Whirlwind Tour Around SAS® Visual Analytics

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ABSTRACT

SAS brings a revolutionary approach for analytical based data visualization, exploration and reporting. Come and join us for a whirlwind tour through SAS Visual Analytics 6.1 inspired by customer experiences and use cases. We start with an overview of the technology concept behind SAS VA and enter into the Hub, leading to various destinations during the tour. From Hub we will do multiple trips out to applications starting with the Data Builder followed by the Explorer, Designer and end the journey with Mobile integration. There will be a sneak peek into world of Microsoft Office and don't worry, SAS coders are not left behind. Final stop will be Enterprise Guide showing you how you can leverage the technology behind SAS Visual Analytics through SAS code.

INTRODUCTION

Organizations of all types and sizes generate data each minute, hour, and day. Regardless of how much data you have, one of the best ways to discern important relationships is through advanced analysis and high-performance data visualization. If sophisticated analyses can be performed quickly, even immediately, and results can be presented in ways that showcase patterns and allow querying and exploration, people across all levels in an organization can make faster, more effective decisions.

SAS® Visual Analytics is a new business intelligence solution that uses intelligent ways to help business analysts and nontechnical users visualize data, see patterns and trends, and identify opportunities for further analysis.

This paper highlights the key features of SAS Visual Analytics 6.1 and provides references to various sources that cover its features in more detail. The application of these features is also highlighted with some industry examples. Features such as integration with Microsoft Office and SAS Enterprise Guide are not covered in detail. This paper highlights only some features that will be available in the next release of SAS Add-In for Microsoft Office 6.1.

TECHNOLOGY OVERVIEW

SAS Visual Analytics is an easy to use, web-based solution that leverages the SAS LASR Analytic Server and empowers organizations to explore small to huge volumes of data very quickly. The SAS LASR Analytic Server is an analytic platform that provides a secure, multi-user environment for concurrent access to data that is loaded into memory across a single server or a distributed computing environment. By loading tables into memory for analytic processing, the SAS LASR Analytic Server enables business analysts to explore data and discover relationships in data at the speed of RAM. As the SAS LASR Analytic Server is an in-memory analytic platform as opposed to an in-memory database it is designed with a high-performance, multi-threaded, analytic code that processes client requests at high speeds. In contrast, an in-memory database invariably speaks some type of query language primarily focused on extracting data before manipulating it. You ask a database to select rows from a table; you ask an analytic platform to produce a box plot or to produce a heat map overlaid with a regression line.

The SAS LASR Analytic Server in a distributed environment supports the Hadoop Distributed File System (HDFS) for co-located storage of data with replication and failover capabilities as well as supports co-located data providers with Greenplum and Teradata. The SAS implementation of HDFS offers some key benefits that include storage of files in blocks which results in balanced memory utilization across the server and reduced execution time.

The topology for SAS Visual Analytics encompasses the client, middle, and server tiers. These tiers interact with the SAS LASR Analytic Server to enable client access to data for performing analytic tasks. Any queries initiated by clients are channeled by the middle tier and the server tier before they are sent to the LASR process. In a distributed environment, the LASR Root node sends the queries to the LASR Worker nodes before results of queries are channeled back to the clients via the server and the middle tiers.

SAS VISUAL ANALYTICS HOME PAGE

Organizations have users performing various roles and performing various different functions using the BI environment. This could vary from simple access to existing reports and dashboards to doing analytical analysis and data exploration to data management activities.

SAS Visual Analytics provides a home page, which is a personalized and secured central entry point for all users to use for their daily activities using SAS Visual Analytics. Figure 1 below shows the home page after a user has logged

into SAS Visual Analytics.

Some of the key features of home page include:

- Access to the home page for all users
- View information based on your assigned role and capabilities
- Navigate to varied end-user actions, such as
    - Exploring data
    - Creating reports
    - Viewing reports
- Provide administration tasks
    - Manage data
    - Monitor and administer systems
- Add favorites and use search
- Add comments to encourage collaboration between users

Figure 1: The SAS Visual Analytics Home Page with Recently Viewed Reports and Explorations with Access to other SAS Visual Analytics Features

SAS VISUAL DATA BUILDER – *FETCH IT, LOAD IT, ANALYZE IT*

SAS Visual Data Builder, a component of SAS Visual Analytics, enables you to query data from various databases, structure it for analytics and reporting, and then load this data into any available SAS library. In particular, SAS Visual Data Builder makes it easy to load data into the SAS LASR Analytic Server for interactive exploration or report creation, or for high performance analytics with SAS High Performance Analytics.

The target audience for SAS Visual Data Builder in your organization is the business intelligence power user, the analytical modeler, and any user responsible for preparing data. It is not designed for activities typically performed by IT and should not be compared with more advanced Data Integration tools.

When it comes of big data and its challenges (including accessing, extracting and structuring the data suitable for analysis) SAS Visual Data Builder proves to be a handy interface. It provides the power to analyze large volumes of

data, including scheduling large extractions, and structuring analytical data, which makes it easy for you to load big data into SAS Visual Analytics.

Here are some of the key features of SAS Visual Data Builder:

- Search for tables
- Join and append tables
- Create computed columns (full expression builder)
- Filter columns and rows (aggregated data or not)
- Load tables or spreadsheets in memory
- Schedule query execution
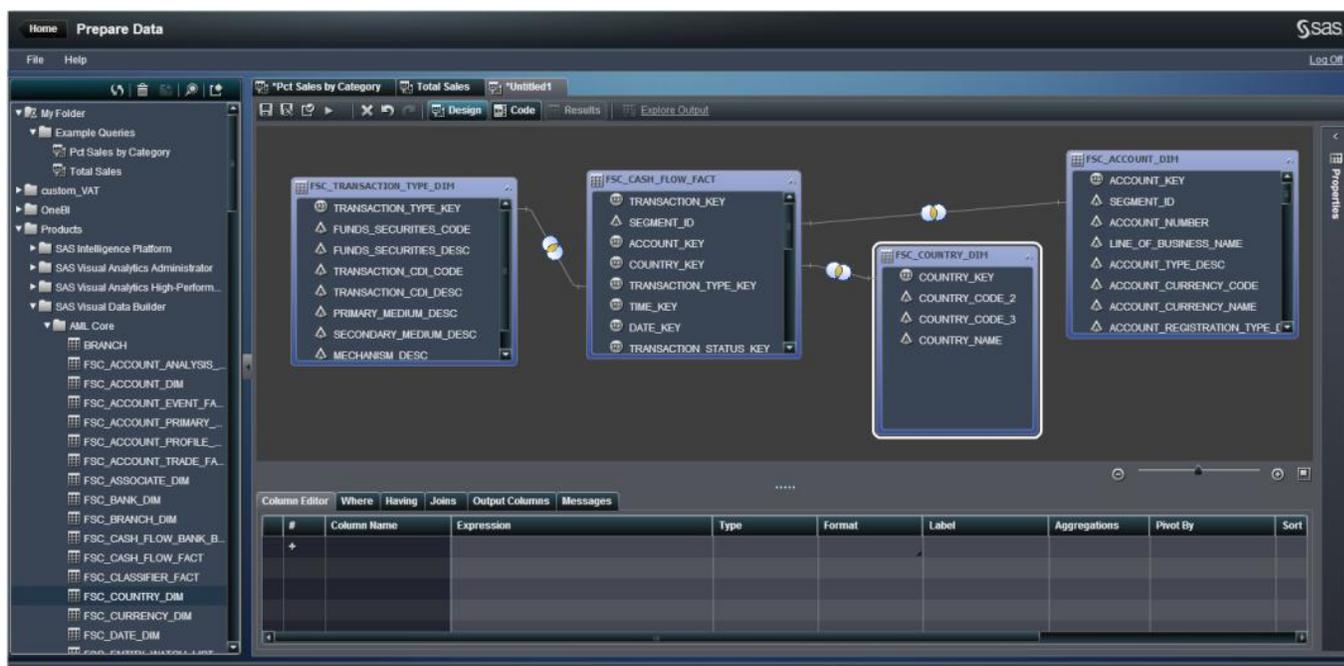
Figure 2: SAS Visual Data Builder Showing a Query that Joins Multiple Data Sources to Prepare the Relevant Data Required for Analysis

SAS Visual Analytics turns the classic data mart approach to data design for reporting on its head. Since hierarchy aggregations and analytic routines happen on the fly in the SAS LASR Analytic Server, the data design requirements are different than in traditional reporting. For example, putting environment capacity to one side (since SAS Visual Analytics is built from the ground up to be scalable to data size requirements) data can be brought in at the lowest grain required by the end users (For example, you no longer need to build intermediary reporting marts or pre-calculated aggregations for performance reasons). This not only enables end users to explore the high-level metrics, but they can also delve into the detail using the same data source and in the same interface with quick response time.

Consider a use case from the finance industry where most enterprise customers have some form of data warehouse to organize their base data into facts and dimensions. SAS Visual Data Builder can be used to join these tables, add business friendly column names, add formats, and produce a wide, flat, long and de-normalized table optimized for analytical exploration and ad-hoc reporting. Alternatively, since the ability to import data directly from local storage is available in SAS Visual Data Builder, an analyst can choose to push a local spreadsheet to the SAS LASR Analytic Server and start visually exploring the data in a few clicks.

SAS VISUAL ANALYTICS EXPLORER – *FROM HINDSIGHT TO FORESIGHT*

Visualizing your data can be both fun and challenging. It is much easier to understand information in a visual compared to a large table with lots of rows and columns. A picture is worth a thousand words – especially when you are trying to understand and gain insights from data.

Organizations have realized the importance of analysing every possible aspect of their data, the need of analytically exploring any size of data and understand the patterns and trends more effectively going beyond tabular reports. Information exploration should be a joyous experience and SAS Visual Analytics Explorer, a component of SAS Visual Analytics, enables you to visually explore data with ease.

Figure 3: The SAS Visual Analytics Explorer Showing a Collection of Various Visual Data Exploration Results with Interactive Filters

SAS Visual Analytics Explorer enables users to take advantage of SAS predictive analytics power to gain insights from their data, with simple to use user actions, and surface consumable analytical results in a visual format, helping customers find relationships and discrepancies in their data. As part of the integrated infrastructure, users can share their findings to web and mobile users.

Note that visual exploration is about using advanced analytics to visually explore any size of data and it is not a reporting tool.

Some of the key features of SAS Visual Analytics Explorer include:

- Explore data and discover new information

- Visualize your data to find relationships, trends, discrepancies, and so on

- Add auto charts

- Create various visuals, such as crosstabs, bar charts, line charts, scatter plots, bubble plots, geo maps, and more

- Add consumable analytics, such as correlations (relationships), regressions (linear, quadradic, cubic, PSpline, best fit), forecasting (multiple algorithms), and summary statistics

- Create dynamic hierarchies (for example, drilling up, drilling down, and drilling across)

- Derive calculated columns

- Use selection and brushing modes for discovering relationships

- Save and share as exploration, report, or PDF

- Export data to Microsoft Excel, as well as CSV or TSV document formats

A great use case for the SAS Visual Analytics Explorer interface is as a tool for ad-hoc train of thought analysis. A senior management team in the Banking sector can include the tool interactively in meetings to ask an analyst on-the-fly questions retrieving instant visual results. For example:

- How many customers, from which segments & geographies, responded to a recent campaign? What can we determine from that regarding the success of our offers? Who are the outliers and what do they have in common?

- What proportion of customers use the bank as their main bank, and how much more valuable are customers which have more than 1 product?

- Which products drive the most value to the bank, from which segments, which geographical regions, and what is the high level future forecast trend for these areas?

SAS VISUAL ANALYTICS DESIGNER – *SELF SERVICE REPORTING*

SAS Visual Analytics Designer is a component of SAS Visual Analytics that brings together classic reporting and highly visual dashboards into a single report. The SAS Visual Analytic Designer enables users to create reports from various report objects such as graphs, tables, gauges, prompts, and geo maps. Users can also add text and images to reports. A single report can use multiple data sources.

Users can set various types of interactions across the report objects in a WYSIWYG design format, derive new data items, create hierarchies, add comments, and export data. Reports created in SAS Visual Analytics Designer (or exported from the SAS Visual Analytics Explorer) are readily available for users to access via a web browser or on supported mobile devices.

Some of the key features of SAS Visual Analytics Designer include:

- Use the WYSIWYG interface to design reports and dashboards

- Leverage existing reports and data to create new reports

- Use multiple data sources

- Choose from a large number of report objects (including tables, graphs, gauges, controls, geo maps, containers, text, and images)

- Add multiple sections to reports, in which each section can have multiple data sources

- Use either the precision and the tiled layout

- Add filter or brush interactions between report objects and prompts

- Add comments to reports

- Create dynamic hierarchies (for example, drilling down, drilling up, and drilling across)

- Derive new data items

- Export data from report objects to Microsoft Excel, as well as CSV or TSV document formats

- Build a report once, and then deploy it to any channel or device

Here is an example of a report in SAS Visual Analytics Designer which has multiple report objects in the precision layout. Each report object can have different data sources.

Figure 4: The SAS Visual Analytics Designer interface Showing an Interactive Report

The simple drag-and-drop design interface, collaboration, and power of the SAS LASR Analytic Server can combine to meet quick ad-hoc reporting needs.

Consider a use case where a manager at a Retail firm has access to a high-level dashboard built in SAS Visual Analytics Designer that he usually views from the SAS Visual Analytics Viewer. However, on this particular occasion, the manager was away from the main office at a retail outlet. He was viewing the same report on his iPad - thanks to the build once and deploy on any channel feature of SAS Visual Analytics Designer. The performance of a particular metric for the retail store concerned him. Normally, this manager has the capability to self-service extend the report and create his own personal version with added detail. Since the manager was away from his desktop, he added a comment to the report from his iPad requesting more detail. The report owner back in the main office quickly added a new section to the report that focused on the same data set behind the high-level metrics but narrowing the level of filtering before saving the report and making it available to the manager's iPad. In a traditional BI scenario this might have necessitated a follow-up visit with a more detailed report for the retail outlet and potentially the need to manipulate data to introduce a new level of aggregation or a whole new report. However, with SAS Visual Analytics the detail is always there, so the time to analysis and the subsequent action was greatly reduced.

SAS MOBILE BI – *INFORMATION: ANYTIME, ANYWHERE*

BI on-the-go is here, thanks to the high-performance mobile devices and evolutions of supporting network and data infrastructure technologies. It is no longer a "nice-to-have" feature. Information workers no longer have to wait to make decisions until they get back to the office when it might be too late. This is applicable to every industry from private organizations to government and public sector.

SAS Visual Analytics provides a native mobile application allowing users to view their reports and dashboards on their selected devices. SAS is continuously monitoring the market trends and the demand from customers for other operating systems and will be extending support for new devices in future releases as required.

SAS Mobile BI provides an adaptive presentation so that users do not have to create separate reports for each device type. With this offering, SAS Mobile BI provides all the required features via a highly visual and interactive mobile application backed by centralized metadata security. While viewing the SAS reports, the content will be downloaded to the device and thus fully support an interactive offline analysis. Administrators can force tethering, where the mobile app will work only when it is connected to the server. When the report is closed, the data is wiped out.

Some of the key features of SAS Mobile BI include:

- View reports on iPad and Android tablets
- Use a highly visual and interactive user interface for filtering, highlighting, drill-down, zooming, and so on
- Add comments to reports to facilitate collaboration
- Share reports via email
- Work with reports offline
- Leverage existing SAS security
- Use additional security features, which focus on support for device encryption, remote wipe, blacklisting, SSL connections, mobile tethering, application passcode, and so on

Figure 5: A SAS Visual Analytics Report Displayed on an iPad

A simple but practical use case of this capability could be a Corporate Bank rolling out SAS Visual Analytics to hundreds of customer-facing staff, like Relationship Managers (RM) and their assistants. The RM can then visit their corporate customers with a mobile report containing the data specifically for that customer enabling the RM to have a far more meaningful conversation. The RM can review the customer's product holdings, transactions, forecasted working capital, and funding requirements in a highly visual and interactive way. The RM can use this information to discuss and identify cross-sell and up-sell opportunities when engaging with their customer, thus driving increased revenue per customer.

ENTERPRISE CLASS READINESS – *MANAGING AND MONITORING*

With the increasing number of BI users and their multiple roles and responsibilities, managing the environment is a topic of concern for IT from a security, as well as a user experience point of view.

SAS Visual Analytics based on SAS 9.3 platform provides enterprise class IT administration features, including metadata-based security for user management, content management, as well as administrative interfaces for managing and monitoring the servers.

SAS Visual Analytics 6.1 uses the metadata authorization layer to manage access to metadata objects such as reports, explorations, stored processes, tables, folders, and queries. User access to data sources in the SAS LASR Analytic Server is managed by the SAS LASR Authorization Service in the middle tier, in collaboration with metadata authorization that is provided by the Metadata Server.

The security administration tasks are performed using the out of the box tools such as SAS High-Performance Computing Management Console and SAS Management Console. For more information, see the *SAS Visual Analytics 6.1: Administration Guide*.

Figure 6 below shows the Resource monitor interface, which allows administrators to view the resource utilization on the SAS Visual Analytics deployment.

Figure 6: The Resource Monitor Tab from the Manage Environment Interface.

Some of the key features for IT administration include:

- Monitor the resource utilization for CPU, memory, and network
- View the data tables in source and in memory
- Upload data to memory and manage their active or inactive state (see Figure 7)
- View and manage the Mobile user connections (see Figure 8)
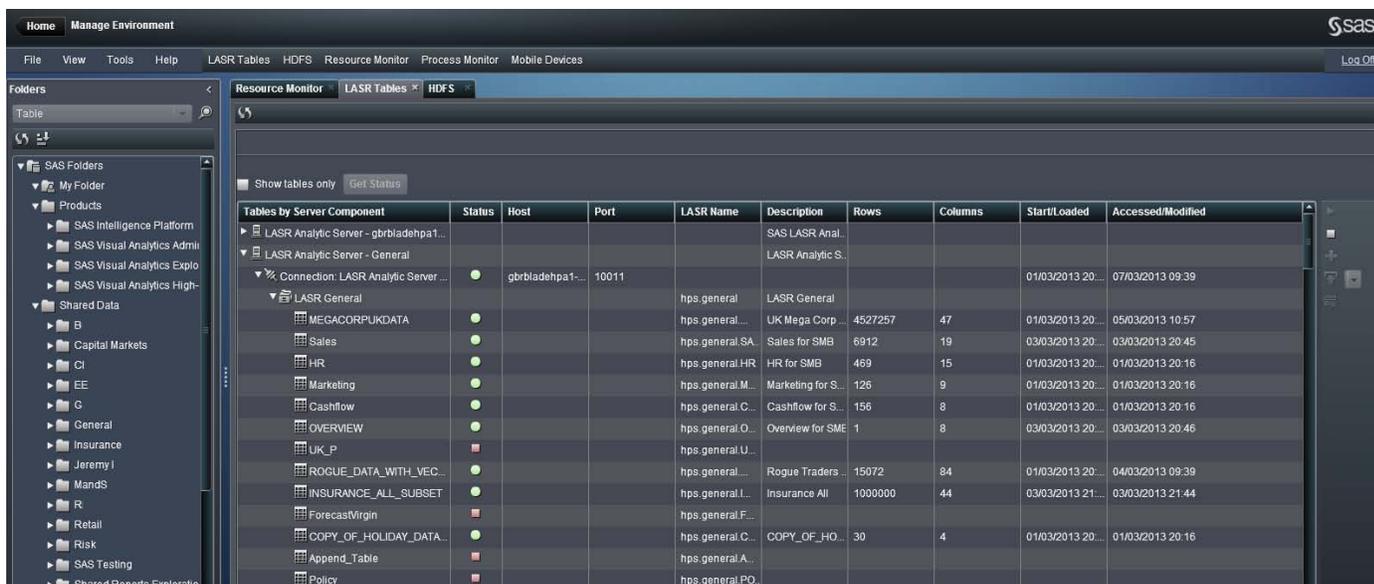
Figure 7: The LASR Tables Tab from the Manage Environment Interface Showing the Data Tables Loaded in Memory with Their Active or Inactive Status.

Figure 8: The Mobile Devices Tab from the Manage Environment Interface Showing the Various Users Connected to the SAS Visual Analytics Environment from Their Mobile Devices

INTEGRATION WITH SAS ADD IN FOR MICROSOFT OFFICE

Some of the most commonly used tools by users of all skill levels across organizations are in Microsoft Word, Microsoft Excel, and Microsoft PowerPoint. The SAS Add-In for Microsoft Office turbocharges these tools, giving users the power to explore and analyze information using SAS software within a familiar environment. SAS continues to enhance its existing offering by integrating SAS Visual Analytics 6.1 and SAS Add-In for Microsoft Office 6.1

Some of the key highlights of this integration include:
- Open SAS Visual Analytics 6.1 reports in Microsoft Word, Microsoft Excel, and Microsoft PowerPoint, utilizing the full, native functionality of Microsoft Office

- Refresh SAS Visual Analytics reports that are embedded in Microsoft Office documents to bring the latest data

- Make the data from a SAS Visual Analytics 6.1 report the direct source within Microsoft Excel for other Microsoft Excel user actions, such as creating native charts or calculations.

- View the favorites from the SAS Visual Analytics 6.1 home page from inside Microsoft Outlook

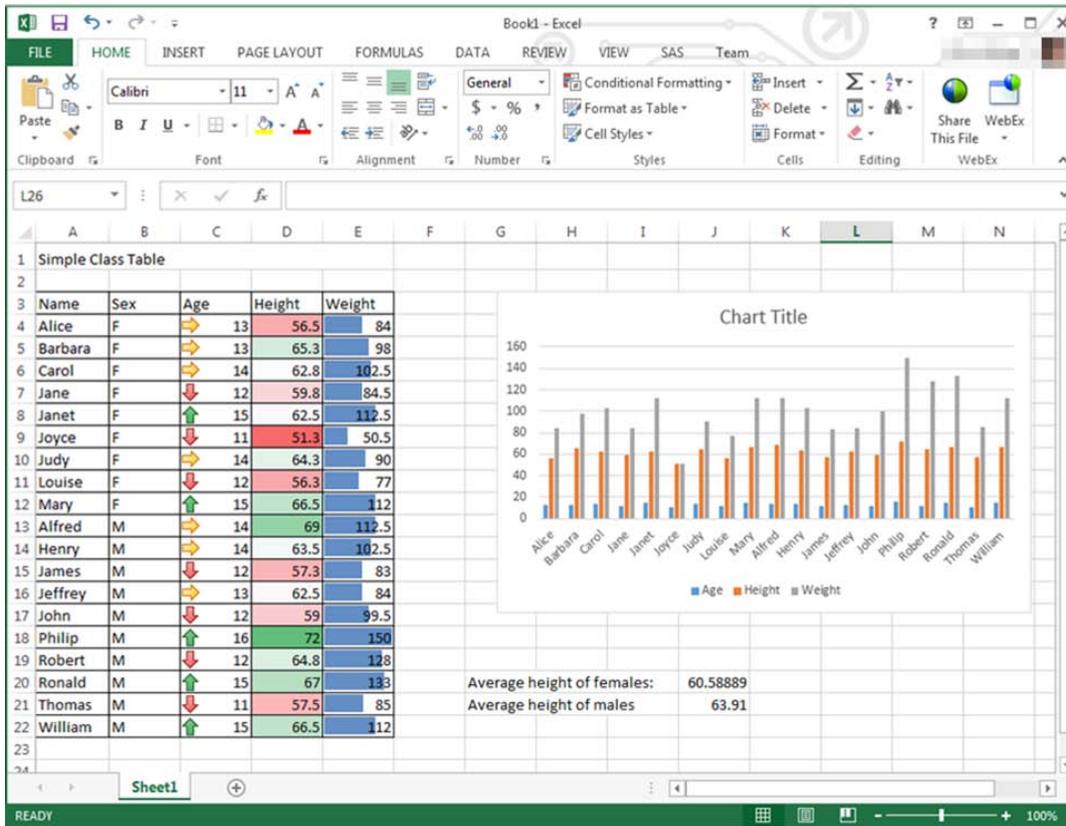- Use the Integrated Gadget pane to view SAS Visual Analytics 6.1 reports, alongside your e-mails.

Figure 9: A SAS Visual Analytics Report with Tabular Output Viewed Inside Microsoft Excel
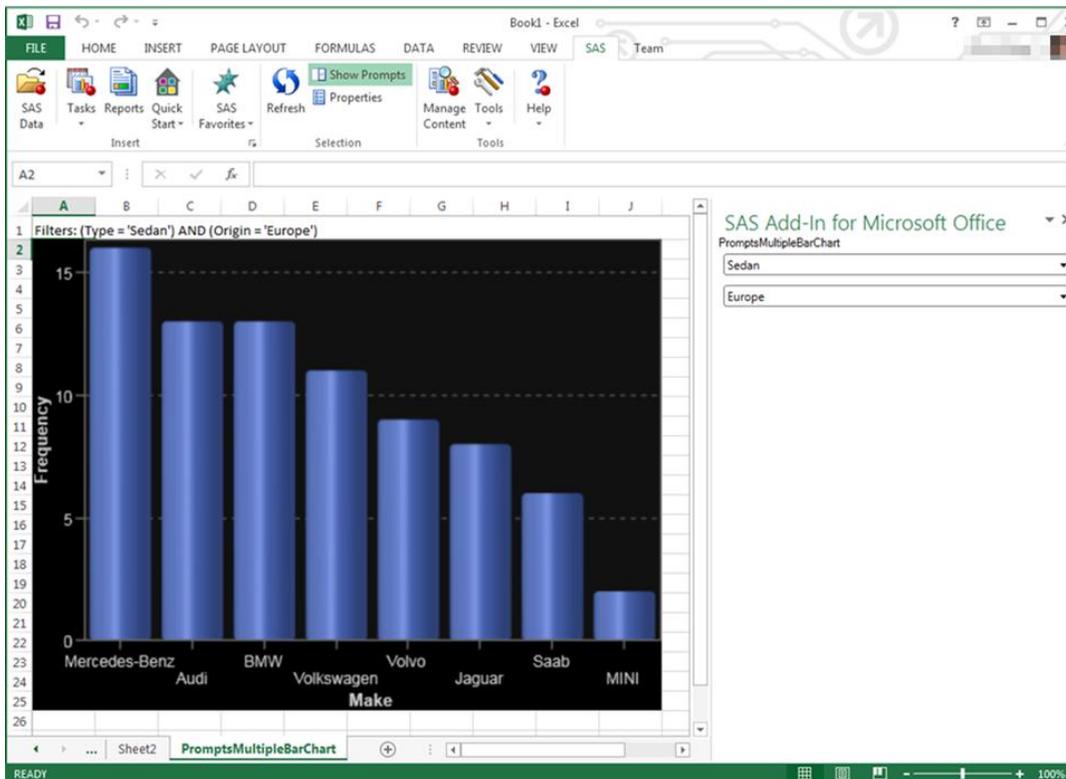

Figure 10: A SAS Visual Analytics Report with a Graph Viewed in Microsoft Excel

SAS VISUAL ANALYTICS – INTEGRATING SAS STORED PROCESSES

Many organizations have a large number of SAS programs completing many activities from generating data to creating analytical reports. Any existing SAS investment that has gone into creating code to generate stored process based output reports can be migrated to SAS Visual Analytics.

SAS Visual Analytics 6.1 provides the continuity to leverage these SAS stored processes inside SAS Visual Analytics in multiple ways. The SAS Visual Analytics home page enables users to open stored processes in the SAS Visual Analytics Viewer, including support of end-user prompt interactions. SAS stored processes can be added to reports in SAS Visual Analytics Designer, which enables users to view traditional SAS output alongside the new more visual and interactive report content generated using SAS Visual Analytics. SAS Visual Analytics reports containing stored processes can also be viewed on mobile devices using the SAS Mobile BI app.

The data sources for stored processes can be either LASR tables in the SAS LASR Analytic Server or any other tables that can be reached through the stored process code logic.

CONCLUSION

SAS Visual Analytics is a unique BI offering from SAS that provides analysis at the speed of RAM. Powered by the SAS Visual Analytics LASR Server and a highly visual, interactive and self-service environment users can enhance the analytic power of their data, explore new data sources, investigate them, create visualizations to uncover relevant patterns, and then easily share those visualizations in reports via the web and mobile devices.

RECOMMENDED READING

- Atassi, Sam. 2013. "Self-Service Data Management: Visual Data Builder." *Proceedings of the SAS Global Forum 2013 Conference*. Cary, NC: SAS Institute Inc.

- Styll, Rick. 2013. "Fast Dashboards Anywhere with SAS® Visual Analytics." *Proceedings of the SAS Global Forum 2013* Conference. Cary, NC: SAS Institute Inc.

- Shneiderman, Ben. 1996. The eyes have it: A task by data type taxonomy for information visualizations. Available at http://www.cs.umd.edu/~ben/papers/Shneiderman1996eyes.pdf

- Few, Stephen. 2011. Exploratory Vistas - Ways to Become Acquainted with a Data Set for the First Time, Perceptual Edge Visual Business Intelligence Newsletter July/August/September 2011. Available at http://www.perceptualedge.com/articles/visual_business_intelligence/exploratory_vistas.pdf

- Chitale, Anand. 2011. "Turbocharging Your Microsoft Office Environment with version 4.3 of the SAS® Add-In for Microsoft Office." *Proceedings of the SAS Global Forum 2011 Conference*. Cary, NC: SAS Institute Inc. Available at http://support.sas.com/resources/papers/proceedings11/053-2011.pdf

- SAS® Visual Analytics 6.1 User's Guide. Available at http://support.sas.com/documentation/cdl/en/vaug/65747/PDF/default/vaug.pdf

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