

Sum Product

NEWSLETTER #85 - December 2019

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Big month for SumProduct

as we turn 10, but it's business as usual, even as the year draws to a close. It's no change for the newsletter either – as another massive newsletter comes to you (who would have thought you could have so much in a monthly newsletter on Excel and financial modelling!?).

This month, we turn our attention to Microsoft's recent *Ignite* conference and reveal what the future holds for Excel given the announcements that were made. Some big news follows!

We have all of the regulars too: VBA Basics, Power Pivot Principles, 20 gazillion Power BI updates (including a new-look Ribbon), we take our look at the A-Z of *Excel Functions* to the **DMAX**, and even have time to mention training and keyboard shortcuts to you.

Season's greetings to you all – time to enjoy the end of year celebrations.

See you next year.

Liam Bastick, Managing Director, SumProduct



Now We Are 10!

Neither the website nor the company went "live" until January 2010, but SumProduct sprang to life in December 2009 as founder **Liam Bastick** started putting the material together before Christmas for what has turned out to be an exciting 10 years. This seems like a good time to lay a stake in the ground for our "birthday".



They say if a company survives five years it will keep going until the owners decide to sell it or shut it. Well, it's lasted 10 years now and continues to thrive! The first Thought article didn't appear until April 2010, but look how far we have come since...





We are going to celebrate at the end of this month – and toast to another 10 years as we continue to grow. Thanks for being there with us.

There are no plans for a sale or a shutdown here: we are going to continue offering our clients all things analytical, with offerings in modelling,

strategy, planning and training. There’s been two books released so far, with at least two more in the pipeline – but more about that *next year*.

Keep reading. Keep interacting. We’re going to keep going.

This Excel is on Fire

Well, it’s *Ignite-d* anyway! One of Microsoft’s flagship events, *Ignite*, occurred last month in Florida. Targeting over 25,000 individuals focused on software development, security, architecture and information technology, the event showcases new hands-on experiences that help users innovate in areas such as security, cloud, hybrid infrastructure and development.

But it’s not all Sheldon Cooper and relativistic quantum mechanics. There was plenty on offer to interest the “mere” accountants in the room too. You’d think with the big data, visualisation and collaboration revolutions reinventing themselves on almost a daily basis, there would be no place

for technology that’s been around for over 30 years.

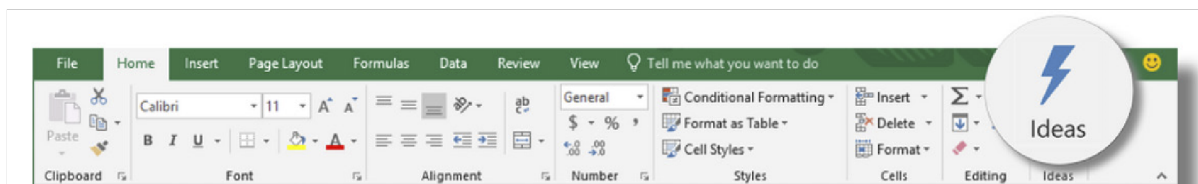
But you’d be wrong.

Excel is still the irritating little upstart that refuses to go away. I often joke that Excel is the second-best software in the world. What for? The thing you can’t afford otherwise. It seems as true now as ever it did, and *Ignite* ensured it would remain as important a piece as ever in what is the Microsoft jigsaw.

It was central to several key announcements. Allow me to take you through them.

Natural Language Ideas Provides Insights

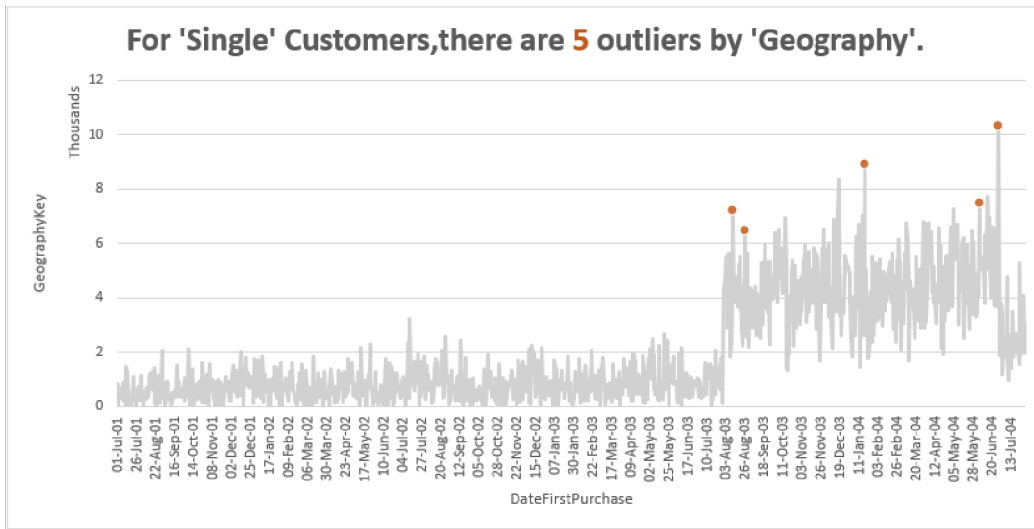
Ideas was previously announced at last year’s *Ignite* conference. According to fellow Excel Most Valuable Professional (MVP) Bill Jelen, *Ideas* was the “... first icon added to the ‘Home’ tab in 11 years, 8 months, 23 days. It must really be something special”.



Essentially, this feature was Excel’s answer Power BI’s highly popular ‘Quick Insights’. Often, understanding data can be quite a challenge, especially if the volume of data is large or if it’s an unfamiliar dataset. With *Ideas* (previously known as *Insights*), Excel automatically points

out interesting patterns in user data, like trends and outliers. *Ideas* in Excel shows high-level summaries, statistically significant findings and recommended visualisations. It also helps you leverage Excel PivotTables and PivotCharts.

Previous updates have included easier to understand chart previews, new types of analysis (e.g. scatter and outlier charts), and updated machine learning models to make more powerful suggestions. That’s right: all that insight from *just pressing a button*:



It's really easy to use. For best results, have just one data table on an Excel worksheet (preferably using an Excel Table, CTRL + T), click anywhere on the worksheet and then simply press the Ideas button on the Home tab:

CustomerKey	GeographyKey	Title	FirstName	MiddleName	LastName	BirthDate	MaritalStatus	Suffix	Gender	YearlyIncome	TotalChildren
11000	26		Jon	V	Yang	08-Apr-66	M		M	\$90,000.00	
11001	37		Eugene	L	Huang	14-May-65	S		M	\$60,000.00	
11002	31		Ruben		Torres	12-Aug-65	M		M	\$60,000.00	
11003	11		Christy		Zhu	15-Feb-68	S		F	\$70,000.00	
11004	19		Elizabeth		Johnson	08-Aug-68	S		F	\$80,000.00	
11005	22		Julio		Ruiz	05-Aug-65	S		M	\$70,000.00	
11006	8		Janet	G	Alvarez	06-Dec-65	S		F	\$70,000.00	
11007	40		Marco		Mehta	09-May-64	M		M	\$60,000.00	
11008	32		Rob		Verhoff	07-Jul-64	S		F	\$60,000.00	
11009	25		Shannon	C	Carlson	01-Apr-64	S		M	\$70,000.00	
11010	22		Jacquelyn	C	Suarez	06-Feb-64	S		F	\$70,000.00	
11011	22		Curtis		Lu	04-Nov-63	M		M	\$60,000.00	
11012	611		Lauren	M	Walker	18-Jan-68	M		F	\$100,000.00	
11013	543		Ian	M	Jenkins	06-Aug-68	M		M	\$100,000.00	
11014	634		Sydney		Bennett	09-May-68	S		F	\$100,000.00	
11015	301		Chloe		Young	27-Feb-79	S		F	\$30,000.00	
11016	329		Wyatt	L	Hill	28-Apr-79	M		M	\$30,000.00	
11017	39		Shannon		Wang	26-Jun-44	S		F	\$20,000.00	
11018	32		Clarence	D	Rai	09-Oct-44	S		M	\$30,000.00	
11019	32		Luke	L	Lal	07-Mar-78	S		M	\$40,000.00	

With an internet connection, the Ideas pane will appear shortly thereafter with some thoughts about your data, which you can choose to review, accept, investigate or ignore. Ideas are displayed graphically in the pane, ready for you to reproduce in Excel simply by clicking on them:

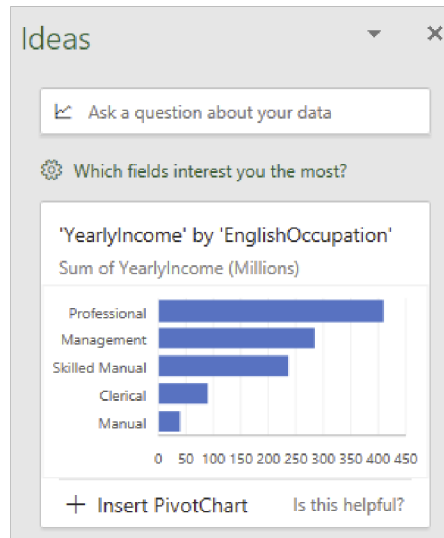
It will highlight the most salient points and guide you towards other findings (note the comment, 'Show all 35 results', at the bottom of the Ideas pane above). You can even guide Ideas regarding which fields are of most interest. It learns.

This is old hat though, quite frankly. It's now gone a step further.

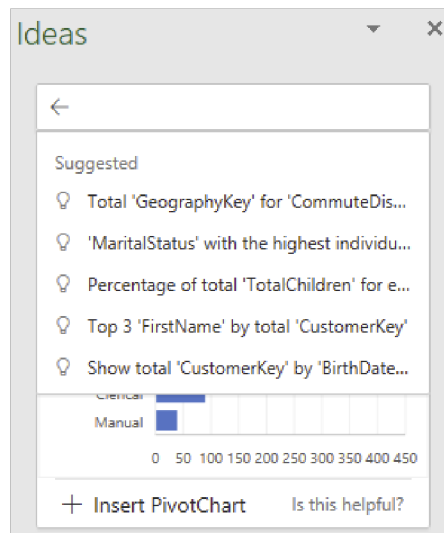
Rolling out to Office Insiders from early November (it is being made available to customers on a gradual basis, starting with Office 365 subscribers on the Monthly Channel in English), **natural language query** is a feature in Ideas in Excel that allows users to ask a question of their data to glean insights without having to write complicated formulae. Using the Artificial Intelligence algorithms that powers Ideas in Excel,

natural language query will quickly answer users' data questions with formulae, PivotTables or PivotCharts. The feature will be available on Windows, Mac and Excel for the web in English language only at this time, with plans to expand to other languages soon.

All you have to do is ask a question in English ("a natural language query"):



Just clicking inside the question box provides suggestions:



Whether you ask your own question or plump for one of the suggestions, Ideas will provide answers supported by formulae, PivotTables or PivotCharts that may be inserted into the workbook.

This type of functionality has gone down a storm in Power BI. There's no reason why this powerful feature won't cause a similar stir for Excel users in the near future too.

XLOOKUP (and XMATCH) Progress Report

As several readers pointed out, we "lied" to you in a previous newsletter item. Late October saw the previously announced **XLOOKUP** function modified, with the addition of **if_not_found**, but Microsoft changed its mind about its positioning. It's moved from being the sixth (final) argument to the fourth argument:

XLOOKUP(lookup_value, lookup_vector, results_array, [if_not_found], [match_mode], [search_mode])

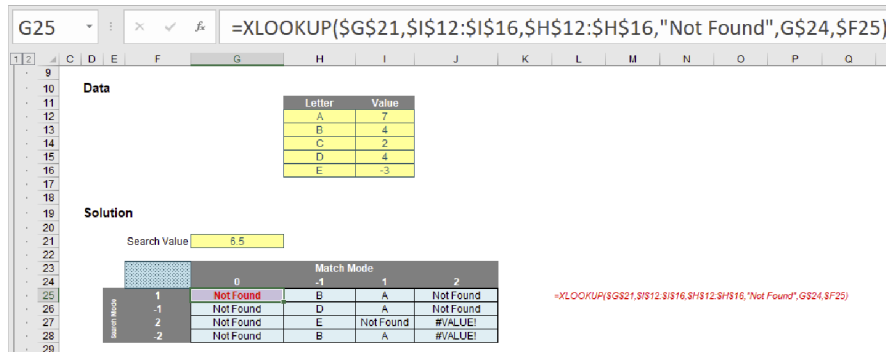
This was highlighted at Ignite as it's the first time syntax order has been changed. This clearly shows Microsoft is listening to its users and is prepared to adapt. That can only be good news for us all. Presumably, the thinking was this argument will be important to many users and hence has been prioritised accordingly.

We eagerly look forward to it moving into first place next month and winning the race.

Having this error case as an argument is consistent with other existing functions such as **IFERROR** and **IFNA**, as well as the dynamic array function **FILTER**. It seems like a good idea as having this argument present as it can tell you when something in your spreadsheet is not working as you might think.

It was further emphasised that this additional argument *won't* be coming to **XMATCH**, a turbo-charged version of **MATCH**.

I have mentioned these two functions several times recently, so I am conscious I don't wish to over-emphasise these two new functions, but the revisions to **XLOOKUP** are beneficial. Consider the following example:



Notice that I am searching the 'Value' column, which is neither sorted nor contains unique items. Do you see how the results have changed once more, depending upon **match_mode** and **search_mode**?

		Match Mode			
		0	-1	1	2
Search Mode	1	Not Found	B	A	Not Found
	-1	Not Found	D	A	Not Found
	2	Not Found	E	Not Found	#VALUE!
	-2	Not Found	B	A	#VALUE!

The **match_mode** zero (0) returns "Not Found" now instead of #N/A because there is no exact match and the formula has now stipulated what to do in such an instance.

When **match_mode** is -1, **XLOOKUP** seeks an exact match or else the largest value less than or equal to **lookup_value** (6.5). That would be 4 – but this occurs more than once (B and D both have a value of 4). **XLOOKUP** chooses depending upon whether it is searching top down (**search_mode** 1, where B will be identified first) or bottom up (**search_mode** -1, where D will be identified first). Note that with binary searches (with a **search_mode** of 2 or -2), the data needs to be sorted. It isn't – hence we have garbage answers that cannot be relied upon.

With **match_mode** 1, the result is clearer cut. Only one value is the smallest value greater than or equal to 6.5. That is 7, and is related to A. Again, binary search results should be ignored, although it is worth noting "Not Found" occurs when Excel identifies the lookup value has not been found.

The **match_mode** 2 results are spurious. This is seeking wildcard matches, but there are no matches, hence "Not Found" instead of N/A for the only **search_modes** that may be seen as credible (1 and -1). It's interesting to note a binary search causes errors which are not trapped by the new argument.

Clearly binary searches are higher maintenance. In the past, it was worth investing in them as they did return results more quickly. However, according to Microsoft, this is no longer the case: apparently, there is "... no significant benefit to using (sic) the binary search options...". If this is indeed the case, then I would strongly recommend not using them going forward with **XLOOKUP**.

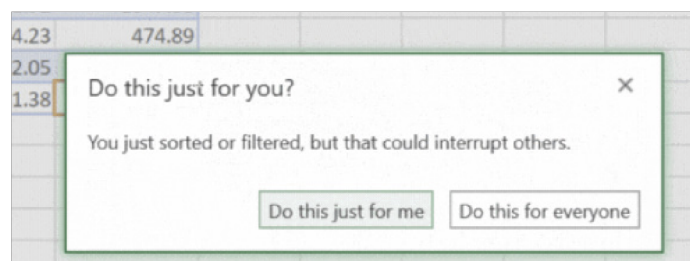
It was announced that **XLOOKUP** and **XMATCH** will become Generally Available "in the coming months". What that means exactly is yet to be determined.

Non-Disrupting Collaboration

Accessibility and collaboration are two of Microsoft's current priorities. Allowing all users to be able to use Excel is a good thing, but for me, the jury remains out on the importance of more than one user working on an Excel file at the same time. Most of the time this causes problems for accountants, with version control and data ownership being just two key issues.

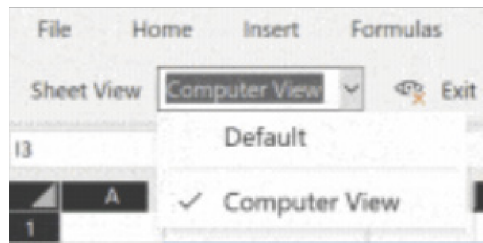
This hasn't deterred Microsoft. Their telemetry does suggest they are right, and my misgivings are misguided. One concern they have

identified is when users open a shared workbook and become concerned when they see data is apparently missing or has been reordered, only to realise another user has made such a change in real time. That may happen regularly for good reasons. Wouldn't it be good if you could choose to make changes to a worksheet without disrupting others, *i.e.* decide whether a change should be viewed just by you or by everyone?



Ignite has announced 'Sheet View' on Excel for the web, making this a problem of the past. 'Sheet View' allows users to sort and filter data, and then select whether to share these changes with others. Once the decision has been made, you can also save the results to view again as a separate view, if desired. All this can be done without disrupting others' view of the data on a shared file.

It goes further though. Views may also be saved so that they may be accessed by other users in the document when collaborating in real time, avoiding disruptions in workflows across teams. All they need to do is click on the View tab and find the 'Sheet View' they need in the drop-down list on the Ribbon:

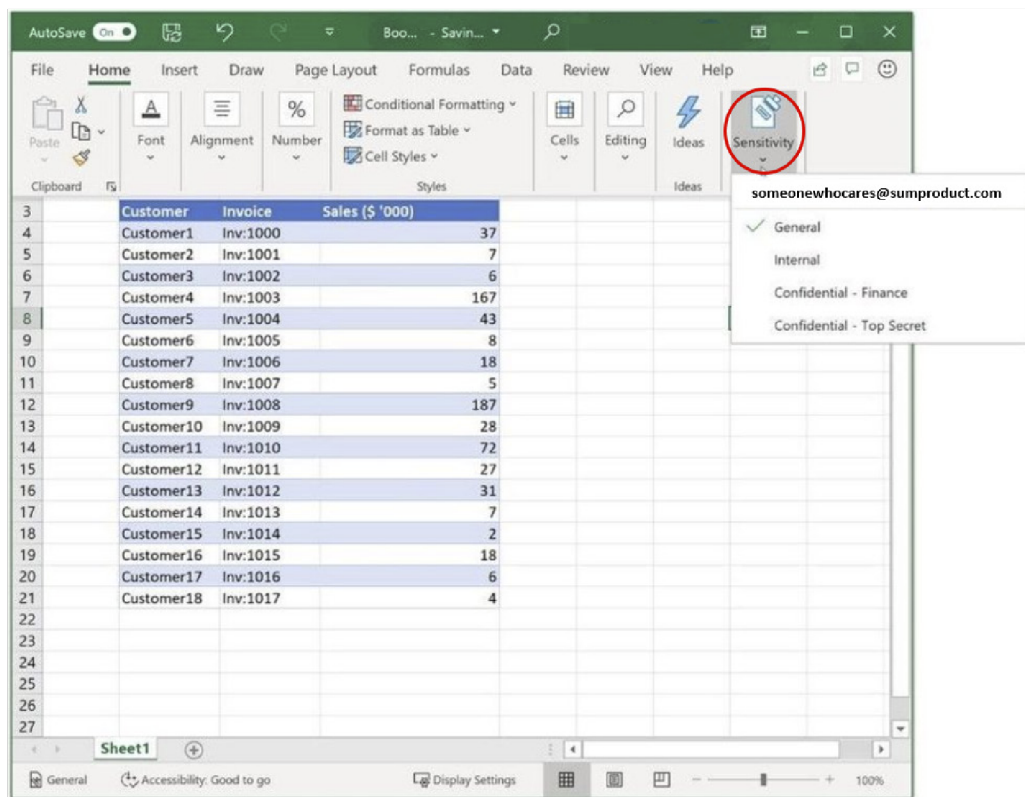


Sheet View will be available by the end of December on Excel for the web.

Document Classification and Access Protection

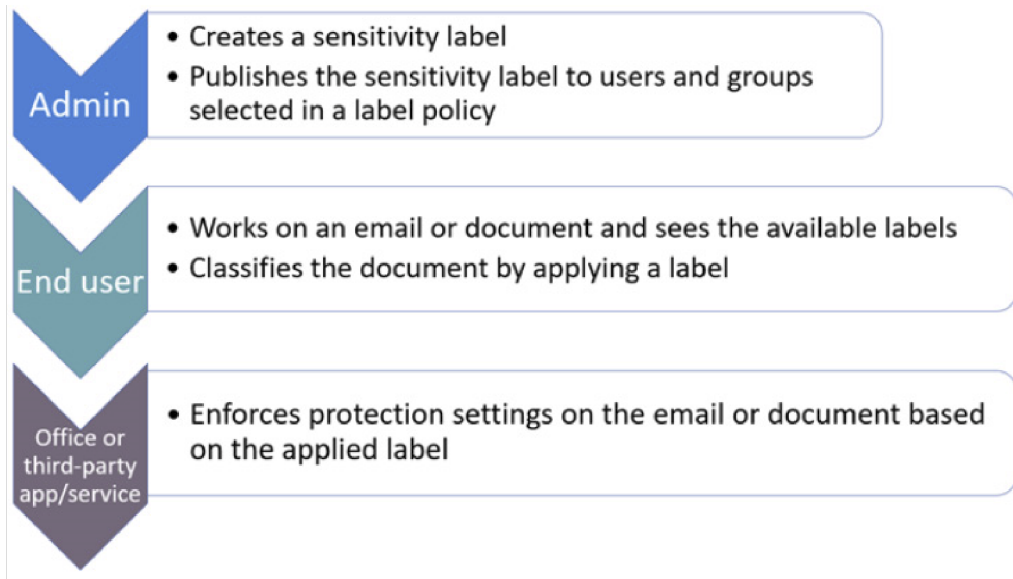
Microsoft has undertaken a lot of work in the recent past around collaboration (as I have just mentioned!). Sharing files and co-authoring has indeed become easier, but this has led to security considerations. Staff in an organisation need to collaborate both internally and externally. This means that content no longer stays behind a firewall – it roams everywhere, across devices, apps, and services. When it roams, companies need to ensure it is managed in a secure, protected way that meets both business and compliance policies.

Understanding both your data and its inherent level of sensitivity, together with incorporating appropriate protection, will help preserve your organisation's most sensitive information. Already in production on Mac and Excel Mobile, Ignite has announced that manual sensitivity labelling is now to roll out on Excel on Windows and the web for Office 365 subscribers.



A shared workbook can be accessed if a user has access rights provided by any encryption associated with the sensitivity label (labels can be configured to have encryption). For example, if a workbook is labelled

Internal, it restricts read / write access to employees of a company, which means employees will be able to open, view and modify content in the document while access is restricted to external users.



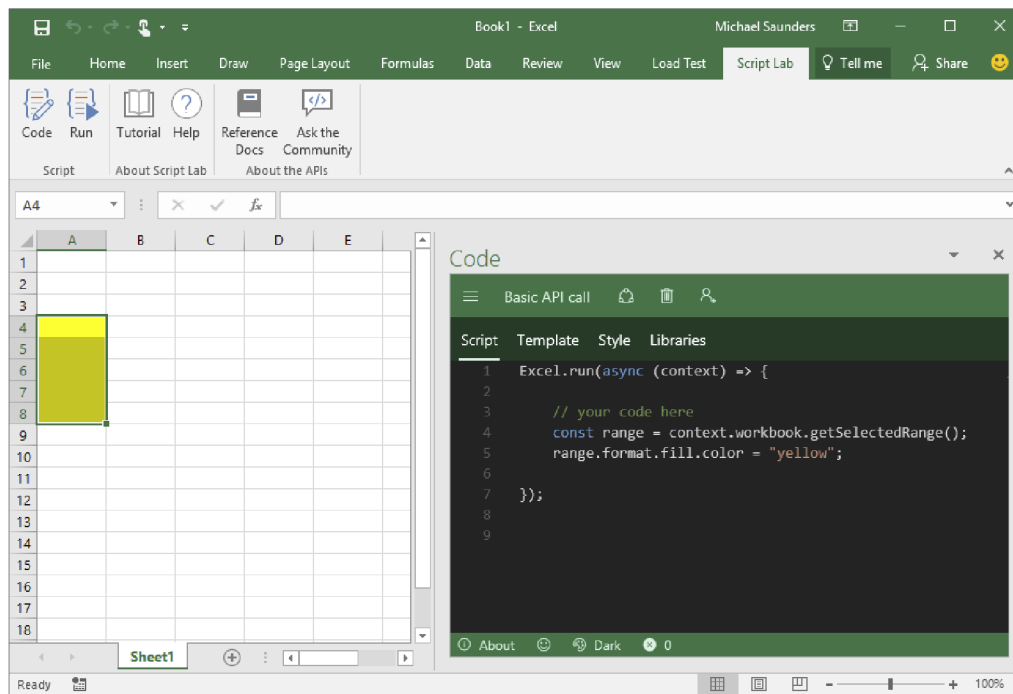
Even though the process is manual, recommended labels may be suggested automatically. Excel will notify you of potential sensitive content in the workbook and recommend a label per your administrator's security settings. Labels will be visible in the Status Bar, and adjustable

through the **Home -> Sensitivity** button (*shown above*).

This automatic sensitivity labelling will also be rolling out to Insider Fast for Excel on Windows and in Preview for Office on the web.

The Write Move for Office Scripts?

Two and a half years ago, Microsoft released Script Lab, a little-known add-in for Excel (and other applications) described at the time as a "Microsoft Garage" project (isn't that a type of '80's music?).



Script Lab was a tool for anyone who wanted to learn about writing add-ins for Excel, Word or PowerPoint. Microsoft were – and still are – keen to push the JavaScript application program interface (API), as they see it as the technology needed for building Office add-ins that run across platforms.

Script Lab had three main features:

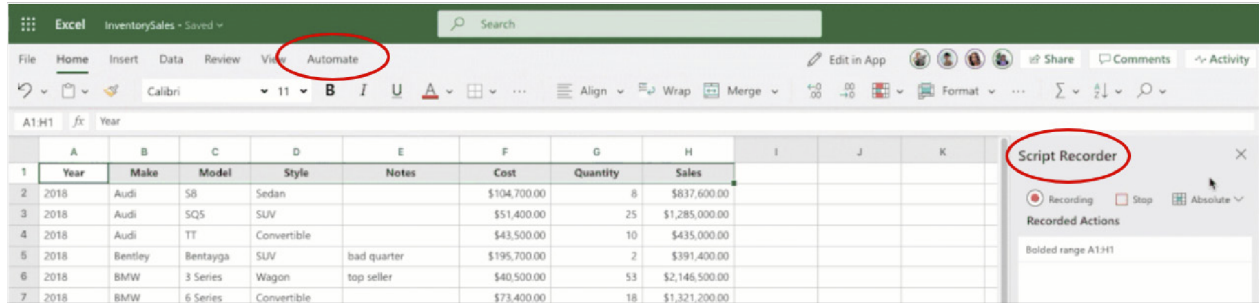
1. Code in a pane beside your spreadsheet
2. Run the code in another pane beside the editor
3. Share your snippets elsewhere.

The problem was, it was really aimed at expert users and quite frankly, didn't really take off.

Well, if at first you don't succeed, try, try again. Maybe not a great motto for parachute enthusiasts, but nevertheless one Microsoft has embraced. This month's *Ignite* has seen "Take 2" announced. Office Scripts has just

been announced as a new feature that enables users, whether novice or expert, to record scripts and automate their tasks.

It's similar in some ways to the old VBA macro recorder. Users begin by clicking the Record button in the new Automate tab, recording the actions desired, stopping the recorder, and then saving / editing the script.



These scripts will be saved to OneDrive for Business for greater accessibility and collaboration. They may then be run manually, automatically (using Flow, say), or conditionally based upon a trigger.

For the more experienced, Office Scripts also allows you to take these

recorded scripts and extend them using the same Excel JavaScript APIs that are available in Office Add-ins.

The feature will be available in Preview on Excel on the web by the end of 2019 (I have no information about availability on Office 365 Insiders).

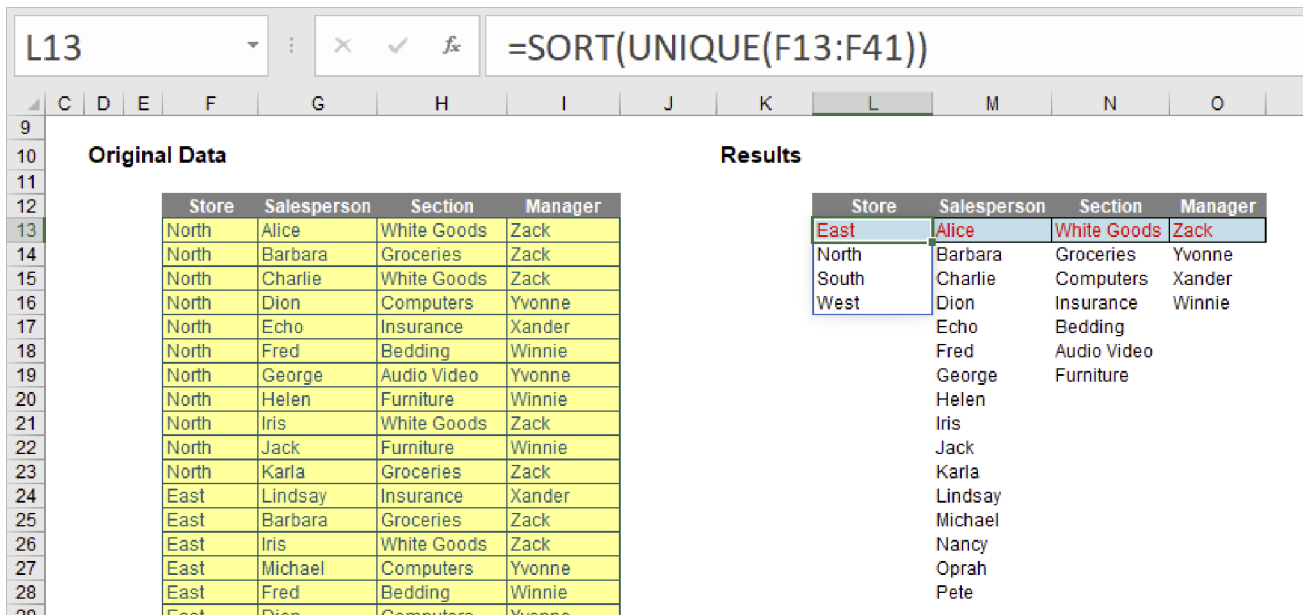
Dynamic Arrays Becoming Generally Available

Never mind any of the above. If the responses to my LinkedIn account are anything to go by, half the world has been waiting for this. The long-awaited roll-out of dynamic arrays starts now. Microsoft has announced at *Ignite* they will slowly become Generally Available starting in early November with Excel for the web.

You are going to need Office 365 at some point (it's not coming to either Excel 2016 or Excel 2019), but Microsoft has stated that they "...will be

rolling out to subsets of our users to continue to gather feedback and monitor quality...".

I have written about these at length, but in case you have just returned from Uranus, imagine a world of sorting data, identifying list items and filtering out what you don't want formulaically with formulae that take three or four seconds to write...



Ah, bliss...

“Bulgaria and Slovenia Excel Conferences Completed!

It's been two conferences in two weeks for SumProduct's very own **Liam Bastick** and several other Excel MVPs as they quickly followed up Sofia's *Bulgaria Excel Days 2019*...



...with Ljubljana's *Excel Olympics Conference & Masterclasses*:



Seems like Excel MVP Gašper Kamenšek had time for a haircut between the two events...

With over 300 attendees between the two events, the Excel Summits can be viewed as a great success. Of course, there will be more similar events next year. Liam's not done yet though: he still has events in London, Melbourne and Brisbane to complete before Christmas, lucky boy!!

Stay tuned to these newsletters to be one of the first to find out and take advantage of any and all discounts going!

A useful tip to consider when working in VBA is to ensure that your code doesn't rely on specific cell references such as **B10** or **C4**, at least, if you don't want your macros to do things unintentionally.

Let's look at a typical block of recorded code:

```
Sub Macro1 ()  
'  
' Macro1 Macro  
'  
'  
  
    Range("C3").Select  
    Selection.Copy  
    Range("D4").Select  
    ActiveSheet.Paste  
    Range("C4").Select  
    Application.CutCopyMode = False  
    Selection.Copy  
    Range("E6").Select  
    ActiveSheet.Paste  
  
End Sub
```

Now, this code works well if no changes are made to the structure of the spreadsheet. However, if rows or columns are inserted, this will cause errors, since the macro will point to cell **C3** in the first line, irrespective of where the original cell was. To avoid this, instead of using cell references, we can define cells with Range Names.

By defining code using range names, you ensure that the code will only impact exactly the cells you want it to, unless the range name is deleted. This gives you much code that will keep working even if columns and rows are added or deleted, as long as the relevant range names still exist.

```
Sub Macro1()  
'  
' Macro1 Macro  
'  
'  
  
    Range("Start").Select  
    Selection.Copy  
    Range("End").Select  
    ActiveSheet.Paste  
    Range("Old").Select  
    Application.CutCopyMode = False  
    Selection.Copy  
    Range("New").Select  
    ActiveSheet.Paste  
  
End Sub
```

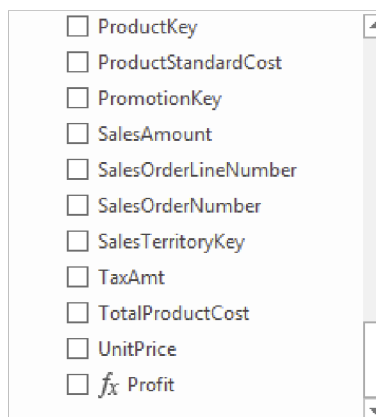
Hopefully, this makes sense! Next time we will start cleaning up the code and making it appear more professional.

More next month.

Power Pivot Principles

We continue our series on the Excel COM add-in, Power Pivot. This month, we look at being able to tell the difference between fields and measures.

Below you will find a screenshot of the fields list from a PivotTable in Excel. Can you tell which items are measures and which items are fields?



Measures are displayed with the “fx” symbol, so in the list above the ‘Profit’ item is a measure and the rest of the items are simply fields. If the list is unsorted, these measures will appear at the bottom of the list.

This screenshot above is from Excel 2016. In earlier versions, the measure is often denoted with an ‘M’ instead, which is actually a little confusing for Excel 2013 users as Power Pivot uses the erroneous nomenclature of

“calculated field” to describe a measure in this version of the software. (A calculated field is a field in a table which contains a formula; a measure is a calculation which is applied to the filtered aggregation of one or more fields and / or calculations).

More *Power Pivot Principles* next month.

Power Query Pointers

Each month we'll reproduce one of our articles on Power Query (Excel 2010 and 2013) / Get & Transform (Office 365, Excel 2016 and 2019) from www.sumproduct.com/blog. If you wish to read more in the meantime, simply check out our Blog section each Wednesday. This month, we take a look at combining columns when some values are null.

Previously, we have shown how easy it is to pivot columns. For example, if we pivot the **expense code** column to show the amounts for each **expense code**, we might have a table with lots of null values in it, as

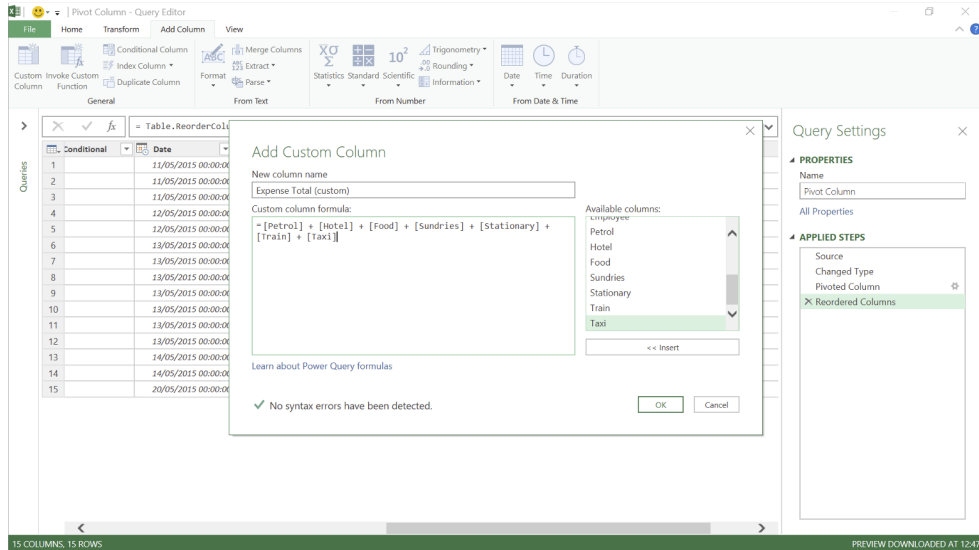
shown below. Let's use this table to show how we may sum columns where some values are null.

	Date	Employee	1.2 Petrol	1.2 Hotel	1.2 Food	1.2 Sundries	1.2 Stationary	1.2 Train
1	11/05/2015 00:00:00	Mary Wells	null	null	39	null	null	null
2	11/05/2015 00:00:00	Mary Wells	null	210	null	null	null	null
3	11/05/2015 00:00:00	Mary Wells	40	null	null	null	null	null
4	12/05/2015 00:00:00	Mary Wells	null	null	12.45	null	null	null
5	12/05/2015 00:00:00	Mary Wells	null	null	null	11.12	null	null
6	13/05/2015 00:00:00	Derek Stand	null	null	43.16	null	null	null
7	13/05/2015 00:00:00	Derek Stand	null	130	null	null	null	null
8	13/05/2015 00:00:00	Derek Stand	50	null	null	null	null	null
9	13/05/2015 00:00:00	Paul Simmons	null	null	43.16	null	null	null
10	13/05/2015 00:00:00	Paul Simmons	null	130	null	null	null	null
11	13/05/2015 00:00:00	Paul Simmons	null	null	null	null	null	null
12	13/05/2015 00:00:00	Paul Simmons	null	null	null	null	null	45
13	14/05/2015 00:00:00	Derek Stand	null	null	22.95	null	null	null
14	14/05/2015 00:00:00	Paul Simmons	null	null	22.95	null	null	null
15	20/05/2015 00:00:00	Mary Wells	null	null	null	null	5	null

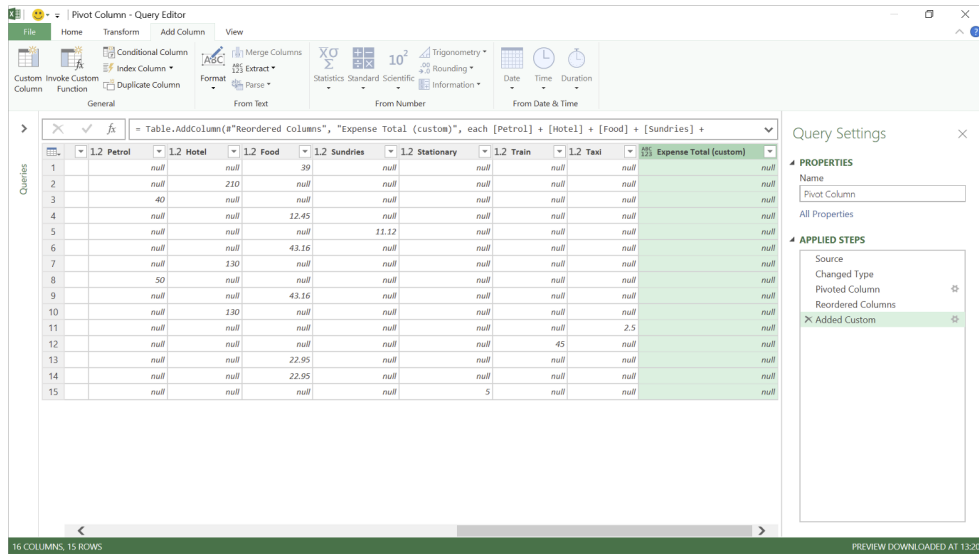
We are going to create a column which adds up everything in the Petrol, Hotel, Food, Sundries, Train and Taxi columns. One thing not to do, is to try and add them all up in a custom column, so we'll start there and show you what happens if you do!

In the 'Add Column' tab, choose the 'Custom Column' option:

We will elect to add up the expense columns:

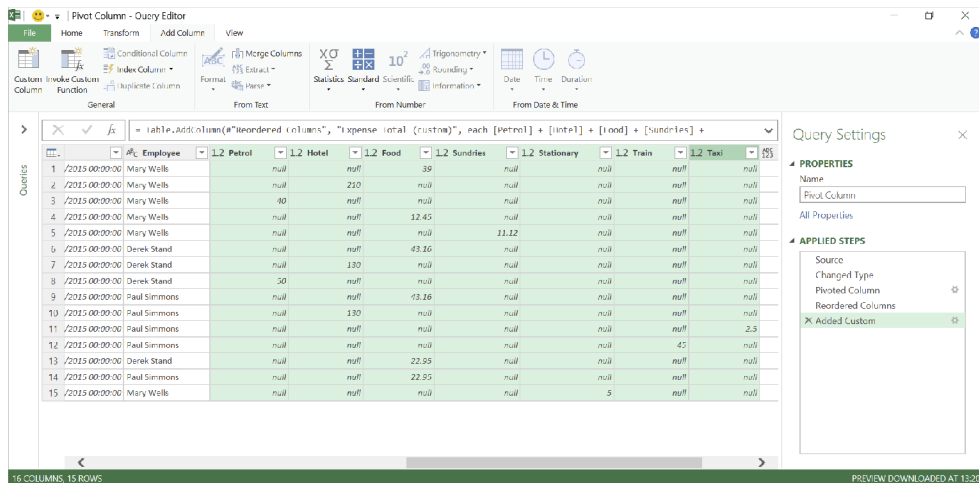


Our columns are all numerical columns, so the formula is fine – but since we are demonstrating what can go wrong, the result is no surprise...

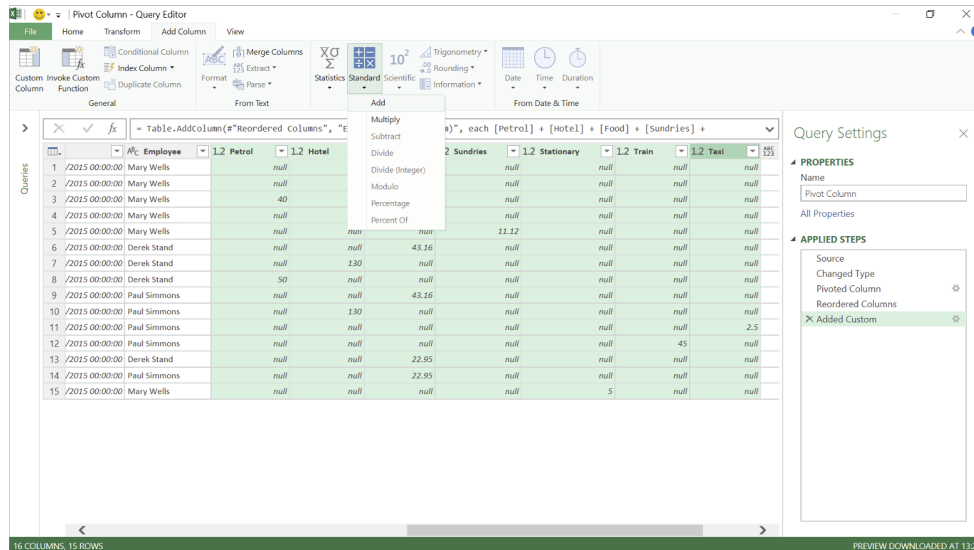


Anything added to a null is null, which is not what we want at all. We could replace the null values with zero, but zero is not *strictly* the same as null, and besides, there is a better way – we like this way because it's delightfully simple and doesn't require any M code knowledge at all.

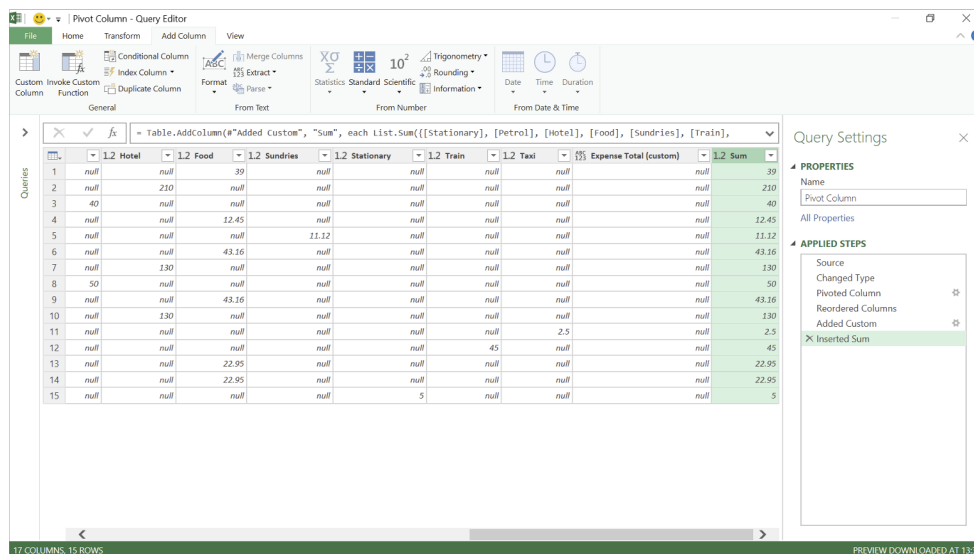
Firstly, select all the columns you want to add up by holding down the CTRL button as you make your choices:



Secondly, in the 'Add Column' tab, go to the 'Standard' dropdown in the 'From Number' section:



This will allow us to add all the selected columns, and it is much better than the custom column:



This is definitely a useful tool to know about – the new **Sum** column has dealt with the nulls and added everything up. The reason why it works, is because the **M** code behind the step uses **List.Sum** instead of simply adding with **+**.

If you compare the two formulae, the original (flawed) approach used the **M** code:

```
= Table.AddColumn("#Reordered Columns", "Expense Total (custom)", each [Petrol] + [Hotel] + [Food] + [Sundries] + [Stationary] + [Train] + [Taxi])
```

whereas the second Power Query generated column operates on a list basis:

```
= Table.AddColumn("#Added Custom", "Sum", each List.Sum({[Stationary], [Petrol], [Hotel], [Food], [Sundries], [Train], [Taxi]}), type number)
```

More next month!

Power BI Desktop Update for November

There were some major updates last month. There's a new, modern Ribbon that aligns Power BI Desktop with Office and adds more functionality. There's a new visualisation too: the decomposition tree, which is one of the most requested ideas out there on the interweb thingy. AI functions have also been integrated into Power Query allows you to enhance your data transformations, plus the usual odds and sods.

Here's the complete list of November updates:

Key change

- Modern Ribbon (Preview)

Reporting

- Decomposition tree visual (Preview)

Analytics

- Conditionally format button formatting

Visualizations

- ArcGIS Maps for Power BI update
- New xViz visuals:
 - o Advanced Gauge
 - o Hierarchical Filter
- ZoomCharts Drill-Down Waterfall Visual
- Financial Reporting Matrix by Profitbase
- Distribution
- Tree

Data connectivity

- LinkedIn Sales Navigator connector
- Edit SAP variables experience now Generally Available
- Vena connector
- SiteImprove connector
- Product Insights connector
- Web By Example connector – support for extracting links

Data Preparation

- AI functions in Power Query (Preview)

Template apps

- LinkedIn Sales Navigator for Sales Operations.

Let's take a look at each in turn.

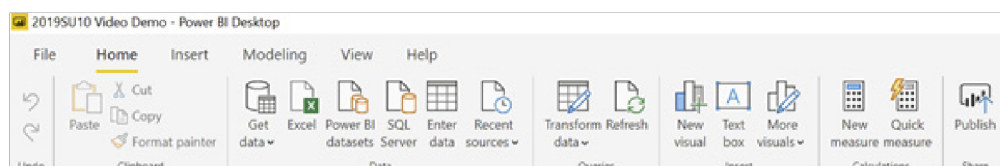
Modern Ribbon (Preview)

The Ribbon in Power BI Desktop has been updated for a "more modern experience". Now, when you turn on the "Updated Ribbon" preview feature, you will see a Ribbon that looks more like the Ribbon in Office products. In the updated Ribbon, you have access to all the existing functionalities but there will be more features too.

Microsoft stated that their aims were to:

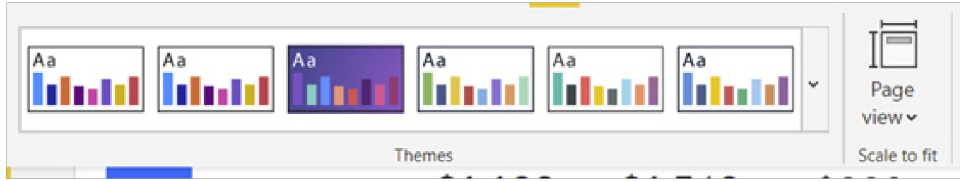
- Make the report design experience easier
- Align the Ribbon with Office
- Provide a visual refresh and modernise the aesthetic of Power BI's User Interface.

This means that another Ribbon tab has been added and the buttons in each tab have been reorganised into conceptual groupings. If this Ribbon looks familiar to you, it is because you will now be using the same Ribbon that you see when using Office 365:

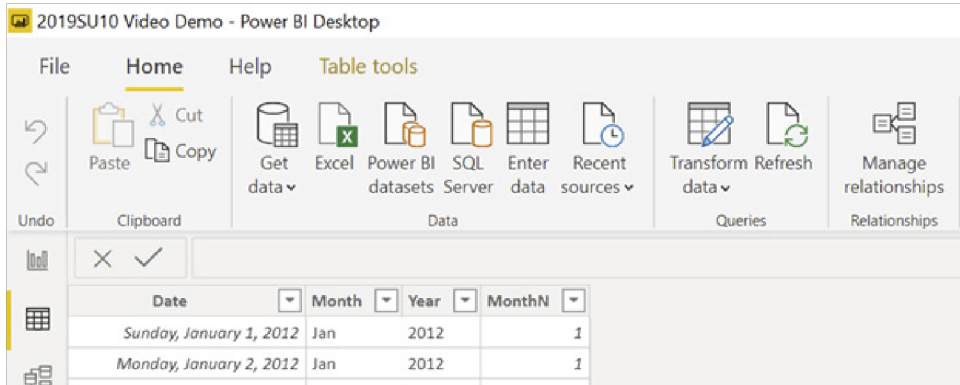


This new Ribbon has several benefits compared to the previous one:

- Improved look, feel and organisation
- A Themes gallery, where you can more easily see which colours will be applied

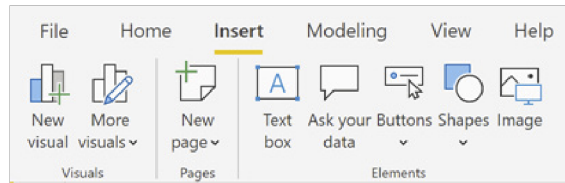


- Dynamic Ribbon content based on your view, so you no longer have so many disabled buttons in the Data and Modeling views



- A single line Ribbon when the Ribbon is collapsed, which allows you to save space while working (see below)
- The Ribbon won't occasionally freeze, for those who had this issue before.

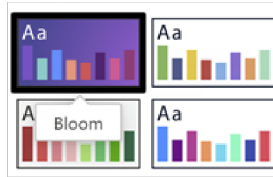
Adding buttons, shapes, and textboxes to your report have been moved to a new Insert tab:



The updated Ribbon displays themes in a gallery so you can more easily see what colours will be applied to your report:

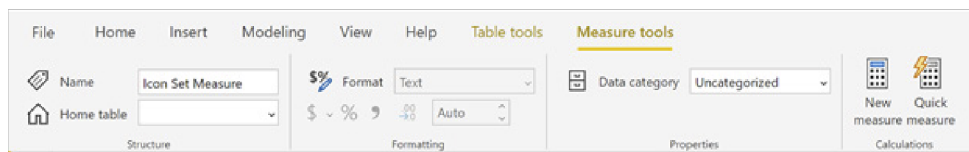
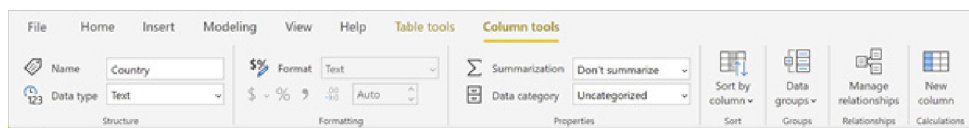
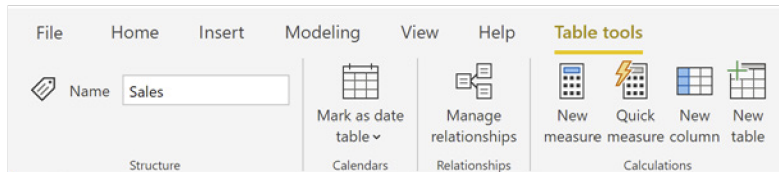


You can still see the name of a theme by hovering over a thumbnail, viz.



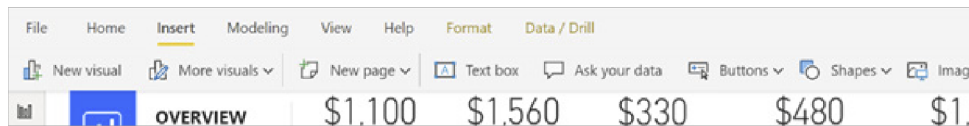
More tabs, also known as **contextual tabs**, will show up in the Ribbon according to what you have selected. For example, in the previous Ribbon, if you selected a visual, the contextual tabs 'Format' and 'Data / Drill' appear. In the new Ribbon, you may have noticed that the Modeling tab has fewer buttons. Now, if you want to modify the structure,

properties or apply formatting to tables, columns and measures, these options will appear as contextual tabs when you select a field in the fields list. The tools available to modify your data are now grouped according to the type of field you have selected. This should help reduce clutter and unnecessary options as you are modifying your data.



Some descriptions have changed. Previously, you could browse custom visuals in the button 'From Marketplace'. Since custom visuals are hosted in AppSource, you can now find them by pressing the 'More visuals' dropdown and selecting 'From AppSource' instead.

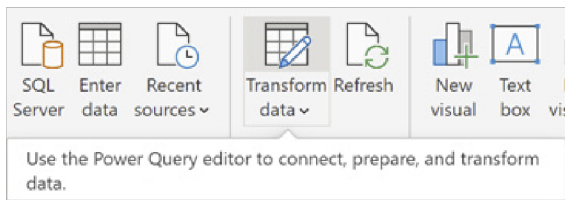
Real estate has become more of a priority too. If you press the chevron in the bottom right hand corner of the Ribbon, it will collapse to help you save space while working.



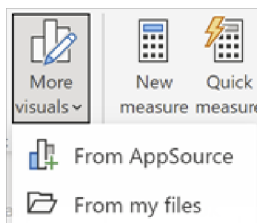
It's no secret that some of the terms that appear in the Ribbon are ambiguous. With this borne in mind, Microsoft has updated some of the names for buttons to be more friendly. The ToolTips have also been updated to give a more detailed explanation as to what each feature does.

Some of the more prominent changes include:

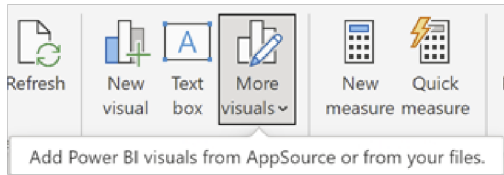
- I must confess, this is not one of my favourite changes, but 'Edit Queries' now appears as 'Transform data'



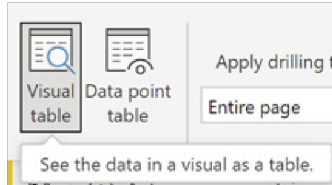
- Adding a custom visual 'From Marketplace' is now 'From AppSource' (I can't help thinking this is Apple Sauce...)



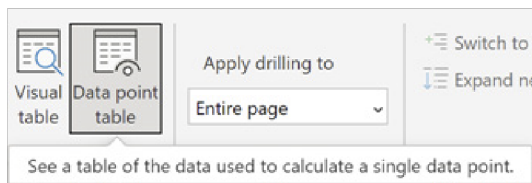
- 'From AppSource' is now be found under the 'More visuals' dropdown



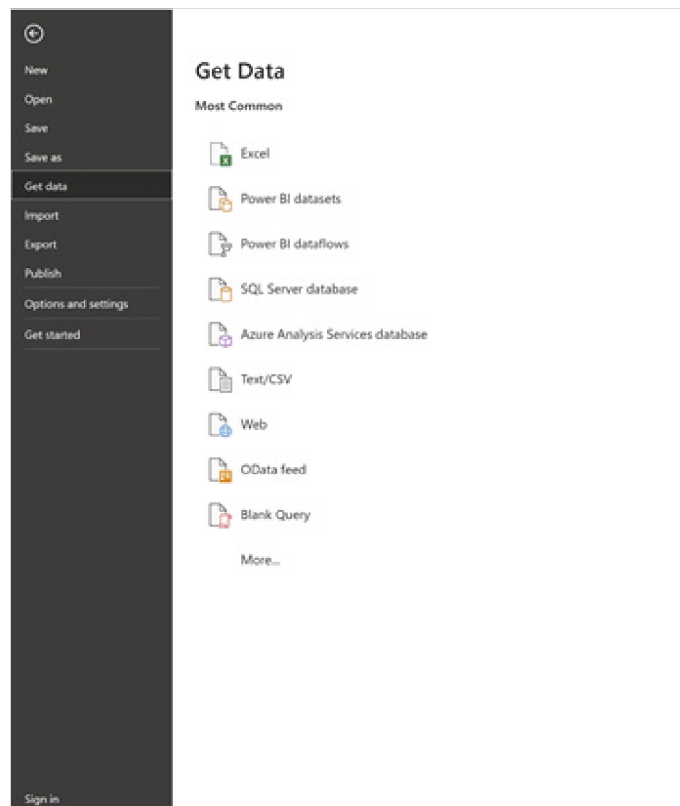
- Since 'See Data' shows the data in a selected visual in a tabular format, it has been renamed as 'Visual table'



- 'See Records' has been renamed 'Data point table', which shows the underlying data that has been used to calculate a data point in a tabular format.



The file menu also has a more modern look. If you work with several reports, in the Open section of the modern file menu, you'll be able to see and pin more reports than you were able to previously.



Therefore, to summarise:

Formerly known as	New name
Edit Queries	Transform data
From Marketplace	From AppSource
Switch Theme	<i>Turned into a Theme gallery</i>
New Group	New data group
Edit Groups	Edit data groups
Prince	Love symbol

Other points:

New visual	New name	New name
New page	Home -> Insert group	Insert -> Pages group
New visual	Home -> Insert group	Insert -> Visuals group
Buttons Text box Image Shapes	Home -> Insert group	Insert -> Elements group
From AppSource From File	Home -> Custom visuals group	Home -> Insert group -> more visuals
Switch Theme	Home -> Themes group	View -> Themes group
Manage Relationships	Home -> Relationships group	Modeling -> Relationships group
Data Formatting group Data Properties group	Modeling	Once you select a table, column, or measure in the Fields List, contextual tabs (Table tools, Column tools, Measure tools) will appear in the Ribbon
New data group Edit data groups	Modeling -> Groups group	Select a column in the fields list Column tools -> Groups group -> Data groups

Microsoft states that this will be the first of many updates that are coming to the Ribbon. The new Ribbon control allows them to, in future updates:

- Use more flexible and intuitive controls for features
- Add the black and dark grey Office themes to Power BI Desktop
- Improve accessibility to be on par with Office's Ribbon.

It should be noted that the Quick Access Toolbar will be unavailable in the updated Ribbon, although in a future update 'Save' will be added to the title bar.

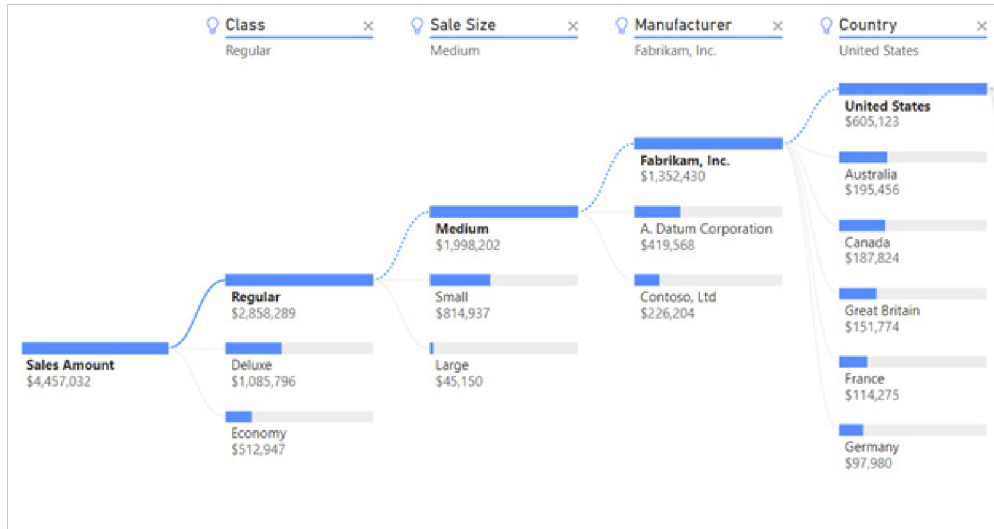
As for the timeline, it is expected that in the first quarter of 2020, the updated Ribbon will transition from being a Preview feature to becoming the default Ribbon in Power BI Desktop. If the updated Ribbon

experience is severely impacting your workflow, you will still be able to turn off the updated Ribbon in your Preview features in the report options dialog. However, when the updated Ribbon is the new default, the previous Ribbon will be deprecated. You should note that if you do turn off the updated Ribbon, you will not get access to all the newest features in Power BI.

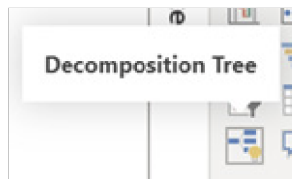
Decomposition tree visual (Preview)

One of the most requested features for Power BI is coming to Preview: a decomposition tree visual. This may be used to perform root-cause analysis by viewing how individual categories in a group contribute to the

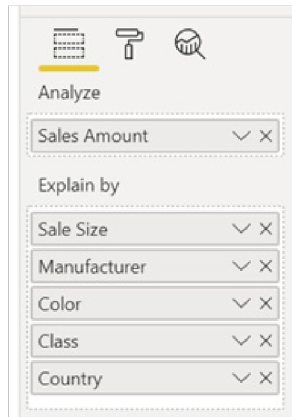
whole. The visual lets you decompos, or break down, a group to see its individual categories and how they can be ranked according to a selected measure, such as by sales amount.



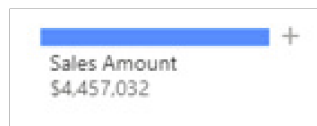
Once you turn on the visual through the Preview tab of the Options dialog, you'll see the new visual option in the Visualization pane.



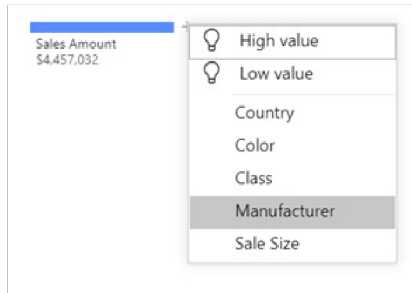
Once you add the visual to your page, you'll see two buckets in the field well. The first, Analyze, is where you'll put the numeric field you want to break down, in this case, Sales Amount. The second bucket, 'Explain by', is where you'll put all the possible fields you'd want to break your numeric field down by.



One of the interesting differences in the decomposition tree, compared to other visuals, is that you get to pick dynamically which of the fields in the explain by field well you want to look at and in what order. This means that the initial view you'll have is just the numeric value with a small '+' next to it.



Clicking on this plus ('+') will allow you to either pick a specific field from the provided options to break down by or let the visual decide which field to use, depending on if you're looking for the highest or lowest value.



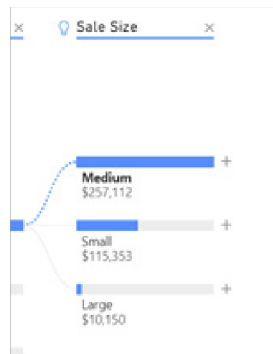
As you expand on different fields, you'll see a path forming in your tree. If the tree expands beyond the dimensions of the visual, you can pan and zoom with your mouse to get a better view.



As you go further down the tree, you can look at the headers and the darkened lines to get a reminder of what part of the tree you're exploring.

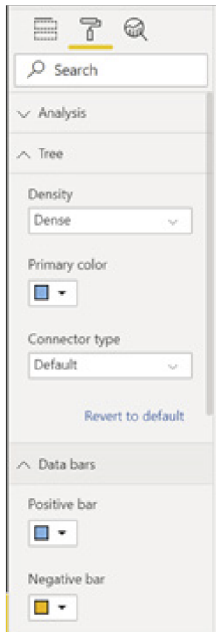


If you pick either high or low values to expand on, you'll also see a lightbulb next to the header to remind you that Power BI is picking the field for you dynamically and it'll update and change as your data refreshes. The connecting line is also dotted, which is another visual cue.



Like our other built-in visuals, you get all the good features you'd expect, such as support for:

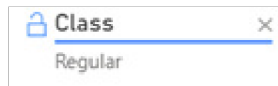
- Cross-highlighting
- Picking up theme colours
- Formatting options



- Bookmarking.

When you save your report, the visual will remember what configuration it was in and reopen to that format, but your consumers will be able to explore and configure the visual as much as they want to find new insights.

If there are specific levels you don't want your users to change, you can lock them using the lock icon near the header (you won't have this option for AI driven levels).

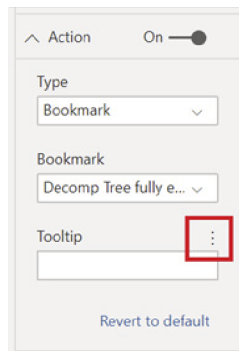


Conditionally format button formatting

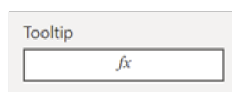
November's conditional formatting updates for formatting are all button related. You can now dynamically set formatting for the following properties:

- Button text font color
- Button text
- Icon line color
- Outline color
- Fill color
- Button ToolTip (under the Action card).

As a reminder, you can tell a property can be conditionally formattable by looking for the three dots on hover.



Once a property has been dynamically set, it will be replaced with an **f_x** button.



ArcGIS Maps for Power BI update

The ArcGIS Maps for Power BI visual has several updates this time. The visual now has support for connecting to ArcGIS Enterprise servers using built-in authentication. You can also now geocode up to 3,500 points as

a free user and 10,000 as an ArcGIS subscriber. Lastly, if you're an ArcGIS subscriber you now get full Esri Technical Support for ArcGIS Maps for Power BI.

New xViz visuals

This month, there are two new visuals in the xViz, an all in one visual suite. There are currently nine visuals in the package, all with free and

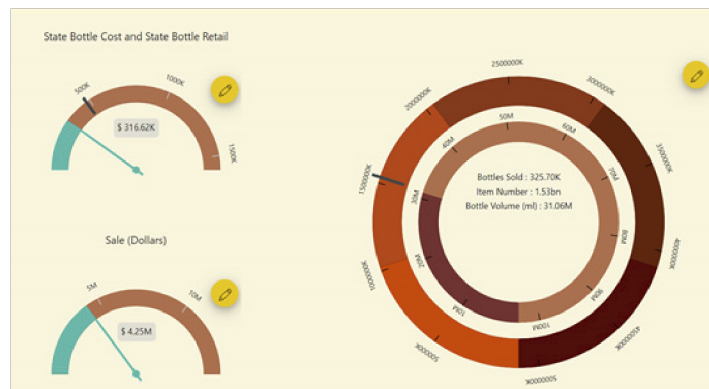
pro features. If you decide to license the pro features, you get access to the advanced capabilities for all the visuals for one price.

ADVANCED GAUGE

The Advanced Gauge visual allows you to easily compare an actual value, such as your key business indicators, against a target value. There are several customisation and configuration options available for this visual. Your gauge can either be a full or semi-circle, with the added ability of showing two different metrics in the same gauge.

Some other configurations include:

- Conditional formatting options for the gauge fill colour
- Set a fill and / or needle indicator for the current value
- Control the colours for the target indicator
- Set a minimum / maximum value
- Axis and number formatting, including tick control.



HIERARCHICAL FILTER

The Hierarchical Filter visual is a slicer visual that supports hierarchies, advanced formatting, search and even displacing a metric of choice. Each node of the slicer allows you to expand and collapse it for optimal navigation and allows you to single and multi-select categories to filter by.

Some of the advanced formatting options for this visual include:

- Conditional formatting support for both the categories of the slice and the optional metric
- Search support with two different search types
- Setting the default expansion level
- Full text and background formatting, including unique formatting for hover and selected value
- Advanced number formatting.

Bottles Sold (ml) by City, County, Store	
Search	Bottle Volume (ml)
– <input type="checkbox"/> ACKLEY	6,000.00
– <input type="checkbox"/> Hardin	2,750.00
– <input type="checkbox"/> KUM & GO #513 / ACKLEY	2,750.00
<input type="checkbox"/> Monday, July 22, 2013	750.00
<input type="checkbox"/> Monday, July 29, 2013	500.00
<input type="checkbox"/> Monday, January 13, 2014	750.00
<input type="checkbox"/> Monday, August 10, 2015	750.00
– <input type="checkbox"/> Webster	3,250.00
<input type="checkbox"/> Ackley Super Foods	3,250.00
<input type="checkbox"/> Monday, July 2, 2012	750.00
<input type="checkbox"/> Monday, May 13, 2013	750.00
<input type="checkbox"/> Monday, January 6, 2014	1,750.00
– <input type="checkbox"/> ADAIR	7,000.00
<input type="checkbox"/> Adair	7,000.00
<input type="checkbox"/> Casey's General Store #2521 / Adair	2,125.00
<input type="checkbox"/> Monday, November 4, 2013	1,750.00
<input type="checkbox"/> Monday, August 25, 2014	375.00
<input type="checkbox"/> KUM & GO #76 / ADAIR	4,875.00
<input type="checkbox"/> Wednesday, Februarv 8, 2012	750.00

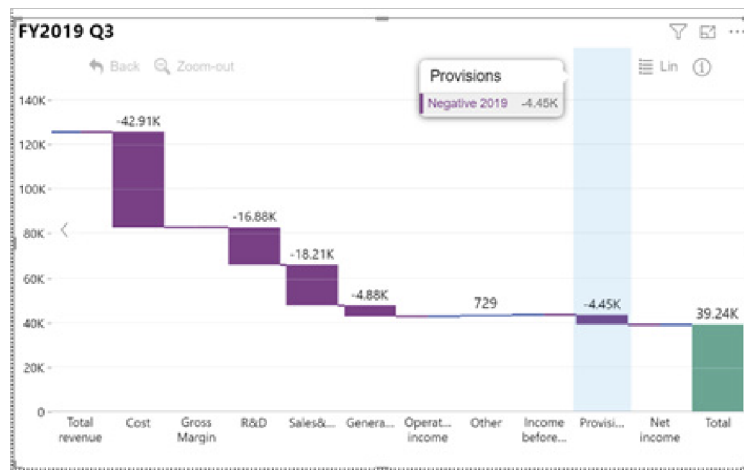
ZoomCharts Drill-Down Waterfall Visual

The ZoomCharts Drill Down Waterfall visual is a new addition to the family of ZoomCharts custom visuals and is equipped with features such as interactive drill down, smooth animations and other customisation options. The visuals are designed to work on both desktop and mobile devices providing an intuitive user experience.

The ZoomCharts Drill Down Waterfall visual's key features include:

- **Subtotal display and calculation:** add and display subtotals straight from the dataset or calculate them automatically
- **Column sequence:** set the display order for columns (change values)
- **Display of the total:** turn on or off the total column; have it calculated dynamically or make it data driven
- **Advanced formatting options:** customise increases, decreases and totals separately (colours, outlines, column widths, connectors, value labels and more)
- **Touch-driven slicer:** filter the report page by using the visual itself (no need for external slicers)
- **Touch-driven drill down:** touch or click any column to drill down into it; long-press it to select the column.

Some common use cases for the Drill Down Waterfall include total profit and loss decomposition in accounting and finance, monitoring stock movement in inventory management, understanding campaign contributions to lead volume in sales and marketing, and viewing changes in staff numbers in human resources.



Financial Reporting Matrix by Profitbase

The Financial Reporting Matrix by Profitbase visual is geared towards easily building financial reports. The visual is a matrix with many of the formatting options you'd expect in a financial report.

Some of the features of this visual include:

- Sub and grand total controls
- Line formatting
- Sticky column and row headers
- Conditional formatting.

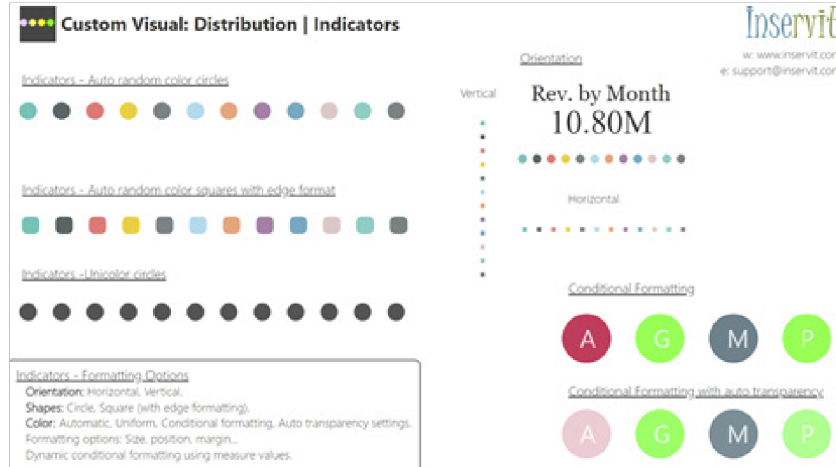
	Actual	This Period Budget	Deviation	%	Actual	Year to Date Budget	Deviation	%
Sales	771,492	729,751	41,741	5.7%	1,058,226	1,014,980	43,246	4.3%
Other Operational Income	102,207	103,031	-824	-0.8%	498,707	606,843	-108,136	-17.8%
Total Operating Income	873,699	832,782	40,917	4.9%	1,556,933	1,621,824	-64,891	-4.0%
Cost of Goods	169,466	265,430	-95,964	-36.2%	354,669	499,181	-144,512	-28.9%
4010 - Cost of SW sold	0	0	0	0.0%	8,301	11,418	-3,117	-27.3%
4020 - Cost of External Consults	214,500	302,113	-87,613	-29.0%	360,955	496,867	-135,912	-27.4%
4060 - Rebillable travel consults	36,341	33,097	3,244	9.8%	36,341	33,097	3,244	9.8%
4090 - Freight cost on goods sc	0	0	0	0.0%	0	0	0	0.0%
4210 - COGS 3rd Party A	0	0	0	0.0%	0	0	0	0.0%
4215 - COGS Other	-84,400	-72,198	-12,202	16.9%	-53,953	-44,620	-9,333	20.9%
4220 - Cost of External Consults	3,025	2,418	607	25.1%	3,025	2,418	607	25.1%
4265 - Cost of rebilled travel	0	0	0	0.0%	0	0	0	0.0%
4290 - Freight, Customs, etc.	0	0	0	0.0%	0	0	0	0.0%
Payroll and social Cost	-200,954	-498,302	297,348	-59.7%	-1,587,320	-1,984,768	397,448	-20.0%
Other Operating Expenses	108,685	90,562	18,123	20.0%	250,919	227,131	23,788	10.5%
Total Operating Costs	77,197	-142,310	219,507	-154.2%	-981,732	-1,258,454	276,724	-22.0%
EBITDA	796,502	975,092	-178,590	-18.3%	2,538,665	2,880,280	-341,615	-11.9%
Other Financial Income	0	0	0	0.0%	0	0	0	0.0%
Interest Income	0	0	0	0.0%	0	0	0	0.0%
Interest Expenses	0	0	0	0.0%	0	0	0	0.0%
Other Financial Cost	600	686	-86	-12.5%	1,428	1,438	-10	-0.7%
Depreciation and Amortization	0	0	0	0.0%	0	0	0	0.0%
Net Financial Items	600	686	-86	-12.5%	1,428	1,438	-10	-0.7%
Net Result	795,902	974,406	-178,504	-18.3%	2,537,237	2,878,841	-341,604	-11.9%

Distribution

The Distribution visual by Inservit allows you to see an indicator for each categories of the field you put into the visual, much like the legend of a visual. You can use these indicators as a way to filter the report.

The indicators have a lot of formatting options, including:

- Ability to show or hide the category and data labels
- Change the indicator border and share
- Swap the orientation between horizontal and vertical
- Conditional formatting for the indicators and border.

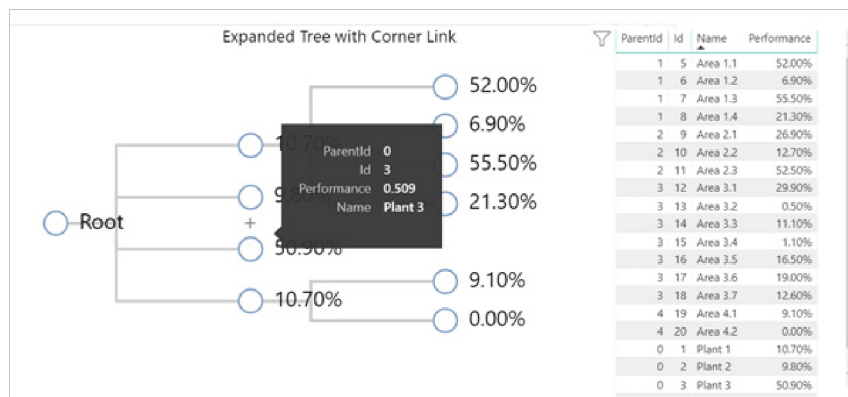


Tree

The Tree visual by CK Corporation allows you to visual your hierarchical data in an easy to use tree structure. All you need to do is give the visual a parent ID and child ID, and it will automatically figure out the tree structure. If there are multiple levels to the tree, you can expand nodes by hovering over them and clicking the plus icon.

You can also use various formatting features, such as:

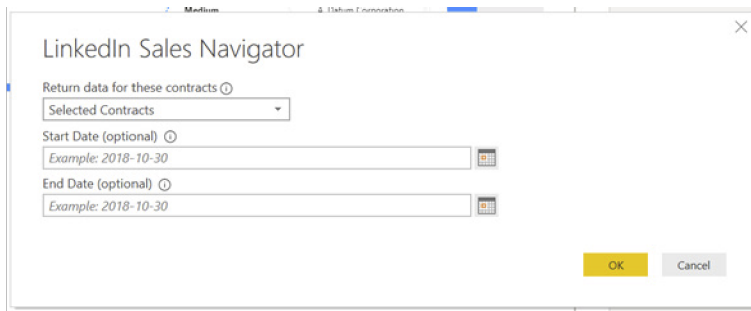
- Switching between horizontal and vertical orientation
- Set the default expansion level
- Customise the labels
- Change the node and line styles
- Set conditional formatting for the nodes.



LinkedIn Sales Navigator connector

LinkedIn Sales Navigator lets you access the power of LinkedIn's 630-million-member network to help sales professionals find and build relationships with prospects and customers. If you're using this feature, you can now pull your data into Power BI using our new connector. You

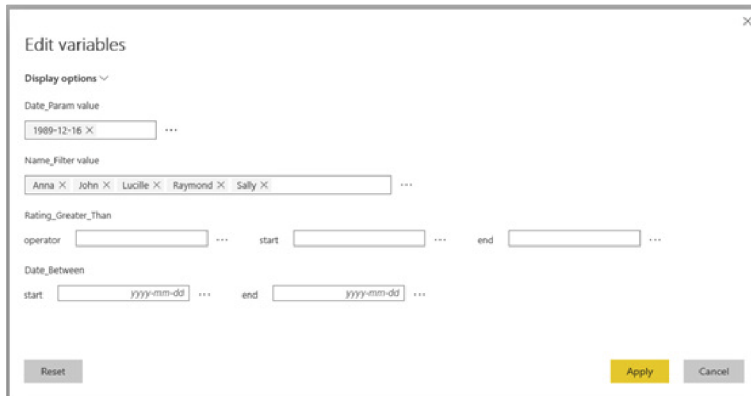
need to have a LinkedIn Sales Navigator Enterprise plan, and be either an Admin or Reporting User on the Sales Navigator Contract to connect to this data.



Edit SAP variables experience now Generally Available

Back in August, Microsoft released a preview of the Edit SAP variables experience, to allow report consumers to edit SAP variables in the Power BI service with their DirectQuery reports. November sees the

announcement that this experience is now Generally Available and also supported in Shared workspaces.



Vena connector

Vena’s finance process management software provides budgeting, forecasting, planning, financial close management and consolidations, and more, by connecting people and enterprise data, resulting in

automated planning / decision making. The Vena Power BI connector connects Vena data to Power BI, enabling faster analysis.

SiteImprove connector

SiteImprove offers a comprehensive cloud-based Digital Presence Optimization (DPO) software. The connector gives access to SiteImprove’s digital insights data to monitor your websites performance

for accessibility, SEO, analytics, quality assurance, and much more to help you measure digital performance and work towards regulatory compliance.

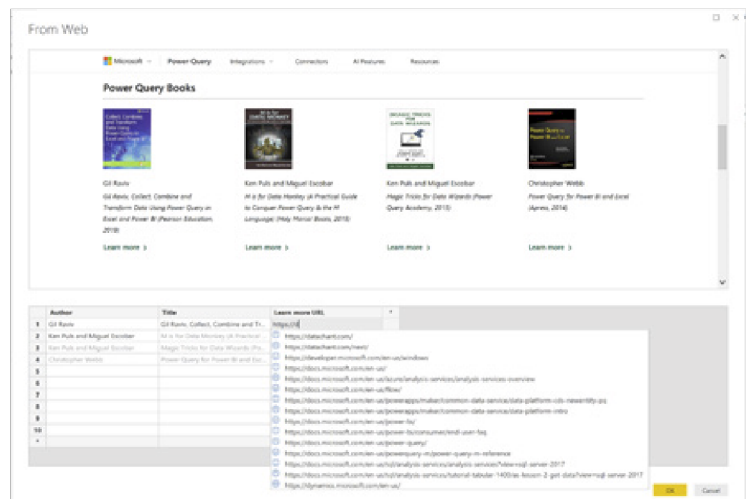
Product Insights connector

Product Insights is a new Dynamics 365 product which allows you to collect signals from your products and services, and gain valuable insight into customer usage, in real-time. The connector accesses aggregated signal data (metrics) from Product Insights.

Web By Example connector – support for extracting links

There’s a significant enhancement to the Web By Example connector in this update, allowing you to extract links (src / href attributes) as part of the Web By Example experience.

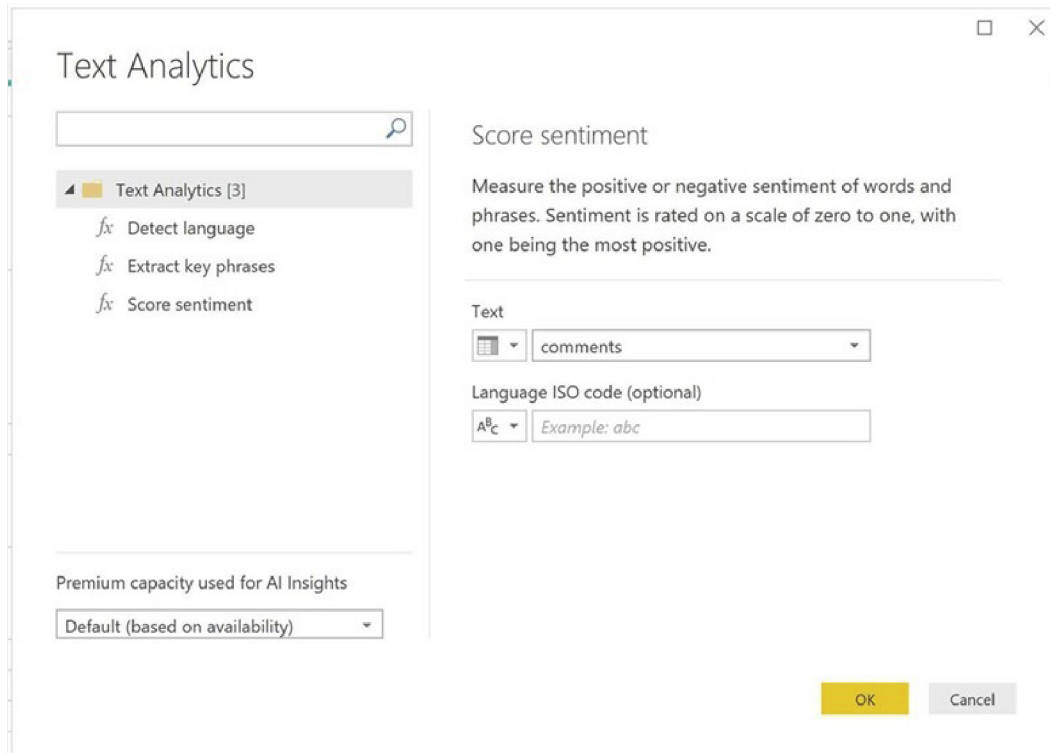
For example, this illustration leverages this new capability in order to extract information about Power Query Books (including Author, Title and URL) from the Power Query resources page: <https://powerquery.microsoft.com/en-us/resources/>



AI functions in Power Query (Preview)

After introducing AI functions in the Power BI Service earlier this year, Microsoft is now releasing these features into the Desktop world as well. You can now extract insights from your text and image data with models for text analytics and vision, and access all your Azure Machine Learning models directly in Power BI Desktop. There are new buttons in the Power Query editor once you have the 'AI functions' option enabled in the Preview settings.

Text analytics can help you detect the language of a text column or field, score its sentiment or extract key phrases. You may also detect topics in images with the image tagging function or run new data through your own Azure ML models. The results of each function are added as a new column to the query.



For functions that return multiple values (currently this is true for Key Phrase Extraction and Image Tagging) the results are returned both as a comma separated column and as new rows for each separate key phrase or tag.

Text analytics and vision models are Premium only features. In the setup window you can choose which capacity to use while editing the report. When you publish the report to a Premium workspace, we will use the

capacity related to that workspace for any data refresh. Text analytics and vision functions cannot be refreshed in non-Premium workspaces.

LinkedIn Sales Navigator for Sales Operations

The LinkedIn Sales Navigator for Sales Operations template app allows sales operations personnel to see aggregated information regarding how effectively a sales team uses Sales Navigator. It enables sales operations personnel to identify and analyse things such as:

- Who is using LinkedIn Sales Navigator
- How many LinkedIn profiles match search criteria
- The Social Selling Index across all users.

To use this template app, you must:

- Have a LinkedIn Sales Navigator Enterprise plan
- Be an Administrator or a Reporting User on the Sales Navigator Contract (note: a reporting license on the Sales Navigator contract does not take up a seat on that contract)
- Be a Power BI user.

The LinkedIn Sales Navigator for Sales Operations template app is available for download from AppSource.

More soon, we're sure!

The A to Z of Excel Functions: DMAX

Wanna take it to **DMAX**? This function returns the largest number in a **field** (column) of records in a list or **database** that matches conditions you that specify.



The **DMAX** function employs the following syntax to operate:

DMAX(database, field, criteria)

The **DMAX** function has the following arguments:

- **database**: this is required and represents the range of cells that makes up the list or database. A **database** is a list of related data in which rows of related information are records and columns of data are fields. The first row of the list contains labels for each column
- **field**: indicates which column is used in the function. Make sure you enter the column label enclosed between inverted commas (double quotation marks), e.g. "Age" or "Yield", or a number (without quotation marks) that represents the position of the column within the list, that is, 1 for the first column, 2 for the second column, and so on. Microsoft's documentation states that this argument is required. We're not convinced. If **field** is omitted, **DMAX** identifies the maximum of all of the records in the table that match the criteria
- **criteria**: is the range of cells that contains the conditions you specify. You can use any range for the **criteria** argument, as long as it includes at least one column label and at least one cell below the column label in which you specify a condition for the column.

It should be further noted that:

- you can use any range for the **criteria** argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition, e.g. if the range **G1:G2** contains the column label Income in **G1** and the amount 10,000 in **G2**, you could define the range as **MatchIncome** and use that name as the **criteria** argument in the database functions
- although the **criteria** range can be located anywhere on the worksheet, do not place the **criteria** range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Excel cannot add the new information
- make sure that the **criteria** range does not overlap the list
- to perform an operation on an entire column in a **database**, enter a blank line below the column labels in the **criteria** range.

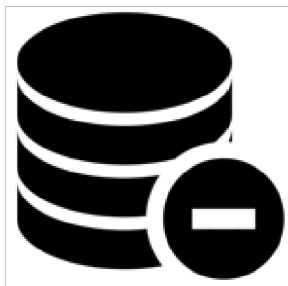
Please see our example below:

	A	B	C	D	E
1	Tree	Height	Height		
2	Apple	>3	<=4		
3	Cherry				
4					
5	Tree	Height	Age	Yield	Profit
6	Apple	6	20	14	105
7	Apple	4	12	10	96
8	Cherry	4.2	14	9	105
9	Apple	4.7	15	10	75
10	Pear	3	8	8	16.8
11	Apple	2.7	9	6	45
12					
13	Formula	Description	Result		
14	=DMAX(A5:E11,"Profit",A1:C2)	The maximum profit of any apple tree with a height greater than three but less than or equal to four metres.	96		
15	=DMAX(A5:E11,"Profit",A1:C3)	Similar to above, this also includes the profit of any cherry tree.	105		
16					

The A to Z of Excel Functions: DMIN

The DMIN function

They say opposites attract. Last time out, we looked at **DMAX**, this time our attention turns to **DMIN**. This function returns the smallest number in a **field** (column) of records in a list or **database** that matches conditions that you specify.



The **DMIN** function employs the following syntax to operate:

DMIN(database, field, criteria)

The **DMIN** function has the following arguments:

- **database**: this is required and represents the range of cells that makes up the list or database. A **database** is a list of related data in which rows of related information are records and columns of data are fields. The first row of the list contains labels for each column
- **field**: indicates which column is used in the function. Make sure you enter the column label enclosed between inverted commas (double quotation marks), e.g. "Age" or "Yield", or a number (without quotation marks) that represents the position of the column within the list, that is, 1 for the first column, 2 for the second column, and so on. Microsoft's documentation states that this argument is required. We're not convinced. If **field** is omitted, **DMIN** identifies the minimum of all of the records in the table that match the criteria
- **criteria**: is the range of cells that contains the conditions you specify. You can use any range for the criteria argument, as long as it includes at least one column label and at least one cell below the column label in which you specify a condition for the column.

It should be further noted that:

- you can use any range for the **criteria** argument, as long as it includes at least one column label and at least one cell below the column label for specifying the condition, e.g. if the range **G1:G2** contains the column label Income in **G1** and the amount 10,000 in **G2**, you could define the range as **MatchIncome** and use that name as the **criteria** argument in the database functions
- although the **criteria** range can be located anywhere on the worksheet, do not place the **criteria** range below the list. If you add more information to the list, the new information is added to the first row below the list. If the row below the list is not blank, Excel cannot add the new information
- make sure that the **criteria** range does not overlap the list
- to perform an operation on an entire column in a **database**, enter a blank line below the column labels in the **criteria** range.

Please see the example below:

	A	B	C	D	E
1	Tree	Height	Height		
2	Apple	>3	<=4		
3	Pear				
4					
5	Tree	Height	Age	Yield	Profit
6	Apple	6	20	14	105
7	Apple	4	12	10	96
8	Cherry	4.2	14	9	105
9	Apple	4.7	15	10	75
10	Pear	3	8	8	16.8
11	Apple	2.7	9	6	45
12					
13	Formula	Description	Result		
14	=DMIN(A5:E11,"Profit",A1:C2)	The minimum profit of any apple tree with a height greater than three but less than or equal to four metres.	96		
15	=DMIN(A5:E11,"Profit",A1:C3)	Similar to above, this also includes the profit of any pear tree.	16.8		

Criteria Examples

Typing an equal sign in a cell indicates you want to enter a formula. To display text that includes an equal sign, surround the text and the equal sign with double quotes, like so:

"=Liam"

You also do that if you're entering an expression (a combination of formulas, operators, and text) and you want to display the equal sign instead of have Excel use it in a calculation. For example:

">=1"

Where *entry* is the text or value you want to find. For example:

What you type in the cell	What Excel evaluates and displays
"=Liam"	=Liam
">=1"	>=1

- When filtering text data, Excel does not distinguish between uppercase and lowercase characters. However, you can use a formula to perform a case-sensitive search (*see below*).

The following sections provide examples of complex criteria.

Multiple criteria in one column

Boolean logic: (Salesperson = "Tim" OR Salesperson = "Kathryn")

To find rows that meet multiple criteria for one column, type the criteria directly below each other in separate rows of the criteria range.

e.g. In the following data range (A5:C9), the criteria range (B1:B3) displays the rows that contain either "Tim" or "Kathryn" in the **Salesperson** column (B5:B9).

	A	B	C
1	Service	Salesperson	Sales
2		=Tim	
3		Kathryn	
4			
5	Service	Salesperson	Sales
6	Consulting	Kathryn	\$ 1,744
7	Training	Tim	\$ 9,183
8	Auditing	Kathryn	\$ 2,599
9	auditing	Cecile	\$ 1,117
10			

Multiple criteria in multiple columns where all criteria must be true

Boolean logic: (Service = "Auditing" AND Sales > 1500)

To find rows that meet multiple criteria in multiple columns, type all of the criteria in the same row of the criteria range.

In the following data range (A5:C9), the criteria range (A1:C2) displays all rows that contain "Auditing" in the **Service** column and a value greater than \$1,500 in the **Sales** column (C5:C9).

	A	B	C
1	Service	Salesperson	Sales
2	=Auditing		>1500
3			
4			
5	Service	Salesperson	Sales
6	Consulting	Kathryn	\$ 1,744
7	Training	Tim	\$ 9,183
8	Auditing	Kathryn	\$ 2,599
9	auditing	Cecile	\$ 1,117
10			

Multiple criteria in multiple columns where any criteria can be true

Boolean logic: (Service = "Auditing" OR Salesperson = "Kathryn")

To find rows that meet multiple criteria in multiple columns, where any criteria can be true, type the criteria in different rows of the criteria range.

In the following data range (A5:C9), the criteria range (A1:B3) displays all rows that contain "Auditing" in the **Service** column (C5:C9) or "Kathryn" in the **Salesperson** column (B5:B9).

	A	B	C
1	Service	Salesperson	Sales
2	=Auditing		
3		Kathryn	
4			
5	Service	Salesperson	Sales
6	Consulting	Kathryn	\$ 1,744
7	Training	Tim	\$ 9,183
8	Auditing	Kathryn	\$ 2,599
9	auditing	Cecile	\$ 1,117
10			

Multiple sets of criteria where each set includes criteria for multiple columns

Boolean logic: ((Salesperson = "Kathryn" AND Sales >2000) OR (Salesperson = "Tim" AND Sales > 1500))

To find rows that meet multiple sets of criteria, where each set includes criteria for multiple columns, type each set of criteria in separate rows.

In the following data range (A5:C9), the criteria range (B1:C3) displays the rows that contain both "Kathryn" in the **Salesperson** column and a value greater than \$2,000 in the **Sales** column, or displays the rows that contain "Tim" in the **Salesperson** column (B5:B9) and a value greater than \$1,500 in the **Sales** column (C5:C9).

	A	B	C
1	Service	Salesperson	Sales
2		=Kathryn	>2000
3		Tim	>1500
4			
5	Service	Salesperson	Sales
6	Consulting	Kathryn	\$ 1,744
7	Training	Tim	\$ 9,183
8	Auditing	Kathryn	\$ 2,599
9	auditing	Cecile	\$ 1,117
10			

Multiple sets of criteria where each set includes criteria for one column

Boolean logic: ((Sales > 2000 AND Sales <= 3000) OR (Sales < 1500))

To find rows that meet multiple sets of criteria, where each set includes criteria for one column, include multiple columns with the same column heading.

In the following data range (A5:C9), the criteria range (C1:D3) displays rows that contain values between 2,000 and 3,000 and values less than 1,500 in the **Sales** column (C5:C9).

	A	B	C	D
1	Service	Salesperson	Sales	Sales
2			>2000	<=3000
3			<1500	
4				
5	Service	Salesperson	Sales	
6	Consulting	Kathryn	\$ 1,744	
7	Training	Tim	\$ 9,183	
8	Auditing	Kathryn	\$ 2,599	
9	auditing	Cecile	\$ 1,117	
10				

Criteria to find text values that share some characters but not others

To find text values that share some characters but not others, do one or more of the following:

- type one or more characters without an equal sign (=) to find rows with a text value in a column that begin with those characters. For example, if you type the text **Lia** as a criterion, Excel finds "Liam", "Liar" and "Lianne"
- use a wildcard character.

The following wildcard characters can be used as comparison criteria:

Use	To Find
? (question mark)	Any single character For example, sm?th finds "smith" and "smyth"
* (asterisk)	Any number of characters For example, *east finds "Northeast" and "Southeast"
~ (tilde) followed by ? , * or ~	A question mark, asterisk, or tilde For example, fy91~? finds "fy91?"

In the following data range (**A5:C9**), the criteria range (**A1:B3**) displays rows with "Co" as the first characters in the **Service** column or rows with the second character equal to "i" in the **Salesperson** column (**B5:B9**).

	A	B	C
1	Service	Salesperson	Sales
2	Co		
3		=?i*	
4			
5	Service	Salesperson	Sales
6	Consulting	Kathryn	\$ 1,744
7	Training	Tim	\$ 9,183
8	Auditing	Kathryn	\$ 2,599
9	auditing	Cecile	\$ 1,117
10			

Criteria created as the result of a formula

You can use a calculated value that is the result of a formula as your criterion. Remember the following important points:

- the formula must evaluate to TRUE or FALSE
- because you are using a formula, enter the formula as you normally would, and do not type the expression in the following way:
="= entry "
- do not use a column label for criteria labels; either keep the criteria labels blank or use a label that is not a column label in the range (in the examples below, **Calculated Average** and **Exact Match**)
- if you use a column label in the formula instead of a relative cell reference or a range name, Excel displays an error value such as **#NAME?** or **#VALUE!** in the cell that contains the criterion. You can ignore this error because it does not affect how the range is filtered
- the formula that you use for criteria must use a relative reference to refer to the corresponding cell in the first row (in the examples below, **C6** and **A6**)
- all other references in the formula must be absolute references.

The following subsections provide specific examples of criteria created as the result of a formula.

Filtering for values greater than the average of all values in the data range

In the following data range (**A5:C9**), the criteria range (**D1:D2**) displays rows that have a value in the **Sales** column greater than the average of all the values (**C6:C9**). In the formula, "C6" refers to the filtered column (C) of the first row of the data range (6).

	A	B	C	D
1	Service	Salesperson	Sales	Calculated Average
2				=C6>AVERAGE(\$C\$6:\$C\$9)
3				
4				
5	Service	Salesperson	Sales	
6	Consulting	Kathryn	\$ 1,744	
7	Training	Tim	\$ 9,183	
8	Auditing	Kathryn	\$ 2,599	
9	auditing	Cecile	\$ 1,117	
10				

Filtering for text by using a case-sensitive search

In the data range (A5:C9), the criteria range (D1:D2) displays rows that contain "Auditing" in the **Service** column by using the **EXACT** function to perform a case-sensitive search (A5:A9). In the formula, "A6" refers to the filtered column (A) of the first row of the data range (6).

	A	B	C	D
1	Service	Salesperson	Sales	Exact Match
2				=EXACT(A6,"Auditing")
3				
4				
5	Service	Salesperson	Sales	
6	Consulting	Kathryn	\$ 1,744	
7	Training	Tim	\$ 9,183	
8	Auditing	Kathryn	\$ 2,599	
9	auditing	Cecile	\$ 1,117	
10				

More Excel Functions next month...

Upcoming SumProduct Training Courses

Location	Course	Date	Duration
Melbourne	Power Pivot, Power Query and Power BI	9 - 11 Dec 2019	3 Days
Sydney	Power Pivot, Power Query and Power BI	9 - 11 Dec 2019	3 Days
Sydney	Excel Tips and Tricks	16 Dec 2019	1 Day
Sydney	Financial Modelling	17 - 18 Dec 2019	2 Days
Melbourne	Excel Tips and Tricks	13 Jan 2020	1 Day
Melbourne	Financial Modelling	14 - 15 Jan 2020	2 Days
Sydney	Power Pivot, Power Query and Power BI	15 - 17 Jan 2020	3 Days
Sydney	Excel Tips and Tricks	27 Jan 2020	1 Day

Sydney	Financial Modelling	28 - 29 Jan 2020	2 Days
Sydney	Power Pivot, Power Query and Power BI	17 - 19 Feb 2020	3 Days
Melbourne	Power Pivot, Power Query and Power BI	2 - 4 Mar 2020	3 Days
Sydney	Excel Tips and Tricks	2 Mar 2020	1 Day
Sydney	Financial Modelling	3 - 4 Mar 2020	2 Days

Key Strokes

Each newsletter, we'd like to introduce you to useful keystrokes you may or may not be aware of. This month, we thought we would **SHIFT CONTROL** of the function keys:

Keystroke	What it does
CTRL + SHIFT + F1	Insert new sheet
CTRL + SHIFT + F2	Save
CTRL + SHIFT + F4	Close application
CTRL + SHIFT + F10	Show On-Object User Interface (OOUI)
CTRL + SHIFT + F11	Show Script Editor

There are over 540 keyboard shortcuts in Excel. For a comprehensive list, please download our Excel file a www.sumproduct.com/thought/keyboard-shortcuts. Also, check out our new daily **Excel Tip of the Day** feature on the www.sumproduct.com homepage.

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- **Project finance**
- **Real options analysis**
- **Refinancing / restructuring**
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- **Valuations**
- **Working capital management**

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Link to Others

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