Introducing
Microsoft
Power BI

Alberto Ferrari and Marco Russo

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Introduction

Microsoft introduced the idea of Self-Service Business Intelligence (BI) back in 2009, announcing Power Pivot for Microsoft Excel 2010. Strangely, at that time, it did not make big announcements, hold conferences, or undertake a big marketing campaign for it. Everything started slowly, with some enthusiastic users adopting the new technology, but the vast majority of people did not even know about its existence. As part of the community of BI professionals, we were very surprised by that approach. At the time, we could clearly see the advantages for users to begin adopting Power Pivot as a tool for gathering insights from data, so this complete lack of marketing was somewhat disappointing.

Thus, for several years we (as a community) kept asking Microsoft what they were waiting for; what was the delay in promoting Self-Service BI to the greater audience of data analysts, data scientists, decision makers, and BI enthusiasts all over the planet. We asked for the ability to share reports with a team, and the answer was to use SharePoint, either on-premises or the online version, with the first release of Power BI—an

experience that was still not completely satisfactory. While we were waiting for Microsoft to fix the issues with the previous versions and to begin advertising the current products, it was doing something different that, with the benefit of hindsight, looks to have been the perfect choice. Microsoft collected the feedback of users, carefully considered what was missing in the world of end-user BI, and then crafted the version of Power BI that's available to you today.

Power BI is an evolution of the add-ins previously available in Excel: Power Pivot, Power Query, and Power View. You can use Power BI with or without Excel—you no longer are dependent on the version of Microsoft Office installed at your company. People did not like to share reports by using only SharePoint, and Microsoft moved away from it. Users wanted a mobile experience, and the development team created it. Data analysts wanted power, simplicity, new visualizations, and all of this is now available in Power BI. In addition, a lot of effort went into the creation of a seamless experience in loading data from many different cloud sources and building the infrastructure needed to provide all BI enthusiasts with a framework with which they can grow their reports, share them with their teams, and refresh the data in a simple yet effective way.

To make a long story short, Microsoft heard the feedback of users and built a great set of tools for the adoption of Self-Service BI. And, now—only now—it has begun marketing it.

Suddenly, in the last few months, Power BI has become the hottest topic at conferences, webinars, talks, and courses. As expected, people like you gathered interest in Power BI and began to search for resources to learn it. This book is one of these resources and its goal is to provide you with an effective introduction to the features available in the new Power BI.

We wanted to write an introduction to Power BI that covers the basics of the tool and, at the same time, shows you what the main capabilities of Power BI are. Thus, it is fair to say that the content of the book is somewhat unbalanced. At the beginning, we go for an easy introduction of the concepts along with an educational approach that lets you follow on your PC the same steps we show in the book. However, if we continued with that same mindset for the entire book, its size would quickly become intimidating. Thus, after the first chapters, we begin to run a bit faster, knowing that we are no longer guiding you step by step. Instead, we show you available features; if you want to learn the details, you will need to read and study more.

This book is targeted to a variety of readers. There are information workers and people who are totally new to the BI world. For those readers, the book acts as a simple introduction to the concepts that are the foundation of BI. Yet, another category of we wanted to target is that of IT professionals and database administrators who might need to drive the decisions of the company in adopting Power BI, because their users are asking for it. If this is you, this book acts as both a simple introduction to the basic concepts, to help you understand why users are so interested in Power BI, and as an overview of the capabilities and tools available in Power BI, so that you can make educated choices in adopting it. Power BI is not just a tool: it is an ecosystem that can integrate existing corporate BI with Self-Service BI. The last chapter of the book gives you an overview of these capabilities.

We hope you enjoy reading the book as much as we enjoyed writing it. Keep in mind that this is probably your first step in the fascinating world of Self-Service BI, the first step of a long journey in gathering insights from your data.

Downloads

All of the chapters in this book include workbooks and databases that let you

interactively try out new material learned in the main text. All sample content can be downloaded from the following page:

http://aka.ms/IntroPowerBI/downloads

Follow the instructions to download the IntroPowerBI_302284_CompanionContent.zip file.

Installing the companion content

Follow these steps to install the companion content on your computer so that you can use them with the exercises in this book.

1. Unzip the IntroPowerBI_302284_CompanionContent.zip file that you downloaded from the book's website (name a specific directory along with directions to create it, if necessary).

2. If prompted, review the displayed end user license agreement. If you accept the terms, select the accept option, and then click Next.

Acknowledgments

As usual with projects of this sort, there are too many people to thank, and a complete list of

everyone who contributed to this book would be impossible to write.

Nevertheless, there are certain people we must mention personally, because of their particular contributions.

We want to thank Microsoft Press and all the people there who worked on the project. Rosemary Caperton has been a great editor who helped us immeasurably with the process of book writing. Many others behind the scenes guided us through the complexity of authoring a book—thanks to you all.

Finally, a special mention goes to our technical reviewer, Ed Price. He double-checked all the content of our original text, searching for errors and sentences that were not clear; giving us invaluable suggestions on how to improve the book. Without his meticulous work, the book would have been much harder to read and would contain more mistakes!

If the book contains fewer errors than our original manuscript, it is only because of them. If it still contains errors, it is our fault, of course.

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Introducing Power BI

David is the manager of budgeting at Contoso, a company that sells electronic products worldwide through several retail shops and a website. Around the globe, country/region managers are responsible for producing figures for next year's budget for their respective countries/regions, which David then aggregates to produce the big picture to show to his boss.

Our scenario begins in October 2015, when David commences working on the budget for 2016. As always, David has a Microsoft Excel workbook containing the relevant information to produce the budget. Based on the results of the workbook, he would typically create a Microsoft PowerPoint presentation to share the results during internal meetings. This year, however, David wants to take advantage of the new Power BI service provided by Microsoft.

This entire book is a journey that we'll take along with David as he discovers how Power BI can help to build a rather sophisticated reporting solution; in this case, based on a budgeting

system. But because this book is about Power BI, not budgeting, we will not focus on the complexity of building a budget. Instead, we will keep the budgeting considerations fairly basic, focusing on the complexity of teamwork, data modeling, and reporting.

We provided all the workbooks and databases that we used to build the demonstrations in the companion content for this book. If you are interested in learning the basics of Power BI, you can replicate David's activities on your computer so that you can augment your learning experience by following the examples. Be aware, though, that the results you obtain by running the demonstrations might be slightly different, and the appearance of webpages and the user interface might not be identical, either. Power BI is evolving very quickly, and we tried our best to show examples that will last some time. Nevertheless, differences might occur; thus, you should concentrate on learning the features of Power BI, not the demonstrations. So, even if the numbers end up being different, what's important is to absorb how to do something, not just replicate what you read in the book.

Moreover, we strongly encourage you to test Power BI using your own data. You can perform the same operations on your personal

information that we describe in the book, thus reaping the combined benefits of learning the Power BI tools while simultaneously gaining insights into your data.

Getting started with Power BI

Any journey begins with the first step, so let's take that step together.

David obtained from IT an Excel report that contains the sales for the past three years, divided by country/region, brand, and month. Sales in Contoso are strongly brand-oriented, and some brands are prone to seasonal effects that David wants to take into account. For this reason, he uses data grouped by month. Figure 1-1 shows a small portion of the resulting data, which he stores in an Excel file. If you would like to become more familiar with David's data, you can open 2015 Sales.xlsx from the book's companion content.

CountryRegion	Brand	Month	Sale 2013	Sale 2014	Sale 2015
China	Contoso	January	1,271.55	3,236.31	9,945.86
China	Contoso	February	7,372.34	5,995.55	1,303.01
China	Contoso	March	11,364.07	2,767.32	3,437.26
China	Contoso	April	13,590.94	17,530.47	25,007.74
China	Contoso	May	11,780.08	13,501.47	5,270.05
China	Contoso	June	8,562.00	8,338.87	7,357.26
China	Contoso	July	7,001.78	13,874.09	31,571.42
China	Contoso	August	605.89	3,340.02	1,386.20
China	Contoso	September	3,958.70	1,709.68	2,224.36
China	Contoso	October	8,785.89	5,787.57	10,792.05
China	Contoso	November	7,631.64	2,412.91	
China	Contoso	December	21,968.86	5,657.70	
China	Fabrikam	January	5,794.38	9,244.97	
China	Fabrikam	February		6,230.00	
China	Fabrikam	March	3,415.96	1,044.89	
China	Fabrikam	April			5,155.78
China	Fabrikam	May	3,657.95	2,954.00	20,177.94

Figure 1-1: An excerpt from the initial Excel workbook for David's budget plan.

Every year, David makes some considerations on these numbers and then he shares his findings with the country/region managers, who then send back to him workbooks with their numbers for the next year. Figure 1-1 shows some data from China, but there are several other countries/regions, as well. During the process of computing those numbers, there are many meetings and discussions in which the managers bring their experience and knowledge to bear on the process, adding their own versions of the original workbooks, each displaying various charts and calculations, which must all be explained to others. This is a daunting task, to be certain, and one that David would like to streamline.

Fortunately, David heard about an interesting tool called Power BI that Microsoft created in 2015 that might be helpful toward creating a collaborative environment in which any stakeholder of the budgeting process can share his findings with others, working together on the goal. But, at this point, the name and maybe a marketing video is all that David knows about Power BI.

Driven by curiosity, he navigates to www.powerbi.com and starts down his learning path. Figure 1-2 depicts the welcome page of the Power BI website.
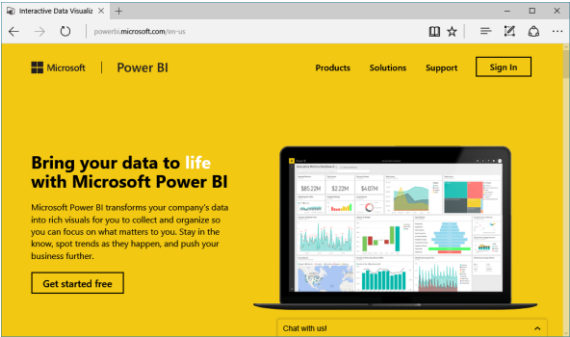

Figure 1-2: The welcome page of Power BI, the starting point of David's journey.

To begin, David clicks the Get Started Free button. He is then offered a choice as to which

experience he would prefer to use: he can choose either Power BI Desktop For Windows or just Power BI, as shown in Figure 1-3.
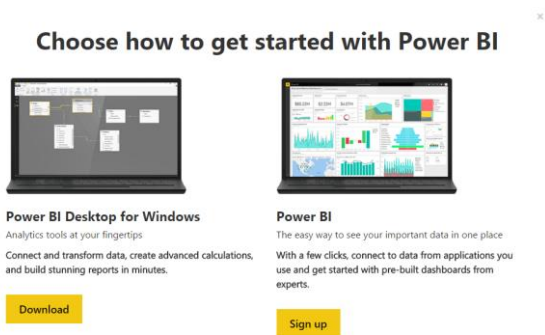

Choose how to get started with Power BI

Power BI Desktop for Windows
Analytics tools at your fingertips

Connect and transform data, create advanced calculations, and build stunning reports in minutes.

Download

Power BI
The easy way to see your important data in one place

With a few clicks, connect to data from applications you use and get started with pre-built dashboards from experts.

Sign up

Figure 1-3: You can start with Power BI by using either of the two main experiences.

Actually, there is very little difference between the two. In fact, Power BI Desktop and Power BI are two sides of the same coin: Power BI Desktop is a Windows application running on your PC, whereas Power BI is a cloud service that you use through the web browser. In both cases, you will be able to perform the same operations, albeit with some subtle differences. Moreover, the two tools complement each other, and you are likely to use both to build your dashboards.

After reading the descriptions, David correctly concludes that Power BI Desktop is designed for more advanced tasks. Given that he's just beginning to learn about it, he opts for plain, vanilla Power BI.

When David clicks the Sign Up button, the screen shown in Figure 1-4 appears. Power BI is a web service to which you can upload data and build insightful dashboards and charts. As with any web service, you need to sign in, but Power BI does not require much in the way of credentials: to get started, all you need is a valid email address, which David provides.
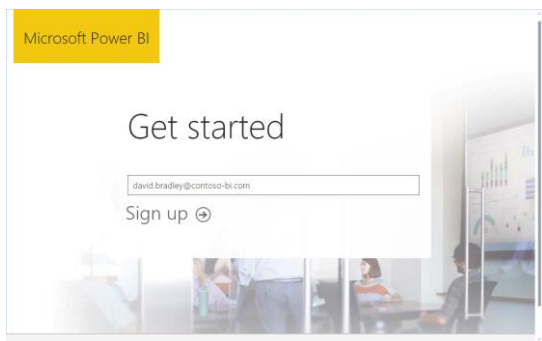

Figure 1-4: You need only a valid email address to gain access to Power BI.

After clicking Sign Up, Power BI informs David that he already has a subscription to Microsoft

Office 365; those credentials are sufficient to gain access to Power BI.

> **Note** If you do not have an Office 365 account, Power BI will send you an email with a link to complete the registration process. (Be aware that you cannot use a personal email service such as Hotmail, Yahoo, or Gmail.) This is to ensure that you actually own the email address. Following the link directs you to the registration page, where you provide some basic details such as first name, last name, and so on. In both cases, no credit card or any other form of payment is required, because most of the features of Power BI are totally free.

On the same No Need To Sign Up page, David could click OK, Got It to sign in without any additional steps. Rather than do that, he goes back to the sign-in page, but instead of clicking Sign Up, he signs in to the portal by using the Sign In button (see Figure 1-2) and then provides his Office 365 credentials. The system takes a few seconds to prepare his account, after which David gets his first glimpse at the Power BI portal, as shown in Figure 1-5.
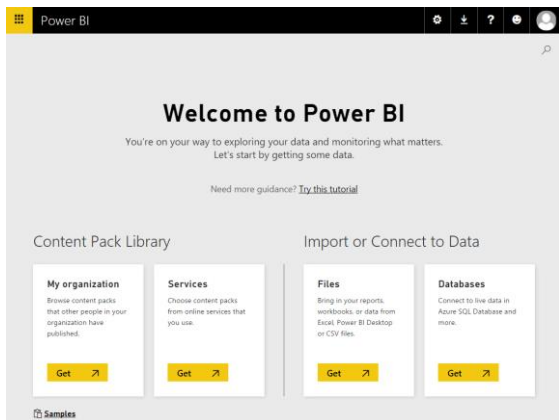
Figure 1-5: The introduction page of the Power BI portal.

Uploading data to Power BI

David has an Excel workbook that he wants to upload to Power BI to see what it has to offer. Because the data is stored in a local file on his laptop, he clicks the Get button on the Files tile (see Figure 1-5). This displays the screen in Figure 1-6, where he can then choose from among several upload options.
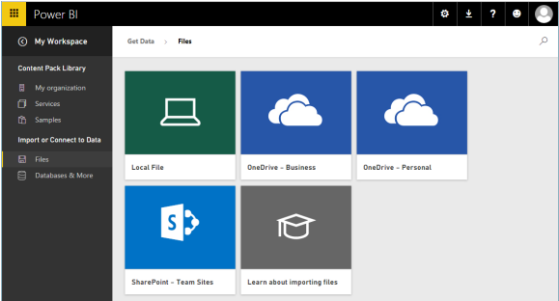
Figure 1-6: Some of the file uploading options in Power BI.

We will explore these options at greater length in the chapters that follow. For now, David chooses Local File, navigates to a file on his laptop named 2015 Sales.xlsx, and then clicks Open to upload the workbook to Power BI. After a few seconds, the Power BI dashboard displays the screen depicted in Figure 1-7.
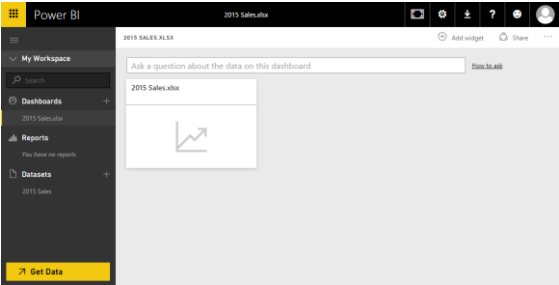

Figure 1-7: This is how the Power BI service looks after you load an Excel workbook.

Before going any further, we want to take a few moments to explain how the Power BI portal is organized. On the left side of the screen, in the pane labeled My Workspace, there are several items. Let's take a look at them:

- **Dashboards**   This lists all of the dashboards you have created. After loading a single workbook, Power BI creates a dashboard for you, using the same name as that of the original workbook.

- **Reports**   Here, you will see the reports based on your data. In Figure 1-7, there is no default report, but we'll follow along as David creates one very soon.

- **Datasets**   This lists all of the data sources that you connected to Power BI. In our narrative thus far, the only workbook David loaded is 2015 Sales.

The Power BI experience is all about gaining insights from data. You begin with a dataset (2015 Sales, in this example), you then build reports on the data, and, finally, you organize visualizations of the reports into dashboards. You will learn how to perform all of these operations in detail in this book. For the moment, we want only for you to become acquainted with the basic operations.

Referring back to Figure 1-7, the central pane is positioned on the 2015 Sales dashboard and, because David has loaded the file but has not yet performed any analysis on the data it contains, the dashboard is essentially empty, showing only the Ask A Question box and the 2015 Sales.xlsx tile, which indicates that the dashboard is indeed connected to his Excel workbook.

Introducing natural-language queries

With Power BI, you have the ability to carry out analysis of your data by asking it questions, in plain English—no special code or syntax is required. This feature is called *natural-language queries*, and with it, you can ask Power BI to perform tasks in much the same way you would ask one of your colleagues. Let's take a look at an example of how David uses natural-language queries in Power BI.

In the central pane, in the question box, David types a simple query: "Show sales 2015 by brand." Power BI understands the query and presents a bar chart (see Figure 1-8) in which the brands are displayed alphabetically and the length of the bars is proportional to the corresponding sales for each brand in 2015.
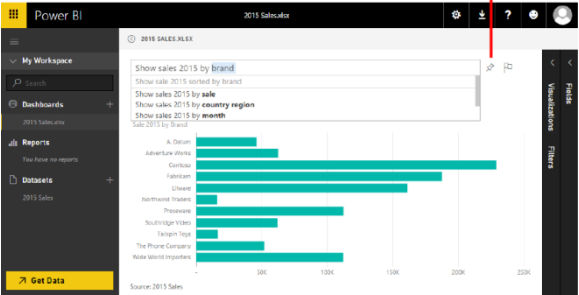
Click to pin to the dashboard

Figure 1-8: Power BI understands queries in natural language and displays the data you request.

Not only did Power BI understand David's query, but, after performing an analysis of his dataset, it also suggests other meaningful queries in a list that appeared when he began to type the query. For David's data, that analysis revealed that he might also be interested in viewing sales in 2015 by country/region or by month, so Power BI suggests those as alternate queries.

Also in Figure 1-8, notice the highlighted pushpin icon to the right of the question box. You can click this to "pin" the currently displayed visualization to the dashboard; this way, you can easily see it when you connect to Power BI. When you click the pushpin button, Power BI opens the Pin To Dashboard dialog box shown in Figure 1-9.
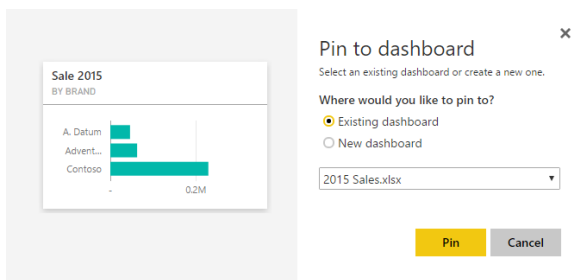

Figure 1-9: Using the Pin To Dashboard dialog box, you can choose to pin a visualization to an existing or a new dashboard.

To save the newly created bar chart to the dashboard, click Pin. Figure 1-10 shows how Power BI presents the dashboard with the pinned bar chart. (You need to go back to the dashboard to see it.)
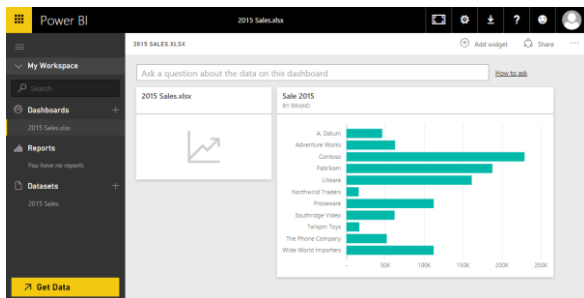
Figure 1-10: The dashboard is a container for visualizations created on top of datasets.

Using natural-language queries is quite impressive, but it is only one of the many ways in which Power BI can analyze your data.

Introducing Quick Insights

Another feature that is worth learning as soon as you begin using Power BI is *Quick Insights*. With this feature, Power BI can search a dataset for interesting patterns and provide you with a list of charts that help you to better understand your data.

To activate Quick Insights, click the ellipsis to the right of the dataset (see Figure 1-11) on which you want to perform the analysis: in David's case,

that's "2015 Sales". This opens the dataset menu; here you choose Quick Insights. When David clicks Quick Insights, the button changes to View Insights.
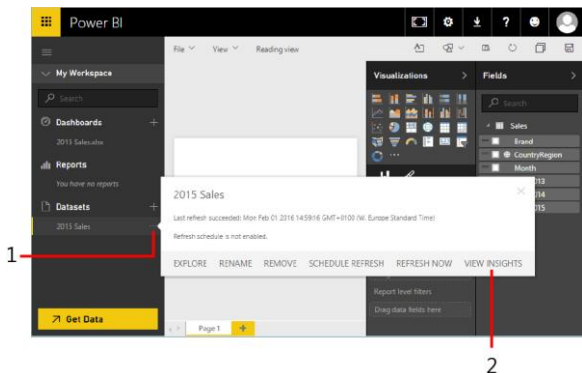

Figure 1-11: You can activate Quick Insights from the dataset menu by clicking Quick Insights.

The first time you run Quick Insights on a dataset, Power BI schedules an analysis of that dataset. This might last for some seconds or minutes, depending on the size of the data. When the search for insights is complete, Power BI notifies you. Of course, whenever you update your dataset, this search operation will need to be repeated. However, as long as the dataset remains unchanged, the insights will be immediately available.

But, what are these insights?

The basic idea is that Power BI can use artificial intelligence to analyze your data, searching for some useful or interesting patterns. It uses very sophisticated algorithms whose speed depends on the size and complexity of the dataset. Obviously, on a small dataset such as the one David uploaded, finding insights takes no more than a few seconds. As soon as the search is complete, you can access it. On the Insights Are Ready dialog box, David clicks View Insights. Figure 1-12 presents the first two insights that Power BI found on David's file. Many others are within the list, so many, in fact, that they would not fit on the page in this book. David scrolls down to view them all.
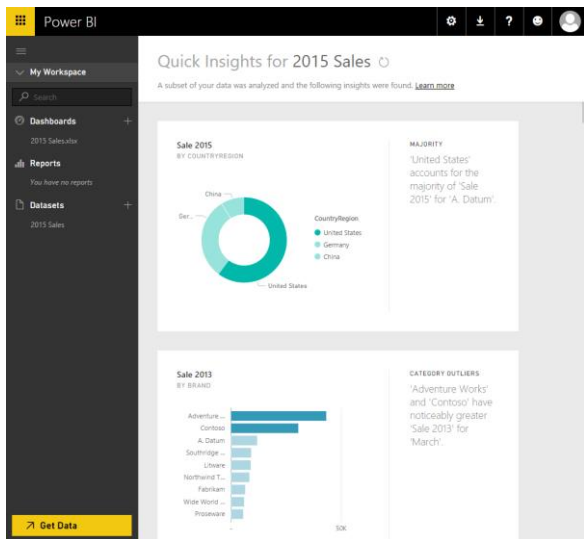
Figure 1-12: Quick Insights are a powerful analytical tool to glean information from your data.

The first insight shows that the United States accounts for most of the sales of the A. Datum brand, compared with China and Germany. The second insight reveals a substantial seasonal-effect increase in sales for the month of March for Adventure Works and Contoso. If you run Quick Insights on the data, you will likely get different insights, which Power BI chooses to display at the top.

Of course, insights are gathered by Power BI without it having any knowledge of your business or the economic scenario as a whole, so there might be many different reasons that explain the data and findings. Power BI cannot replace your brain when it comes to interpreting the numbers, but it can prove extremely useful because it can easily find some points of interests in your data by using the brute force of algorithms.

The best way you can use Quick Insights is to browse through them, looking for the confirmation of what you already know about your data and, at the same time, for fresh ideas. It might be the case that some of the insights are not really meaningful, but, with the sheer number of insights that Power BI finds for you, it's likely that there are some real hidden gems that might improve your knowledge of your numbers.

More info You can find a more complete description of the algorithms used by Power BI and the types of insights that it can reveal by going to https://powerbi.microsoft.com/en-US/documentation/powerbi-service-auto-insights-types/. Of course, with newer versions of the analytics engine, the numbers and the quality of insights might change and improve.

You can click any insight to enlarge it. If you hover over one, the same pushpin button as that of the natural-language query appears so that you can pin the insight to the dashboard if you want. David clicks the Category Outliers Insight from Figure 1-12 to enlarge it, clicks the Pin icon, and then in the Pin To Dashboard dialog box, he leaves Existing Dashboard selected and clicks Pin to pin it to his dashboard.

Pinning one of the insights to the dashboard makes it more interesting. Moreover, by doing that, you will learn that you can move and resize visualizations pinned to a dashboard by using a convenient grid, making them more aesthetically appealing. David returns to look at his expanded 2015 Sales.xlsx dashboard, and he moves the new Sale 2013 By Brand visualization below the others. Figure 1-13 demonstrates David's dashboard, which now contains two visualizations.
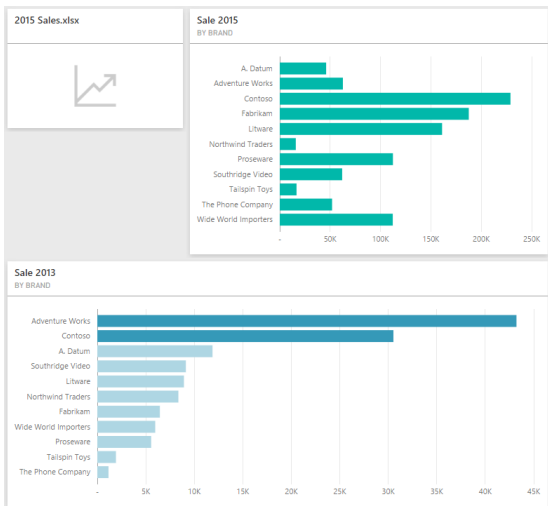
Figure 1-13: A dashboard can contain multiple visualizations organized in a grid, individually moved and resized.

Introduction to reports

So far, David has used only automated report building, using a natural-language query as well as the Quick Insights feature. As you might imagine, he only scratched the surface of Power BI's reporting capabilities. In fact, he can build reports manually, unleashing the full potential of Power BI visualizations.

To create a new report, in the Datasets section of the navigation pane, click a dataset. David clicks 2015 Sales. Power BI opens an empty report based on that dataset, as illustrated in Figure 1-14.
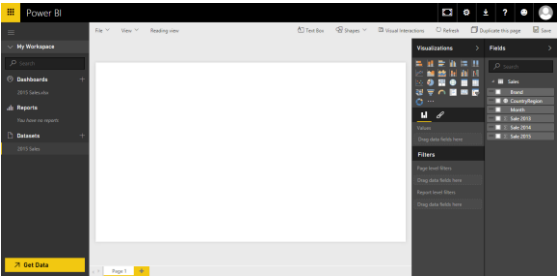

Figure 1-14: Clicking a dataset creates an empty report based on that dataset.

The user interface of a report is very powerful because it combines many different features in a single window. On the far left is the standard Power BI navigation pane. The central pane is the canvas on which you can build a report by adding visualizations. Here, you can also configure the properties of each visualization. On the right are two panes: Visualizations and Fields. The Visualizations pane offers the entire set of available visualizations at the top; the bottom section presents filtering options. The Fields pane contains the list of all the fields of your dataset. In David's case, you can see how the

Fields pane lists the columns of the Excel table he uploaded to Power BI.

Figure 1-15 shows an enlarged view of the Fields pane. If you focus your attention on the individual columns there, you can see that some of them have a small icon beside their names. This icon identifies the main usage of the field. For example, the fields Sale 2013, Sale 2014, and Sale 2015 each have a summarization icon (a Greek sigma), indicating that the total for each column will be displayed if used in a report. The CountryRegion field shows a small globe, indicating that this field contains geographical data, and it will be used to draw data on maps.
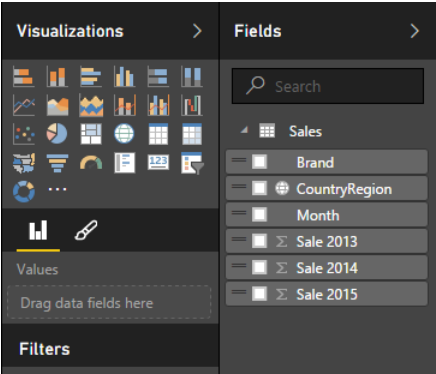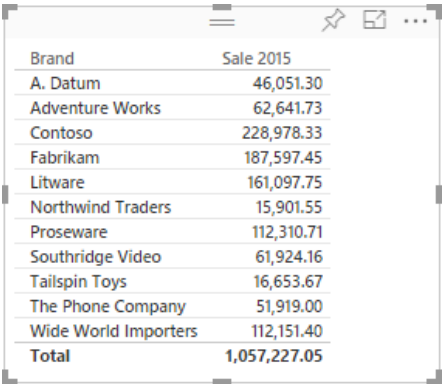

Figure 1-15: Many columns in the Fields list display a small icon. The icon indicates the default aggregation it uses.

To create a report, select the fields that you want to appear in the report. For example, referring back to Figure 1-14, in the Fields pane, David clicks Brand and then Sale 2015. Because Brand has no summarization icon, it is used to slice data, whereas Sale 2015, which displays a sigma, will present the sum for that column, generating the report shown in Figure 1-16.

Brand	Sale 2015
A. Datum	46,051.30
Adventure Works	62,641.73
Contoso	228,978.33
Fabrikam	187,597.45
Litware	161,097.75
Northwind Traders	15,901.55
Proseware	112,310.71
Southridge Video	61,924.16
Tailspin Toys	16,653.67
The Phone Company	51,919.00
Wide World Importers	112,151.40
Total	**1,057,227.05**

Figure 1-16: A first visualization based on Brand and Sale 2015.

What David just created is the default visualization; that is, it's a grid with the brands and the sum of Sale 2015 on the rows, showing raw numbers. Numbers are very interesting, but they do not give a clear idea of the relationship among them. In fact, at first glance it's not evident which brand is the most important one,

which ones are the smallest, and what the relative importance of the numbers is. Charts, on the other hand, can give viewers a much quicker understanding of the data.

You can modify the visualization of a tile by choosing one of the many available types of charts in the Visualizations pane. For example, you can use a column chart by first selecting the visualization and then clicking the column chart icon, which is among the many highlighted in Figure 1-17.

The chart
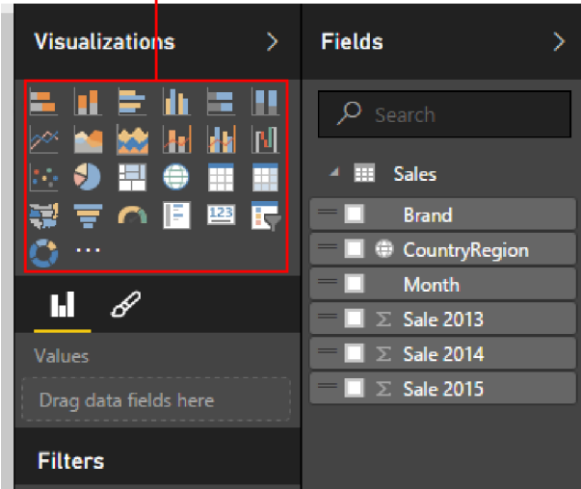types available
in Power BI

Figure 1-17: The Visualizations pane offers many different visualizations to use in your reports.

Note If you click a visualization type but do not have a specific tile selected, Power BI inserts a new, empty visualization. If this happens to you, do not worry: just select the empty chart and delete it by pressing the Delete key. Then, select the tile that you want to change and try again.

As Figure 1-18 so clearly demonstrates, the same numbers—Sale 2015 by Brand—shown in a column chart are much easier to understand.
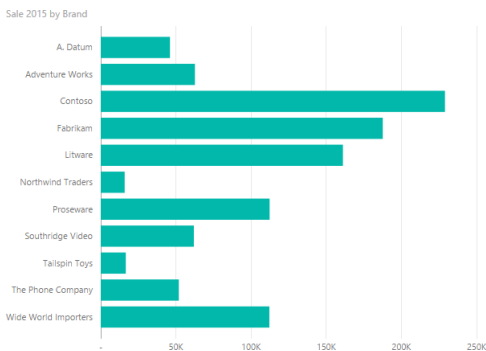

Figure 1-18: With the correct visualization, numbers are much more meaningful.

Note Before proceeding further, feel free to experiment by using different visualizations for

the same data. As you will discover, each visualization offers a different insight from the same numbers. With Power BI you can use different visualizations to find the best way to tell a story about your data, using the same numbers.

So far, you've learned how to create an individual chart. But one chart alone is not yet a full report. If you click an empty area of the central canvas and repeat the aforementioned procedure, but, adding the CountryRegion and Sale 2015 fields, you will generate a new tile, this time displaying a map with sales in the three countries/regions contained in the demonstration dataset, as shown in Figure 1-19.
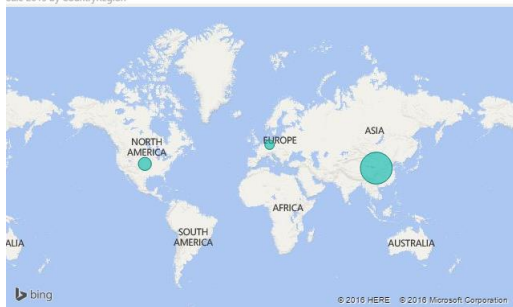

Figure 1-19: A map of the world showing sales in different countries/regions, highlighted as bubbles.

Now, maps are powerful charting tools, but, as Figure 1-19 demonstrates, by having only three values they look dispersive. There are too many details in the map, whereas the goal is to show only the relative size of three areas. In this case, a column chart does this job well. You can transform the map into a column chart and then move the two visualizations so that they look like those shown in Figure 1-20.
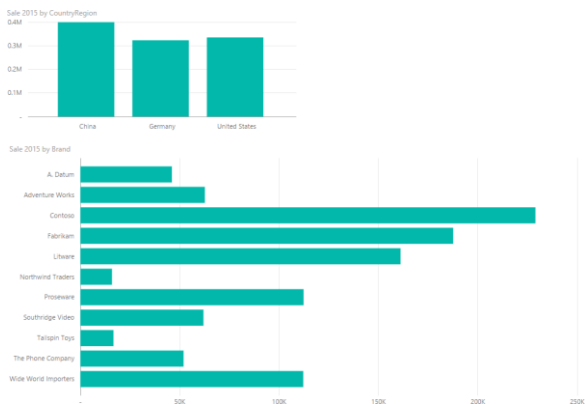

Figure 1-20: A report can contain multiple visualizations.

As you have seen, a report is a collection of visualizations organized in such a way as to communicate insights about the data. In Figure 1-20, a reader has an immediate feeling that sales in China, Germany, and the United States