6 Working with Tables

Basically everything in Excel is tables, except the diagrams. A spreadsheet is itself a large table. When I talk about tables, I mean defined regions in the spreadsheet with a group of data. This group of data has some column headers and maybe, but not necessarily, some row headers.

We have already worked a little with tables in connection with formatting. If you have read the section on formatting tables, you might remember that several things happened beyond giving the table some nice colours.

6.1 Create a Table

The starting point for the exercises in this book is a small list of different movies that I have in my DVD collection. The list should perhaps include 150 movies, but I am pretty sure that in that you would not want to do the exercise!

We therefore confine ourselves to five films, which should be enough to get an understanding of working with tables. With so few rows, it seems foolish to make grades and filterings, but I will ask you to imagine that we are doing the same with a long list.

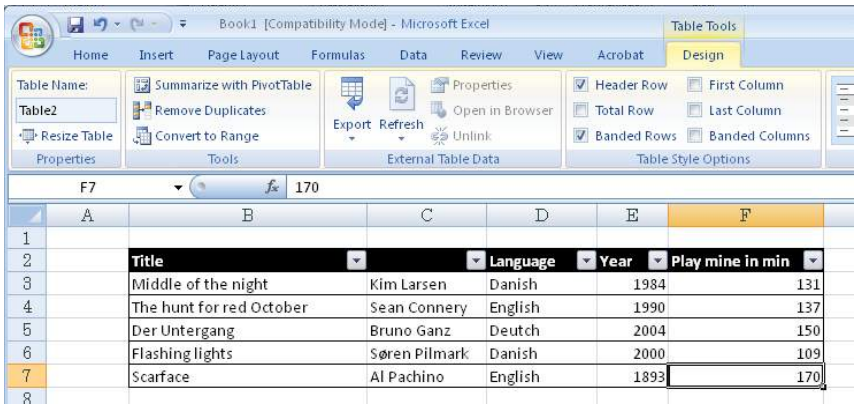
If you have a collection of movies, music or anything else, you could make a small index of it afterwards to practice what you have learned in this section.

1. To get some material to work with in the following exercises you must create a spreadsheet similar to the one shown in Figure 53. You are probably going to have to adjust the width of the columns to be able to view all of it.

	A	B	C	D	E	F	G
1							
2		Title	protagonist	Language	Year	Play mine in min	
3		Middle of the night	Kim Larsen	Danish	1984	131	
4		The hunt for red October	Sean Connery	English	1990	137	
5		Der Untergang	Bruno Ganz	Deutch	2004	150	
6		Flashing lights	Søren Pilmark	Danish	2000	109	
7		Scarface	Al Pachino	English	1893	170	
8							
9							

Figure 53: Starting point for the exercise.

2. Place the cursor, so one of the cells inside the table is the active cell.
3. In the Ribbon, ensure the **Home** Tab is selected, then click the button **Format as Table**.
4. Click on a table colour. You have now created your table.



	A	B	C	D	E	F
1						
2		Title		Language	Year	Play mine in min
3		Middle of the night	Kim Larsen	Danish	1984	131
4		The hunt for red October	Sean Connery	English	1990	137
5		Der Untergang	Bruno Ganz	Deutch	2004	150
6		Flashing lights	Søren Pilmark	Danish	2000	109
7		Scarface	Al Pachino	English	1893	170
8						

Figure 54: Sample table. Note that the Ribbon at the top has changed.

This table is the starting point for several exercises to come.

6.2 Filtering

Once you have created a table, you have to use filters on it. You use filters to select and show certain data in the table, according to criteria which you have defined.

Excel operates with two different types of filters called “AutoFilter” and “Advanced Filter”.AutoFilter is readily available in the column headings when you have defined a table. Advanced Filter requires a little more work, but it also gives you more options.

In practice AutoFilter is by far the easiest to use, and it can deal with most tasks. Advanced Filter is preferable if you want to filter your table based on values in cells outside of the table you are filtering.

6.2.1 AutoFilter

The AutoFilter is located at the top of the table in the headers. As you may have noticed, a button has appeared next to each heading. By clicking the buttons you will have access to AutoFilter.

In our exercise, we want the table to show pre-1990 Danish films. The approach is that we look at which columns contain data that we want to find. Then we take one column at a time and define the criteria for it.

1. Click on the arrow to the right of the header “Language”.

A menu will appear, where you have different options relating to sorting and filtering the column, Do not choose any of the sorting options yet; we will look at that later.

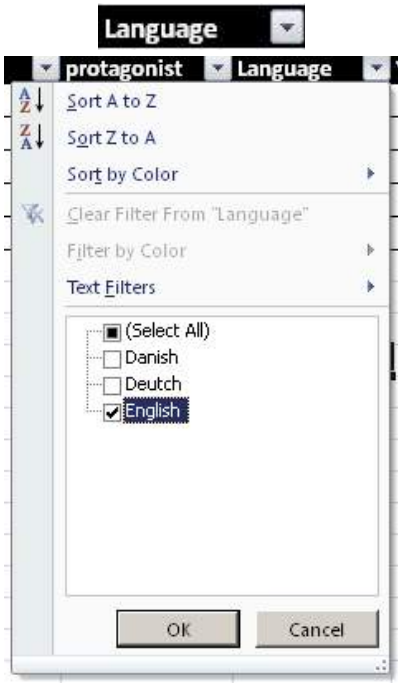


Figure 55: Filtering options.

In the menu that appeared you can also see a list of all the values you have typed into the 'Language" column. In our case it is "Danish" "English" and "German". At the moment there's a "tick" next to all three values, which means we have not filtered anything out yet.

2. Click on the selection by **Select All** to make the markers disappear.
3. Then insert a marker by English. Now it should only be "English", that is marked, as in Figure 60.
4. Click on **OK**.

You have created the first filter, so you are shown only Danish film titles. The other films are still there, but they are hidden at the moment. Notice the spreadsheet row numbers on the left side. Row

	A	B	C	D	E	F	G
1							
2		Title	protagonist	Language	Year	Play mine in min	
4		The hunt for red October	Sean Connery	English	1990	137	
7		Scarface	Al Pachino	English	1893	170	
8							

Figure 56: Now only Danish film titles from the list are shown.

4, 5 and 7 are not displayed, and the rows that contain filtered data are shown in blue row numbers. When row numbers are blue, it means that a filter is active.

It also means that you must think carefully if you want to create two tables with different filters side by side. Excel hides the entire row in the worksheet when a cell value does not satisfy a given criterion. So if you have a second table standing next to the table you are filtering, you may inadvertently hide data in it.

The aim of our exercise was to find pre-1990 Danish film titles, so we need to filter by year. To filter by year before 1990, we have to define a "custom filter".

5. Click on the small arrow next to the header "Year"
6. In the menu that appears, point to **Number Filters**.
7. A submenu will appear. Click on **Less Than** to open a dialog box.

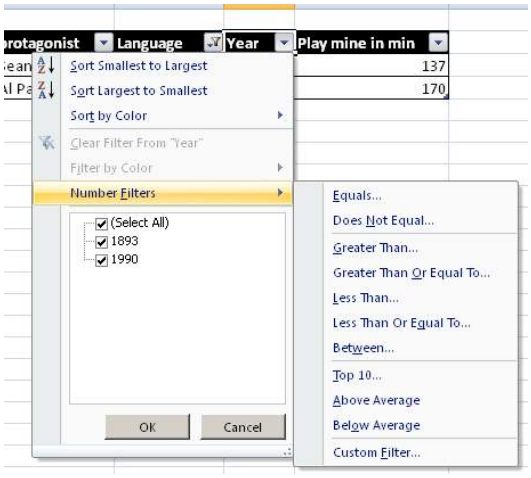


Figure 57: The Filter "Less than".

In the dialog box you must indicate that you want to see the rows of the table where the year is "less than" 1990. The dialog box allows you to specify two different criteria, but in this exercise we only use one.

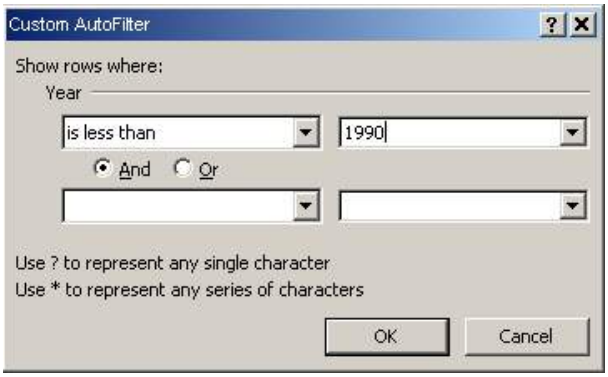


Figure 58: Custom filter.

8. Fill out the dialog box as shown in Figure 58 and click **OK**.

Now we have used filters on the columns, "Language" and "Year", and the result should look like Figure 59:

	A	B	C	D	E	F
1						
2		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
7		Scarface	Al Pachino	English	1893	170
8						

Figure 59: The result of our exercise with filters.

After all the hard work creating the filters we must remove them again. Fortunately, it is fairly easy, and it can be done in two ways. The first method is to remove the filters individually from each column. We will try with "Year".

9. Click on the filter button next to the header "Year".
10. In the menu that appears, click on **Remove Filter From "Year"**

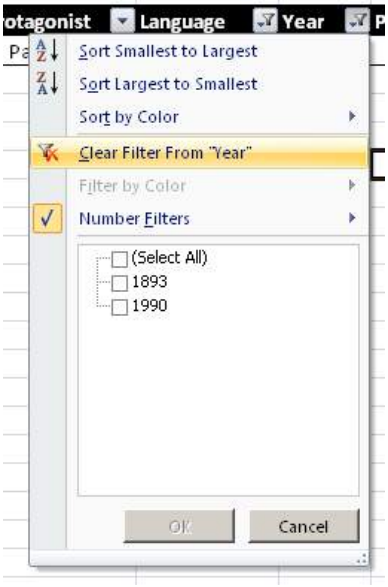


Figure 60: Remove a filter.

Now the two Danish movies in our collection are shown again. The other way of removing filters is used to remove all filters at once.

11. Make one of the cells in the table the active cell.
12. In the Ribbon, click the **Data** Tab.
13. Click the **Filter** button. It is easy to find because it will be yellow/orange at this point.

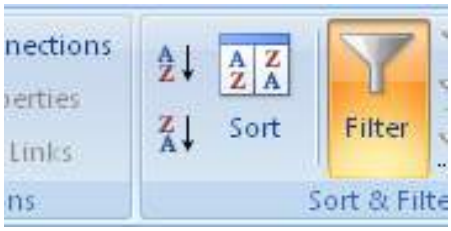


Figure 61: The filter button is easy to find.

The filters have been removed and all the rows in the table are shown again.

6.2.2 Advanced Filter

The Advanced Filter works in a completely different way than the AutoFilter. In the Advanced Filter you must create an additional table named "criteria range" with the same column headings as the table that you want to filter. In the extra table you must specify the criteria and tell Excel where to find the criteria.

Finally, you must also indicate whether you want the table filtered by hiding rows, or by writing the results elsewhere in the spreadsheet. The latter option means you do not have any hidden rows.

In this exercise, we continue working with the list of our small film collection. Again, it seems extremely foolish to filter a table with five rows, but it is easier to understand the different concepts when we only have little data to work with.

First we must make some space above the table for our Criteria Range. At least three blank rows above the table are required for the criteria range, since there are some rules that must be observed to make it work:

- The Criteria Range should have column headings, and it must be the same as the column headings in the table to be filtered.
- The Criteria Range should have room for at least one row of criteria.
- There must be at least one empty row acting as the space between the criteria range and the table to be filtered.

In this exercise, there should be room for three series of criteria, so we must have five blank rows above the table to make room for it all. We can either do this by simply moving the table four rows down, or by inserting four empty rows above it. We choose the latter.

1. Click with the right mouse button on the column heading for row "1". A menu will pop up.
2. Click on **Insert** (Not to be confused with **Paste**).

You have now added an empty row at the top. We need three more, but since I was born lazy and want to teach you some small tweaks, we will not repeat the same procedure again.

3. Hold the CTRL key on the keyboard down and press the Y key three times.

When you hold down the CTRL key and press the Y key, you use the command "Repeat last action". It works for many commands, and in all MS-Office programs. It also works in many other programs.

Now your spreadsheet looks like this:

Title	protagonist	Language	Year	Play mine in min
Middle of the night	Kim Larsen	Danish	1984	131
The hunt for red October	Sean Connery	English	1990	137
Der Untergang	Bruno Ganz	Deutch	2004	150
Flashing lights	Søren Pilmark	Danish	2000	109
Scarface	Al Pachino	English	1893	170

Figure 62: Now there is room for the criteria range.

Now we need some column headings for the criteria range, Since they are the same as in the table, we can just copy those.

4. Select cell region B6:F6.
5. Hold the CTRL key on the keyboard down and press the C key.
6. Activate cell B1.
7. Hold the CTRL key on the keyboard down and press the V key.

Your spreadsheet should now look like Figure 63:

Title	protagonist	Language	Year	Play mine in min
Middle of the night	Kim Larsen	Danish	1984	131
The hunt for red October	Sean Connery	English	1990	137
Der Untergang	Bruno Ganz	Deutch	2004	150
Flashing lights	Søren Pilmark	Danish	2000	109
Scarface	Al Pachino	English	1893	170

Figure 63: The criteria range with column headings.

Now we can define some criteria, but I would like to try to explain how the criteria range works, because it is not always easy to grasp.

As mentioned, the criteria range is designed as a table with rows and columns. The columns have headings that correspond to those in the table that is to be filtered according to the criteria. There is obviously a reason why you can write multiple rows of criteria, namely that you can put "AND" or "OR" between the criteria.

Criteria with "AND" in between are placed in the same row Criteria with "OR" between are placed in separate rows.

An example in our table could be that we want to display rows in the table containing films that are Danish AND prior to1990.

8. Type the word "Danish" in cell D2.
9. Type "<1990" in cell E2 (means "less than 1990").
10. Activate another cell in the table you want to filter, for example C7.
11. Choose the **Data** Tab in the Ribbon.
12. Click on the **Advanced** button in the Ribbon.

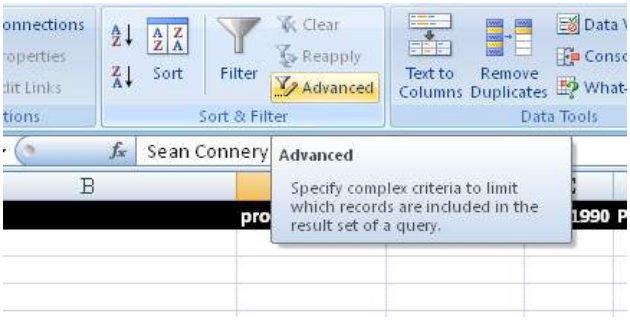


Figure 64: The **Advanced** button.

This opens the **Advanced filter** dialog box, where you must define what is to be filtered and where the criteria are.

13. Make sure that **Filter List Locally** is selected. This means that the filter, like AutoFilter is hiding the rows that do not meet the criteria.
14. The field **List Range** has probably been inserted automatically. It should say "$B$6:$F$11", which is the cell region we are going to filter.
15. In the field **Criteria Range** you must delete what you have previously inserted, since it is often wrong. With the mouse, mark cell region B1:F2. It should now say "'SHEET 1'!$B$1:$F$2" in this field. Do not get confused when it says "'Sheet1'!" in front of the cell reference. That is because it is possible to work in multiple sheet tabs in Excel, although we do not for this exercise.
16. Click **OK**.

This gives the result "Midt om Natten", which is the only film title that fulfils both criteria (Figure 65).

	A	B	C	D	E	F
1		Title	protagonist	Language	Year	Play mine in min
2				English	1990	
3						
4						
5						
6		Title	protagonist	Language	Year	Play mine in min
8		The hunt for red October	Sean Connery	English	1990	137
12						
13						

Figure 65: Two criteria with AND between.

Another example could be that we wish to view the rows in the table containing either Danish films OR pre-1990 film titles. In other words, we want to view all the Danish film titles and all pre-1990 films.

Figure 66: The **Clear** button.

17. In the Ribbon, click the **Clear** button, which will cancel the filtration.
18. Erase contents in cell E2.
19. Type "<1990" in cell E3.
20. Select a cell in the table you want to filter and click on the **Advanced** button in the Ribbon.
21. Fill in the dialog box as previously shown, but this time the Criteria Range is "'SHEET1'!$B$1:$F$3", since we have several criteria .
22. Click **OK**.

This gives us three rows, "Midt om Natten" which is Danish, "Blinkende Lygter", which is also Danish, and "Scarface", which is not Danish, but which is from before the year 1990 (Figure 67). Each film need only meet one of the listed criteria when it says OR between them.

	A	B	C	D	E	F
1		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
2				English		
3					<1990	
4						
5						
6		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
7		Middle of the night	Kim Larsen	Danish	1984	131
8		The hunt for red October	Sean Connery	English	1990	137
9		Scarface	Al Pachino	English	1893	170

Figure 67: Two criteria with OR between.

You can also combine. If you want the filtered table to show films that are EITHER Danish AND prior to 1990, OR all films after 1990, it looks like this:

	A	B	C	D	E	F
1		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
2				English	<1990	
3					>1990	
4						
5						
6		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
7		Middle of the night	Kim Larsen	Danish	1984	131
8		Der Untergang	Bruno Ganz	Deutch	2004	150
9		Flashing lights	Søren Pilmark	Danish	2000	109

Figure 68: Three criteria with a combination of AND and OR.

When you combine AND and OR it is important to know the math behind. When you type in two rows of criteria, all the criteria in the same row should be considered one large criterion. Thus in our last example we had two criteria of which the first criterion was a combination of two criteria that both had to be fulfilled.

	A	B	C	D	E	F
1		Title	protagonist	Language	Year	Play mine in min
2					1990	
3						
4						
5						
6		Title	protagonist	Language	Year	Play mine in min
7		Middle of the night	Kim Larsen	Danish	1984	131
8		The hunt for red October	Sean Connery	English	1990	137
9		Der Untergang	Bruno Ganz	Deutch	2004	150
10		Flashing lights	Søren Pilmark	Danish	2000	109
11		Scarface	Al Pachino	English	1893	170

Figure 69: The year is based on a formula. Note the Formula Bar.

6.2.3 Advanced Filter with Formulas

When using the advanced filter, you are not limited to manually having to write the criteria every time. You can also write equations where the outcome serves as a criterion in the filter. For example, if you had to extract values from a table with a filter which is based on a calculation either directly in the filter or as a result of a complicated calculation elsewhere in the spreadsheet or workbook.

In our previous exercise, you might wish to change to a year in cell H2, which you import to cell E2 using the formula "=H2".

If you run the filter, the movie with the year 1990 will be the only one that meets the criterion. But what if you want to view the list of all movies from before the year 1990? This requires that it says "<1990" in the criterion, but how is that done with a formula?

The answer is that you must use what is called a "text string". As you may be aware, Excel knows the difference between numbers and text. If you want a formula to display text, the text must be surrounded by double quotes.

In our formula, we need to show text in the form of "<" and a number based on the content in cell H2. This is done by typing = "<" & H2 in cell E2. In principle the formula should show only two different values, and when you have to do something like that you always have to separate the different values with an & symbol.

	A	B	C	D	E	F
1						
2		Title	protagonist	Language	Year	Play mine in min
3		Der Untergang	Bruno Ganz	Deutch	2004	150
4		Flashing lights	Søren Pilmark	Danish	2000	109
5		Middle of the night	Kim Larsen	Danish	1984	131
6		Scarface	Al Pachino	English	1893	170
7		The hunt for red October	Sean Connery	English	1990	137

Figure 70: The Filter with a slightly more advanced formula. Again, notice the Formula Bar.

When you write a formula where you use the & symbol to display multiple values in succession, Excel will always consider the result as a piece of text. One would expect that to cause problems when we want to filter according to numbers, but in this case Excel is clever enough to figure out what you mean.

6.3 Sorting

Of course you can also sort by the various columns in the table. Like so much else in Excel, there is a simple and a complicated way of doing so.

We are working with the same table that we used when we were working with filters. But since we do not need filters anymore, I have deleted the top four rows in order to save a little space. You can do the same if you want, but it is not required.

First we will sort the list so the films appear in alphabetical order

1. Make one of the cells in the column "Title" the active one.
2. Ensure the **Data** Tab has been selected in the Ribbon
3. Click on the **Sort A–Z** button to sort in ascending order.

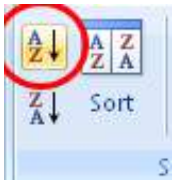


Figure 71: The **Sort A–Z** button.

Now the list has been sorted alphabetically.

	A	B	C	D	E	F
1						
2		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
3		Middle of the night	Kim Larsen	Danish	1984	131
4		Flashing lights	Søren Pilmark	Danish	2000	109
5		Der Untergang	Bruno Ganz	Deutch	2004	150
6		Scarface	Al Pachino	English	1893	170
7		The hunt for red October	Sean Connery	English	1990	137

Figure 72: The table has been sorted according to title.

That was the simplest method for sorting. But you can also sort multiple columns at once, by ranking columns according to what must be sorted first.

In the following exercise we want to sort by language first, then by year.

4. Activate one of the cells in the table. It does not matter which one you choose.
5. Click on the **Data** Tab in the Ribbon, then click on the **Sort** button.

A dialog box appears, where you must specify which columns you want sorted, and what level each column should be sorted by in relation to each other.

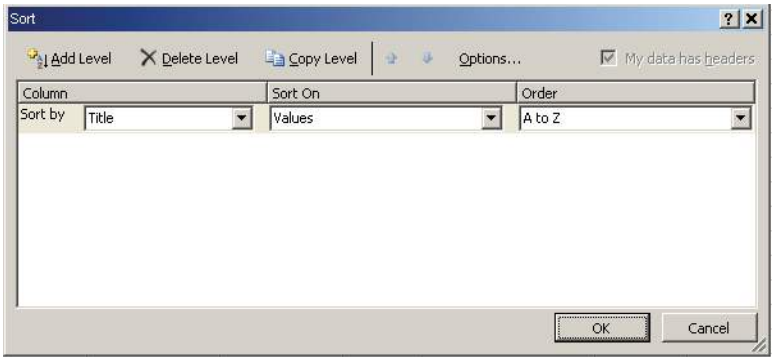


Figure 73: The dialog box "Sort".

6. In Figure 73 you can see what you must choose. You should sort the column "Language", according to values in ascending order
7. Click on the **Add Level** button to specify another sorting level.

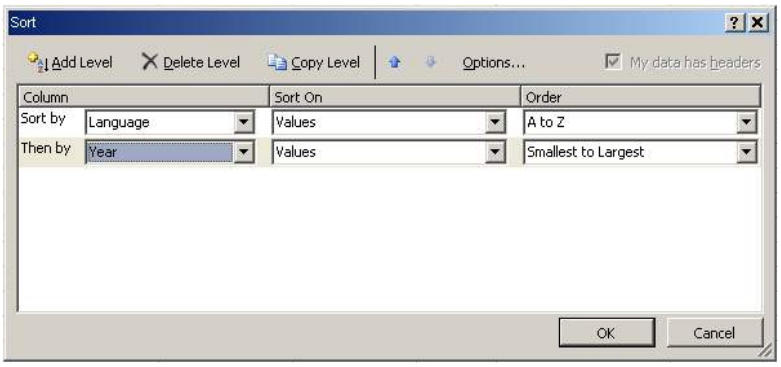


Figure 74: The second sorting level is being defined.

8. Choose as shown in Figure 74 and click **OK**.

The table now looks like this:

	A	B	C	D	E	F
1						
2		**Title**	**protagonist**	**Language**	**Year**	**Play mine in min**
3		Middle of the night	Kim Larsen	Danish	1984	131
4		Flashing lights	Søren Pilmark	Danish	2000	109
5		Der Untergang	Bruno Ganz	Deutch	2004	150
6		Scarface	Al Pachino	English	1893	170
7		The hunt for red October	Sean Connery	English	1990	137

Figure 75: The table has been sorted by language and year.

The Films have now been sorted by language and year.

You have now learned the basics about filtering and sorting tables. Now we need to try some slightly more advanced features, since it goes without saying that Excel can perform calculations on such a table as well.

6.4 Pivot Tables

To "Pivot" means something like "turning around a centre." In Excel we use pivot tables to do some sophisticated summaries and calculations on an existing table. You are able to very quickly analyse different things from different perspectives. That is probably why Microsoft has chosen to call them "pivot tables".

We will continue working with our movie file, where we will now make some quick calculations with a pivot table.

1. Make one of the cells in the table the active one. Another Tab will appear in the Ribbon called **Design**.
2. Click on the **Design** Tab in the Ribbon.
3. Click on the **Summarize With Pivot Table** Tab in the Ribbon.

Figure 76: The **Summarize with Pivot Table** Tab.

4. Leave the settings as they are and click **OK**.

Now we have created an empty pivot table and are ready to feed it information. But first, we have to take a look at the pivot table's work range.

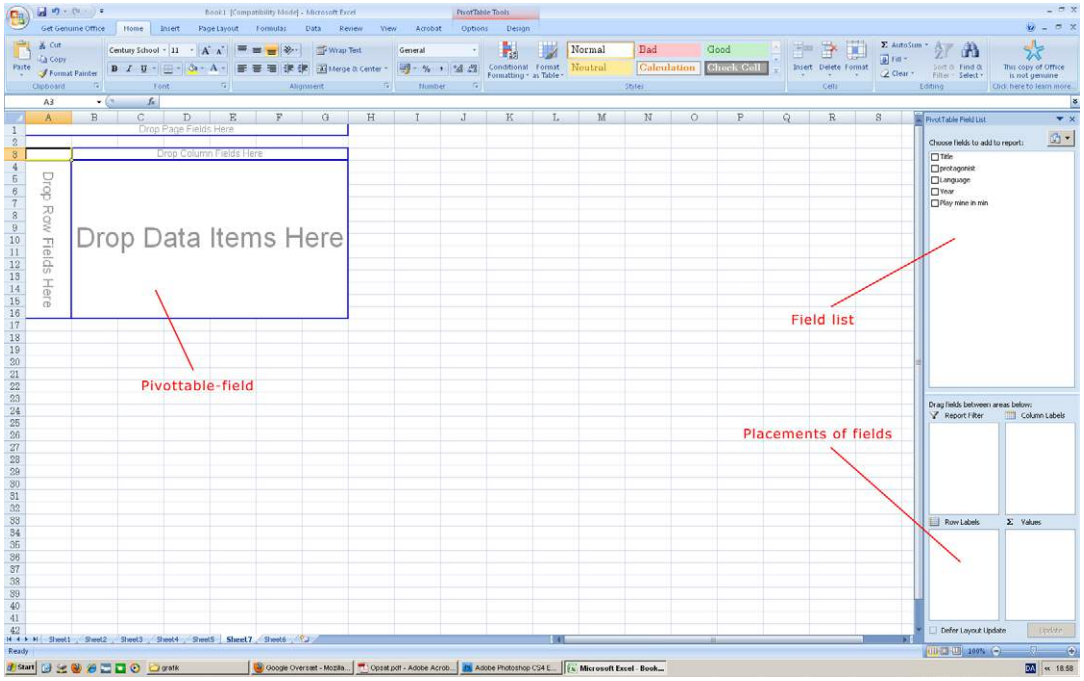


Figure 77: Work area when working with pivot tables.

The work area consists of three essential elements:

- The actual pivot table that shows the result of our choices.
- A field list, where we choose what data to use in the pivot table. When we work with pivot tables a "field" corresponds to a column in the table that we pull data from. The field list contains the equivalent to the columns in our directory.
- An area for placement of fields from the field list. The pivot table's look and performance depends on how we place the fields in these four windows. Fields to be placed in the window "Column Labels" will form a number of columns in the pivot table corresponding to different values in the table. The same is the case for the series labels. Fields to be placed in the window "Values" will be the cells used for calculations in the pivot table. Finally, there is the pane "Report Filter". It can be used for selecting data from the table based on various criteria.

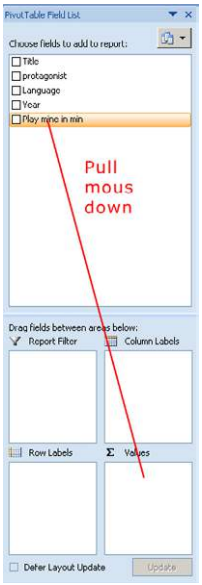


Figure 78: Drag using the mouse.

To make calculations, we must drag some fields from the field list to the area for placement of fields.

5. Point to the field **Running Time In Minutes** in the field list.
6. Click with the left mouse button and hold it down while dragging the field down to the **Values** pane. Now, release the mouse button. Refer to Figure 78.

The pivot table now displays the sum of the running times for all movies in the directory.

We could also have done that using a simple formula, so let us try something a bit more advanced.

7. Drag the **Language** field into the "Row Labels" pane.

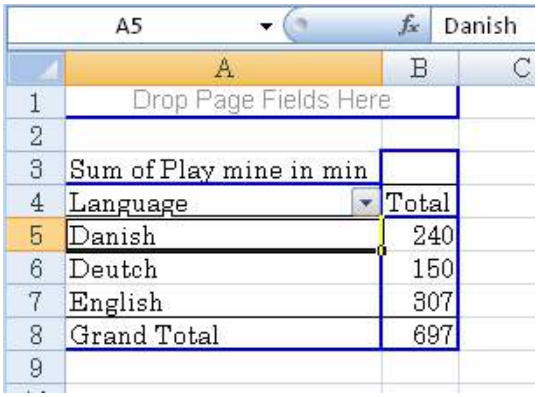


Figure 79: Total running time for each language.

Now you have a sum of running times for each language. Do you see the trick?

Of course, Excel can do more than calculating sums. You can also get the number of movie titles, or you can calculate averages, running sums, and even standard deviation and variance, if you need it

8. Double-click on cell B3, which is the column label "Sum of running time in minutes."

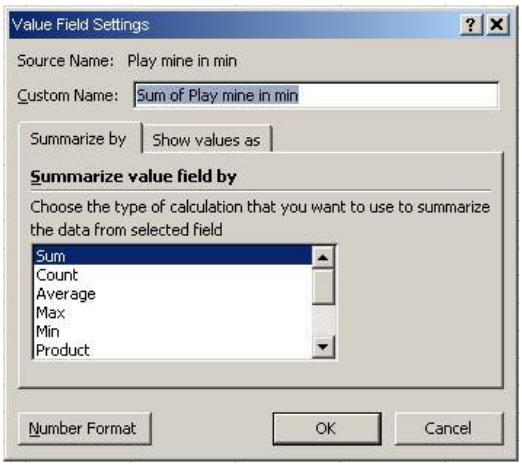


Figure 80: Settings for the value field.

A dialog box appears (Figure 80), where you can choose what the pivot table should do about the numbers. You can change what should be in the column label, and you can select what should be counted out. There is also the option to change number format by clicking the **Number Format** button

9. Click **Number** on the list, and then **OK**.

Now the pivot table shows that we have two Danish, two English and a German film in our directory. In this context, it does not matter if we have used the field "Year" or any other field. With the "Number" feature Excel simply notes that there is a value, and counts it as 1.

10. Drag the field **Year** from the field list into the "Column Labels" pane.

	A	B	C	D	E	F	G
1	Drop Page Fields Here						
2							
3	Count of Play mine in min	Year					
4	Language	1893	1984	1990	2000	2004	Grand Total
5	Danish		1		1		2
6	Deutch					1	1
7	English	1		1			2
8	Grand Total	1	1	1	1	1	5

Figure 81: Now the years have become column labels.

You now have an overview of how many movies you have in each language from different years. The pivot table automatically inserts totals to the right and bottom. Maybe that is not the best way to display it, so it is fortunate that we can have multiple row and column headings at the same time.

11. Drag the field **Year** down into the Column "labels" pane. Thus there will be two fields in this pane, and **Year** will disappear from the "Column Labels" pane.

It now looks like this:

	A	B	C
1			
2			
3	Sum of Play mine in min		
4	Language	Year	Total
5	Danish	1984	131
6		2000	109
7	Deutch	2004	150
8	English	1893	170
9		1990	137
10	Grand Total		697

Figure 82: Two column labels.

Be aware that labels are tiered. In the pane "Row Labels" you have **language** at the top, and so the pivot table will group data by language first, then year. By default Excel inserts a "Subtotal" of the overall levels. For example, it says "2" next to the "English" label. This is very smart, but it can also be a problem if later you need to work with data elsewhere. You can omit the subtotals by clicking the right mouse button on one of the labels (e.g. cell A7) and click on **Subtotal for "Language".**

	A	B	C
1			
2			
3	Sum of Play mine in min		
4	Language	Year	Total
5	⊟Danish	1984	131
6		2000	109
7	Danish Total		240
8	⊟Deutch	2004	150
9	Deutch Total		150
10	⊟English	1893	170
11		1990	137
12	English Total		307
13	Grand Total		697
14			

Figure 83: Pivot table with report filter.

As is the case with row labels, you can also have column labels in several levels. My experience is that it is only something you should do in an emergency, as it tends to get confusing. You can also drag multiple values into the "Values" window, but I believe you would find that quite unmanageable. It is better to make an extra pivot table or to use the kind of filters I will describe for you next

Notice that there is a small button in cell A3. By using that you can create a filter exactly like an AutoFilter in a common table. If you want to, you can experiment with it yourself.

There is also another filter option for pivot tables.

12. Drag the field **Protagonist** down into the pane "Report Filter".

Now an extra filter is placed on the pivot table.

13. Click on the button B1 and choose **Al Pacino**.

This will ensure that only data in which Al Pacino is the protagonist will be displayed. In this case it is only one film.

6.4.1 Preserving Results

Once you have set up a pivot table and used some filters, you might want to preserve the calculation that you made, even if you also want to continue working with the pivot table. You can copy the pivot table to another location, so you have two pivot tables to work with. You can also, once you have copied the table to the clipboard, choose to insert the table somewhere else as "values". This clears it of all pivot functionality, and it can be treated as pure data with no risk of further changes.

6.4.2 A Couple of Tips on Pivot Tables

Pivot tables are an excellent tool for analysing and summarising large amounts of data, but you can also quickly lose track if you "bury" the table in too many labels on several levels.

It is a good idea to take small steps when you build a PivotTable. Start with the value field and then insert some row labels. Finally insert the column labels. This is the approach that best ensures that you have an overview of the table throughout the construction phase

Consider what should be row labels and what should be column labels before you begin. A field with many different values will provide as many labels, while a field that can have only three different values will only create three labels.

In my experience it is best to use fields with few values as column labels and let the fields with many values be row labels. If you have many column labels, the table quickly becomes very wide and thus confusing.

If you need to do a complex pivot table where you have to have labels at multiple levels, you may wish to consider the use of filters. Otherwise, you can decide whether it is better to make two different pivot tables that are manageable in isolation, instead of one big confusing table.