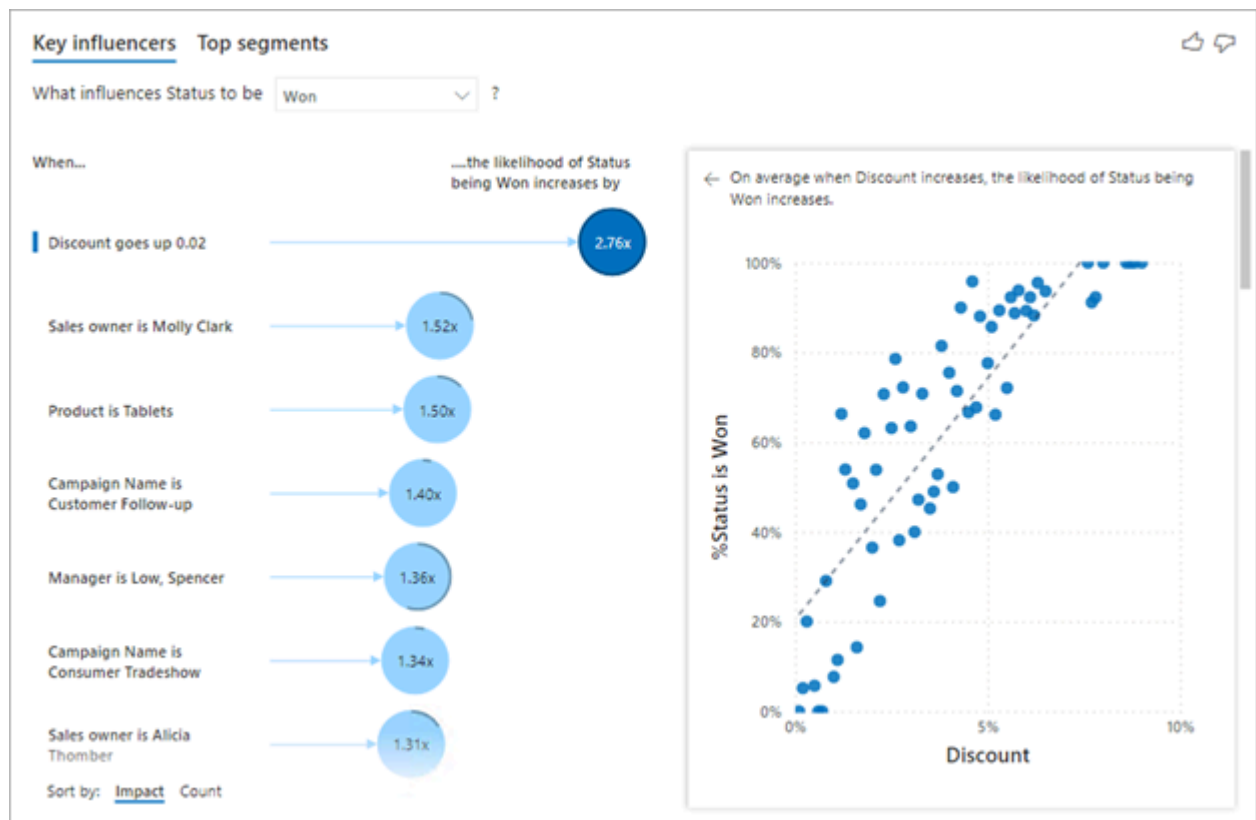
Tip

When adding an AI visual to your report, make sure that you size it to become as large as possible. That way, report consumers can fully interact with, and explore, the data in the visual.

Key influencers

The **Key influencers** visual helps report consumers understand the factors that drive a particular metric, like sales revenue. By using AI, Power BI analyzes the data, ranks the factors that matter, and then presents them as key influencers.

In the following example, the visual helps report consumers understand the important factors that contribute to won sales opportunities. According to the visual, when the discount rate increases by 2 percent, the likelihood of a won sales opportunity increases by a factor of 2.76.



The **Key influencers** visual is many visuals inside one frame. When you select a key influencer, an adjacent visual displays a representation of the influencer as a comparison against the remainder of the data. Additionally, the **Key influencers** visual includes the **Top segments** view, which shows the highest-ranking segments that contribute to a particular metric.

The capabilities of the **Key influencers** visual are best described by following an example. For a demonstration of the **Key influencers** visual, watch the following video.

For more information, see [Create key influencers visualizations](#).

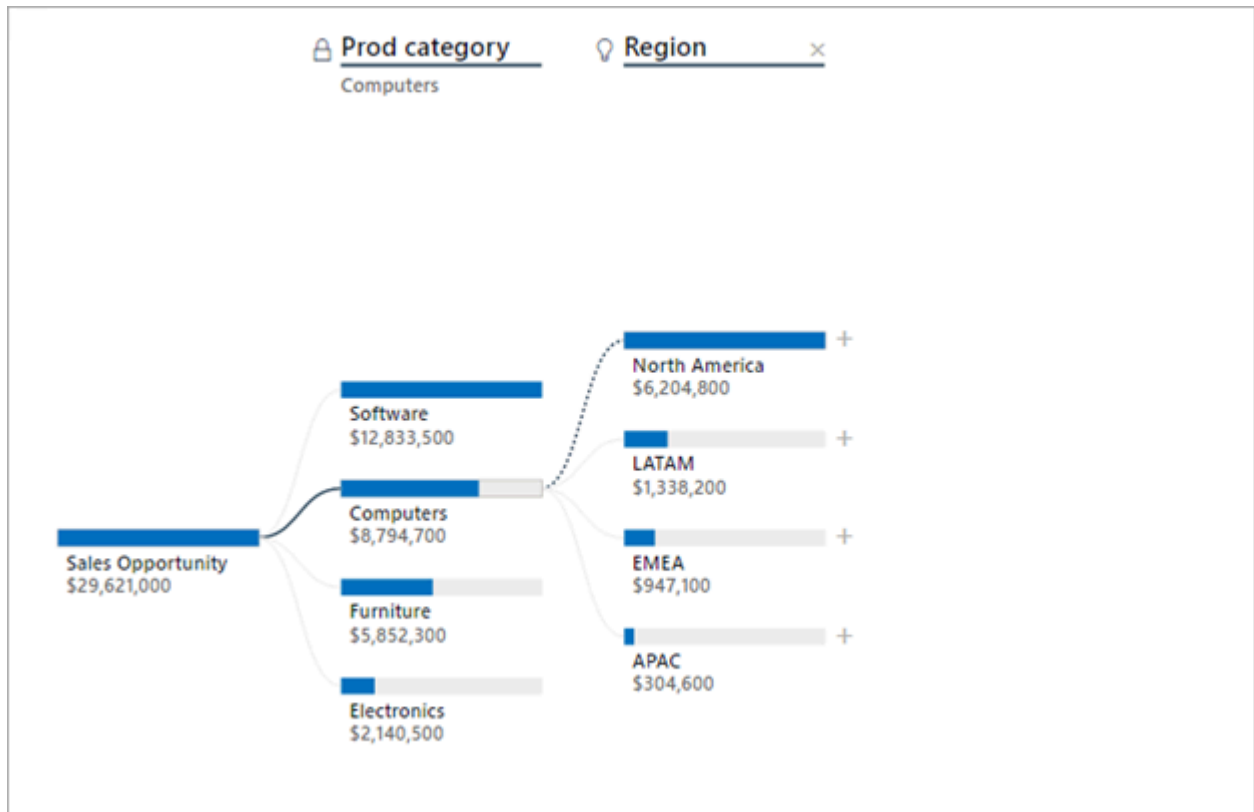
Decomposition tree

The **Decomposition Tree** visual helps report consumers visualize data across multiple dimensions. It automatically aggregates data and enables consumers to drill down into dimensions in any order. As a result, it's a valuable tool for exploration and conducting root cause analysis. As an AI visual, a

decomposition tree provides a guided exploration experience that helps by finding the next dimension for consumers to drill down into.

In the following example, a **Decomposition Tree** visual helps report consumers to understand the breakdown of sales opportunity revenue.

For a demonstration of the **Decomposition Tree** visual, watch the following video. The lock icon next to the **Prod Category** split means that the report author added the split and set it so that it can't be removed. Additionally, the light bulb icon next to the **Region** split means that the report consumer used an AI split to discover the best split.

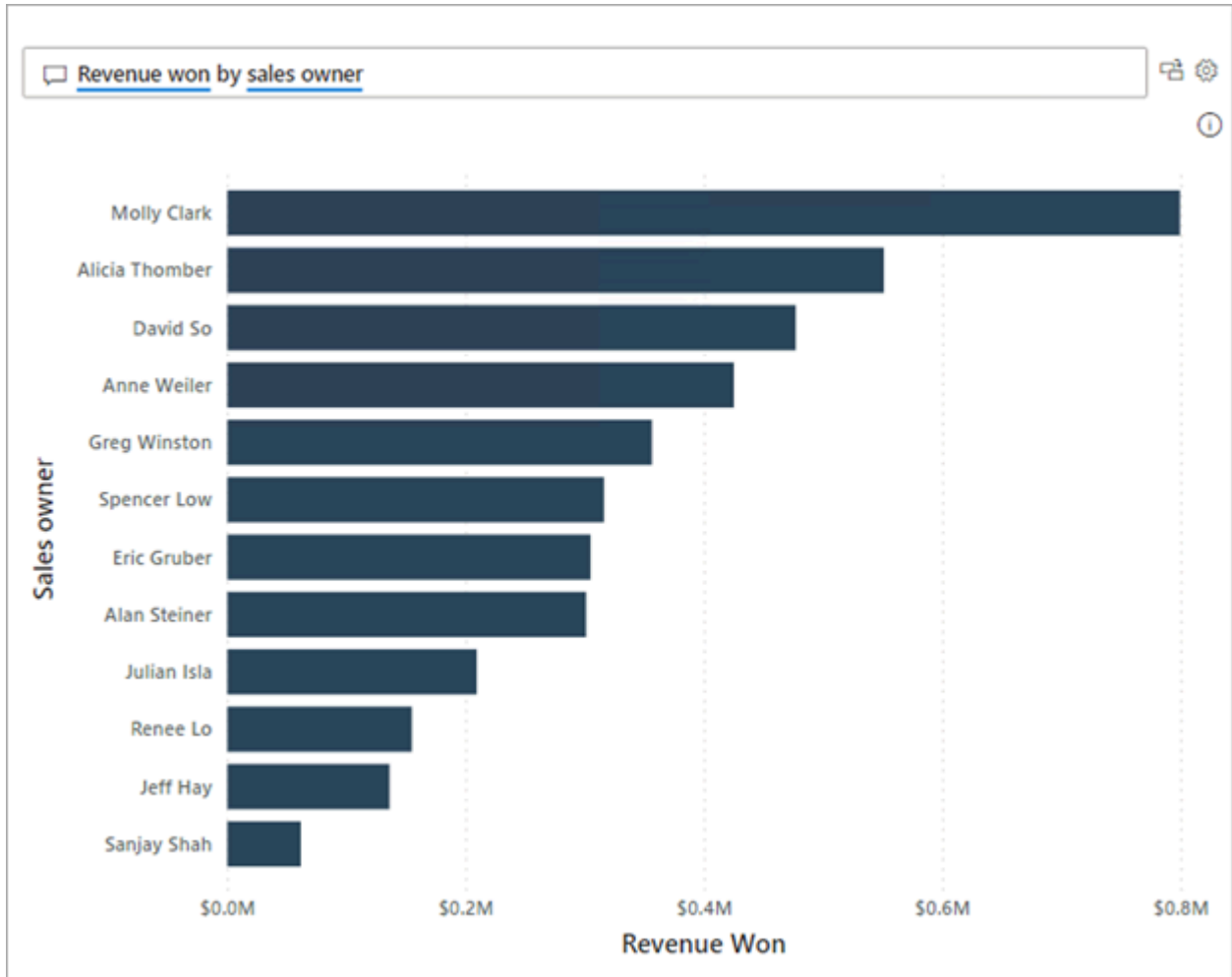


The capabilities of the **Decomposition Tree** visual are best described by following an example. For a demonstration of the **Decomposition Tree** visual, watch the following video.

For more information, see [Create and view decomposition tree visuals in Power BI](#).

Q&A

The **Q&A** visual allows report consumers to ask questions of their data and receive responses as data visualizations. Similar to how web search engines parse and understand complex search requests, report consumers can write natural language questions (in English).



Tip

To optimize the Q&A experience, ensure that the data field names are user-friendly. You can also enhance the semantic model with synonyms and terms. Additionally, you can hide fields, such as fields that are used in model relationships, to restrict their use in Q&A. You can also add suggested questions that become prompts in the **Q&A** visual.

For a demonstration of the **Q&A** visual, watch the following video.

For more information, see [Use Power BI Q&A to explore your data and create visuals](#).

10. Exercise - Perform analytics in Power BI

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/10-lab>

Exercise - Perform analytics in Power BI

Completed

In this exercise, you learn how to:

- Create animated scatter charts
- Use a visual to forecast values

This lab takes approximately **20** 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](#).

Tip

You need access to the Power BI service to complete this exercise in your own environment. Work with your IT organization or create a free [Microsoft 365 Developer account](#).

Access your environment

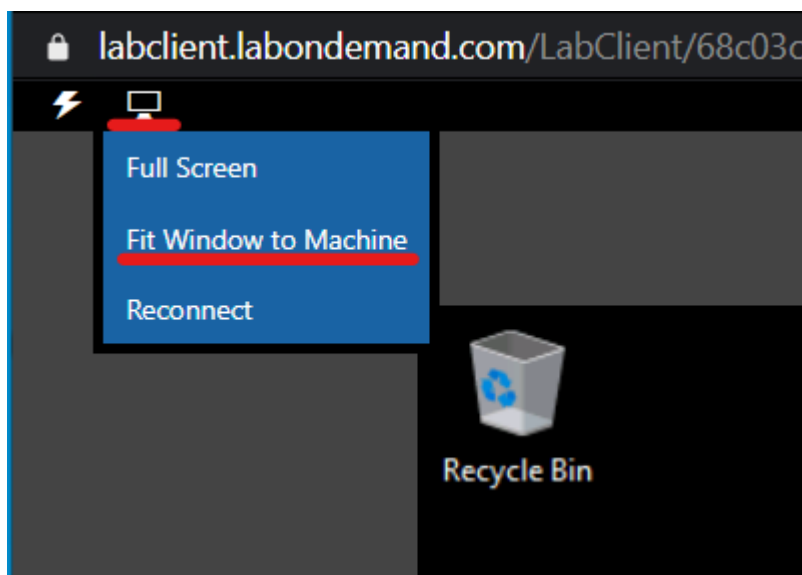
Before you start this lab (unless you are continuing from a previous lab), select **Launch lab** above.

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**.



11. Check your knowledge

<https://learn.microsoft.com/en-us/training/modules/perform-analytics-power-bi/11-check>

Check your knowledge

Completed

12. Summary

Summary

Completed

In this module, you learned about the emerging power of advanced analytics and discovered how the advanced analytics capabilities of Power BI can bring value the decision making and strategy formulation of your organization.

You enhanced the reports and dashboard to enable your organization to ask more questions and find more information that's specific to their teams and work contexts. You used Power BI to explore your data and create a statistical summary to find key takeaways and trends and identify outliers that might require immediate action. You conducted a time series analysis of your data to see how your data progressed over time so that you could make observations and forecast behavior.

Additionally, you used the *Analyze feature* to get Power BI to explain the increases and show you where the distribution was different in your data. You built upon the standard visuals in your report by adding custom visuals that helped you solve business problems and display data in more enhanced, animated ways. Then, you returned to Power BI to check for quick insights in your data to find more useful insights that you could add to your dashboards. Lastly, you used the grouping, binning, and clustering techniques to segment and present your data in different ways.

The advanced analytical techniques that you applied to your data enabled you to gain new insights from that data, and further scrutinize the data to uncover patterns, trends, and outliers that you didn't know existed. The results of your advanced analysis empower your organization to make more robust business decisions, plans, and forecasts.