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Tips for Building Rich Interaction in Your SAS® Visual Analytics Reports

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ABSTRACT

Your data has a lot to say. How do you make these insights available to your audience? Enhance the report viewing experience by taking advantage of features in SAS® Visual Analytics to build reports that engage your audience in exploration. This paper highlights features including automated analytical objects, object interactions, drilling hierarchies, as well as report and page controls. The paper also describes techniques to make the most out of these features. With these tips, you can create an interactive report that helps you and your audience dig deeper into the data to gain insights.

INTRODUCTION

Have you ever looked at a report and thought "I wish I could see the detailed list of transactions?" or "I have the sales by region but I wish I could see the sales by country"?

Your audience has a lot of questions, and your report can answer them in a number of different ways. So what is the best strategy to connect your audience with answers found in the data? As a report author, you are likely to consider the following when crafting your report:

- Who is your target audience?
- What is the goal of the report?
- How does your audience plan to use the report?

Depending on the answers to these questions, you might consider adding interactivity to your reports.

WHAT'S IN IT FOR YOUR REPORT AUDIENCE

1. Package multiple data insights into one concise report view.
2. Empower your audience to answer their own questions by adjusting data on demand.

WHAT'S IN IT FOR YOU

1. Take advantage of the capabilities of your web-based application, rather than being limited by a static report.
2. Answer more questions with fewer reports by building one report for multiple audiences.

This paper highlights new and existing tools report authors can use to add interactivity, such as filters, report and page controls, and object interactions. This paper is intended for those new to SAS Visual Analytics who want to take their skills to the next level.

Please note that these recommendations do not take into consideration the performance impact of interactions. In general, the more interactions and calculations used in a report, the more time a report needs to update. Use interactions wisely.

CREATE A NARRATIVE WITH NAVIGATION

No SAS Visual Analytics report can be called "typical." However, many users rely on pages and page order to create a narrative flow within their reports. Most report audiences are likely to move through the contents of a report page by page, or else select the page with the information they seek. But as a report author, you can also build additional navigational paths for your audience. This enables you to better control the order in which your audience views the information given, or to provide additional context to those in your audience who prefer a deeper dive.

LINKING

Page and report linking provides an alternative structure to a report. You can connect objects to other pages or other reports. If you link to a page or report from a specific object, your audience can simply double-click to access your linked path. You may find it useful to link to existing reports containing previous years' data for better comparison.

One particularly clever use of linking allows you to create a table of contents that links to each page of your report. First, create a new text object and place it where you'd expect to see a table of contents (you can find the text object in the Content section of the Objects pane). The first page is a natural choice, or another if you already use a title page. Enter the name of the first content page within your report and then highlight the text. When a toolbar appears, click the Add page link button and select the page you want to link to within the subsequent window. Continue to add linked text until you've included all pages in your report. You can even add links to external sites managed by your organization using the Add URL link button in the toolbar. You can find out more about creating tables of contents at the *Beautiful Reports* website.

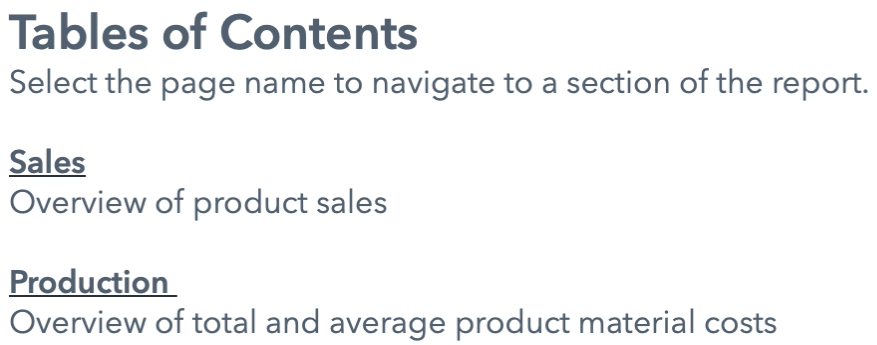


Figure 1. Example of a Simple Table of Contents Using Page Links

POP-UP WINDOWS

If you've used SAS Visual Analytics before, you may be familiar with the hidden page feature. By creating a new page and clicking on the menu button, you can select Hide page. A change in the appearance of the page tab indicates which of your pages has been hidden. Use a hidden page as an area of exploration, or to test out a new layout design. Your audience cannot see the content on a hidden page. Unless, of course, you use a hidden page to create a pop-up window for your audience.

A pop-up window is an area of your report that will not appear in the page tab navigation but can be reached by a link. In other words, your audience can double-click on an object of your choice to open the pop-up window.

Pop-up windows assist your audience by showing content that may not be pertinent to all readers. One excellent use of a pop-up window is to provide a detailed description of a metric or chart type used in your report. Just make sure that you provide enough context to ensure that your audience knows that the pop-up window exists and can be accessed by double-clicking the link or object of your choice.

The simplest way to create a pop-up window is to create a new page. Then open the Options pane and select the Hide and link to page as pop-up window check box. This option will hide your page and provides inputs allowing you to adjust the size of the pop-up window when viewed by your audience. Then, create a new text object from which you'd like to open your pop-up window. Note that your text object should not be on the hidden page you just created. Highlight the text and click Add page link, just as if you were linking to a visible page. Select the hidden page you just created. Note that your view of the hidden page will differ between Edit and View mode.

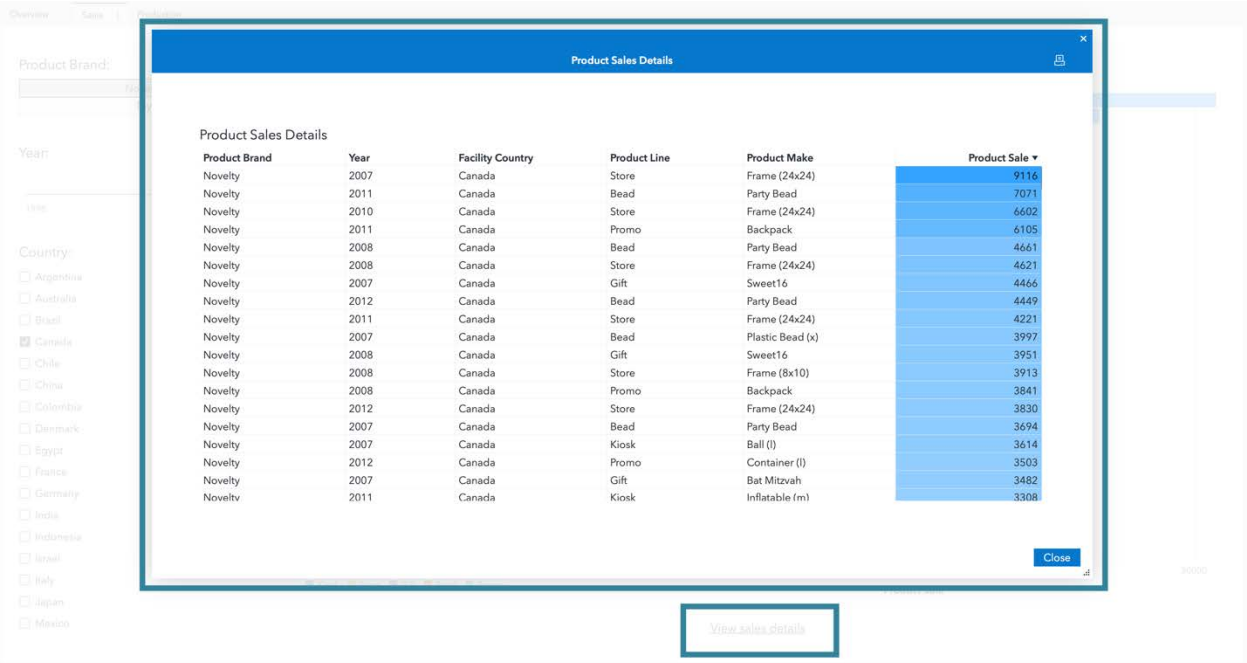


Figure 2. Example of a Pop-up Window Opened by a Text Object

You can also create a pop-up window that can be opened by a non-text object. However, be careful. If you choose a pie chart as your originating object for example, a report user will most likely double-click on a specific slice of the pie to open the pop-up window. If you've included any data object like a key value, list table, or something similar in the pop-up window, those objects will be filtered by the originating object.

If your pop-up window contains dynamic data values, you can elect to periodically reload page data to ensure the values shown are always up to date. However, turning on this feature may affect the report's performance. For more information, see the *SAS Visual Analytics 8.5: User's Guide*. Also keep in mind that since pop-up windows appear outside of the context of a normal page, certain features of the application cannot be accessed while the window is open. Ensure that the information you put in a pop-up window is self-contained.

FILTER YOUR DATA

As you build your report, you will likely use standard filters from the Filters pane. However, taking advantage of SAS Visual Analytics' robust specialized filtering features is a great way to build rich interaction into your report. With specialized filtering, you can apply specific contexts from page to page and drill deeper into data objects. You can be sure that your report audience always views the information most relevant to them, without building separate reports for each audience.

PAGE AND REPORT CONTROLS

Page and report controls provide a way to filter an entire page or report simply and intuitively. They are also sometimes referred to as page and report prompts. These controls can help your audience self-select the most relevant information for them. For example, you might add a report control that filters all objects in the report to show a single financial quarter or a region of interest. Your report audience will feel empowered, and you can save time otherwise used to create multiple reports.

Control areas can only contain control objects and prompt containers. By default, report and page controls are located at the top of the report. Report control areas sit below a report title and above the page tabs. The page control areas sit below a report's page tabs and above the page content.

Reports and pages allow for four placement positions of the control areas: top, bottom, left, and right. You may choose a design which best fits your report structure. It is common to place control objects at the top and left, but you may wish to move them to a less conspicuous place on your page, below report content. To change the position, select the page or report, open the Options pane, and expand the Page Controls section or the Report Controls section.

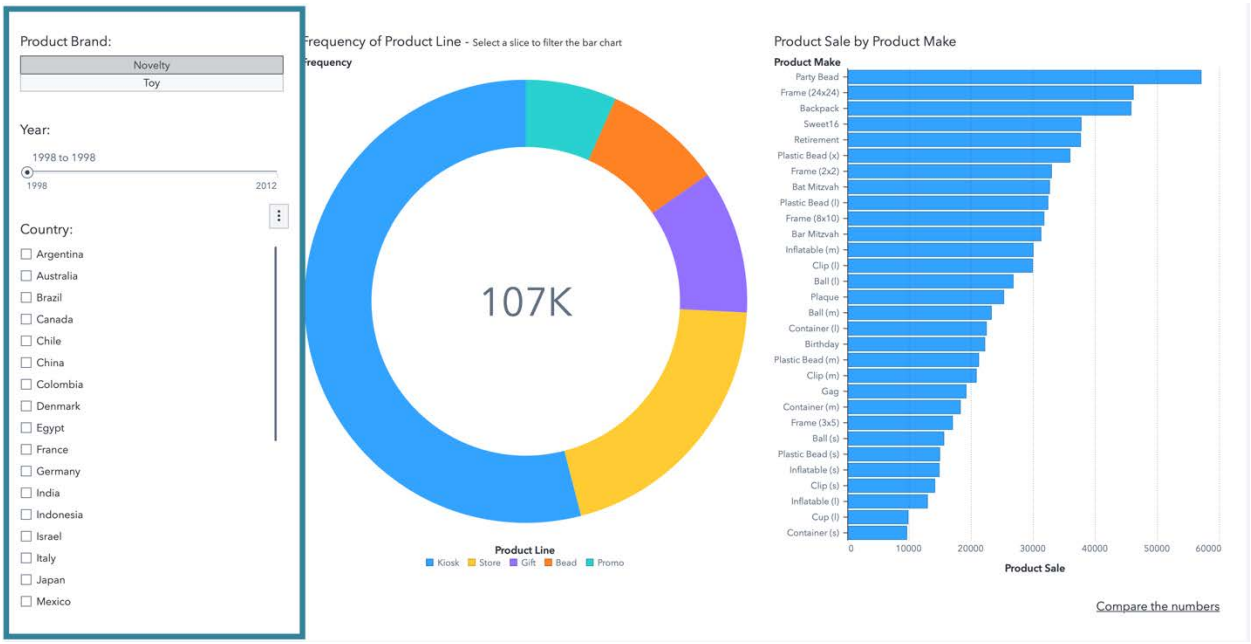


Figure 3. Example of a Page with Page Controls on the Left

Creating a page or report control is easy: drag and drop your selected data onto the aforementioned areas of the report and release after the appropriate blue area is highlighted. The software detects the most appropriate control object for your data.

ONE- AND TWO-WAY FILTERING

If you appreciate the power of page and report control filtering, but prefer a more open-ended approach, one- or two-way filtering may help you reach your goal.

One-way filtering acts just like a page control. However, this type of filtering does not provide your report audience with any drop-down lists, sliders, or other controls. Instead, your audience can select any data element on the page, and the rest of the objects on that page will be filtered by that selected data element. For example, a report user may click on a slice of a pie chart showing sales of all regions and choose one specific region. The rest of the page will be filtered by the selected region. You can combine more than one filter by selecting additional data elements.

If you believe your audience is savvy enough to prefer their own filtering methods, or don't want to clutter your report with numerous page or report controls, try one-way filtering.

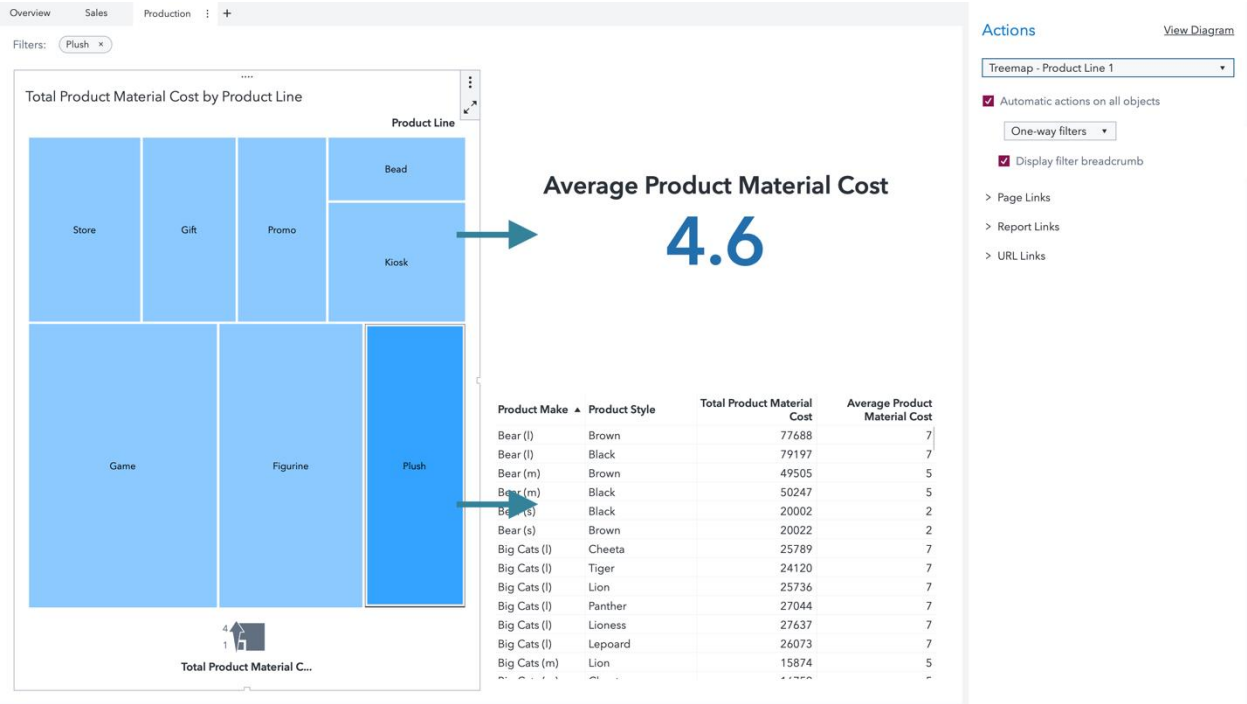


Figure 4. Example of Automatic One-way Filtering**. The Selected Value "Plush"** in the Treemap is Filtering the Key Value and List Table on the Page.

Unlike one-way filtering, two-way filtering applies filters to all objects on the page, including the object that is the source of the filter. This allows filters to more quickly compound. However, if used incorrectly, two-way filtering can easily result in all data being filtered out of an object or page. For more in-depth information about using two-way filtering, see the *SAS Visual Analytics 8.5: User Guide*.

To turn on one- or two-way filtering, open the Actions pane. Select the Automatic actions on all objects checkbox and select the type of filtering from the drop-down list. The Actions pane defaults to one-way filtering.

When a one- or two-way filter is applied to a report, a filter breadcrumb with blue oval tokens appears. The breadcrumb communicates exactly which filters are currently applied. Dismiss individual filters by clicking on the small "x" beside each token. You can turn off the filter breadcrumb, if you prefer. However, when using two-way filtering, the filter breadcrumb is required.

LINKING WITH A FILTER CONTEXT

You already know that linking from a text object or other object can be a useful way to navigate through a report without using page tabs. However, you can also use linking to navigate while applying a specific filter to each subsequent page or report while in a linked state.

More simply, page and report linking act as a form of cross-page or cross-report drilling. For example, you might apply a page link to a bar chart on Page 1 that shows sales by geographic area. If your end user is only interested in one specific geographic area, they might double-click the Southeast region, linking them to Page 2. All information shown on Page 2 will be filtered by the initial object selection.

To set up a page or report link, select the object that will initiate the link and open the Actions pane. Expand the Page Links or Report Links section and select a page or report to link to.

Navigation while using link filters can be confusing, which is why SAS Visual Analytics restricts all other navigation actions when in this linked state. If you use a page or report link by selecting a data element, you'll see normal report tabs disappear. Instead, you'll notice the title of your report will show a breadcrumb that helps your audience to understand the source of each filter.

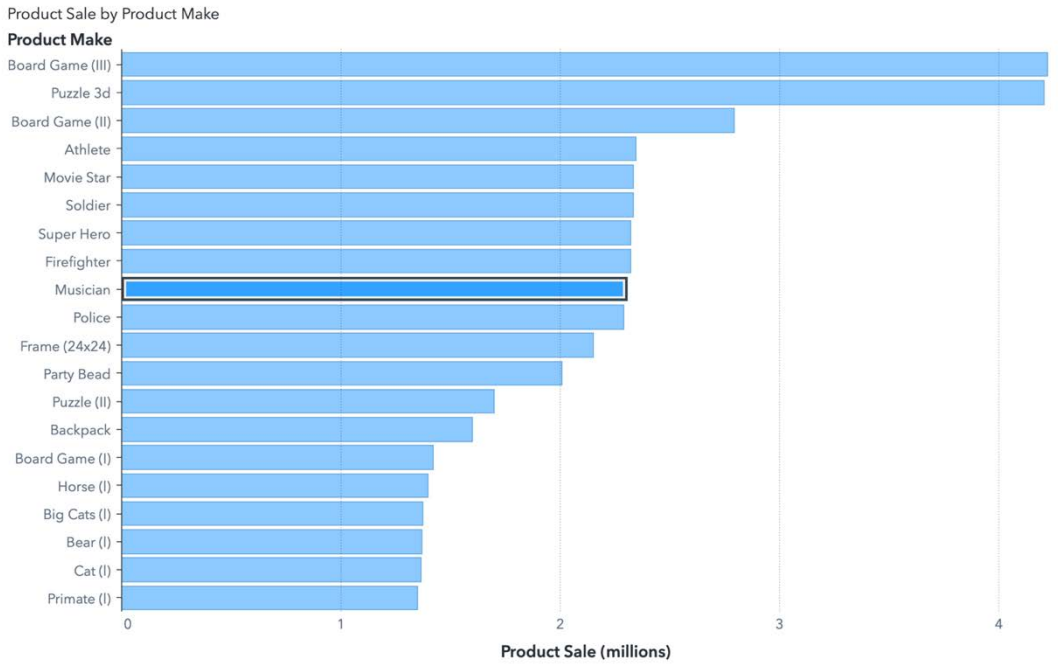
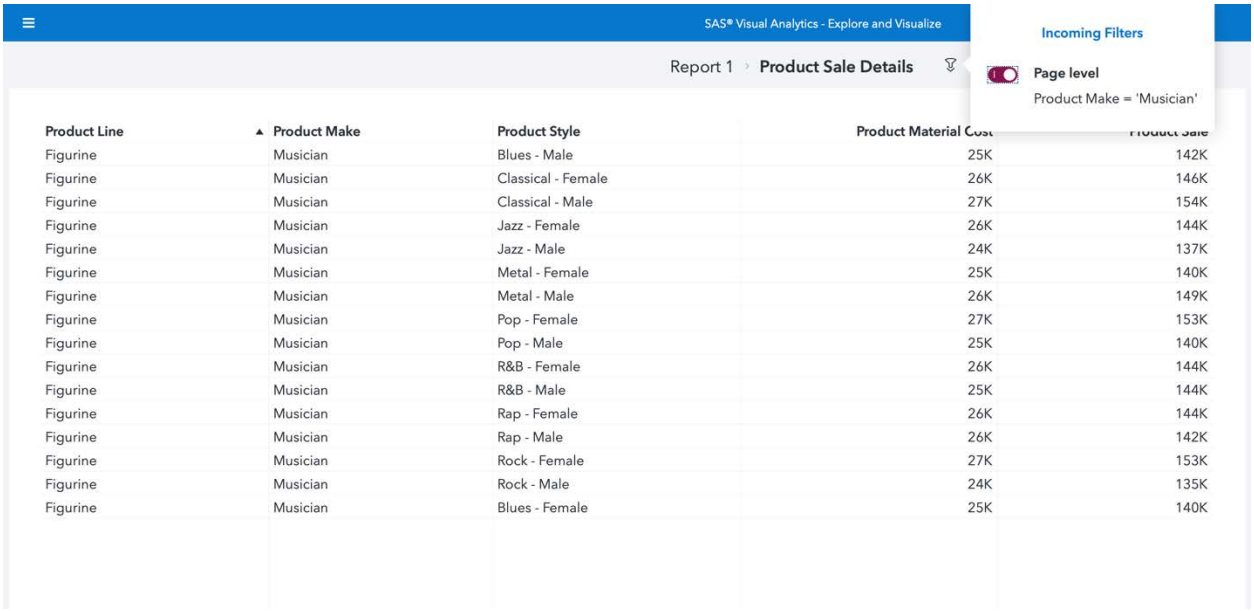


Figure 5. Example of a Bar Chart that Initiates a Page Link with a Filter Context



Product Line	Product Make	Product Style	Product Material Cost	Product Sale
Figurine	Musician	Blues - Male	25K	142K
Figurine	Musician	Classical - Female	26K	146K
Figurine	Musician	Classical - Male	27K	154K
Figurine	Musician	Jazz - Female	26K	144K
Figurine	Musician	Jazz - Male	24K	137K
Figurine	Musician	Metal - Female	25K	140K
Figurine	Musician	Metal - Male	26K	149K
Figurine	Musician	Pop - Female	27K	153K
Figurine	Musician	Pop - Male	25K	140K
Figurine	Musician	R&B - Female	26K	144K
Figurine	Musician	R&B - Male	25K	144K
Figurine	Musician	Rap - Female	26K	144K
Figurine	Musician	Rap - Male	26K	142K
Figurine	Musician	Rock - Female	27K	153K
Figurine	Musician	Rock - Male	24K	135K
Figurine	Musician	Blues - Female	25K	140K

Figure 6. Example of a Page Filtered by the V**alue "Musician" from the** Bar Chart in Figure 5

To exit the linked state and view your report normally, you can click the title of your report or the first link entry in the title breadcrumb. You can double-click in the white space of an object to clear a selection.

Keep in mind that filters compound upon each other – more than one filter may be applied to an object at a time. View which filters are applied to an object in the Filters pane.

REVEALING CONNECTIONS

SAS Visual Analytics provides a multitude of features that allow you to showcase connection and insights across objects. Select features discussed below are linked selection, drilling hierarchies, and using automated objects.

LINKED SELECTION

Linked selection is a simple yet powerful technique. When you add a linked selection, the same data is highlighted in multiple objects. Adding a linked selection will allow your report audience to easily reference corresponding values across objects.

For example, some audiences prefer to view data in table form. You don't have to customize your report based on this assumption. Instead, use linked selection to connect a more focused object, like a bar chart, to a list table. When you click on a bar in the bar chart, all of the specified transactions will be highlighted in the table. This way, users benefit from both representations of the value in question.

Perhaps you would like to show a list table on a page but would prefer another object on that page be the focal point. You might not have enough horizontal space to show all columns. Use linked selection and create a pie chart (for example) so that any row your end-user clicks will clearly show what category that observation is part of.

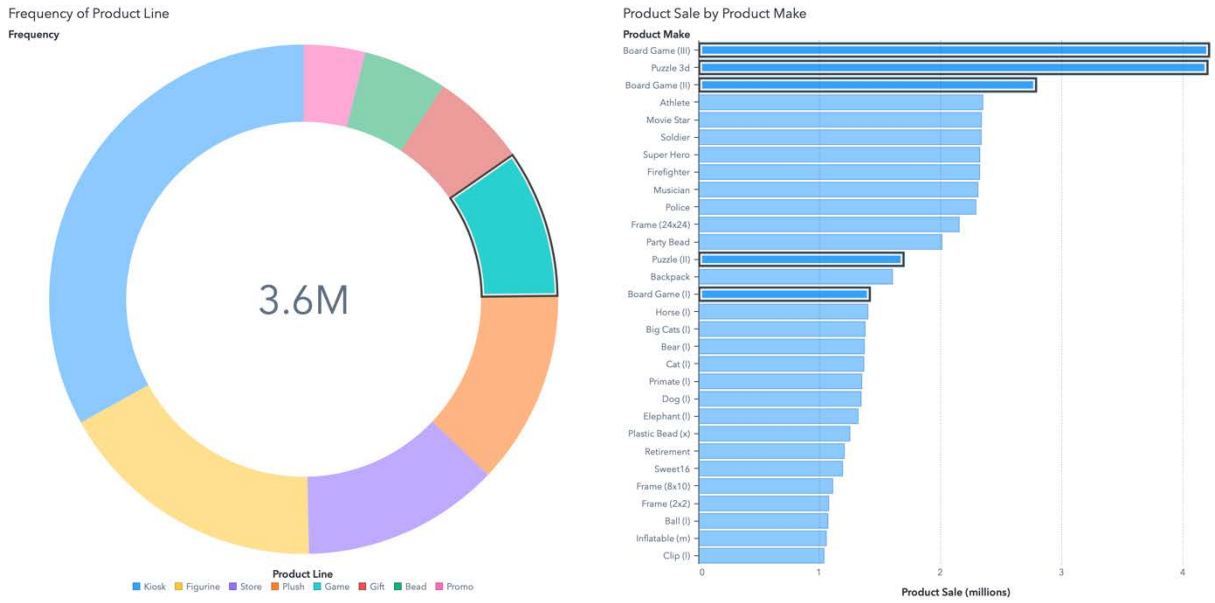


Figure 7. Example of a Linked Selection. The Pie Chart Selection Highlights the Same Data in the Bar Chart

You can add a linked selection from the same pane as where you add one- and two-way filtering. After creating all your objects, from the Actions pane of one of the objects, check the other objects you would like to link with and change the action type from Filter to Linked selection. You can also select the Automatic actions on all objects checkbox and select Linked selection from the drop-down list to automatically apply linked selection to all objects on the page.

HIERARCHIES

Hierarchies are useful for inserting multiple levels of information into one object. They work very well with crosstabs, as well as objects like bar and pie charts. When used in an object, hierarchies allow you and your audience to examine a high-level view of the data but also to dig deeper to see the information at a more granular level − all in one object.

For example, you can create a Year − Quarter − Month hierarchy and use it in a bar chart. The bar chart initially shows the data by year. When you double-click to drill down on a bar, you can now see the data by each financial quarter of that year. If you double-click the bar showing the first quarter, you will see the data by the months that made up the first quarter.

Only category data items may be placed into a hierarchy and some data items work better than others in a hierarchy. Data items based in geography or time make useful hierarchies.

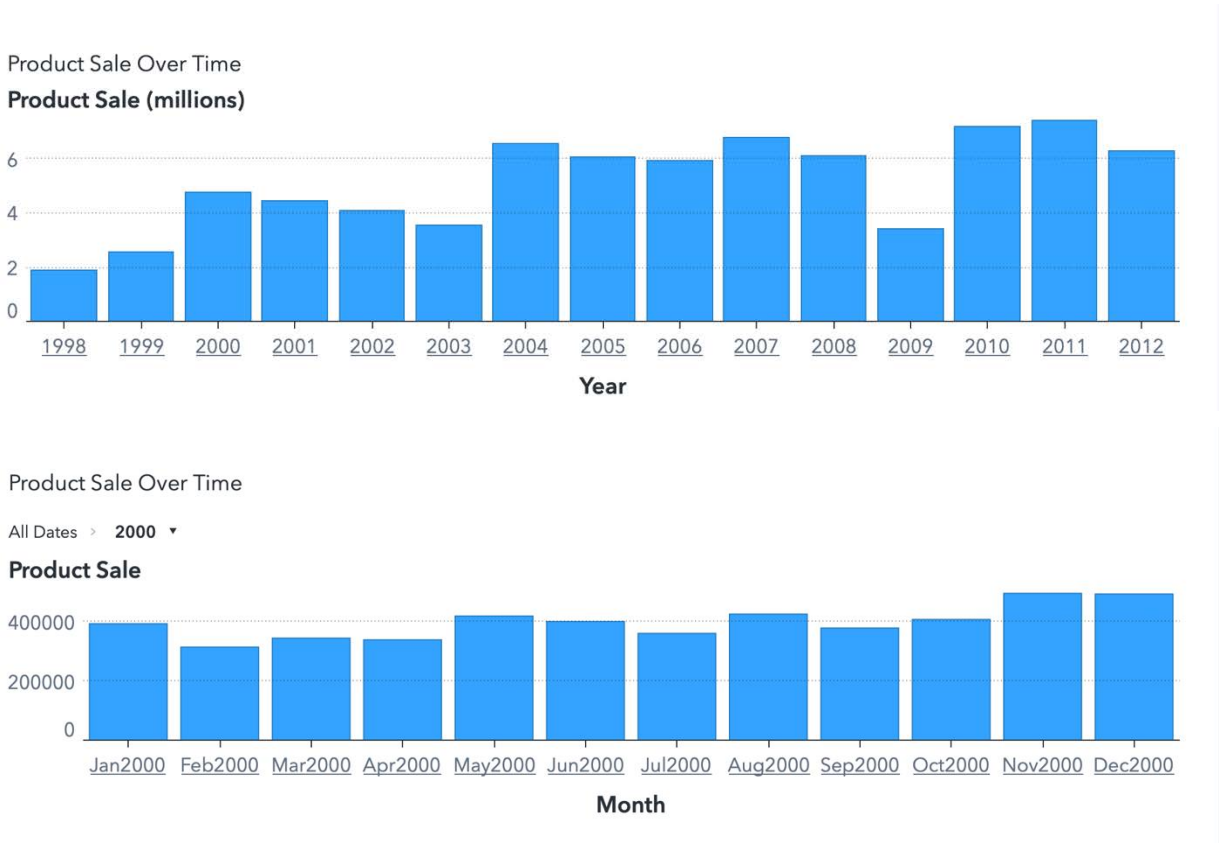


Figure 8. Example of a Bar Chart with a Year – Month Hierarchy.

To create a drilling hierarchy, you must first create a hierarchy data item in the Data pane in Edit mode. In the Data pane, click New data item and select Hierarchy from the list. Next, you can select which existing data items you'd like to put in the hierarchy.

When a hierarchy is used in an object, a friendly breadcrumb and drop-down list enables you to navigate up and down the levels of the hierarchy. If you have multiple hierarchies in one object, you will eventually see one dropdown per hierarchy.

AUTOMATED EXPLANATION AND AUTOMATED PREDICTION

The more data exploration-inclined audience may be interested in the use of the automated explanation and automated prediction objects. These objects provide the power of approachable analytical exploration to your report audience.

The automated explanation object visualizes how underlying factors affect a response variable, helping you determine relationships between your data items (Carey 2019). It also provides a relative importance value for each underlying factor in relation to the response variable so that you can determine which factors to examine further. This useful feature was introduced in SAS Visual Analytics 8.3 as the automated analysis object. It is now referred to as the automated explanation object.

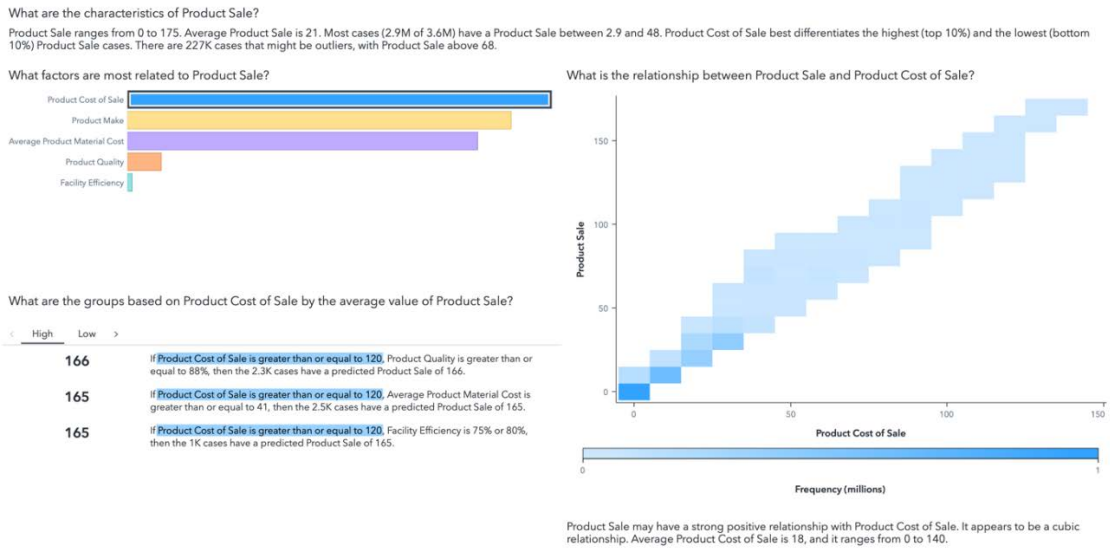


Figure 9. Example of the Automated Explanation Object

In contrast, the automated prediction object determines the best model for predicting the chosen response variable. The automated prediction object provides a form for the user to enter specific values for the underlying factors. You can see how the response variable prediction changes as the values change. Below the prediction, users will see an automatically generated summary. The automated prediction object is available in SAS Visual Analytics 8.5. It is useful if you want your users to explore outcomes specific to cases that are not all known at the time that the report is being authored.

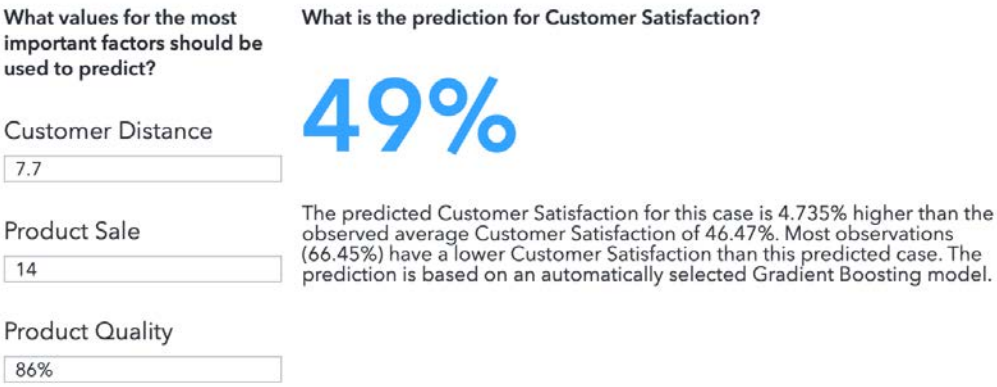


Figure 10. Example of the Automated Prediction Object

Both objects provide natural-language generated text that displays descriptive, easy to understand statistics summarizing the results. You can also view additional details about the decisions and results if you maximize the objects and view the details.

You can add these objects from the Objects pane when you are creating your report. You can also begin with a data item as a response variable in the Data pane and choose to Explain or Predict using the data item.

For both objects, you can review the list of underlying factors in the Options pane. If you like, you can remove factors that you do not want to be used in the predictive model. Note that if you do this, the model training reruns.

For more information about the automated explanation and automated prediction objects, see the *SAS Visual Analytics 8.5: User's Guide*.

CONCLUSION

SAS Visual Analytics provides many features to bridge the gap between your data and your audience. This paper brings awareness to a few interactivity features. For more details about the features mentioned in this paper, please refer to the *SAS Visual Analytics 8.5: User's Guide*.

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- SAS Institute Inc. 2019. *SAS® Visual Analytics 8.5: User's Guide*. Cary, NC: SAS Institute. Available http://support.sas.com/en/software/visual-analytics-support.html#documentation (accessed February 18, 2020)

RECOMMENDED READING

- Ramarajan, R. and M. Malek. 2020. "What's New in SAS® Visual Analytics? Smart BI, Smart Analytics." *Proceedings of the SAS Global Forum 2020 Conference.* Cary, NC: SAS Institute Inc.
- Styll, R. 2019. "AI is Coming for Your BI: Automated Analysis in SAS® Visual Analytics." *Proceedings of the SAS Global Forum 2019 Conference.* Cary, NC: SAS Institute Inc. Available http://www.sas.com/content/dam/SAS/support/en/sas-global-forum-proceedings/2019/3526-2019.pdf.

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