

# Insightful Data Visualization with SAS<sup>®</sup> Viya<sup>®</sup>



Falko Schulz  
Travis Murphy

The correct bibliographic citation for this manual is as follows: Schulz, Falko and Travis Murphy. 2020. *Insightful Data Visualization with SAS® Viya®*. Cary, NC: SAS Institute Inc.

**Insightful Data Visualization with SAS® Viya®**

Copyright © 2020, SAS Institute Inc., Cary, NC, USA

ISBN 978-1-951684-38-9 (Hardcover)

ISBN 978-1-951684-34-1 (Paperback)

ISBN 978-1-951684-35-8 (Web PDF)

ISBN 978-1-951684-36-5 (EPUB)

ISBN 978-1-951684-37-2 (Kindle)

All Rights Reserved. Produced in the United States of America.

**For a hard copy book:** No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, or otherwise, without the prior written permission of the publisher, SAS Institute Inc.

**For a web download or e-book:** Your use of this publication shall be governed by the terms established by the vendor at the time you acquire this publication.

The scanning, uploading, and distribution of this book via the Internet or any other means without the permission of the publisher is illegal and punishable by law. Please purchase only authorized electronic editions and do not participate in or encourage electronic piracy of copyrighted materials. Your support of others' rights is appreciated.

**U.S. Government License Rights; Restricted Rights:** The Software and its documentation is commercial computer software developed at private expense and is provided with RESTRICTED RIGHTS to the United States Government. Use, duplication, or disclosure of the Software by the United States Government is subject to the license terms of this Agreement pursuant to, as applicable, FAR 12.212, DFAR 227.7202-1(a), DFAR 227.7202-3(a), and DFAR 227.7202-4, and, to the extent required under U.S. federal law, the minimum restricted rights as set out in FAR 52.227-19 (DEC 2007). If FAR 52.227-19 is applicable, this provision serves as notice under clause (c) thereof and no other notice is required to be affixed to the Software or documentation. The Government's rights in Software and documentation shall be only those set forth in this Agreement.

SAS Institute Inc., SAS Campus Drive, Cary, NC 27513-2414

October 2020

SAS® and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are trademarks of their respective companies.

SAS software may be provided with certain third-party software, including but not limited to open-source software, which is licensed under its applicable third-party software license agreement. For license information about third-party software distributed with SAS software, refer to <http://support.sas.com/thirdpartylicenses>.

# Contents

<b>About This Book .....</b>	<b>vii</b>
<b>About These Authors .....</b>	<b>xi</b>
<b>Acknowledgments .....</b>	<b>xiii</b>

## **Part 1: In Principle..... 1**

### **Chapter 1: Data-Driven Journeys ..... 3**

Overview .....	3
Audience .....	3
Introduction.....	3
Dashboards .....	5
A Dashboard Supports Decision Making .....	7
Foundations of a Modern Dashboard .....	7
Creating Data Visualizations .....	10
Data Visualization Gallery .....	11
Conclusion.....	16
References .....	16

### **Chapter 2: Three Is of Visualization Value – INFORM, INSIGHT, INSPIRE ..... 19**

Overview .....	19
Audience .....	19
Introduction.....	20
The Three Is of Visualization Value.....	20
The Personas .....	23
Completing the Model .....	28
Importance of Skills Development .....	30
Rise of AI and the Role of Automation and Skills Augmentation .....	30
Conclusion.....	31
References .....	31

### **Chapter 3: SAS and Data Visualization ..... 33**

Overview .....	33
Audience .....	33
Introduction.....	33
A Short History .....	34
Conclusion.....	39
References .....	40

<b>Chapter 4: The Analytics Life Cycle with SAS Viya.....</b>	<b>41</b>
Overview .....	41
Audience .....	41
Introduction .....	42
Choice and Control.....	42
Accelerate the Analytics Life Cycle .....	44
Powering Digital Transformation .....	45
Conclusion .....	46
References.....	46
<b>Chapter 5: Design Approaches .....</b>	<b>47</b>
Overview .....	47
Audience .....	47
Introduction .....	47
Choosing the Right Data Output .....	48
Humans Are Visual Creatures .....	49
Tips for Insightful Data Visualization .....	49
Learn from Other Approaches .....	51
SAS Visual Analytics Design Tips for Analysts .....	56
Conclusion .....	58
References.....	58
<b>Chapter 6: Visual Elements .....</b>	<b>59</b>
Overview .....	59
Audience .....	60
Introduction .....	60
Learn from Infographics .....	60
Elements of Your Data Visualization .....	61
Deciding Which Visualization to Use .....	62
A Starting Point .....	62
Traditional Graphs Versus Analytic Driven Visualizations .....	62
Analytics-Driven Visualization .....	62
Traditional Graphs: Simple Yet Powerful.....	66
Endless Graphing Options Within SAS Visual Analytics .....	68
More Than a Pretty Picture .....	68
Go Beyond Default Settings .....	69
Conclusion .....	70
References.....	70

<b>Chapter 7: Creation Process .....</b>	<b>71</b>
Overview .....	71
Audience .....	71
Introduction.....	71
Approach Patterns.....	72
Approaching Your Data Visualization Project .....	72
The Process .....	73
Workflow for Building Your Data Visualization with SAS Visual Analytics .....	73
Final Tips for Data Visualization Projects .....	76
Conclusion.....	77
References .....	77
<b>Part 2: In Practice .....</b>	<b>79</b>
<b>Chapter 8: Data Holds the Answers .....</b>	<b>81</b>
Overview .....	81
Audience .....	81
Introduction.....	82
Data Is Everywhere .....	82
Preparing Data for Dashboards.....	83
Conclusion.....	87
References .....	87
<b>Chapter 9: Examples Overview.....</b>	<b>89</b>
Overview .....	89
Audience .....	89
Introduction.....	89
General Structure of Examples .....	90
Data.....	90
Topics.....	91
Tools.....	91
Conclusion.....	92
References .....	92
<b>Chapter 10: Example 1: SAS and Social Media Data .....</b>	<b>93</b>
Overview .....	93
Audience .....	93
Introduction.....	94
Project Approach.....	94
INFORM .....	95
INSIGHT.....	100
INSPIRE .....	109
Conclusion.....	111
References .....	111

<b>Chapter 11: Example 2: SAS and Climate Data .....</b>	<b>113</b>
Overview .....	113
Audience .....	114
Introduction .....	114
INFORM .....	114
INSIGHT .....	120
INSPIRE .....	132
Conclusion .....	134
References .....	135
<b>Chapter 12: Example 3: SAS and Outbreak Data .....</b>	<b>137</b>
Overview .....	137
Audience .....	138
Introduction .....	138
INFORM .....	138
INSIGHT .....	141
INSPIRE .....	152
Conclusion .....	155
References .....	155
<b>Chapter 13: Sharing and Collaboration .....</b>	<b>157</b>
Overview .....	157
Audience .....	157
Introduction .....	158
Audience Requirements Are Critical .....	158
Three-I Model from the Audience Perspective .....	158
INFORM .....	159
INSIGHT .....	162
INSPIRE .....	165
Consider How You Will Share Your Visualization .....	167
Conclusion .....	176
References .....	177
<b>Chapter 14: Future of Data Visualization .....</b>	<b>179</b>
Overview .....	179
Audience .....	180
Introduction .....	180
Future Trends .....	180
Audience and Analyst .....	183
Next Steps .....	184
Conclusion .....	185
References .....	185

# About This Book

## What Does This Book Cover?

A data visualization is the gateway to artificial intelligence (AI) and big data. A data visualization is a data application answering a question or range of questions for the business user and analyst. It can be a portal or a headline. It is the flexible “on ramp” to data-driven decision making in the enterprise.

SAS has been creating dashboards and data visualizations via many software tools over many decades. This book shows how the latest SAS Viya tools can be used to create data visualizations in an easier, smarter, and more engaging way than ever before. SAS Visual Analytics combined with human creativity can produce endless possibilities. In this book, you will learn tips and techniques for getting the most from your SAS Visual Analytics investment. From beginner to advanced SAS users, this book has something for everyone. Use AI wizards to create data visualization automatically, learn to use advanced analytics in your dashboards to surface smarter insights, and learn to extend SAS Visual Analytics with advanced integrations and options.

People often ask us to show how we build our data visualizations, and this book is a way to share that with the world.

Topics covered in this book include:

- SAS Visual Analytics
- Data visualization with SAS
- Reports and dashboards
- SAS code examples
- Self-service analytics
- Create reports with SAS
- SAS data Access
- Extending SAS beyond drag and drop

## Is This Book for You?

This book is for all SAS users.

This book is structured in two parts. First, we step through some foundations and explore ideas about what approaches you can take to create more insightful data visualization. Part two is a practical exploration of achieving these designs with SAS Visual Analytics on SAS Viya. If you are interested in understanding more about dashboards, each part has something for you.

If you are an intermediate or advanced SAS user, then this book will assist you in understanding the value of creating for the audience using impactful visualization, and the possibilities that visualizations provide for engaging your audience.

For a beginner SAS user, this book provides the necessary overview to understand dashboard and report foundations and their origins to then progress through the book and use the step-by-step examples to work along with.

This book is aimed at SAS users who create and design reports and dashboards for their users. Managers can use this book to determine what their teams could create and design with SAS® Visual Analytics.

All levels of SAS skills are covered in this book: beginners, intermediate, and advanced. Beginners learn to use SAS to add data and create dashboards with ease, intermediate users get to extend with custom data elements and custom visual elements, and advanced users get to see the power of code and APIs to enhance and share data visualizations.

## Prerequisites

You do not have to have any previous experience with SAS tools to read this book. However, if you do have some experience with SAS code and data preparation, then you may find some parts of this book and examples easier.

## Examples: Data, Reports, and Code

There are examples provided in this book, including code samples, reports, and data where applicable. These files can be downloaded from the author pages at [support.sas.com/Schulz](https://support.sas.com/Schulz) and [support.sas.com/Murphy](https://support.sas.com/Murphy).

## Software Used

Support Documentation is located at <http://support.sas.com/documentation/>

Here are the specific software versions used in this book:

- SAS Visual Analytics 8.5.1
- SAS Visual Statistics 8.5.1
- SAS Visual Data Mining & Machine Learning 8.5
- SAS Data Preparation 8.5

Documentation links and further reading are outlined in this book.

## SAS OnDemand for Academics

If you are using SAS OnDemand for Academics to access data and run your programs, then please check the SAS OnDemand for Academics page to ensure that the software contains the product or products that you need to run the code: [https://www.sas.com/en\\_us/software/on-demand-for-academics.html](https://www.sas.com/en_us/software/on-demand-for-academics.html).

Code examples are designed to run against the open data referenced.

## SAS Visual Analytics Trial

To access a free trial of SAS Visual Analytics software, go to: [www.sas.com/va](http://www.sas.com/va).

Samples in this book are designed to work with SAS Visual Analytics 8.5.

## We Want to Hear from You

SAS Press books are written *by* SAS Users *for* SAS Users. We welcome your participation in their development and your feedback on SAS Press books that you are using. Please visit [sas.com/books](http://sas.com/books) to do the following:

- Sign up to review a book
- Recommend a topic
- Request information on how to become a SAS Press author
- Provide feedback on a book

Do you have questions about a SAS Press book that you are reading? Contact the author through [saspress@sas.com](mailto:saspress@sas.com) or [https://support.sas.com/author\\_feedback](https://support.sas.com/author_feedback).

SAS has many resources to help you find answers and expand your knowledge. If you need additional help, see our list of resources: [sas.com/books](http://sas.com/books).



## About These Authors

Travis and Falko get asked all the time to help people with creating engaging data visualization with SAS Visual Analytics. One way to share this to a larger audience is to create a book, and this is that book. In a paper presented at SAS Global Forum 2018, Travis and Falko teamed up to share some insight on creating supercharged dashboards using SAS Visual Analytics. That paper set the foundation for this book idea, and together the two authors aim to combine, create, and share something great to enable the reader to re-create the examples to take their data visualizations to the next level. This book introduces many concepts and provide step-by-step examples and samples to reuse in SAS software around the globe.



Falko Schulz is widely regarded as one of the best infographic data visualization creators using drag-and-drop tools like SAS Visual Analytics. He is also a distinguished developer in SAS R&D, making SAS Visual Analytics what it is today. His creative approach has produced many stunning visualization examples. Falko has been involved in many projects over the years helping customers to visualize business insights and tell data stories. He is an active SAS community member and is enabling SAS users by sharing technical papers, data visualization examples, and blogs

posts to explain and show the capabilities of SAS.

Falko Schulz is a Distinguished Software Developer in the SAS Business Intelligence Research and Development division. He works actively on products such as SAS Visual Analytics, further enhancing user experience and analytical capabilities. Falko has a strong background in delivering business analytical applications in a wide range of industries.

Prior to joining the R&D division, Falko worked in customer-facing roles and was responsible for critical technical implementations and BI architectural designs. During his 20 years at SAS, Falko has worked in various countries including Germany, Australia, and the US.

For more information, visit:

[support.sas.com/schulz](https://support.sas.com/schulz)

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

**LinkedIn:** <https://www.linkedin.com/in/falkoschulz/>

**Email:** [Falko.Schulz@sas.com](mailto:Falko.Schulz@sas.com)



Travis is a strong advocate and evangelist for self-service analytics and data visualization. A data visualization and business intelligence maven, he has helped many organizations deliver on the promise of self-service analytics and get the most from their investment in business analytics software.

Travis Murphy has worked for over 20 years in data warehousing, business intelligence, and analytics. Prior to SAS, Travis held roles with other large IT vendors focused on business analytics products. These roles included product marketing, consulting/implementation, training, and presales. His experience includes working with customers and vendors implementing data solutions.

Within SAS, Travis has held presales, technical account management, business solution management, and marketing roles focused on SAS data visualization tools. Travis is always trying to better communicate the value and insight of data using software tools and get business users and stakeholders more involved in the use of data.

Travis is a published SAS author and has presented at SAS Global Forums, conferences, and SAS marketing roadshows. He continues to evangelize the benefits of approachable analytics and data visualization.

For more information, visit:

[support.sas.com/murphy](https://support.sas.com/murphy)

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

**LinkedIn:** <https://www.linkedin.com/in/travismmurphy/>

**Email:** [Travis.Murphy@sas.com](mailto:Travis.Murphy@sas.com)

# Chapter 1: Data-Driven Journeys

Overview.....	3
Audience.....	3
Introduction .....	3
Dashboards .....	5
A Dashboard Supports Decision Making .....	7
Foundations of a Modern Dashboard .....	7
Intended Audience.....	7
A Thoughtful, Data-Driven Journey .....	9
Design Once and Use Everywhere .....	9
Creating Data Visualizations.....	10
Data Visualization Gallery .....	11
Conclusion .....	16
References .....	16

## Overview

This chapter sets the tone for what is to come in the book and includes some visual examples of data visualizations and what you can expect to create with SAS Viya yourself. Looking back in time, we will discuss how common terminology in data visualization, like the dashboard, came to be and introduce topics that we delve into further as the book continues.

## Audience

This chapter is for all readers because it provides an introduction and origins of what is contained in this book on data visualization. No matter your experience is in SAS Viya, you will be shown some ideas to help explain what is to come.

**“Every company has big data in its future, and every company will eventually be in the data business.”**

*Thomas H. Davenport*

## Introduction

Studies have shown that readers of newspapers skim the paper for headlines, images, and data visualizations to decide if they want to read the article. This skimming is heightened in a world of personalized newsfeeds across many channels and sources. This means that the dashboards of

yesterday might not be equipped to meet the audience requirements of today. Learning from other information channels provides some great ideas for data visualization and dashboard design. As the quote from Davenport alludes, all companies will be leveraging big data and will be challenged to turn this into competitive advantage. Just remember that data visualizations are primarily designed to deliver this valuable information with clarity and simplicity... do yours?

Creating modern dashboards and reports that can be shared and remembered by people is so important today. In Figure 1.1 you can see an example of sharing COVID-19 data in a poster format created using SAS Visual Analytics on SAS Viya. This book steps through many examples and tips to make your SAS Visual Analytics reports and dashboards grab your audience's attention and deliver insight with your data visualizations.

**Figure 1.1: SAS Visual Analytics example showing the global impact of coronavirus (COVID-19) outbreak for selected countries (Schulz 2020)**



Attracting and retaining the attention of a modern-day audience is tougher than ever before. The rise of information volume and velocity has changed our lives in almost every way. We are in the information age, and we are “informavores” (Miller 1983).

## INFORMAVORE:

### Information + *Vorare* (Latin – to devour)

Originally used as a way of describing humans in the Information Age, being informavores has quickly become our new way of life. In the way that herbivores eat plants or carnivores eat meat, the informavore consumes information as the primary source of their diet. Today with social media and our digital life, information analysis is much harder than ever before. Using this simple analogy in the idea of a carnivore or omnivore, an informavore is simply a consumer of information. The question is whether your information is cutting through into the stream at all? With so many options today for information, if your data projects are not being consumed, people are filling the gap with other sources.

In short, as analysts, our information products are competing with a massive amount of information today, from social media, to niche websites, Reddit, news (fake included), microblogs, video blogs, and ever-changing sources that we rely on to live our modern lives. To deliver value to our audience, we need to create impactful, data-driven journeys.

This is important for data analysts today because we are crafting the interaction with data for our audience to consume. The audience is overwhelmed with information, yet they need information to survive and function. This dichotomy is the challenge of our time and has seen data visualizations rise in record numbers to bridge this gap and make information more consumable. To break into the audience’s trusted network of information, analysts need to create impact with their information products, especially data dashboards.

## Dashboards

A common type of data project that sets the foundation for modern data visualization is a dashboard. People often start the history of data visualization with hieroglyphs or cave paintings; however, more recently with big data transformation, the origins are more consistent with business intelligence software tools and dashboards. The origins of the dashboard from the practical and literal to the modern use as a form of interface to data science, the term has had a journey well before this book was written. The following definitions are useful to understand a dashboard and decide what this means for the modern analyst. Webster’s definitions are great to get the essence of the word dashboard as there is some history here.

A dashboard was:

“a screen on the front of a usually horse-drawn vehicle to intercept water, mud, or snow”

Or as time marched on:

“a panel extending across the interior of a vehicle (such as an automobile) below the windshield and usually containing instruments and controls”

*(Merriam-Webster)*

The origin of the word dashboard is interesting and sits at the heart of technical advancement but is also a continued nod to the past. Originally used to describe a horse-drawn carriage’s kick board, the dashboard was used to keep drivers safe and stop mud and dirt from hitting them. This term evolved over time and was continued to be used as the modern carriages with motors came into use like the automobile and other instrumentation. This instrumentation shows the performance of the vehicle in real time and over time – with very narrow parameters.

The modern use of the word dashboard harkens back to that era, and now we travel the world each minute on our smart devices and the internet. As was true in the past, a dashboard protected the user from the dirt and mud of what was being kicked up, which still holds true for data visualization today. Let’s take a look at what a modern data dashboard is:

“a dashboard is a user interface that, somewhat resembling an automobile's dashboard, organizes and presents information in a way that is easy to read. However, a computer dashboard is more likely to be interactive than an automobile dashboard.”

*(WhatIs.com)*

The modern dashboard keeps this principle and extends it to vast nuance of data and meaning. Now the dashboard can show data and performance of a single item, a collection of items on a single topic, or even a collection of items on many topics – every time this modern dashboard can differ. Dashboards are both a collection of data visualizations and can also perform as a single infographic data visualization. Businesses across the globe rely on dashboards to support their digital transformation. The modern dashboard has become a data application almost like an app on your phone. Just like apps, you can have useful and not so useful dashboards. The not so useful dashboards are easily forgotten and have limited reason for the audience to come back. We have all seen dashboards that make you excited and ones that make you sigh.

Engaging the audience each time a new modern dashboard is created can be tough and often gets lost in the noise of the rest of life’s modern information requirements. Today, people are informavores, and this means they don’t waste time learning something with perceived low value.

## A Dashboard Supports Decision Making

A dashboard, like the original cockpit-style display, is a collection of information served visually to assist with “just in time” decision making. This has shifted during the digital age, and during the automation age, and it continues to evolve and will keep evolving in the AI era to come. What was a car dashboard of simple gauges and levers in the past has changed to a more nuanced and dynamic context-sensitive layered display with many more areas of data and information. No longer do we have to look down at a gauge as a heads-up display (HUD) allows augmented reality to provide the most important information in our main view. In an aircraft scenario, the cockpit has evolved also in a similar way. Think of it like this: the automation increased, and the human now has different requirements of the dashboard or data visualization. The data-driven organization is also heavily evolving and information is everywhere, leaving people wondering – what do I look at?

You could call this information overload, and as the data increases, the dashboard concept has been embedded in nearly every digital channel that we have today – even refrigerators have dashboard displays letting us know updates such as: the milk is running low, the balance of cold air is correct in all chambers, and the vegetables and meat are still fresh. The audience is getting quite adept at understanding useful and not so useful information displays in today’s generation. Simply put, humans are becoming great users of technology. The issue is that many of us are not great creators of technology, just great users of the technology. The smart phone generation has seen everything become a dashboard showing many notifications like the number of messages in their inbox, the number of tasks on the to-do list today, and when someone *likes* their social media post.

The great evolution of a dashboard has required data visualization tools to evolve and to become simpler than ever before. We now require simplicity *and* the flexibility to keep all the data-driven journey requirements covered. The boardroom needs information at the speed of thought, and this book shows you how to create modern dashboards and data visualizations that can be shared and dynamically explored by your teams using SAS Visual Analytics on SAS Viya. Enhance your existing dashboards and reports with easy drag-and-drop wizards while still providing performance, repeatability, and scalability on massive data that your enterprise demands.

## Foundations of a Modern Dashboard

As introduced above, a great dashboard has some simple characteristics. Here are some ideas about what works for users of dashboards and why they work.

### Intended Audience

Dashboards and reports need to support actions, not just share insights from the data. Choosing the right dashboard type for your audience ensures you provide the correct format and options to support your audience.

**Figure 1.2: Types of dashboards should match your audience requirements**



To achieve your next project, you should think of dashboards as belonging to four possible categories. As seen in Figure 1.2, the four categories are:

1. Operational – the “now” aspect of the business – for example, the performance on the factory floor or the call center operations.
2. Strategic – KPI performance and future projections.
3. Analytical – artificial intelligence (AI) and machine-learning (ML) rich dashboards.
4. Tactical – monitor details within an organization against the strategies.

These categories provide some excellent guard rails for your dashboard and report designs and how the audience will use the dashboard. Then you can also think of other information products that may be a better fit for that category including reports or notifications. Often, the category is also an indicator of the audience, but this is not always the case. If you overlay author Stephen Few’s thoughts on dashboards, then you could also create common subcategories of audience and break them down again to management and reporting dashboards (Few 2006). Although, this may not be necessary as the target audience is often clear by the category. From experience, though, each category above requires a collection of information products like dashboards, reports, and alerts to harden the production processes needed to provide robust services to your stakeholders. We could do an entire book on these categories alone and include these to ensure you can see where your next dashboard project fits, as this will provide initial guidance on how your dashboard may be used and by whom.

What dictates the final dashboard is the intended audience and their skill levels with data. A dashboard is an information application, and like many of the best apps, the best dashboards don't require any additional training or special skills to use. The user can simply open the dashboard and start to navigate by clicking and moving on areas that matter or are interesting to the question the audience has. Today, all insight from data is competing for a user's attention, and we only have seconds to provide a reason for the audience to stay. A great dashboard needs to grab the attention of the audience.

## A Thoughtful, Data-Driven Journey

Crafting a deliberate and simple story line throughout the data-driven journey is important. The best dashboards or data visualization engage the audience on multiple levels. This is achieved with the following considerations.

- **Layered Context.** The best dashboards are layered, and these layers are often built into multiple tabs or pages of your dashboard and linked together to move between these layers with context from each question the audience has. The challenge today is cutting through the noise and grabbing the attention of the audience to drive more engagement with your dashboard designs.
- **Intuitive and Simple Pathways.** How will the audience navigate the dashboard? Will they click or tap the tabs or each object? What path will they take? Is there a single line of thought navigation built in, or are there multiple pathways to take for the user at any time? Actionable insight is key for a dashboard user, and each click of the mouse or tap of the screen should provide more detail or a different perspective, while still maintaining context. The dashboard moves from highlights to detail with ease and simplicity.
- **Interactive.** It is important to consider how interactive or static the dashboard needs to be, and sometimes this is not for the designer to decide, but rather consider how the users will interact with the final design. Static dashboards are more like today's infographics as they will often end up on a wall as a poster, on a television screen in the lobby, or as a social media tile shared on the internet.

## Design Once and Use Everywhere

A great data visualization is designed once and used by many users in many contexts. This means that there need to be multiple hooks and entry points into the dashboard or data visualization. Each user gets a custom experience even though the look and feel are never different, so the context is the only thing that changes. Creating a context-sensitive landing page for your data-driven journey allows for many entry points to the same content and increases the use cases and audience without limiting the value for each group. Delivering enterprise-ready data visualization requires resources to be shared, and this is true with the outputs of data visualization projects. We will explore some of these key considerations in more detail throughout this book and highlight when these are leveraged in each data visualization example in the upcoming chapters.

## Creating Data Visualizations

Data visualizations are like an iceberg – they look simple and approachable above water; however, much lies beneath the surface to ensure they make sense, are accurate, and trustworthy. A plethora of software tools claim they create data visualization and dashboards today. In recent years, we have seen the growth and consolidation in vendors in this space, and a heightened claim of advanced capability of tools and broader platforms. It is important to look at data visualizations from two perspectives, the **analyst** and the **audience**. These software tools have strengths and weaknesses, and this book will highlight how SAS Visual Analytics provides many features to complement other SAS solutions, but in particular how the analyst and the audience interact in design and use of data visualizations.

The world is full of hype around AI, and many software vendors claim to embed it and enable businesses to achieve success. In reality, the hype falls short when reviewing capabilities in more detail across these solutions. The steps toward robots and the science fiction view of AI have to start somewhere, and this is important for the future applications. One of the most impactful uses of AI to business users is embedded AI, which assists both analytics professionals and novices alike and is changing the game when it comes to data visualization and communicating insight. SAS provides advanced capabilities to users of all levels via a visual interface and code. These can be combined to deliver the most impactful data visualizations that you have ever achieved. SAS has made advancement in embedding AI and ML into the tools that also create and share data visualizations, making SAS the premier platform or engine for your organization's information. The dashboard of today should be as easy as PowerPoint and as smart as AI. Your analytics platform needs to enable you to have flexibility and simplicity to achieve simple analysis and the most complex AI. Here are some attributes of the platform that are useful to consider, and this book will aim to unlock these throughout:

- Easy to get data in and scalable for complex processes
- Easy to get insight and flexible to add precise visuals
- Easy to share and embed anywhere
- Simple for individuals and ready for enterprise
- Drag-and-drop or code where needed

With over 40 years' experience in data analysis and enterprise deployment, SAS has all the components and personas covered to support any organization. Data-driven journeys have been a continuous focus for SAS since the beginning. SAS has been excellent at seeing and adapting to those market shifts in technology and the latest trends. SAS Visual Analytics continues to evolve and include new capabilities to tell amazing data stories and create data visualization. SAS Visual Analytics includes built-in intelligence and drag-and-drop wizards to create insightful, data-driven journeys with great visual appeal.

## Data Visualization Gallery

No matter the skills that you have today, you can create data visualizations with SAS. You can either be a consumer of information, or a creator of information, or a combination of both depending on your area of expertise. This book shows you that you have an option, right now, with your current SAS investment. You can step forward with your data-driven journey by applying a makeover to existing reports and dashboards or by taking some of the characteristics of the examples in this book and applying these in the build phase of your next data visualization project.

Let us begin with showing what you will be able to achieve by the end of this book with some visual examples. Here is a gallery of the type of data visualizations that you will create by the end of this book.

**Figure 1.3: Sample dashboard created with SAS Visual Analytics showing data visualization embedded in a highly formatted image of a desktop (Schulz 2018a)**



**Figure 1.4: Sample dashboard created with SAS Visual Analytics comparing 2012 and 2016 NASA nighttime satellite images to illustrate how illumination patterns have changed over time (Schulz 2018b)**

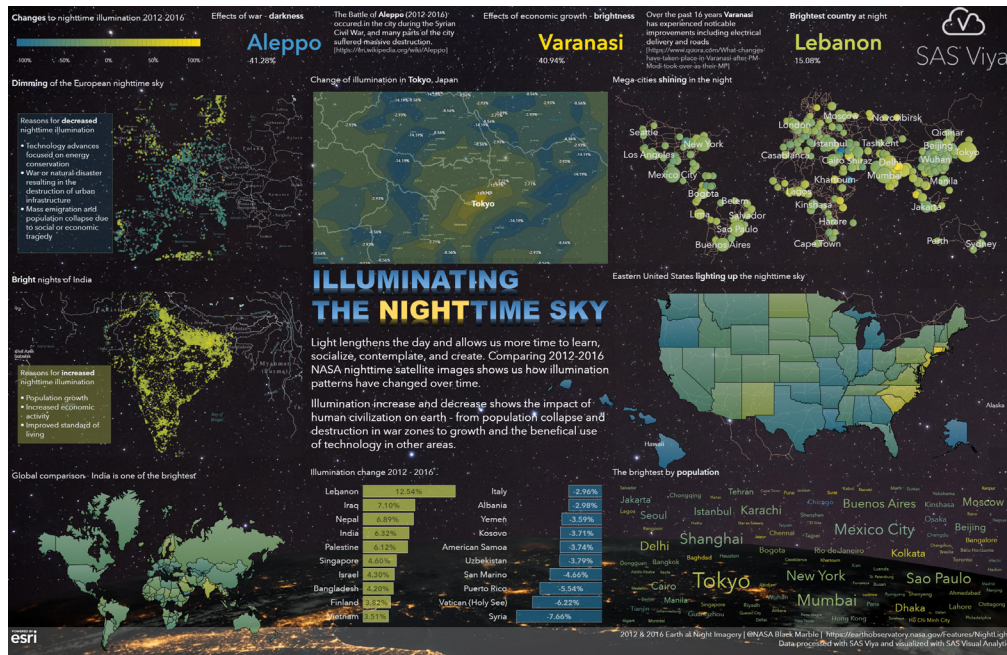
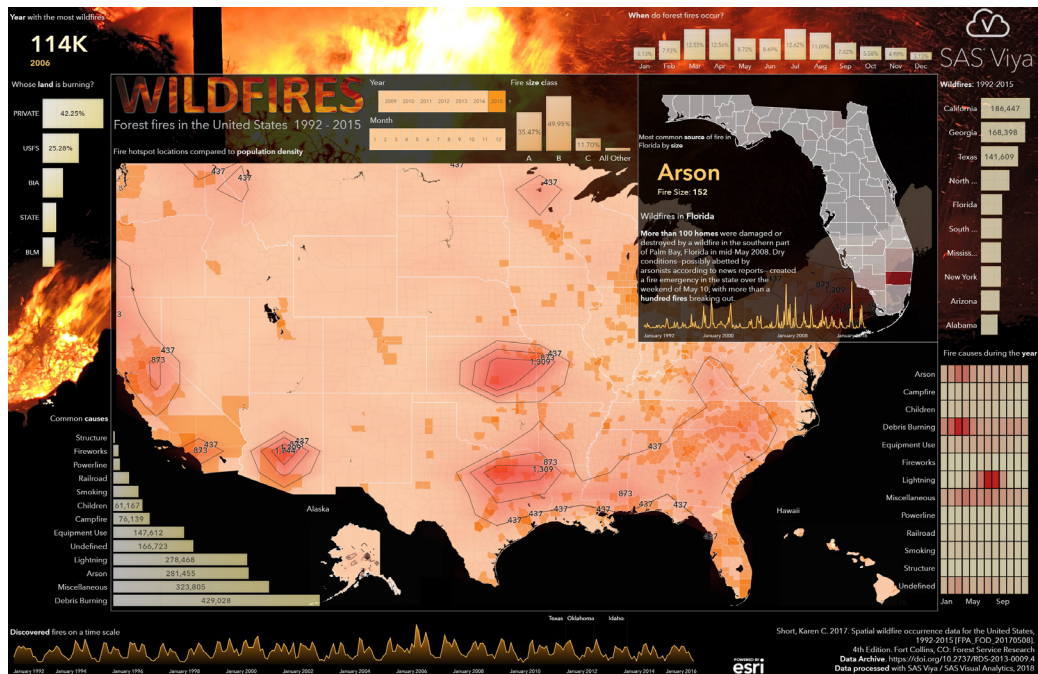
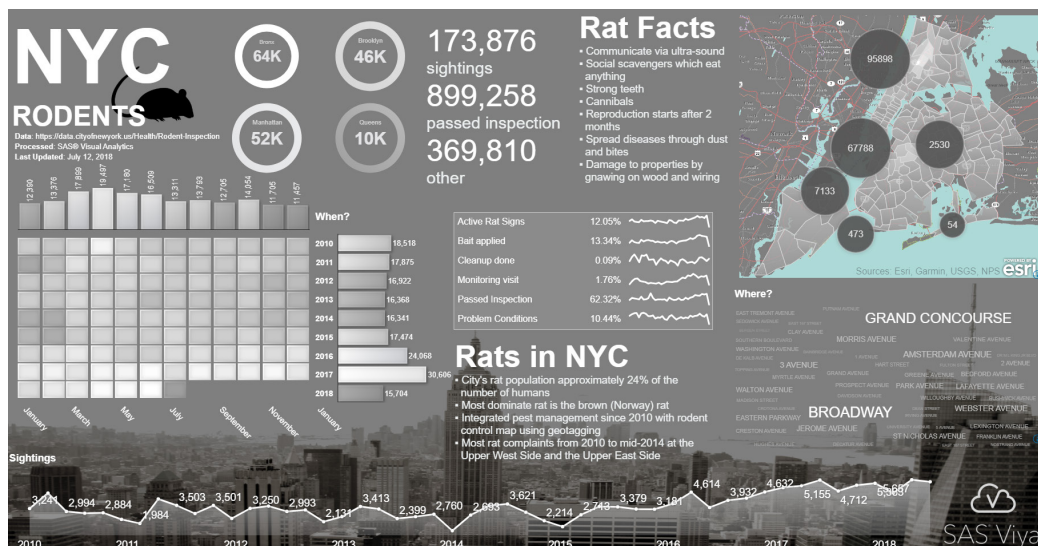


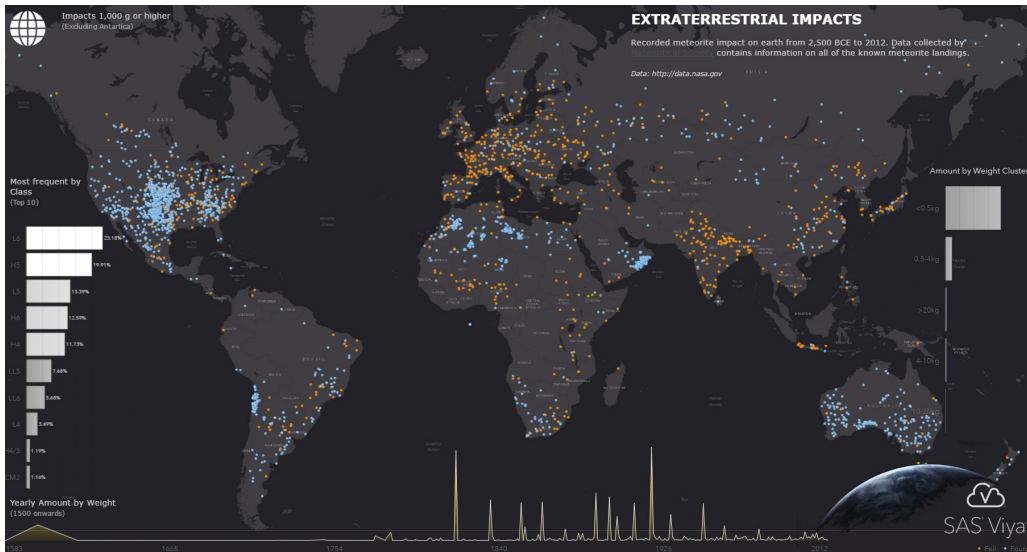
Figure 1.5: Sample dashboard created with SAS Visual Analytics displaying forest fire data from 1992–2015 in the United States showing the locations, common causes, and when wildfires occur (Schulz 2018c)



**Figure 1.6: Sample dashboard created with SAS Visual Analytics showing public pest data to create an operational dashboard to monitor rodent and pests in New York City (NYC) (Schulz 2018d)**



**Figure 1.7: Sample dashboard created with SAS Visual Analytics showing meteorite impacts across the globe from 2500BC to 2012 and colored by impact type (Schulz 2018e)**



**Figure 1.8: Sample dashboard created with SAS Visual Analytics visualizing customer segmentation using analytical clustering and location analytics (Schulz 2017a)**

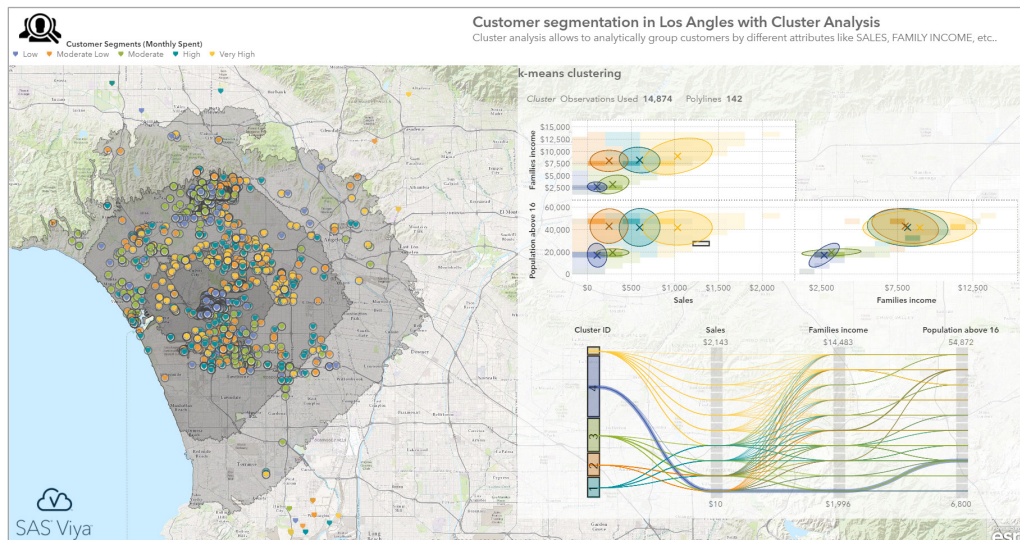


Figure 1.9: Sample dashboard created with SAS Visual Analytics showing ticket member distribution based on geographical location and ticket sales (Schulz 2018f)

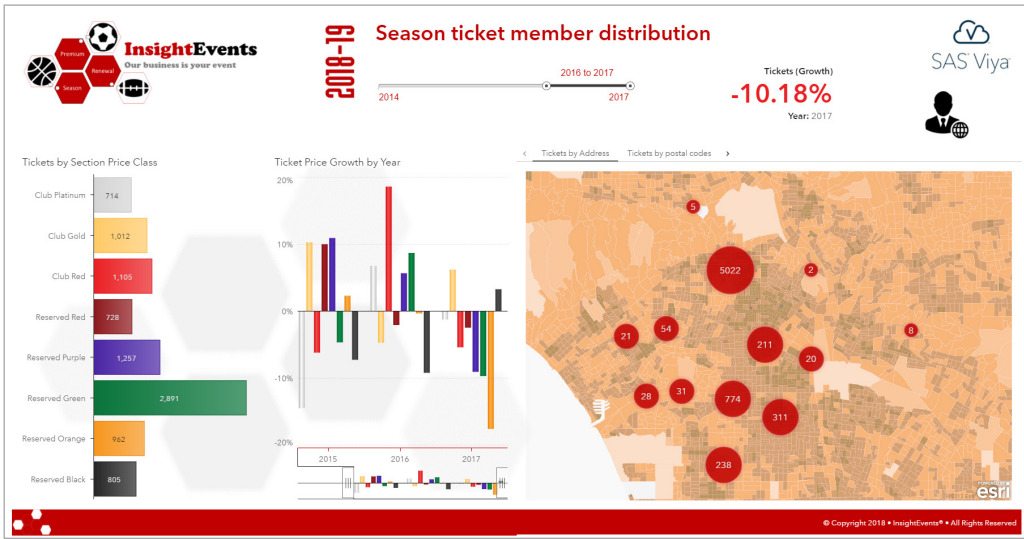
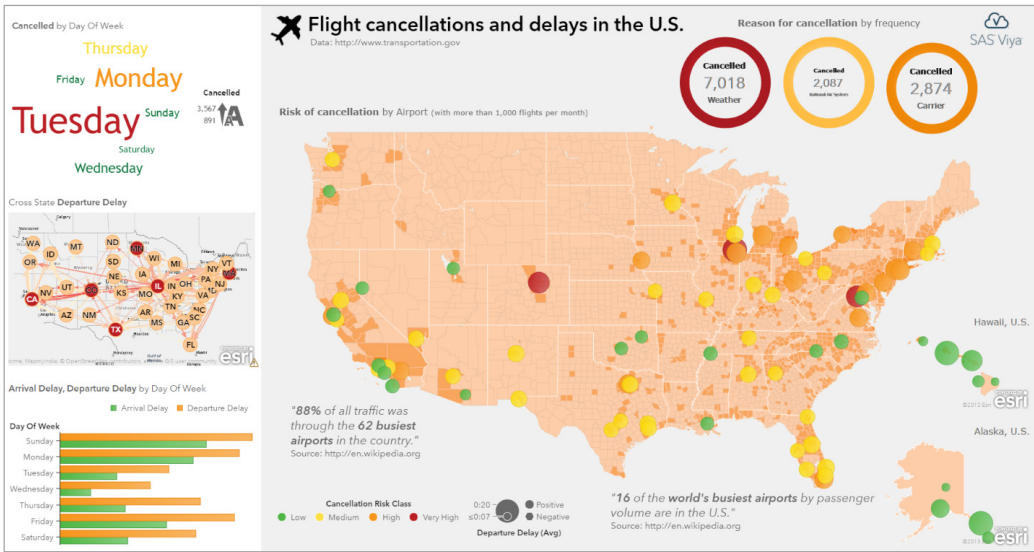


Figure 1.10: Sample dashboard created with SAS Visual Analytics displaying flight delays including a map highlighting major hubs at risk of delay, including indicators for best and worst airports (Schulz 2017b)



## Conclusion

This book looks at how the recent releases of SAS Visual Analytics running on SAS Viya allows analysts to design and create visually rich and impactful dashboards and data visualizations like never before. You will learn tips and techniques to get the most from your SAS Visual Analytics software, which you can apply back at the office and with your team. You will be shown the perfect balance of creative ideas and practical examples to better engage your entire organization with high impact data driven journeys.

We will cover some topics to set the stage and break down why impact matters in your dashboards. Then we will step through a gallery of examples and discuss how to re-create your own at your organization. You can easily follow along and download the samples and work through each exercise. Also, you can pick up some tricks and tips to help you with creating your next data visualization.

As per the example visualizations shown earlier, you can see the types of outputs you will be able to create, and these may be building on the dashboards that you create today. Or you may get some ideas on how to makeover your existing data visualization and find inspiration for your next project.

## References

- "Dashboard." Merriam-Webster.com Dictionary, s.v. Accessed September 1, 2020, <https://www.merriam-webster.com/dictionary/dashboard>.
- "Informavore Definition." World Wide Words. Available <http://www.worldwidewords.org/turnsofphrase/tp-inf3.htm>. Accessed on February 26, 2020.
- Davenport, Thomas H. 2014. *Big Data at Work: Dispelling the Myths, Uncovering the Opportunities*. Boston: Harvard Business Review Press.
- Few, Stephen. 2006. *Information Dashboard Design: The Effective Visual Communication of Data*. Sebastopol, CA: O'Reilly.
- Machlup, Fritz and Una Mansfield. 1983. *The Study of Information: Interdisciplinary Messages*. New York, NY: John Wiley and Sons Inc.
- Rouse, Margaret. n.d. "What Is a Dashboard?" WhatIs.com, Last updated September 2005. Accessed February 20, 2020. <http://searchcio.techtarget.com/definition/dashboard>.
- Schulz, Falko. 2017a. "Customer Segmentation with Cluster Analysis." SAS Communities. August 6, 2017. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/Customer-segmentation-with-Cluster-Analysis/ta-p/482350>.
- Schulz, Falko. 2017b. "Flight cancellations and delays in the United States." SAS Communities. August 3, 2017. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/Flight-cancellations-and-delays-in-the-United-States/ta-p/482348>.
- Schulz, Falko. 2018a. "Global airports - connecting the world." SAS Communities. August 29, 2018. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/Global-airports-connecting-the-world/ta-p/488388>.
- Schulz, Falko. 2018b. "The dark side: analyzing global changes in nighttime illumination." SAS Communities. July 9, 2018. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/The-dark-side-analyzing-global-changes-in-nighttime-illumination/ta-p/468253>.
- Schulz, Falko. 2018c. "Analyzing US Wildfires using SAS Visual Analytics." SAS Communities. June 7, 2018. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/Analyzing-US-Wildfires-using-SAS-Visual-Analytics/ta-p/467894>.

- Schulz, Falko. 2018d. "New York City - Rodent Inspection." *SAS Communities*. July 13, 2018. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/New-York-City-Rodent-Inspection/ta-p/477334>.
- Schulz, Falko. 2018e. "Extraterrestrial Impacts - Recorded meteorite impacts on earth." *SAS Communities*. August 15, 2018. <https://communities.sas.com/t5/SAS-Visual-Analytics-Gallery/Extraterrestrial-Impacts-Recorded-meteorite-impacts-on-earth/ta-p/482358>.
- Schulz, Falko. 2018f. "Analyze ticket sales using location analytics and customer segmentation in SAS® Visual Analytics." *SAS Communities*. April 26, 2018. <https://blogs.sas.com/content/sascom/2018/04/26/analyze-ticket-sales-using-location-analytics-and-customer-segmentation-in-sas-visual-analytics/>.

