

Carry-on Suitcases and Mobile Devices: Using SAS® Visual Analytics Designer for Creating Optimally Designed Reports for SAS® Mobile BI

Lavanya Mandavilli and Anand Chitale, SAS Institute Inc.

ABSTRACT

Packing a carry-on suitcase for air travel and designing a report for mobile devices have a lot in common. Your carry-on suitcase contains indispensable items for your journey, and the contents are limited by tight space. Your reports for mobile devices face similar challenges—data display is governed by tight real estate space and other factors such as users' shorter attention span and information density come into play. How do you overcome these challenges while displaying data effectively for your mobile users? This paper demonstrates how smaller real estate on mobile devices, as well as device orientation in portrait or landscape mode, influences best practices for designing reports. The use of containers, layouts, filters, information windows, and carefully selected objects enable you to design and guide user interaction effectively. Appropriate selection of font styles, font sizes, and colors reduce distraction and enhance quick user comprehension. By incorporating these recommendations into your report design, you can produce reports that display seamlessly on mobile devices and browsers.

INTRODUCTION

This paper explores how and why report designers should leverage certain features available in SAS Visual Analytics for creating reports that display optimally on smaller mobile devices. Views of report sections from SAS Mobile BI on smartphones show examples of the layout of report objects, and how information density can be managed with SAS Visual Analytics features. Finally, we examine and learn how to choose an appropriate container that can effectively showcase report objects on smartphones.

DESIGN A MOBILE REPORT JUST LIKE YOU PACK YOUR CARRY-ON SUITCASE

When you travel with an airline, especially an international airline, the carry-on suitcase or bag that you take with you is mandated by several airline requirements. The maximum dimensions of the carry-on suitcase cannot exceed the dimensions specified by the airline. The carry-on suitcase weight cannot exceed the limit set by the airline. Liquid containers inside the carry-on suitcase cannot exceed three ounces or 100 ml.

You get the picture, right?

Your carry-on suitcase can only contain what is absolutely necessary and indispensable for your travel, and what you pack is mandated and determined by the physical limitations of that suitcase in combination with the rules set by the airline and the government. Within these boundaries, you have to figure out what you can pack in your carry-on.

Designing a report for a mobile device, specifically smartphones, has a lot in common with packing a carry-on bag for air travel. The mobile device is small in size and display, and its mobility allows users to view and interact with data presented on the device under a variety of conditions and environments. This type of geographic and physical flexibility, coupled with limited real estate space and shorter attention span of mobile device users, creates special requirements for how you organize the report so that it is visually attractive, efficient, and made for appropriate interactivity on the mobile device.

By implementing the recommendations made in this paper, you will succeed in creating a report that honors the limitations and conditions that apply to mobile devices. All reports display seamlessly on the web and on mobile devices, thereby empowering your mobile users, building loyalty, and increasing user satisfaction.



Figure 1 – Mobile Devices and Carry-on Suitcases Share a Commonality – They’re Smaller in Size!

THE ROLE OF RIGHT FORMAT AND DESIGN FOR BUSINESS INTELLIGENCE REPORTS

Enabling fact-based decision making at every layer of the organization requires getting the right information to the right people at the right time and in the right format.

When users access business intelligence reports on their mobile devices, information presented in the “right format” within a well-designed report plays a critical role in establishing a successful mobile strategy throughout the organization. Ease of user interaction with a mobile report should be a priority for report designers.

Presenting information in the right format requires report designers to do the following:

- acknowledge the differences between web and mobile users
- perform a needs assessment to understand the report audience
- identify the key components of report design for smartphones
- establish consistency in report designs and presentation format
- selectively apply design features for reports created with SAS Visual Analytics Designer

SAS Visual Analytics Designer enables users to easily create reports or dashboards that can be saved and viewed on either a mobile device or in SAS Visual Analytics Viewer. SAS Visual Analytics Designer is part of SAS Visual Analytics that enables someone with either the Analysis or Administration role to view, interact with, and create reports.

SAS Visual Analytics Designer software is a powerhouse loaded with many report design features. By selectively choosing and leveraging specific design features, you can create reports that are optimal and efficient when they are viewed seamlessly on a variety of mobile devices and in SAS Visual Analytics Viewer. The Viewer enables users to view reports in web browsers.

The key to producing reports that display effectively on mobile devices (tablets, phablets, and smartphones) is to first design reports for smartphones, and verify that they display optimally on such devices with smaller real estate. If you verify the display of reports on smaller mobile devices (before deploying the reports for users), you can successfully eliminate or reduce any possible limitations faced by your users with the smaller real estate of mobile devices.

ACKNOWLEDGE DIFFERENCES BETWEEN WEB AND MOBILE USERS

Acknowledge the differences between web users and mobile device users, and apply that awareness to your report design:

The biggest difference between web users and mobile users is that the mobile users are often on the go, their attention span is shorter, their time with the report is shorter, and connectivity is not guaranteed (Ina and Cothran 2014).

In a world with desktops that are running SAS Visual Analytics Viewer, your web users have large real estate on their desktop monitors, and you, as the report designer, have the flexibility to create reports that do not have any restrictions on real estate. When reports are displayed in the Viewer, the larger real estate on the desktop allows for forgiveness if a single section has numerous report objects. In addition, the report size and the download time might not be critical factors for displaying reports in the Viewer.

Bring mobile devices into the picture, and the scenario changes because of the following several factors that come into play:

- Real estate for report viewing and display is limited
- Scrolling is the key feature that allows users to view and select report objects
- Users' geographic and physical flexibility vary significantly. For example, the environmental conditions under which the mobile device is used (indoors or outdoors and differences in natural or artificial lights), and the physical status of the user (standing, sitting, walking, and so on)
- Users are more likely to be multitasking when viewing reports on the mobile device
- Users have shorter attention span for viewing reports on a mobile device
- Download time needed for tethered reports might be different from download time for non-tethered reports
- Connectivity to the server is not guaranteed, and the user might be accessing the report in offline mode or airplane mode

The unique factors and limitations that surround the smaller screens in mobile devices is nicely summarized by Nielsen and Budiu (2012):

Reading on mobile devices is challenging because users can see less at any given time, and they must rely on their memory when they are trying to understand anything that is not fully explained within the viewable space. Less context = less understanding.

Because a small screen impairs comprehension, it's important to make sure that it's used optimally and not occupied with unnecessary or redundant information. (Nielsen and Budiu 2012)

When you build reports by being aware of these conditions, and you honor the conditions that apply to mobile report users and small mobile devices, you are much more likely to create useful reports that build user loyalty and add value to the mobile user experience.

NEEDS ASSESSMENT – BE SURE TO DO IT!

Report design, creation, and availability to users should be preceded by a needs assessment. Needs assessment enables you to have a clear understanding of the report users, their specific needs for business intelligence, and whether they will view the report on the desktop, mobile device, or both. Needs assessment also eliminates trial and error scenarios where reports are redesigned after deployment to address unanticipated issues that crop up when users access and view reports.

You should determine the following:

- How many types of users in my organization or outside my organization will be using this report, and what are the various types of data required? If users are in different departments and divisions, then evaluate how you can create multiple reports for varying groups of users instead of one humungous report.
- Is the access to reports on smartphones a key requirement? Then, plan on designing and testing your reports on smaller mobile devices where real estate is limited. All reports display seamlessly, but smaller screens determine how you choose and present report objects.
- Will the users be accessing reports in offline mode? If the answer is yes, then you might want to include features that do not require live connectivity to the server.

Depending on the complexity of the data and or the user needs in your organization, you might need to expand the scope of needs assessment to address other issues such as security applied to the reports, or the need to create reports that are built for accessibility.

THE ROAD TO OPTIMALLY-DESIGNED MOBILE REPORTS

Here are some basic design concepts for creating optimally designed reports and enhance mobile user experience with ease of navigation and interaction:

- layout of report objects
- information density in reports
- visual design element

LAYOUT OF REPORT OBJECTS

Layout refers to how report objects are organized, presented, and flow in a report view. SAS Visual Analytics offers two types of layouts: Tiled and Precision.

When a Tiled Layout is applied to reports, SAS Visual Analytics Designer adjusts report objects for different display and aspect ratios. Tiled Layout is applied as the default layout for new sections in the report. Tiled layout also limits the possibility of overlapping objects on different display and aspect ratios, thereby building flexibility into the report when it is viewed on different devices. Retain Tiled Layout as the default layout for your reports, especially if the reports are viewed on different devices with different screen sizes.

Precision Layout enables you to overlap objects or position them precisely during report design. Because you control the precise location of the objects during the design phase, the fixed location of these objects does not change for varying screen sizes.

When viewed on different devices, the positioning of the objects can change and create a less compelling experience, especially when users attempt to interact with a visual object. (Ina and Cothran 2014).

In this paper, the reports are laid out with the default Tiled Layout.

INFORMATION DENSITY IN REPORTS

Within the context of SAS Mobile BI, we now turn our attention of information density. *Here, we define information density as the amount of screen space that is available and the optimal presentation of the report objects and the design features that were applied.*

Note: Adding a huge number of report objects to a single report section or adding a huge number of sections to a single report is not a good example of information density. Users' experience tells us that including an excessive number of sections in a report can impact the quick and efficient download of a report to the users' mobile devices. Organizing report objects in multiple sections, as well as including a reasonable number of sections in a report constitutes effective use of information density.

SAS Visual Analytics Designer is rich with features that enable you to build information density effectively and efficiently into your mobile reports. And the conscious selection of certain features can overcome the limitation imposed by smaller real estate on mobile devices.

Achieving Information Density Effectively during Report Design

Here are three examples of how you can use SAS Visual Analytics Designer to achieve information density effectively in a report viewed on smartphones.

Provide Useful and Descriptive Text in SAS Visual Analytics Designer about Each Report Object

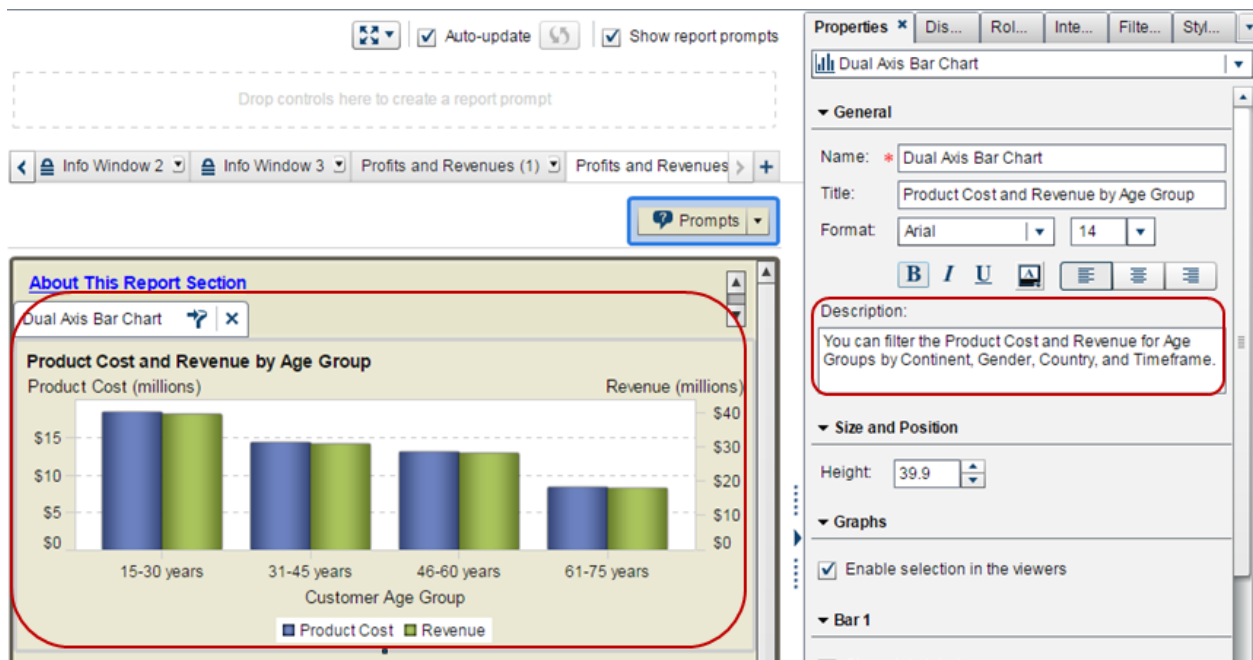


Figure 2 – Specify a Description in SAS Visual Analytics Designer That Can Display in the Information View on the Smartphone

Your user taps on a report object, and on the information icon at the top. The information view displays the descriptive text that you specified in SAS Visual Analytics Designer during report creation. By placing descriptive text for the report object in the Description field, you can also avoid creating lengthy header titles for the report objects.



Figure 3 – Users Select the Report Object in SAS Mobile BI and Tap on the Information View Icon to View Object-specific Description and Any Instructional Text

Empower Your Users with Filtering Choices

Include a prompt container with filtering controls either at the report level or at the section level in SAS Visual Analytics Designer.

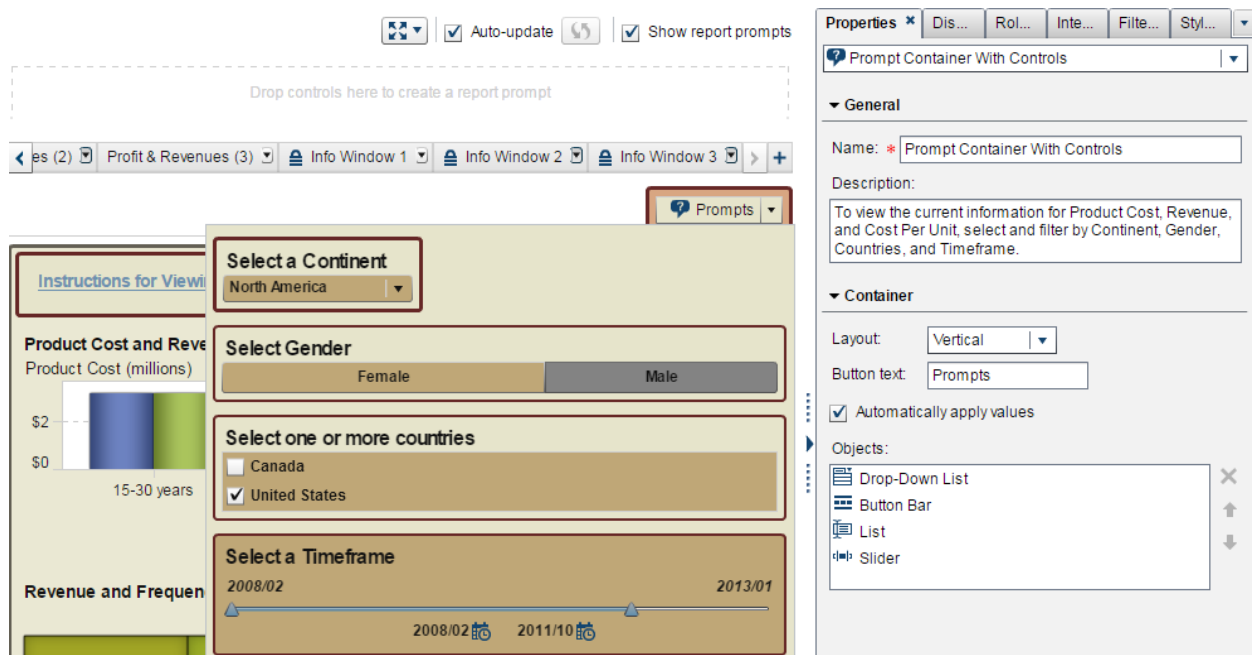


Figure 4 – Use a Prompt Container with Controls to Empower Your Users to Filter and View Report Objects

In SAS Mobile BI, users select the filtering controls of choice within that prompt container, tap **Done** in the prompt container, and view filtered data in the report objects.

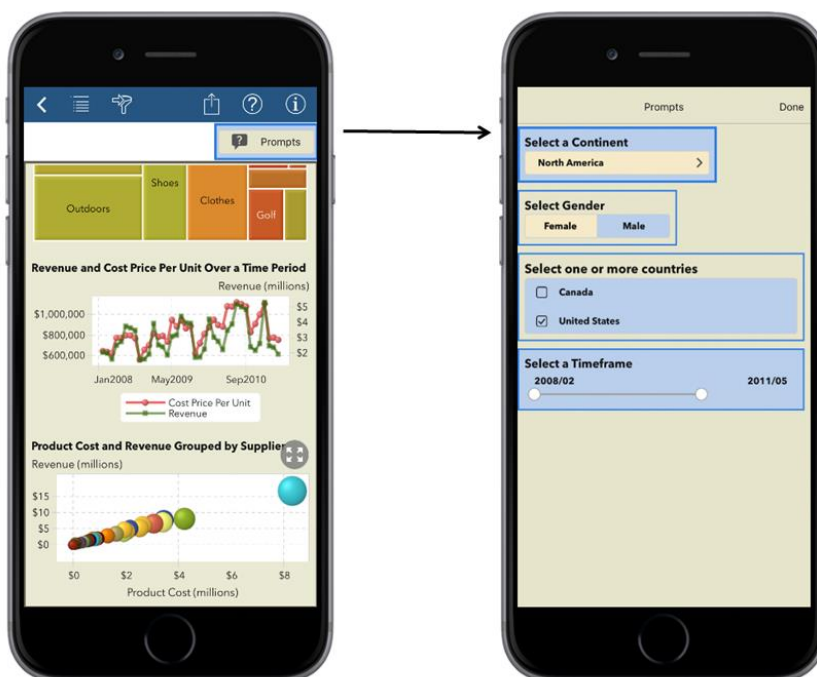


Figure 5 – Users Tap on Prompts in SAS Mobile BI to Select Filtering Options That Are Applied to the Objects in the Report Section

Prompt containers are awesome because they save real estate space both in SAS Visual Analytics Viewer and in SAS Mobile BI. When your users are done selecting the filter controls, they can tap on the filter control icon and remove the display of the prompt container from the precious real estate on smartphones. Voila! Real estate space is freed up on the smartphone! When your users want the prompt container back on display, they just tap again on the filter control icon. And the prompt container is back in view. See Figure 6.

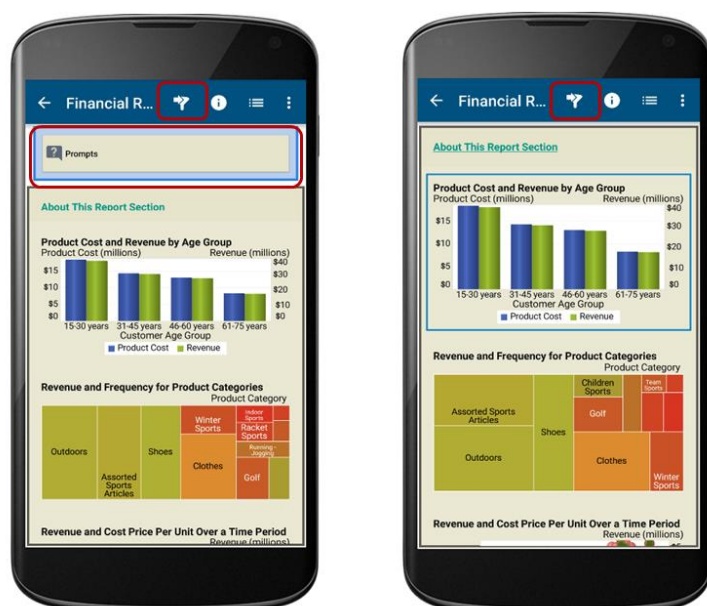


Figure 6 – Tapping the Filter Control Icon Removes the Prompt Container from Display

Add an Info Window to Sections and Report Objects

An Info Window is a pop-up window that provides report viewers additional information about the selected object. When designing your report, an Info Window is simply an additional report section defined as an “Info Window” that is actually hidden to your end users. Within SAS Mobile BI, when your user takes a link from a report object to view the contents of the Info Window, the Info Window slides into view, and it can be dismissed easily by the user.

The Info Window is a great example of bringing information density effectively to smartphones, along with scrollable text.

Info Windows provide the following:

- Offer you an opportunity to communicate important details that you want users to know
- Enable you to save real estate space in a report section by adding detailed information (for example, instructions) in an easy reachable view from the report section
- Give you the flexibility to increase information density at both report level and object level (for example, adding one Info Window for each report object in a section)
- Provide an ideal location for adding logos, branding information, detailed instructional text, system maintenance schedule, contact information for the system administrator, or even display of report objects. Again, you save real estate space in a report section by moving these details to an Info Window

Here is an example of an effective use of information density with an Info Window added to each section, and each report object within those sections.



Figure 7 – An Example of Info Windows Added to Three Sections and to the Report Objects within those Three Sections

In Figure 8, a new section was added to the report and **Display as Info Window** was chosen to convert that new section into an Info Window.

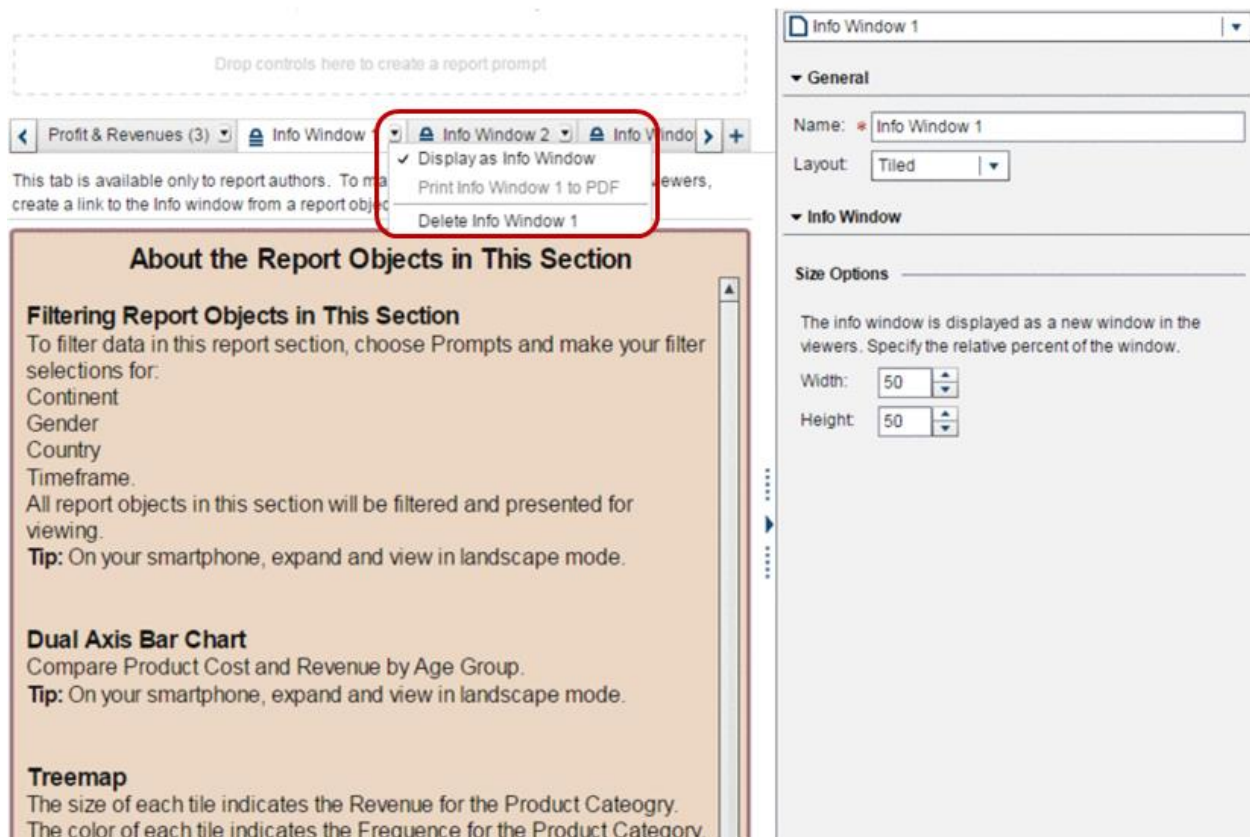


Figure 8 – Add a New Section to the Report and Choose Display as Info Window

After adding a report section and an Info Window to your report, add a Text object to the report section, and choose **Hyperlink** to link the text object to the Info Window. Note that this is just one example of how an Info Window can be used.

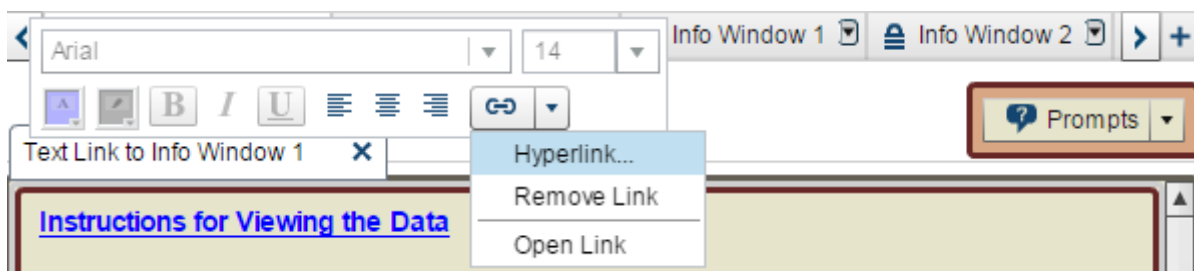


Figure 9 – Create a Hyperlink from the Report Section to an Info Window

In the illustration shown in Figure 10, users tap on the link that was added to the Text object in the report section and view the detailed instructional text in the Info Window.



Figure 10 – Users Tap on the “About This Report Section” Link and View the Info Window with Details About the Report Objects in That Section

VISUAL DESIGN

Here are three important aspects to visual design that apply to your reports:

- colors
- fonts
- space

All three design aspects should be knit together in harmony when you create reports. Be consistent in the use of colors and fonts in your reports.

Use of Data Colors

While it is enticing to use a wide variety of data colors for report objects and their backgrounds, pay attention to the purpose of these colors. Clean and simple reports are easier to navigate, and are less taxing on your small mobile device users. When using strong and vibrant colors in a report, make sure that you have a definite purpose in mind for using those colors. A significant variation in the use of colors in report objects, or an excessive use of strong colors can be distracting to users.

USING ADOBE KULER FOR COLOR THEMES

SAS Visual Analytics includes a color palette where you can click and select a color. In addition to the color palette in SAS Visual Analytics Designer, Adobe Kuler offers color themes that you can view. If you like a color in a particular theme, you can easily obtain the hexadecimal code from the Adobe Kuler color theme and specify it as a custom color in SAS Visual Analytics Designer. Another option is to enter the hexadecimal code as a custom color in SAS Visual Analytics Designer color palette, and view different shades of that same color before you select a finalize custom color.

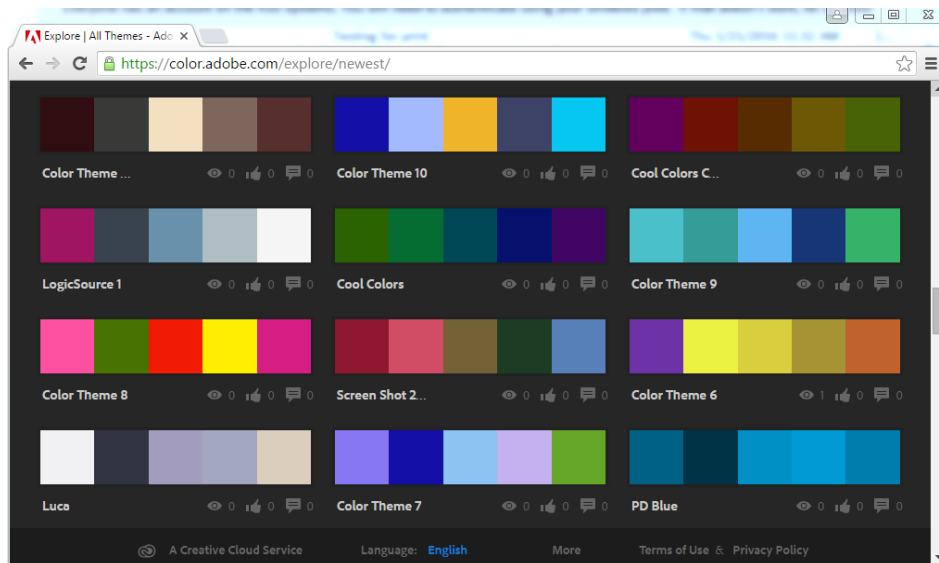


Figure 11 - Adobe Kuler Offers Themes with Hexadecimal Codes for the Theme Colors

Fonts

Your users might have more difficulty reading content on a mobile screen than they do reading the same content on a computer screen. It is also harder to understand information when reading from a mobile screen.

Although you might have a lengthy list of fonts available to you in SAS Visual Analytics Designer, err on the side of caution when using fonts. SAS Mobile BI honors and displays reports with fonts that are commonly used fonts. If you apply a special font to your reports, SAS Mobile BI substitutes the font with a default font.

Space

Space is what your users see inside and outside of containers, within and outside of report objects, information windows, and prompt controls. SAS Visual Analytics Designer enables you to control spacing for certain elements such as fonts, borders, size of objects, and so on. When you test your reports on smartphones, evaluate the spacing in the report layout, and make any adjustments as needed.

Report Theme

You can use SAS® Theme Designer for Flex to establish a consistent report theme for reports in your organization. A report theme brings consistency when it is applied to all reports in your organization. Consistency promotes ease of use for your users.

You have the following two choices for applying a theme to your reports:

- Use one of the themes supplied by SAS within SAS Visual Analytics Designer, and customize your report design with a selection of colors and fonts for the various elements in your report such as buttons, cells, borders, and so on.
- Create a custom theme using SAS Theme Designer for Flex, and apply it to your reports. A custom theme saves you time by the automatic application of pre-selected colors, fonts, backgrounds, and so on to various elements in new reports.

TO CONTAIN OR NOT CONTAIN?

Containers are useful for presenting report objects in different layouts. SAS Visual Analytics Designer offers three types of containers for arranging report objects in a report section: Vertical, Stack, and Horizontal. A fourth type of container is used exclusively for filtering controls.

If you don't apply a container to a report section, SAS Mobile BI automatically rearranges the layout of report content in a vertical flow, based on available screen space. That's because the **Settings** screen includes a global setting for all reports: **Best-fit Layout**. On smartphones, this setting is enabled by default. On tablets, the default setting is off and the app does not change the layout for the report objects.

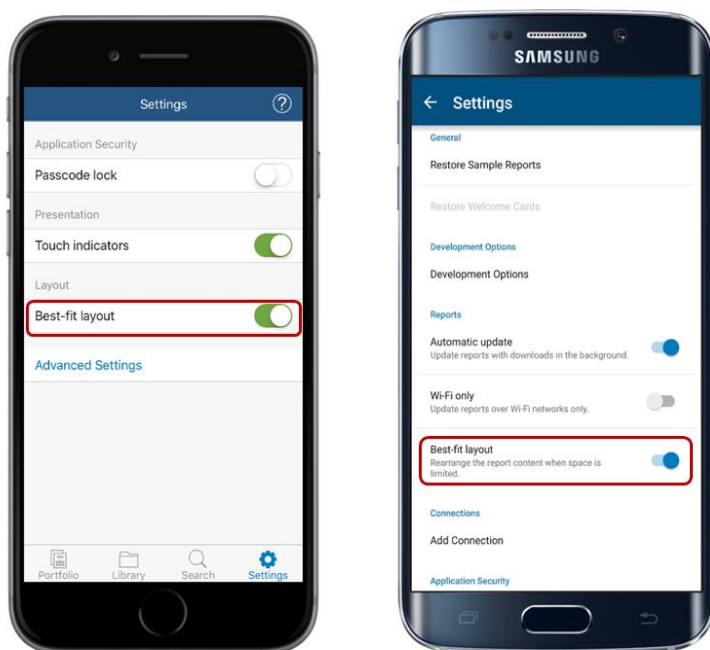


Figure 12 – Best-Fit Layout Enabled by Default on Smartphones

In addition, a report viewed in the app also has a **Rearrange Layout** option that is enabled by default on smartphones.

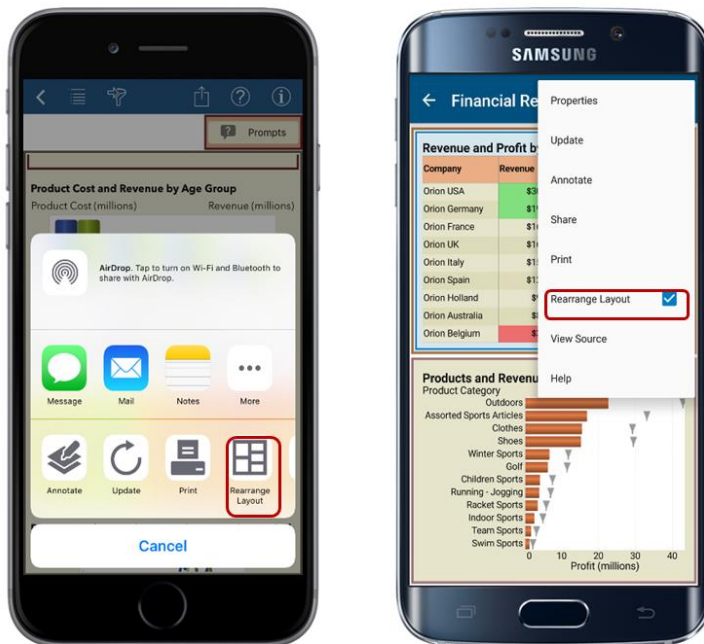


Figure 13 – Rearrange Layout is Enabled by Default on Smartphones

Let's look at the various container options, and how each one provides the flow of report objects on smartphones.

Report Displayed in SAS Visual Analytics Viewer

Here is a report displayed in Viewer without any container:

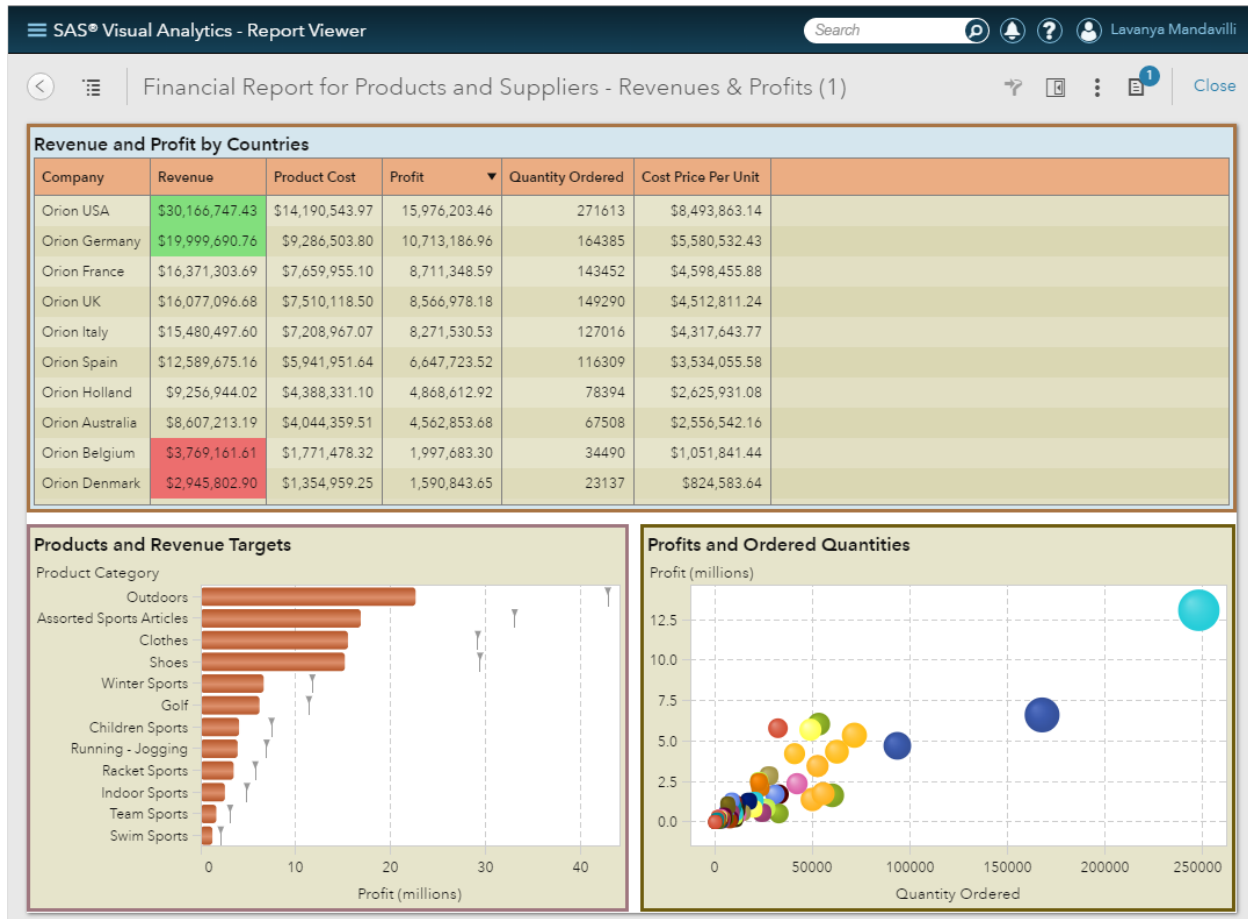


Figure 14 – Report Objects without a Container as Seen in SAS Visual Analytics Viewer

No Container

You should always use containers for the report objects in your report. Containers enable scrollability of report objects in SAS Visual Analytics Viewer and in SAS Mobile BI.

If you don't apply a container for the report section in SAS Visual Analytics Designer, the report objects are fixed and cannot be scrolled in SAS Visual Analytics Viewer.

In SAS Mobile BI, the **Best-fit Layout** setting in SAS Mobile BI (which is enabled by default on smartphones) arranges the report objects in a vertical flow, with scrollability enabled for the report objects. However, if the **Best-fit Layout** setting is disabled or turned off, again scrollability is lost on the smartphones, and this can cause confusion for your users.



Figure 15 – Report Section on a Smartphone with Initial View and Scrolled View When No Container is Used

Vertical Container

Report objects that are arranged in a vertical container empower smartphone users to scroll report objects vertically (similar to the scenario where report objects are in a section without any container). The vertical container is a good choice if you want multiple report objects displayed in a sequential, vertical format, and you want users to scroll and view the report objects. Some report objects might require the user to maximize them for viewing.



Figure 16 – Report Section on a Smartphone with the Initial View and Scrolled View When Vertical Container is Used

Stack Container

A stack container displays one report object at any given time. You scroll the report objects in a stack by tapping on the navigation button bar. The report object is displayed optimally on the mobile device screen. A stack container is a great choice if you want to display only one report object at a time, yet have the flexibility to quickly access other report objects in a single report section. Typically, your user is not required to maximize the report object because it is already displaying in a maximized space on the mobile device. Report objects display well in both landscape and horizontal viewing on smartphones.



Figure 17 – Report Section on a Smartphone with Three Different Report Objects in a Stack Container

Horizontal Container

You can add any report object to horizontal container, and any number of report objects fit in a horizontal container. In Viewer (and also on tablets), the real estate space available on the desktop favors the presence of multiple report objects in a horizontal container.

On smartphones, the horizontal container, which allows horizontal scrolling of report objects, can be applied optimally for a single report object that might require scrolling within the report object. For example, a crosstab or a list table display well as a single report object in the horizontal container. In general, a horizontal container is not the most optimal choice for presenting multiple report objects on smartphones.

The figure shows two Samsung smartphones displaying financial reports in a horizontal container. The left phone displays a report titled "Financial Report..." with columns for Company, Revenue, and Product Cost. The right phone displays a report titled "Financial Report for Products and Suppliers - Re..." with columns for Company, Revenue, Product Cost, Profit, Quantity Ordered, and Cost P.

Company	Revenue	Product Cost
Orion USA	\$30,166,747.43	\$14,190,543.
Orion Germany	\$19,999,690.76	\$9,286,503.
Orion France	\$16,371,303.69	\$7,659,955.
Orion UK	\$16,077,096.68	\$7,510,118.
Orion Italy	\$15,480,497.60	\$7,208,967.
Orion Spain	\$12,589,675.16	\$5,941,951.
Orion Holland	\$9,256,944.02	\$4,388,331.
Orion Australia	\$8,607,213.19	\$4,044,359.
Orion Belgium	\$3,769,161.61	\$1,771,478.
Orion Denmark	\$2,945,802.90	\$1,354,959.

Company	Revenue	Product Cost	Profit	Quantity Ordered	Cost P
Orion USA	\$30,166,747.43	\$14,190,543.97	15,976,203.46	271613	
Orion Germany	\$19,999,690.76	\$9,286,503.80	10,713,186.96	164385	
Orion France	\$16,371,303.69	\$7,659,955.10	8,711,348.59	143452	
Orion UK	\$16,077,096.68	\$7,510,118.50	8,566,978.18	149290	
Orion Italy	\$15,480,497.60	\$7,208,967.07	8,271,530.53	127016	
Orion Spain	\$12,589,675.16	\$5,941,951.64	6,647,723.52	116309	
Orion Holland	\$9,256,944.02	\$4,388,331.10	4,868,612.92	78394	
Orion Australia	\$8,607,213.19	\$4,044,359.51	4,562,853.68	67508	

Figure 18 – Report Section on a Smartphone with a Single Report Object in a Horizontal Container

Prompt Container

A prompt container is used specifically for applying multiple filtering controls to report objects, either at the report level, section level, or object level. In the earlier topic in this paper, *Empower Your Users with Filtering Choices*, we have explored how a prompt container with filtering controls displays effectively on smartphones, and enables your users to filter the data.

CONCLUSION

We hope that this paper has provided some insights and a high-level overview of how you can design reports that display effectively on mobile devices. Remember – all reports display seamlessly in SAS Visual Analytics Viewer and SAS Mobile BI. However, by paying attention to the unique conditions that apply to smaller mobile devices, and by leveraging specific features available to you in SAS Visual Analytics Designer, you can significantly improve and enhance your mobile users' experiences with report viewing.

REFERENCES

Ina, Peter J., and Khaliah H. Cothran. 2014. "Designing for the Mobile Workforce." *Proceedings of the SAS Global Forum 2014 Conference*. Cary, NC. SAS Institute Inc. Available <http://support.sas.com/resources/papers/proceedings14/SAS143-2014.pdf>.

Mobley, Karen, Hogan, Rich, and Phadke, Pratik. 2016. "Designing SAS Visual Analytics Reports: Write Once, View Anywhere." *Proceedings of the SAS Global Forum 2016 Conference*. Cary, NC. SAS Institute Inc.

Nielsen, Jakob, and Raluca Budiu. 2012. *Tips for Writing Content for Mobile Users*. Peachpit Press, San Francisco, CA. Available <http://www.peachpit.com/articles/article.aspx?p=1966021>.

Piperides, Alexis. "How to Make Your Ideas Look Good: A Beginner's Guide to Mobile App Visual Design." Available <http://blog.proto.io/how-to-make-your-ideas-look-good-a-beginners-guide-to-mobile-app-visual-design/>. Last modified 2015. Accessed on October 30, 2015.

Renison, Keith. 2014. "Getting the Most Out of SAS® Visual Analytics: Design Tips for Creating More Stunning Reports." *Proceedings of the SAS Global Forum 2014 Conference*. Cary, NC. SAS Institute Inc. Available <http://support.sas.com/resources/papers/proceedings14/SAS120-2014.pdf>.

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RECOMMENDED READING

- *SAS Visual Analytics Designer User Guide®*
- *SAS Theme Designer for Flex User Guide®*

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contact the authors at:

Lavanya K. Mandavilli
Quality User-Driven Enterprise Software Testing
100 SAS Campus Drive
Cary, NC 27513
SAS Institute Inc.
1-919-531-2980
Lavanya.Mandavilli@sas.com

Anand Chitale
Global Technology Practice, Business Management
Marlow, UK
SAS Institute Inc.
44 (162) 8490615
Anand.Chitale@sas.com

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