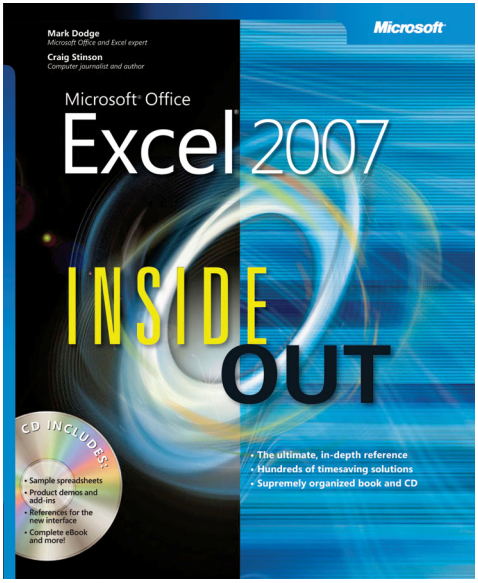

Microsoft® Office Excel® 2007 Inside Out

Mark Dodge and Craig Stinson

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Table of Contents

CHAPTER 22

Analyzing Data with PivotTable Reports

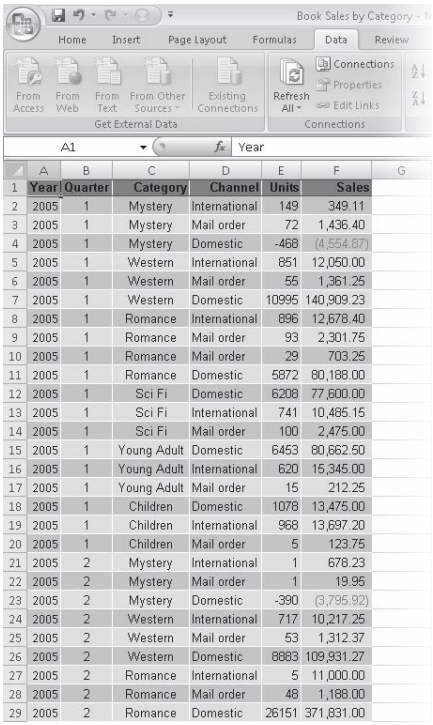
A PivotTable report is a special kind of table that summarizes information from selected fields of a data source. The source can be a Microsoft Office Excel 2007 list, a relational database file, an Online Analytical Processing (OLAP) cube, or multiple *consolidation ranges* (multiple ranges containing similar data, which the PivotTable can assemble and summarize). When you create a PivotTable, you specify which fields you're interested in, how you want the table organized, and what kinds of calculations you want the table to perform. After you build the table, you can rearrange it to view your data from alternative perspectives. This ability to "pivot" the dimensions of your table—for example, to transpose column headings to row positions—gives the PivotTable its name and its analytical power.

Introducing PivotTables

PivotTables are linked to the data from which they're derived. If the PivotTable is based on external data (data stored outside Excel), you can choose to have it refreshed at regular time intervals, or you can refresh it whenever you want.

Figure 22-1 shows Books.xlsx, a list of sales figures for a small publishing firm. The list is organized by year, quarter, category, distribution channel, units sold, and sales receipts. The data spans a period of eight quarters (2005 and 2006). The firm publishes six categories of fiction (Mystery, Western, Romance, Sci Fi, Young Adult, and Children) and uses three distribution channels—domestic, international, and mail order. It's difficult to get useful summary information by looking at a list like this, even though the list itself is well organized.

You'll find the Books.xlsx file in the Sample Files section of the companion CD.



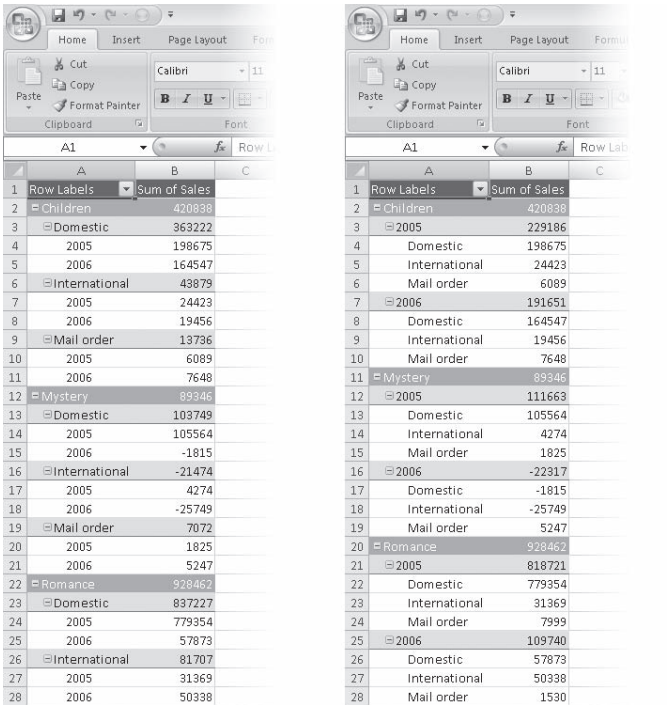
	A	B	C	D	E	F	G
1	Year	Quarter	Category	Channel	Units	Sales	
2	2005	1	Mystery	International	149	349.11	
3	2005	1	Mystery	Mail order	72	1,436.40	
4	2005	1	Mystery	Domestic	-468	(4,554.87)	
5	2005	1	Western	International	851	12,050.00	
6	2005	1	Western	Mail order	55	1,361.25	
7	2005	1	Western	Domestic	10995	140,909.23	
8	2005	1	Romance	International	896	12,678.40	
9	2005	1	Romance	Mail order	93	2,301.75	
10	2005	1	Romance	Mail order	29	703.25	
11	2005	1	Romance	Domestic	5872	80,188.00	
12	2005	1	Sci Fi	Domestic	6208	77,600.00	
13	2005	1	Sci Fi	International	741	10,485.15	
14	2005	1	Sci Fi	Mail order	100	2,475.00	
15	2005	1	Young Adult	Domestic	6453	80,662.50	
16	2005	1	Young Adult	International	620	15,345.00	
17	2005	1	Young Adult	Mail order	15	212.25	
18	2005	1	Children	Domestic	1078	13,475.00	
19	2005	1	Children	International	968	13,697.20	
20	2005	1	Children	Mail order	5	123.75	
21	2005	2	Mystery	International	1	678.23	
22	2005	2	Mystery	Mail order	1	19.95	
23	2005	2	Mystery	Domestic	-390	(3,795.92)	
24	2005	2	Western	International	717	10,217.25	
25	2005	2	Western	Mail order	53	1,312.37	
26	2005	2	Western	Domestic	8883	109,931.27	
27	2005	2	Romance	International	5	11,000.00	
28	2005	2	Romance	Mail order	48	1,188.00	
29	2005	2	Romance	Domestic	26151	371,831.00	

Figure 22-1 It's difficult to see the bottom line in a flat list like this; turning the list into a PivotTable will help.

Figures 22-2 through 22-4 show several ways you can transform this flat table into PivotTables that show summary information at a glance.

The example on the left in Figure 22-2 breaks the data down first by category, second by distribution channel, and finally by year, with the total sales at each level displayed in column B. Looking at this table, you can see (among many other details) that the Children category generated domestic sales of $363,222, with more revenue in 2005 than in 2006.

In the example on the right in Figure 22-2, the per-category data is broken out first by year and then by distribution channel. The data is the same; only the perspective is different.



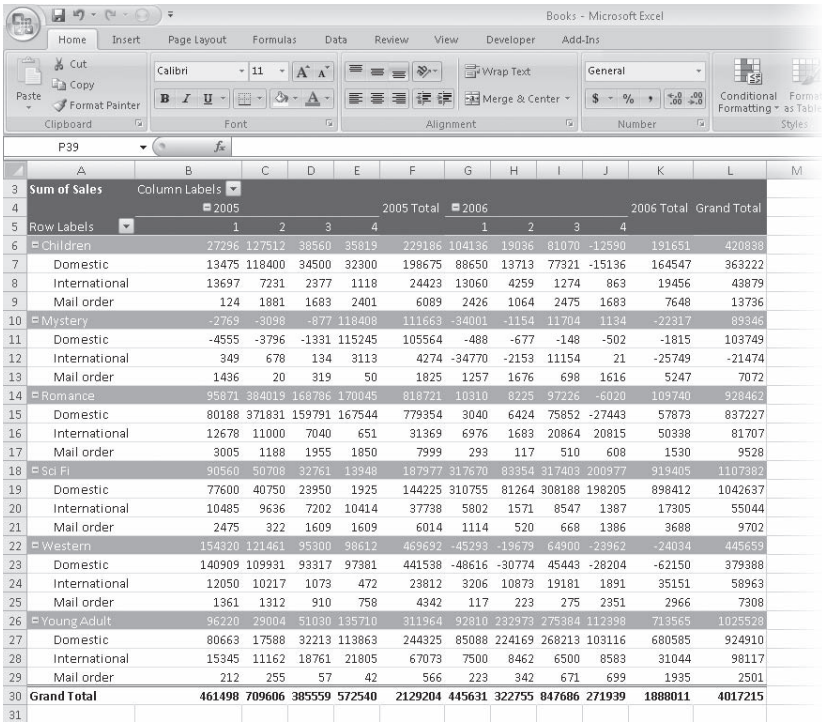
Row Labels	Sum of Sales
Children	420838
Domestic	363222
2005	198675
2006	164547
International	43879
2005	24423
2006	19456
Mail order	13736
2005	6089
2006	7648
Mystery	89346
Domestic	103749
2005	105564
2006	-1815
International	-21474
2005	4274
2006	-25749
Mail order	7072
2005	1825
2006	5247
Romance	928462
Domestic	837227
2005	779354
2006	57873
International	81707
2005	31369
2006	50338

Row Labels	Sum of Sales
Children	420838
2005	229186
Domestic	198675
International	24423
Mail order	6089
2006	191651
Domestic	164547
International	19456
Mail order	7648
Mystery	89346
2005	111663
Domestic	105564
International	4274
Mail order	1825
2006	-22317
Domestic	-1815
International	-25749
Mail order	5247
Romance	928462
2005	818721
Domestic	779354
International	31369
Mail order	7999
2006	109740
Domestic	57873
International	50338
Mail order	1530

Figure 22-2 These two PivotTables provide summary views of the information in Figure 22-1.

Both the PivotTables shown in Figure 22-2 are single-axis tables. That is, we've generated a set of row labels (Children, Mystery, Romance, and so on) and set up outline entries below these labels. (And, by default, Office Excel 2007 displays outline controls beside all the headings, so we can collapse or expand the headings to suit our needs.)

Figure 22-3 shows a more elaborate PivotTable that uses two axes. Along the row axis, we have categories broken out by distribution channel. Along the column axis, we have years (2005 and 2006). And we added the quarterly detail (not included in the Figure 22-2 examples) so we can see how each category in each channel did each quarter of each year. With four *dimensions* (category, distribution channel, year, and quarter) and two axes (row and column), we have a lot of choices about how to arrange the furniture. Figure 22-3 shows only one of many possible permutations.

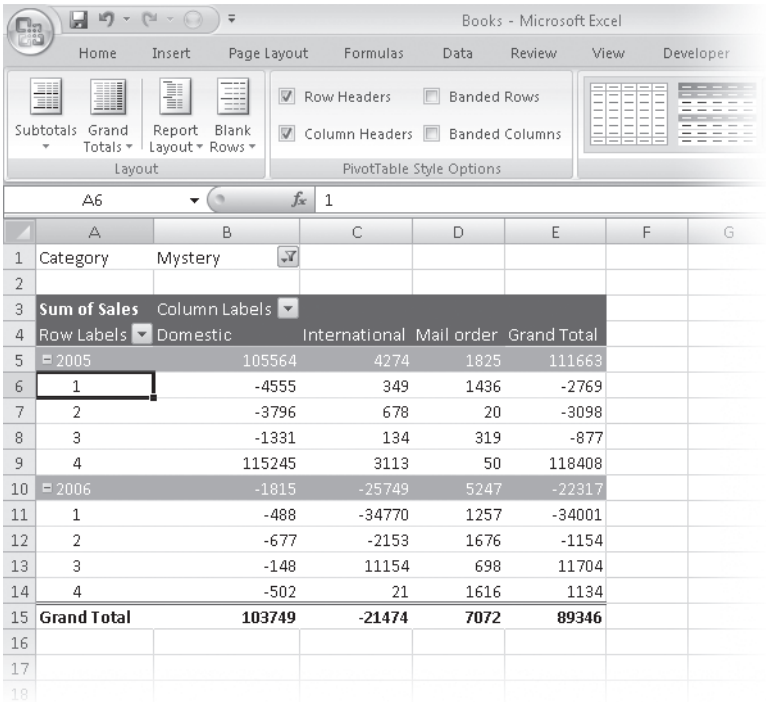


	A	B	C	D	E	F	G	H	I	J	K	L	M
3	**Sum of Sales**	Column Labels											
4		2005				2005 Total	2006				2006 Total	Grand Total	
5	Row Labels	1	2	3	4		1	2	3	4			
6	Children	27296	127512	38560	35819	229186	104136	19036	81070	-12590	191651	420838	
7	Domestic	13475	118400	34500	32300	198675	88650	13713	77321	-15136	164547	363222	
8	International	13697	7231	2377	1118	24423	13060	4259	1274	863	19456	43879	
9	Mail order	124	1881	1683	2401	6089	2426	1064	2475	1683	7648	13736	
10	Mystery	-2769	-3098	-877	118408	111663	-34001	-1154	11704	1134	-22317	89346	
11	Domestic	-4555	-3796	-1331	115245	105564	-488	-677	-148	-502	-1815	103749	
12	International	349	678	134	3113	4274	-34770	-2153	11154	21	-25749	-21474	
13	Mail order	1436	20	319	50	1825	1257	1676	698	1616	5247	7072	
14	Romance	95871	384019	168786	170045	818721	10310	8225	97226	-6020	109740	928462	
15	Domestic	80188	371831	159791	167544	779354	3040	6424	75852	-27443	57873	837227	
16	International	12678	11000	7040	651	31369	6976	1683	20864	20815	50338	81707	
17	Mail order	3005	1188	1955	1850	7999	293	117	510	608	1530	9528	
18	Sci Fi	90560	50708	32761	13948	187977	317670	83354	317403	200977	919405	1107382	
19	Domestic	77600	40750	23950	1925	144225	310755	81264	308188	198205	898412	1042637	
20	International	10485	9636	7202	10414	37738	5802	1571	8547	1387	17305	55044	
21	Mail order	2475	322	1609	1609	6014	1114	520	668	1386	3688	9702	
22	Western	154320	121461	95300	98612	469692	-45293	-19679	64900	-23962	-24034	445659	
23	Domestic	140909	109931	93317	97381	441538	-48616	-30774	45443	-28204	-62150	379388	
24	International	12050	10217	1073	472	23812	3206	10873	19181	1891	35151	58963	
25	Mail order	1361	1312	910	758	4342	117	223	275	2351	2966	7308	
26	Young Adult	96220	29004	51030	135710	311964	92810	232973	275384	112398	713565	1025528	
27	Domestic	80663	17588	32213	113863	244325	85088	224169	268213	103116	680585	924910	
28	International	15345	11162	18761	21805	67073	7500	8462	6500	8583	31044	98117	
29	Mail order	212	255	57	42	566	223	342	671	699	1935	2501	
30	**Grand Total**	**461498**	**709606**	**385559**	**572540**	**2129204**	**445631**	**322755**	**847686**	**271939**	**1888011**	**4017215**	
31													

Figure 22-3 In this PivotTable, we've rearranged the data along two axes—rows and columns.

Figure 22-4 presents a different view. Now the distribution channels are arrayed by themselves along the column axis, while the row axis offers years broken out by quarters. The category, meanwhile, has been moved to what you might think of as a page axis. The data has been filtered to show the numbers for a single category, Mystery, but by using the filter control at the right edge of cell B2, we could switch the table to a different category (or combination of categories). Filtering the Category dimension by one category after another would be like flipping through a stack of index cards.

None of these tables required more than a few clicks to generate.



	A	B	C	D	E	F	G
1	Category	Mystery					
2							
3	**Sum of Sales**	Column Labels					
4	Row Labels	Domestic	International	Mail order	Grand Total		
5	⊟2005	105564	4274	1825	111663		
6	1	-4555	349	1436	-2769		
7	2	-3796	678	20	-3098		
8	3	-1331	134	319	-877		
9	4	115245	3113	50	118408		
10	⊟2006	-1815	-25749	5247	-22317		
11	1	-488	-34770	1257	-34001		
12	2	-677	-2153	1676	-1154		
13	3	-148	11154	698	11704		
14	4	-502	21	1616	1134		
15	**Grand Total**	**103749**	**-21474**	**7072**	**89346**		
16							
17							

Figure 22-4 This PivotTable presents a "filtered" view, confining the report to a single category.

Creating a PivotTable

You can create a PivotTable from either an Excel range or an external data source. If you're working from an Excel range, your data should meet the criteria for a well-constructed list. That is, it should have column labels at the top (the headings will become field names in the PivotTable), each column should contain a particular kind of data item, and you should not have any blank rows within the range. If the range includes summary formulas (totals, subtotals, or averages, for example), you should omit them from the PivotTable; the PivotTable will perform its own summary calculations.

For information about connecting to and querying external data sources, see Chapter 23, "Working with External Data."

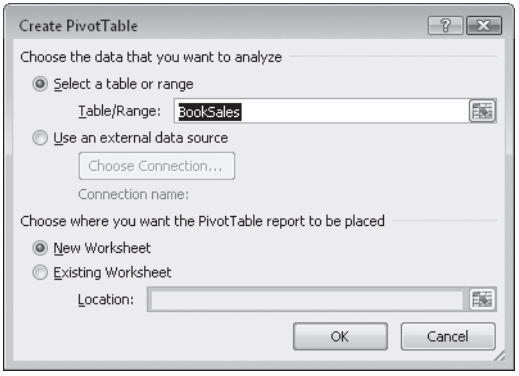
The source range on your Excel worksheet can be a table (as described in Chapter 21, "Managing Information in Tables") or an ordinary list. Starting from a table has the advantage of allowing for expansion. When you create a PivotTable from a table, Excel references your source data by its table name (either a default name, such as Table1, or the name you assign to the table). If you add rows to a table, the table name automatically adjusts to encompass the new data, and hence your PivotTable stays in sync with the expanded source data.

For information about converting a list to a table, see "Creating a Table" on page 669.

To create a PivotTable, select a single cell within the source data and do either of the following:

- Click the Insert tab, and then click PivotTable (in the Tables group).
- If your source data is a table and you're currently on the Design tab under Table Tools, click Summarize With PivotTable (in the Tools group).

Either way, the Create PivotTable dialog box appears. If your source data has a name (we've assigned the name BookSales to the source table in our example), that name appears in the Table/Range box. Otherwise, Excel discerns the extent of your source data and presents a range reference in that box:



By default, your PivotTable arrives on a new worksheet, and that's generally a good arrangement. If you want it elsewhere, specify where in the Location box. After you click OK, Excel generates a blank table layout on the left side of the worksheet and displays the PivotTable Field List window on the right (see Figure 22-5). The PivotTable Field List window is docked at the right by default. You can make it wider or narrower by dragging the split bar on its left edge. You can also undock it or drag it across the worksheet and dock it on the left.

> **Note**
>
> If you want to work with only a subset of items in a field, you can filter the field before you add it to the table. If your data source is large, and particularly if the source is external, you can save some time by filtering in advance. (You can also filter fields after you have created the table, of course.) To filter a field before you add it to the table, select the field name in the PivotTable Field List window, and then click the arrow on the right. For more details, see "Filtering PivotTable Fields" on page 728.

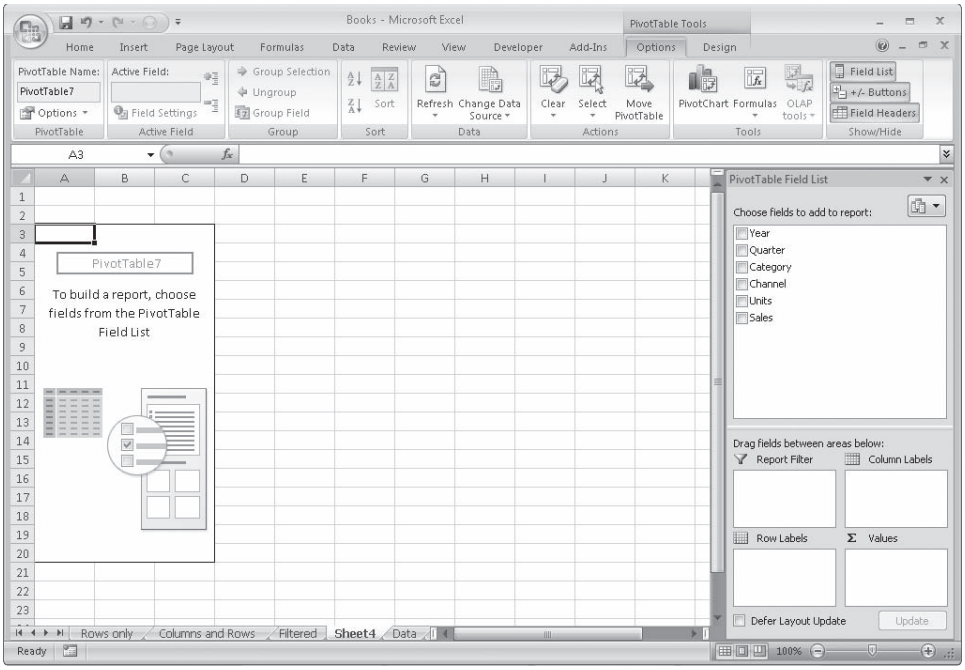


Figure 22-5 As you select the check boxes for fields in the PivotTable Field List window, Excel populates the table layout at the left side of the worksheet.

To put some fields and data on that blank layout, begin by selecting the check boxes for those fields in the Choose Fields To Add To Report area of the PivotTable Field List window. As you select fields, Excel positions them in the four boxes below. These four boxes represent the various components of the table. The Row Labels and Column Labels boxes hold the fields that will appear on the row and column axes. The Report Filter box holds the field (or fields) you want to use to filter the table (comparable to the Category field in Figure 22-4), and the Values box holds the field (or fields) you want to use for calculations—the data you're summarizing (your sales, for example).

Initially, Excel puts selected fields in default table locations that depend on their data types. Most likely you'll want some arrangement other than the one you get by default. That's not a problem, because you can move fields from one location to another easily; just drag them between the various boxes below the PivotTable Field List window. Let's look at an example.

To create the table shown in Figure 22-3, we want to put the Category and Channel fields in the Row Labels box, the Year and Quarter fields in the Column Labels box, and the Sales field in the Values box. When we select the check boxes for those fields, Excel drops the Category and Channel fields in the Row Labels box (because they are text fields) and the Sales field in the Values box (because it's a numeric field). These are all good guesses on the part of Excel—and, in fact, it's just what we want. In addition to

putting field headings in the appropriate boxes, Excel begins creating our PivotTable—as Figure 22-6 shows.

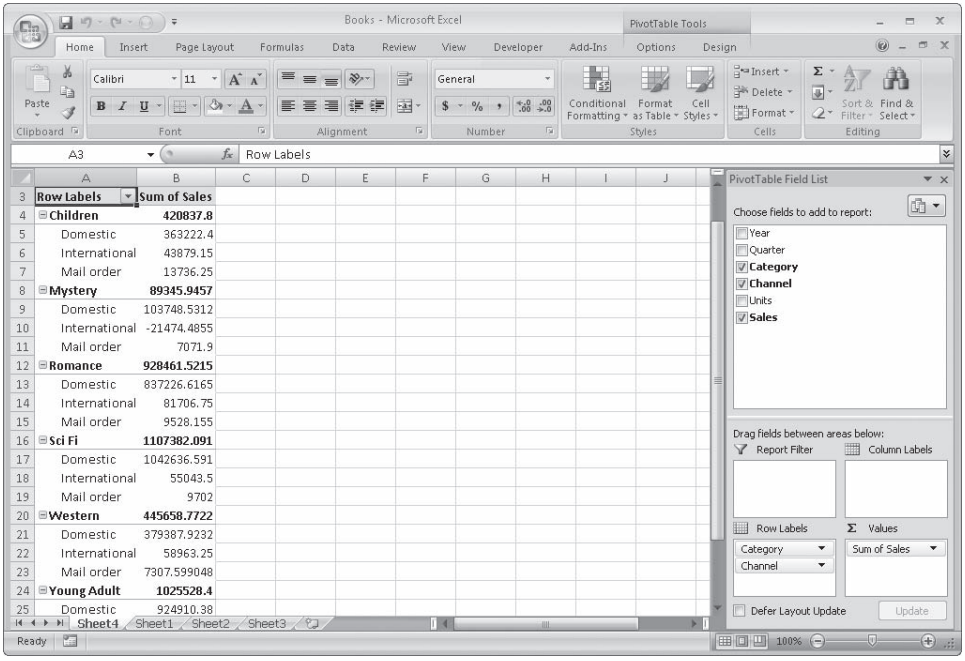


Figure 22-6 Excel builds the table, piece by piece, as you select fields.

So far, so good. The numeric formats aren't right, but we can fix that easily enough.

What remains is to put the Year and Quarter fields into the Column Labels box. Unfortunately, if we simply select their check boxes, Excel drops these fields in the Values box, because the fields are numbers and the program has a predilection for adding numbers. This (see Figure 22-7) is definitely not what we want.

The solution is simple: Select the check boxes for the Year and Quarter fields, and then drag the Sum of Quarter and Sum of Year headings from the Values box to the Column Labels box. (Alternatively, you can make sure your field headings go where you want them by dragging them directly from the Choose Fields To Add To Report box to the appropriate boxes below, disregarding the defaults.)

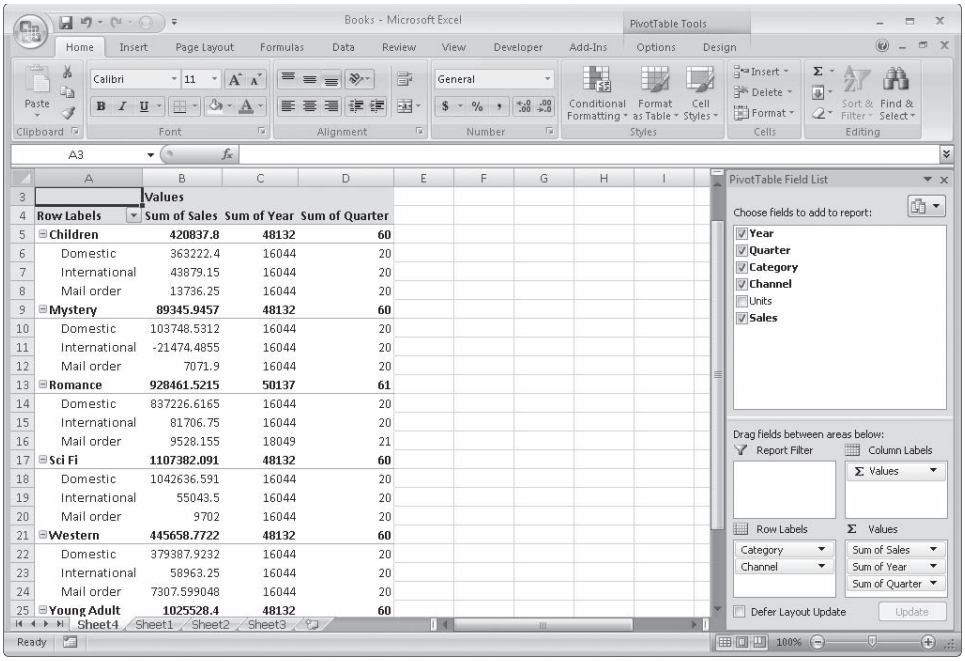
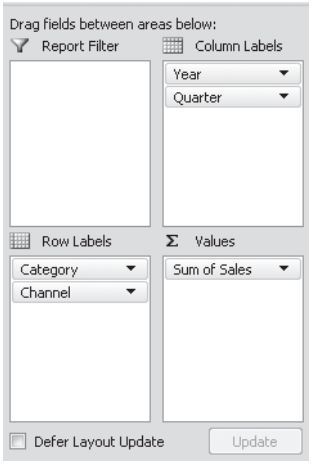


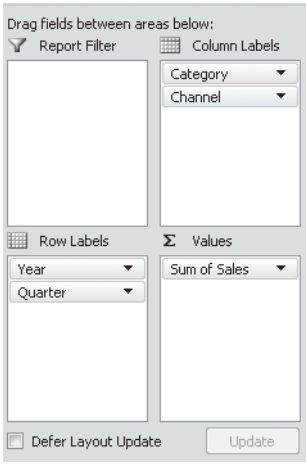
Figure 22-7 By default, Excel puts all numeric fields, including years and quarters, in the Values box. You can fix that by dragging field headings to the appropriate locations.

Rearranging PivotTable Fields

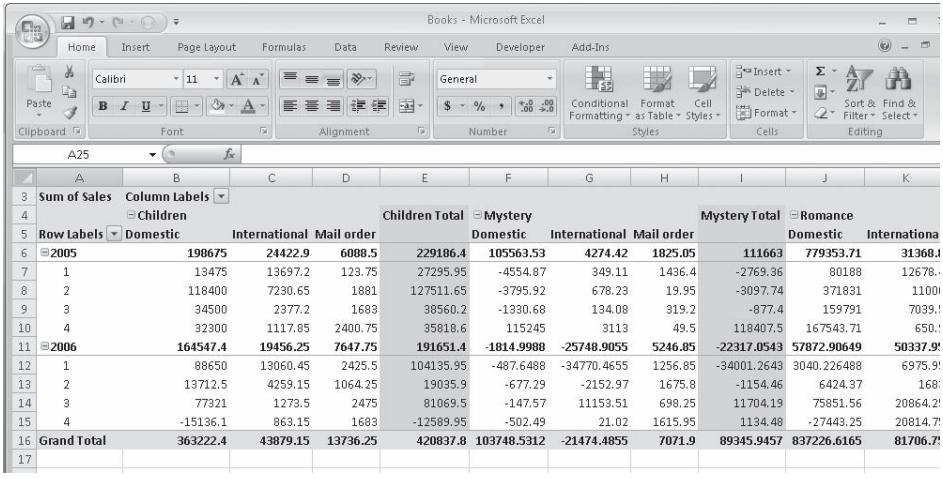
To pivot, or rearrange, a PivotTable, drag one or more field headings from one part of the PivotTable Field List window to another. For example, by using the mouse to change this configuration of the PivotTable Field List window:



to this one:



we can change the table from the form shown in Figure 22-3 to this:



Sum of Sales	Column Labels									
	Children			Children Total	Mystery			Mystery Total	Romance	
Row Labels	Domestic	International	Mail order		Domestic	International	Mail order		Domestic	International
2005	198675	24422.9	6088.5	229186.4	105563.53	4274.42	1825.05	111663	779353.71	31368.4
1	13475	13697.2	123.75	27295.95	-4554.87	349.11	1436.4	-2769.36	80188	12678.4
2	118400	7230.65	1881	127511.65	-3795.92	678.23	19.95	-3097.74	371831	11001
3	34500	2377.2	1683	38560.2	-1330.68	134.08	319.2	-877.4	159791	7039.5
4	32300	1117.85	2400.75	35818.6	115245	3113	49.5	118407.5	167543.71	650.5
2006	164547.4	19456.25	7647.75	191651.4	-1814.9988	-25748.9055	5246.85	-22317.0543	57872.90649	50337.95
1	88650	13060.45	2425.5	104135.95	-487.6488	-34770.4655	1256.85	-34001.2643	3040.226488	6975.95
2	13712.5	4259.15	1064.25	19035.9	-677.29	-2152.97	1675.8	-1154.46	6424.37	168
3	77321	1273.5	2475	81069.5	-147.57	11153.51	698.25	11704.19	75851.56	20864.25
4	-15136.1	863.15	1683	-12589.95	-502.49	21.02	1615.95	1134.48	-27443.25	20814.75
Grand Total	363222.4	43879.15	13736.25	420837.8	103748.5312	-21474.4855	7071.9	89345.9457	837226.6165	81706.75

Note

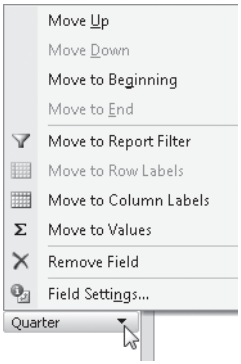
If you don't see the PivotTable Field List window, select a cell in the PivotTable (it disappears when your selection is not within the table). If you still don't see it, click the Options tab under PivotTable Tools on the Ribbon, and then click Field List. This button is a handy way to toggle the field list in and out of view, letting you reduce distraction when you don't need to do any field rearrangement.

INSIDE OUT

Pivot Your Tables the Excel 2003 Way If You Prefer

Earlier versions of Excel let you move fields around by dragging them directly on the table, instead of requiring you to work with the PivotTable Field List window. If you prefer that way of working, right-click any cell in the PivotTable, and click PivotTable Options. In the PivotTable Options dialog box, click the Display tab. Then select the Classic PivotTable Layout (Enables Dragging Of Fields In The Grid) check box. Note, however, that this option also changes the appearance of your table from the compact, outline-style presentation of Excel 2007 to the more space-consuming tabular style of earlier versions.

To rearrange fields within the same axis—for example to put Year before Quarter or Channel before Category in Figure 22-3, you can drag field headings from one place to another within the same area of the PivotTable Field List window. Often it's simpler to click the arrow to the right of the field heading you want to move. (For example, you might click the arrow to the right of Category in the Row Labels box.) The menu that appears includes easy-to-use positioning commands:



Refreshing a PivotTable

Because users often generate PivotTables from large volumes of data (and in many cases that data resides on external servers), Excel doesn't automatically update PivotTables when their source data changes. To refresh a PivotTable, right-click any cell within it, and click Refresh. Alternatively, under PivotTable Tools, click the Options tab, and then click Refresh in the Data group. Or, if you like keyboard shortcuts, press Alt+F5.

To ensure that your PivotTable is sorted whenever you open the file, click a cell within the table, click the Options tab under PivotTable Tools, and then click Options in the PivotTable group. In the PivotTable Options dialog box, click the Data tab. Then select the Refresh Data When Opening The File check box, and click OK.

Changing the Numeric Format of PivotTable Data

As Figure 22-6 shows, Excel initially displays numeric PivotTable data in the General format, regardless of how it's formatted in your source range. To fix that, right-click a cell in the field you want to change, and then click Number Format.

Choosing Report Layout Options

PivotTables in Excel 2007, by default, use a more compact presentation style than earlier versions used. This default layout (called Compact) indents inner fields on the row axis beneath their outer fields, letting you see more information at a glance. If you prefer, you can select from two alternative layouts, called Outline and Tabular. To switch from one layout to another, select a cell within the table, click the Design tab under PivotTable Tools, click Report Layout (in the Layout group), and then click one of the displayed layouts (Show In Compact Form, Show In Outline Form, or Show In Tabular Form). Figure 22-8 compares the three layout options.

Note that the layout options affect the row axis only. For example, the outline form simply indents the distribution channels below each category of book.

	A	B	C	D
3	Sum of Sales	Column Labels		
4		2005		
5	Row Labels	1	2	3
6	Children	27296	127512	38560
7	Domestic	13475	118400	34500
8	International	13697	7231	2377
9	Mail order	124	1881	1683
10	Mystery	-2769	-3098	-877
11	Domestic	-4		
12	International			
13	Mail order	1		

	A	B	C	D
3	Sum of Sales		Year	Quarter
4			2005	
5	Category	Channel	1	
6	Children		27296	1275
7		Domestic	13475	1184
8		International	13697	7
9		Mail order	124	1
10	Mystery		-2769	-3
11		Domestic		
12		International		
13		Mail order		

	A	B	C	D
3	Sum of Sales		Year	Quarter
4			2005	
5	Category	Channel	1	
6	Children	Domestic	13475	118
7		International	13697	7
8		Mail order	124	1
9	Children Total		27296	127
10	Mystery	Domestic	-4555	-3
11		International	349	
12		Mail order	1436	
13	Mystery Total		-2769	-3

Figure 22-8 Excel offers three PivotTable layout options: Compact (left), Outline (center), and Tabular (right).

Formatting a PivotTable

The Design tab that appears on the Ribbon under PivotTable Tools when you select any part of a PivotTable includes a large selection of professionally designed PivotTable styles. These work just like—and, in fact, are similar to—the styles available with ordinary tables. By choosing from the PivotTable Styles gallery, you can ensure that your PivotTable looks good and uses colors consistent with the rest of your workbook. You can customize the built-in style choices by selecting or clearing the check boxes in the PivotTable Style Options group, and you can add your own designs by clicking New PivotTable Style at the bottom of the PivotTable Styles gallery. To display the PivotTable Styles gallery, click the More button at the bottom of the scroll bar. (This button is a small arrow with a line above it.) For more information about using and customizing built-in styles, see "Formatting Tables" on page 705.

Customizing the Display of Empty or Error Cells

Empty cells in a PivotTable are usually displayed as empty cells. If you prefer, you can have your PivotTable display something else—a text value such as NA, perhaps—in cells that would otherwise be empty. To do this, right-click any cell in the PivotTable, and click PivotTable Options. On the Layout & Format tab in the PivotTable Options dialog box, select the For Empty Cells Show check box, and in the text box type the text or value that you want to see.

If a worksheet formula references a cell containing an error value, that formula returns the same error value. This is usually true in PivotTables as well. Error values in your source data propagate themselves into the PivotTable. If you prefer, you can have error values generate blank cells or text values. To customize this aspect of PivotTable behavior, right-click any cell in the PivotTable, and click PivotTable Options. On the Layout & Format tab in the PivotTable Options dialog box, select the For Error Values Show check box. Then, in the text box, type what you want to see.

Merging and Centering Field Labels

When you have two or more fields stacked either on the column axis or on the row axis of a PivotTable, centering the outer labels over the inner ones can sometimes improve the table's readability. Just right-click a PivotTable cell, click PivotTable Options, and then select the Merge And Center Cells With Labels check box on the Layout & Format tab in the PivotTable Options dialog box. With this option, you can change this kind of presentation:

to this:

Hiding Outline Controls

You'll probably find outline controls useful in some contexts and not in others. They're great when you have large or complex PivotTables and you want to be able to switch quickly from a details view to an overview. But if you find they clutter the picture instead of enhancing it, you can banish them easily: Select a PivotTable cell, click the Options tab under PivotTable Tools, and then click the +/− Buttons in the Show/Hide group.

> **Note**
>
> With outline controls suppressed, you can still expand and collapse field headings. Select a heading in the field you're interested in, click the Options tab under PivotTable Tools on the Ribbon, and then click Expand Entire Field or Collapse Entire Field in the Active Field group.

Hiding *Row Labels* and *Column Labels*

The headings *Row Labels* and *Column Labels* that Excel displays near the upper-left corner of your PivotTable may prove distracting at times. You can suppress them by selecting a PivotTable cell, clicking the Options tab under PivotTable Tools, and then clicking Field Headers in the Show/Hide group. Note, however, that removing these labels also removes their associated filter controls—and you might want those controls from time to time (see "Filtering PivotTable Fields" on page 728). The Field Headers command is a toggle. Click it again to restore the headings—and the filter controls.

> **Note**
>
> You can change the name of a PivotTable field or an item within a field by selecting any occurrence of it and typing the name you want. When you change one occurrence, all occurrences in the table change.

Displaying Totals and Subtotals

By default, Excel generates grand totals for all outer fields in your PivotTable using the same summary function as the body of the table. In Figure 22-3, for example, row 30 displays grand totals for each quarter of each year, as well as for the years themselves. Column L, meanwhile, displays per-category totals by channel. The intersection of column L and row 30 displays the grandest of totals, the sum of all sales for the period covered by the table. Because the body of the table uses the SUM function, all these grand totals do as well.

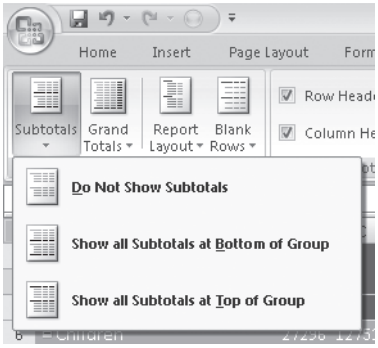
To remove grand totals from a PivotTable, right-click any cell in the table, and click PivotTable Options. On the Totals & Filters tab in the PivotTable Options dialog box, clear the Show Grand Totals For Rows check box, the Show Grand Totals For Columns check box, or both check boxes.

Naturally, PivotTables are not restricted to calculating sums. For other calculation options, see "Changing PivotTable Calculations" on page 731.

Customizing Subtotals

By default, Excel creates subtotals for all but the innermost fields. For example, in Figure 22-3, cell B6 displays the sum of cells B7:B9 (the Children subtotal for Quarter 1 of 2005), cell C10 displays the sum of cells C11:C13 (the Mystery subtotal for Quarter 2 of 2005), and so on. Columns F and K display yearly subtotals. The innermost fields, Channel (for the row axis) and Quarter (for the column axis), do not have subtotals.

To find options affecting all subtotals, select a cell in the PivotTable, click the Design tab under PivotTable Tools, and then click Subtotals on the left edge of the Ribbon:



You can use this menu to turn subtotaling off altogether or to move row-axis subtotals from their default position above the detail items to a position below.

To customize subtotals for a particular field, right-click an item in the field, and then click Field Options. (Alternatively, select an item in the field, click the Options tab under PivotTable Tools, and then click Field Settings in the Active Field group.) Figure 22-9 shows the Field Settings dialog box for the Category field in our example PivotTable.

The Automatic option on the Subtotals & Filters tab in this dialog box means—as Automatic means throughout Excel—you're letting the program decide what to do. In other words, this option gets the default behavior. You can turn off subtotals for the selected field by selecting None. Selecting Custom lets you change the default subtotal calculation, such as from Sum to Average. And, as the text above the function list suggests, you're not limited to one function. You can select as many as you need by holding down Ctrl while you click. Figure 22-10 shows a PivotTable with four subtotaling calculations applied to the Category field. (Note that when you have multiple subtotals for a field, Excel moves them below the detail.)

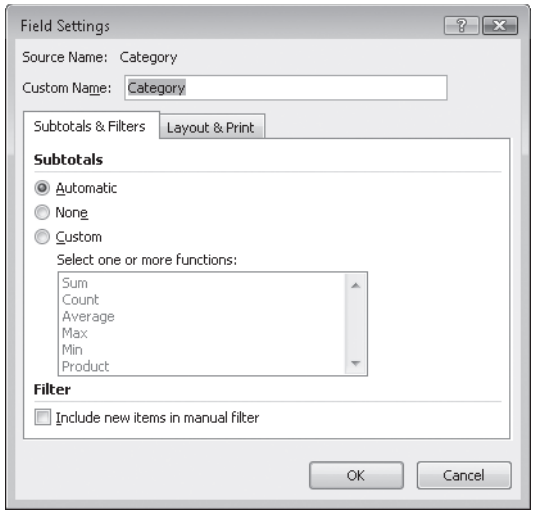


Figure 22-9 In the Field Settings dialog box, you can override the default subtotaling behavior for a particular field.

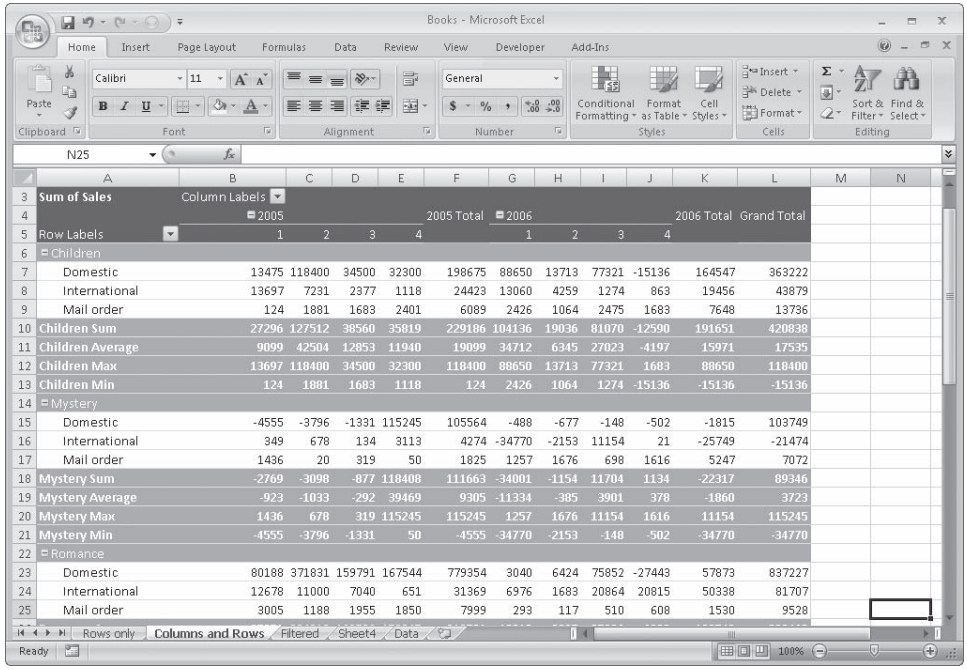


Figure 22-10 You can generate subtotals using more than one summary function; this table uses four for the Category field.

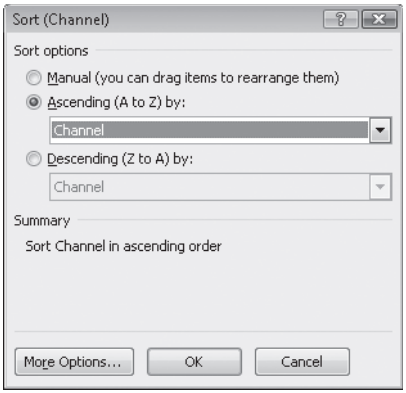
By using the Field Settings dialog box, you can also generate subtotals for innermost fields—subtotals that Excel usually does not display. Such inner subtotals appear at the bottom of the table (just above the grand total row) or at the right side of the table (just to the left of the grand total column). Figure 22-11 shows an example of inner-field subtotaling.

	A	B	C	D	E	F	G	H	I	J	K	L	M
3	**Sum of Sales**	Column Labels											
4		2005				2005 Total	2006				2006 Total	Grand Total	
5	Row Labels	1	2	3	4		1	2	3	4			
6	Children												
7	Domestic	13475	118400	34500	32300	198675	88650	13713	77321	-15136	164547	363222	
8	International	13697	7231	2377	1118	24423	13060	4259	1274	863	19456	43879	
9	Mail order	124	1881	1683	2401	6089	2426	1064	2475	1683	7648	13736	
10	Mystery												
11	Domestic	-4555	-3796	-1331	115245	105564	-488	-677	-148	-502	-1815	103749	
12	International	349	678	134	3113	4274	-34770	-2153	11154	21	-25749	-21474	
13	Mail order	1436	20	319	50	1825	1257	1676	698	1616	5247	7072	
14	Romance												
15	Domestic	80188	371831	159791	167544	779354	3040	6424	75852	-27443	57873	837227	
16	International	12678	11000	7040	651	31369	6976	1683	20864	20815	50338	81707	
17	Mail order	3005	1188	1955	1850	7999	293	117	510	608	1530	9528	
18	Sci Fi												
19	Domestic	77600	40750	23950	1925	144225	310755	81264	308188	198205	898412	1042637	
20	International	10485	9636	7202	10414	37738	5802	1571	8547	1387	17305	55044	
21	Mail order	2475	322	1609	1609	6014	1114	520	668	1386	3688	9702	
22	Western												
23	Domestic	140909	109931	93317	97381	441538	-48616	-30774	45443	-28204	-62150	379388	
24	International	12050	10217	1073	472	23812	3206	10873	19181	1891	35151	58963	
25	Mail order	1361	1312	910	758	4342	117	223	275	2351	2966	7308	
26	Young Adult												
27	Domestic	80663	17588	32213	113863	244325	85088	224169	268213	103116	680585	924910	
28	International	15345	11162	18761	21805	67073	7500	8462	6500	8583	31044	98117	
29	Mail order	212	255	57	42	566	223	342	671	699	1935	2501	
30	Domestic Sum	388280	654704	342440	528257	1913681	438429	294118	774869	230035	1737452	3651132	
31	International Sum	64605	49925	36587	37573	188689	1773	24694	67519	33560	127546	316235	
32	Mail order Sum	8614	4978	6532	6710	26834	5429	3942	5298	8344	23013	49847	
33	**Grand Total**	**461498**	**709606**	**385559**	**572540**	**2129204**	**445631**	**322755**	**847686**	**271939**	**1888011**	**4017215**	
34													

Figure 22-11 Subtotals for Channel, an inner field, appear in rows 30–32 of this table.

Sorting PivotTable Fields

You can sort a PivotTable field either by its own items (for example, alphabetizing the categories in Figure 22-11) or on the basis of values in the body of the table (for example, sorting categories in descending order of sales totals so the best-selling categories appear at the top). To sort a field, right-click any item in that field, and then click Sort. On the menu that appears, you can click Sort A To Z or Sort Z To A if you want to sort the field by its own items. If you want to sort the field by values in the body of the table, click More Sort Options. You'll see a dialog box similar to the one shown on the next page (with the name of the field you selected in the title of the dialog box).



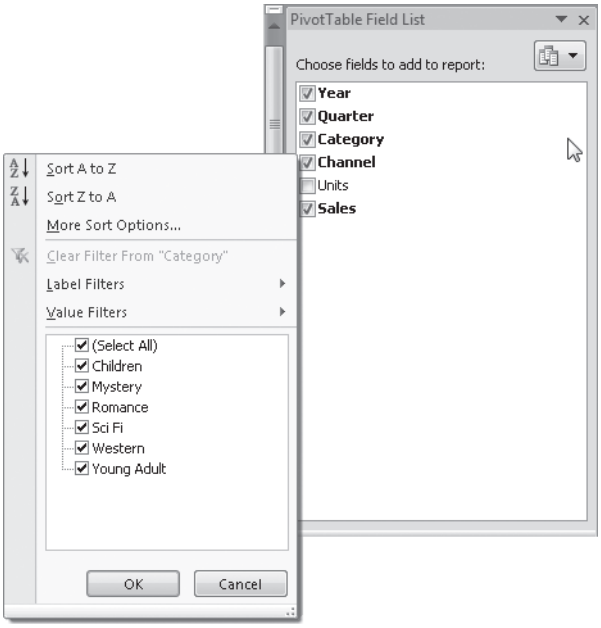
To sort by values in the table body instead of by items in the selected field, open the Ascending or Descending list. The list will include the available value fields.

> **Note**
>
> To ensure that Excel retains your sort specification when you update your PivotTable, click More Options in the dialog box shown above. Then select Sort Automatically Every Time The Report Is Updated.

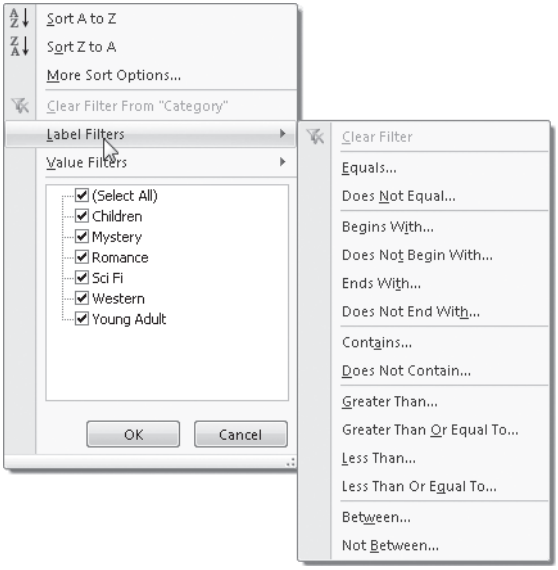
Filtering PivotTable Fields

Filtering a field lets you focus your table on a subset of items in that field. You can filter on the basis of the field's own content (only the Children and Young Adult categories, for example) or on the basis of values associated with the field (for example, the three categories with the best overall sales). You can apply filters either in the PivotTable Field List window or on the PivotTable. If you're working with a large external data source and you need only a subset of the data, you can save yourself some time by filtering in the PivotTable Field List window before you execute the query and create the table.

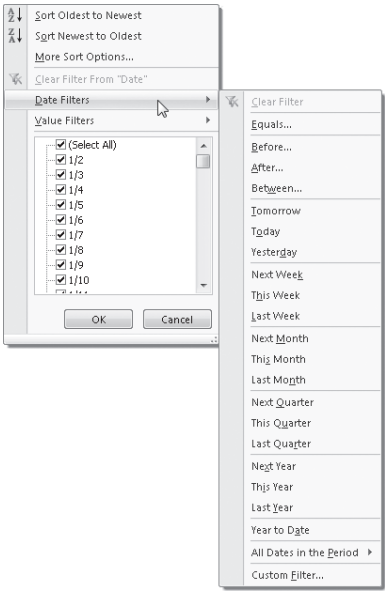
To filter in the PivotTable Field List window, select the heading for the field you want to filter, and then click the arrow to the right of the field heading. The dialog box that appears includes check boxes for each unique item in the selected field:



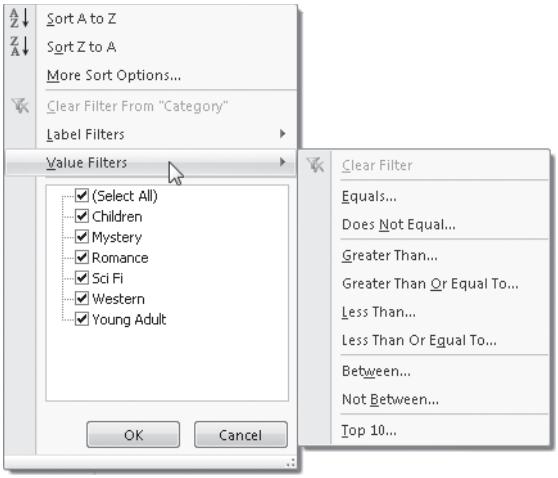
You can use the check boxes to select one or more particular items in your selected field. If your field is more complex than the example here, you might want to click Label Filters, in response to which Excel presents many additional filtering options:



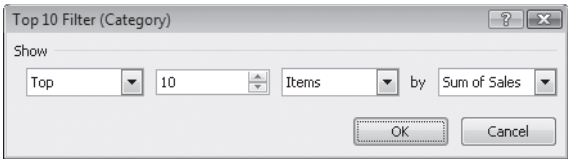
The options that appear on this menu are tailored for the data type of the selected field. If your field holds dates instead of text, for example, you will see these options:



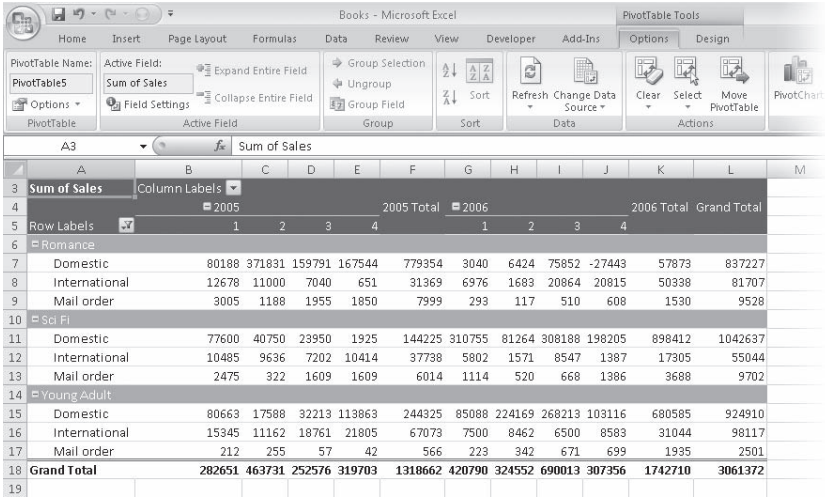
To filter a field on the basis of values associated with that field, click the arrow next to the field heading in the PivotTable Field List window, and then click Value Filters on the menu that appears. For example, to filter the PivotTable in Figure 22-3 so it shows only the three categories with the highest total sales, click the arrow beside Category, and then click Value Filters. In the Value Filters menu:



you would click Top 10, which would take you to the Top 10 Filter dialog box:



where you replace the 10 with a 3 and then click OK. Figure 22-12 shows the result.



	A	B	C	D	E	F	G	H	I	J	K	L	M
3	Sum of Sales	Column Labels											
4		2005				2005 Total	2006				2006 Total	Grand Total	
5	Row Labels	1	2	3	4		1	2	3	4			
6	Romance												
7	Domestic	80188	371831	159791	167544	779354	3040	6424	75852	-27443	57873	837227	
8	International	12678	11000	7040	651	31369	6976	1683	20864	20815	50338	81707	
9	Mail order	3005	1188	1955	1850	7999	293	117	510	608	1530	9528	
10	Sci Fi												
11	Domestic	77600	40750	23950	1925	144225	310755	81264	308188	198205	898412	1042637	
12	International	10485	9636	7202	10414	37738	5802	1571	8547	1387	17305	55044	
13	Mail order	2475	322	1609	1609	6014	1114	520	668	1386	3688	9702	
14	Young Adult												
15	Domestic	80663	17588	32213	113863	244325	85088	224169	268213	103116	680585	924910	
16	International	15345	11162	18761	21805	67073	7500	8462	6500	8583	31044	98117	
17	Mail order	212	255	57	42	566	223	342	671	699	1935	2501	
18	**Grand Total**	**282651**	**463731**	**252576**	**319703**	**1318662**	**420790**	**324552**	**690013**	**307356**	**1742710**	**3061372**	
19													

Figure 22-12 We filtered the table to show only the three best-selling categories.

Note that when you apply a value filter to a field, Excel bases its calculations on the current grand total associated with that field. If we wanted to see the three top-selling categories for the year 2005 (in the example shown in Figure 22-3), we would need to filter the Year field as well as the Category field.

Changing PivotTable Calculations

By default, Excel populates the Values area of your PivotTable by applying the SUM function to any numeric field you put there or by applying the COUNT function to any nonnumeric field. But you can choose from many alternative forms of calculation, and you can add your own calculated fields to the table.

Using a Different Summary Function

To switch to a different summary function, right-click any cell in the Values area of your PivotTable, and then click Value Field Settings. (Alternatively, click the Options tab under PivotTable Tools, and then click Field Settings in the Active Field group.) Excel displays the Value Field Settings dialog box, shown in Figure 22-13. Select the function you want from the Summarize Value Field By list, and then click OK.

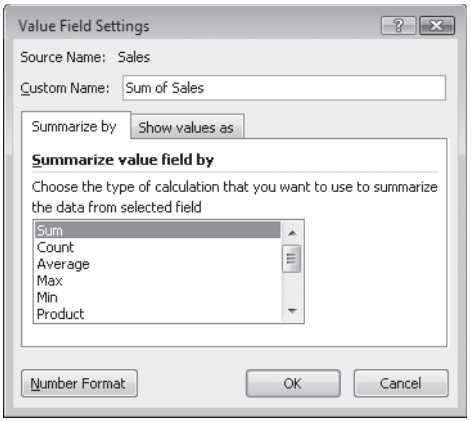


Figure 22-13 Using this dialog box, you can change the function applied to a field in the Values area of your PivotTable.

Excel fills in the Custom Name line in this dialog box according to your selection in the Summarize Value Field By list. If you switch from SUM to AVERAGE, for example, the Custom Name line changes to include the word *Average*. You can type whatever you like there, though.

Applying Multiple Summary Functions to the Same Field

You can apply as many summary functions as you want to a value field. To use a second or subsequent function with a field that's already in the Values area of your PivotTable, drag another copy of the field from the PivotTable Field List window into the Values box. Then select a Values area cell, return to the Value Field Settings dialog box, and select the function you want to use. The available functions are SUM, COUNT, AVERAGE, MAX, MIN, PRODUCT, COUNT NUMBERS, STDDEV, STDDEVP, VAR, and VARP.

Using Custom Calculations

In addition to the standard summary functions enumerated in the previous paragraph, Excel also offers a set of custom calculations. With these you can have each item in the Values area of your table report its value as a percentage of the total values in the same row or column, create running totals, or show each value as a percentage of some base value.

To apply a custom calculation, right-click a cell in the Values area, and then click Value Field Settings. Click the Show Values As tab in the Value Field Settings dialog box. Then select a calculation from the Show Values As list. Table 22-1 lists the available options.

When you select a calculation in the Show Values As list, the Base Field and Base Item boxes display choices that are relevant to your calculation. For example, as Figure 22-14 shows, if you select Difference From in our books example, the Base Field box displays Quarter, Category, Channel, and so on. If you select Quarter in this list, the Base

Item box presents the four quarters, along with the self-explanatory items (Previous) and (Next).

Table 22-1 Custom Calculation Options

Difference From	Displays data as a difference from a specified base field and base item
% Of	Displays data as a percentage of the value of a specified base field and base item
% Difference From	Displays data as a percentage difference from a specified base field and base item
Running Total In	Displays data as a running total
% Of Row	Displays each data item as a percentage of the total of the items in its row
% Of Total	Displays each data item as a percentage of the grand total of all items in its field
Index	Uses this formula: ((value in cell) * Grand Total of Grand Totals)) / ((Grand Row Total) * (Grand Column Total))

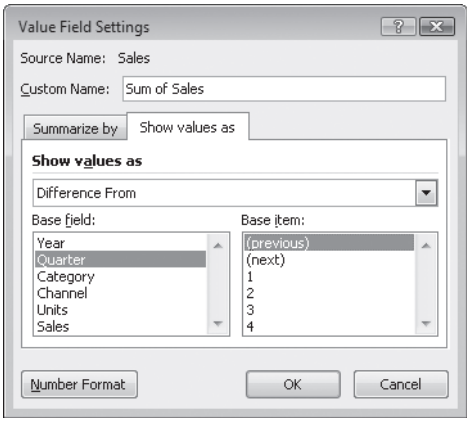
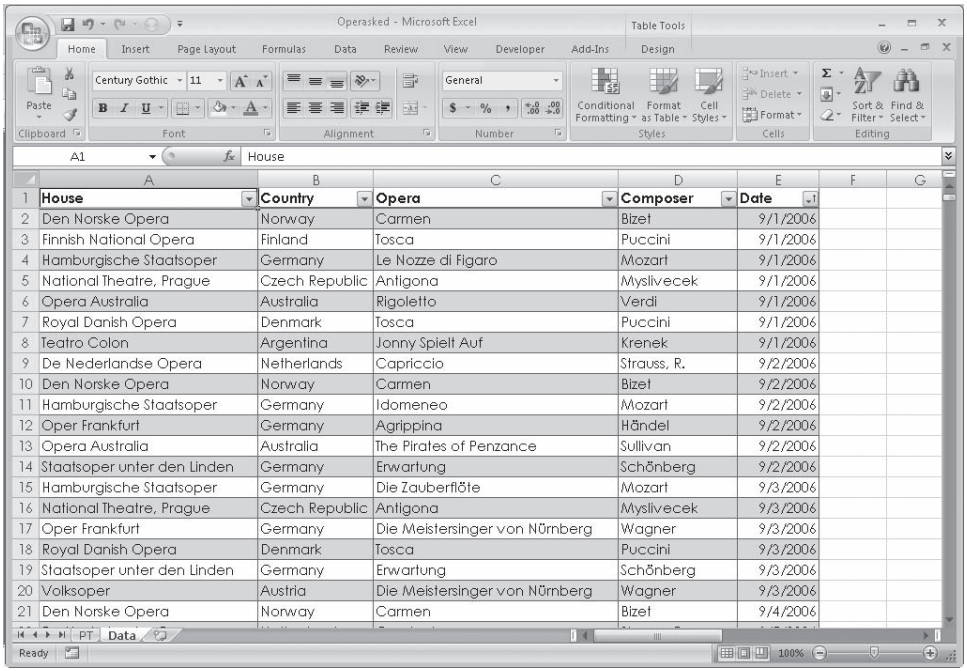


Figure 22-14 When you choose a calculation such as Difference From, the Base Field and Base Item boxes display relevant options.

Figure 22-15 and Figure 22-16 illustrate some ways you can modify default calculations and Values field names. The table in Figure 22-15 lists 2006–2007 performances at major opera houses around the world by theater, country, opera, composer, and performance date. The PivotTable in Figure 22-16 includes the Date field twice in the Values box. The default summary calculation for date data is Count, and that's fine because we want the number of performances and counting dates is a way to get that. But we used the Custom Name box in the Value Field Settings dialog box (refer to Figure 22-13) to change the name from Count of Date to No. of Performances. When we dragged the second instance of the Date field into the Values box, we used the Value Field Settings dialog box to make the field report the percentage of total. You could use similar techniques with other kinds of polling or survey applications.



	A	B	C	D	E
1	House	Country	Opera	Composer	Date
2	Den Norske Opera	Norway	Carmen	Bizet	9/1/2006
3	Finnish National Opera	Finland	Tosca	Puccini	9/1/2006
4	Hamburgische Staatsoper	Germany	Le Nozze di Figaro	Mozart	9/1/2006
5	National Theatre, Prague	Czech Republic	Antigona	Myslivecek	9/1/2006
6	Opera Australia	Australia	Rigoletto	Verdi	9/1/2006
7	Royal Danish Opera	Denmark	Tosca	Puccini	9/1/2006
8	Teatro Colon	Argentina	Jonny Spielt Auf	Krenek	9/1/2006
9	De Nederlandse Opera	Netherlands	Capriccio	Strauss, R.	9/2/2006
10	Den Norske Opera	Norway	Carmen	Bizet	9/2/2006
11	Hamburgische Staatsoper	Germany	Idomeneo	Mozart	9/2/2006
12	Oper Frankfurt	Germany	Agrippina	Händel	9/2/2006
13	Opera Australia	Australia	The Pirates of Penzance	Sullivan	9/2/2006
14	Staatsoper unter den Linden	Germany	Erwartung	Schönberg	9/2/2006
15	Hamburgische Staatsoper	Germany	Die Zauberflöte	Mozart	9/3/2006
16	National Theatre, Prague	Czech Republic	Antigona	Myslivecek	9/3/2006
17	Oper Frankfurt	Germany	Die Meistersinger von Nürnberg	Wagner	9/3/2006
18	Royal Danish Opera	Denmark	Tosca	Puccini	9/3/2006
19	Staatsoper unter den Linden	Germany	Erwartung	Schönberg	9/3/2006
20	Volksoper	Austria	Die Meistersinger von Nürnberg	Wagner	9/3/2006
21	Den Norske Opera	Norway	Carmen	Bizet	9/4/2006

Figure 22-15 From this table, a PivotTable will apply the COUNT function to the Date field to count performances.

You'll find the OperaSked.xlsx file in the Sample Files section of the companion CD.

> **Note**
>
> If you filter a field, percentage-of-total calculations are based on the data that meets the filter criterion, not the unfiltered data set.

Using Calculated Fields and Items

In case custom calculations don't meet all your analytic needs, Excel lets you add calculated fields and calculated items to your PivotTables. A *calculated field* is a new field, derived from calculations performed on existing fields in your table. A *calculated item* is a new item in an existing field, derived from calculations performed on other items that are already in the field. After you create a custom field or item, Excel makes it available to your table, as though it were part of your data source.

Custom fields and items can apply arithmetic operations to any data already in your PivotTable (including data generated by other custom fields or items), but they cannot reference worksheet data outside the PivotTable.

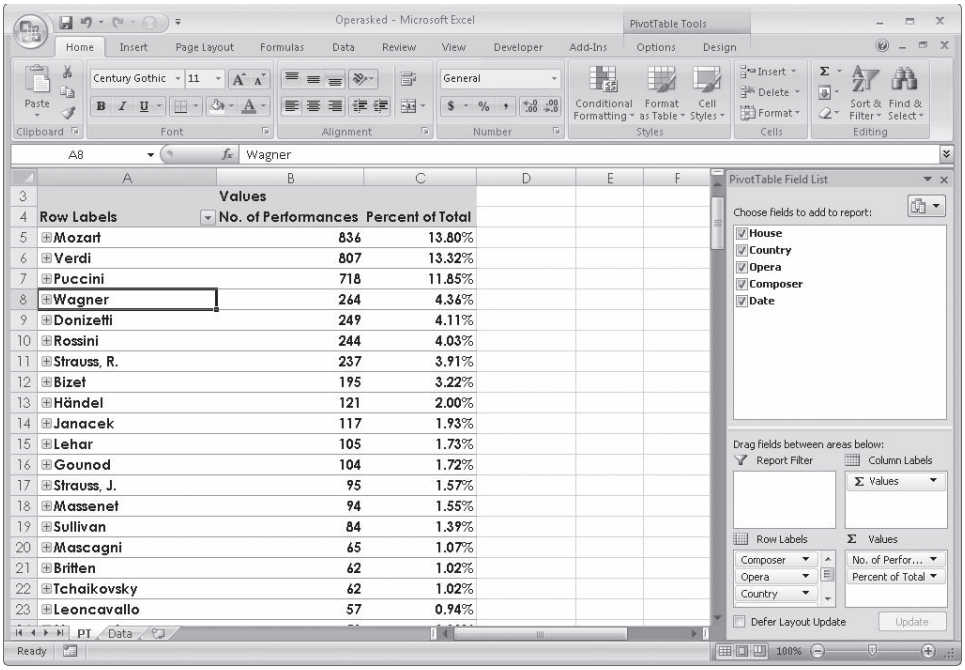


Figure 22-16 The PivotTable uses the Date field from Figure 22-15 twice—once to count performances, a second time to calculate percentage of total.

Creating a Calculated Field

To create a calculated field, select any cell in the PivotTable. Then click the Options tab under PivotTable Tools, and click Formulas in the Tools group. On the Tools menu, click Calculated Field. Figure 22-17 shows the Insert Calculated Field dialog box.

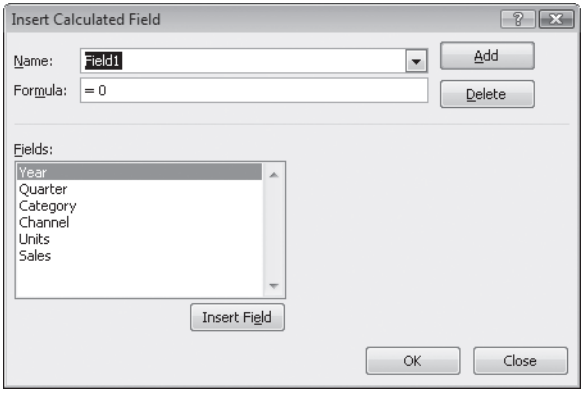


Figure 22-17 Create a calculated field in this dialog box.

Type a name for your calculated field in the Name box. Then type a formula in the Formula box. To enter a field in the formula, select it from the Fields list, and click Insert Field. Figure 22-18 shows an example of a calculated field.

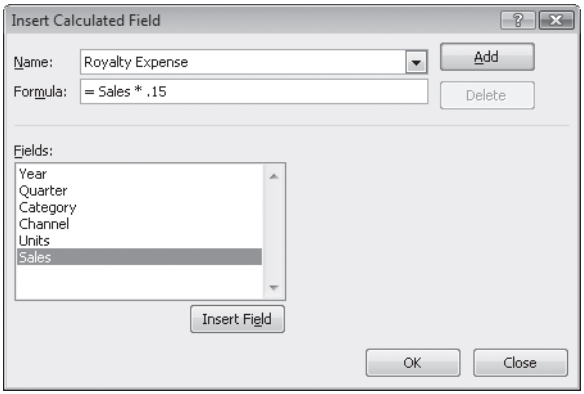


Figure 22-18 This calculated field multiples an existing field by a constant.

Excel adds a new calculated field to your PivotTable when you click either Add or OK. You can then work with the new field using the same techniques you use to work with existing fields.

Creating a Calculated Item

To create a calculated item for a field, select any existing item in the field or the field heading. Then click the Options tab under PivotTable Tools, and click Formulas in the Tools group. On the Formulas menu, click Calculated Item. Excel displays a dialog box comparable to the one in Figure 22-19.

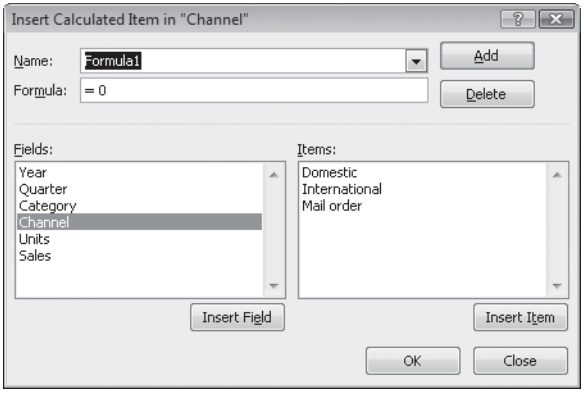


Figure 22-19 Use this dialog box to create a calculated item for a field.

To create a calculated item, type a unique name for the item in the Name box. Then enter a formula in the Formula box. You can select from the Fields and Items lists and click Insert Field and Insert Item to enter field and item names in the formula.

> **Note**
>
> You cannot create calculated items in fields that have custom subtotals.

Figure 22-20 shows an example of a calculated item. In this case the new item represents domestic sales divided by the sum of international and mail order sales.

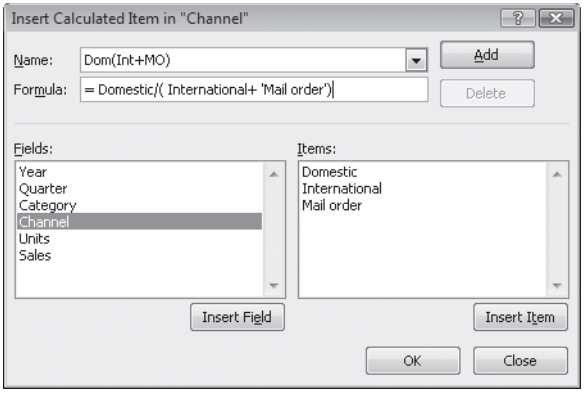
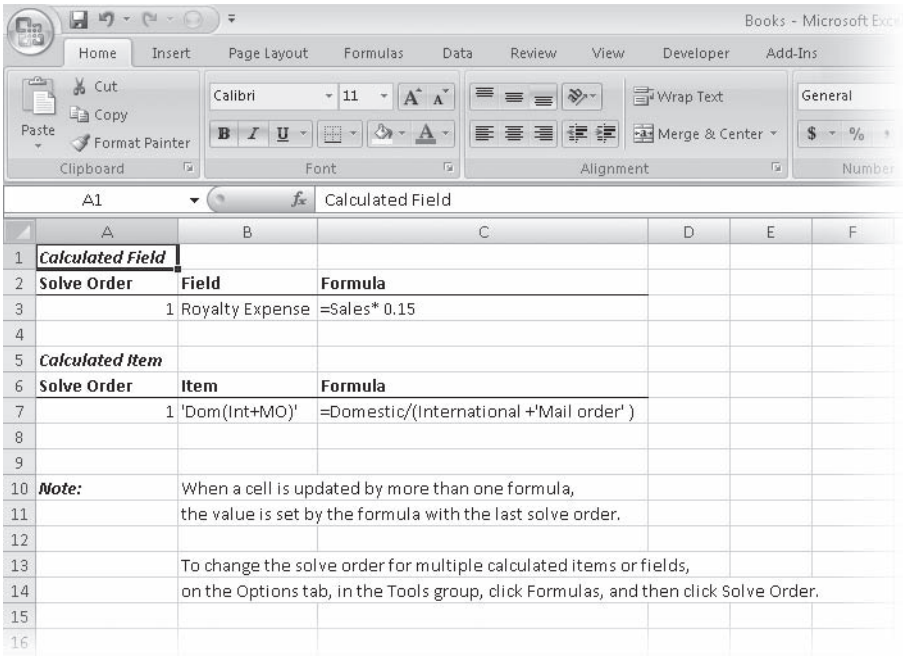


Figure 22-20 This calculated item will appear by default whenever you include the Channel field in the PivotTable.

Displaying a List of Calculated Fields and Items

To display a list of your calculated fields and items, along with their formulas, click the Options tab under PivotTable Tools, and then click Formulas in the Tools group. On the Formulas menu, click List Formulas. Excel displays the list on a new worksheet, as shown in Figure 22-21.

As the note in Figure 22-21 indicates, you need to be careful when a cell in your table is affected by more than one calculated field or item. In such cases, the value is set by the formula that's executed last. The Solve Order information in the list of calculated fields and items tells you which formula that is. If you need to change the solve order, select the worksheet that contains the PivotTable, click the Options tab under PivotTable Tools, and then click Formulas in the Tools group. On the Formulas menu, click Solve Order.



	A	B	C	D	E	F
1	***Calculated Field***					
2	**Solve Order**	**Field**	**Formula**			
3	1	Royalty Expense	=Sales* 0.15			
4						
5	***Calculated Item***					
6	**Solve Order**	**Item**	**Formula**			
7	1	'Dom(Int+MO)'	=Domestic/(International +'Mail order')			
8						
9						
10	***Note:***	When a cell is updated by more than one formula,				
11		the value is set by the formula with the last solve order.				
12						
13		To change the solve order for multiple calculated items or fields,				
14		on the Options tab, in the Tools group, click Formulas, and then click Solve Order.				
15						
16						

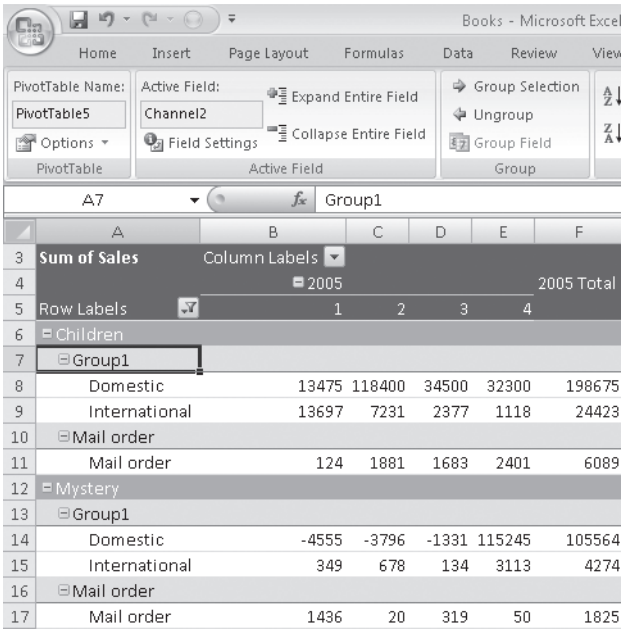
Figure 22-21 Excel lists calculated fields and items on a new worksheet.

Grouping and Ungrouping Data

PivotTables group inner field items under each outer field heading and, if requested, create subtotals for each group of inner field items. You might find it convenient to group items in additional ways—for example, to collect monthly items into quarterly groups or sets of numbers into larger numeric categories. Excel provides several options for grouping items.

Creating Ad Hoc Item Groupings

Suppose that after looking at Figure 22-3 you decide you'd like to see the domestic and international sales figures grouped into a category called Retail. To create this group, select the Domestic and International items anywhere in the table. Then click the Options tab under PivotTable Tools, and click Group Selection in the Group group. Excel creates a new heading called Group1:



	A	B	C	D	E	F
3	Sum of Sales	Column Labels				
4		2005				2005 Total
5	Row Labels	1	2	3	4	
6	Children					
7	Group1					
8	Domestic	13475	118400	34500	32300	198675
9	International	13697	7231	2377	1118	24423
10	Mail order					
11	Mail order	124	1881	1683	2401	6089
12	Mystery					
13	Group1					
14	Domestic	-4555	-3796	-1331	115245	105564
15	International	349	678	134	3113	4274
16	Mail order					
17	Mail order	1436	20	319	50	1825

Now you can rename Group1 by simply typing over any instance of it.

Grouping Items in Date or Time Ranges

Figure 22-22 shows a PivotTable that summarizes daily transactions by payee. As you can see, the data in this table is extremely sparse. Most intersections between a day item and a payee item are blank.

You'll find the Transactions.xlsx file in the Sample Files section of the companion CD.

To make this kind of table more meaningful, you can group the date field. To do this, select an item in the field. Then click the Options tab under PivotTable Tools, and click Group Field. Excel responds by displaying the Grouping dialog box, shown in Figure 22-23.

Excel gives you a great deal of flexibility in the way your date and time fields are grouped. In the By list, you can choose any common time interval, from seconds to years, and if the standard intervals don't meet your needs, you can select an arbitrary number of days. You can also create two or more groupings at the same time (hold down Ctrl while you select); the results of grouping by both Quarter and Month are shown in Figure 22-24.

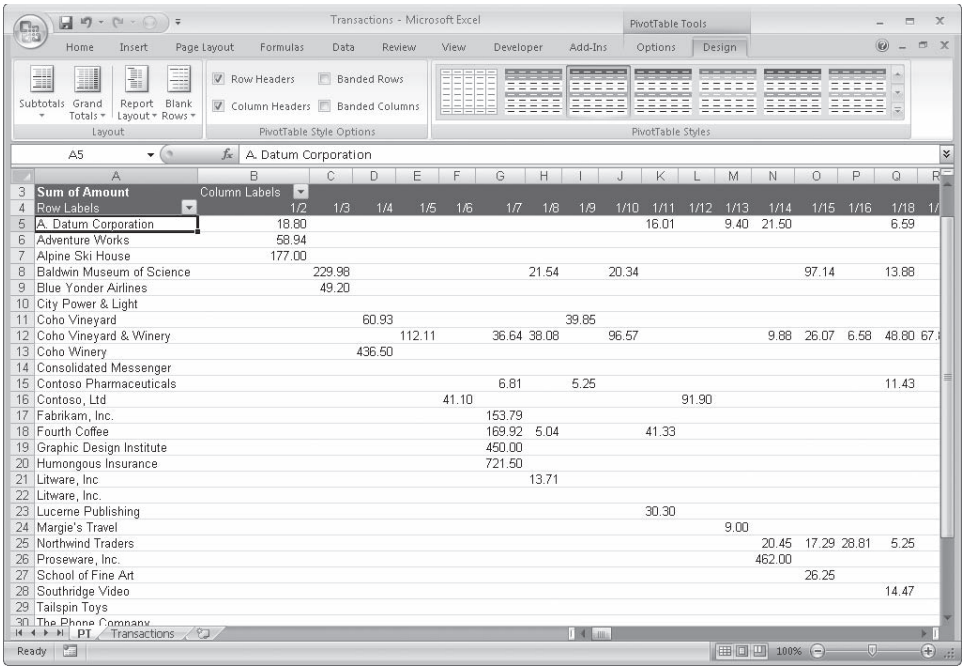


Figure 22-22 To make the data in this table more meaningful, you can group the date field.

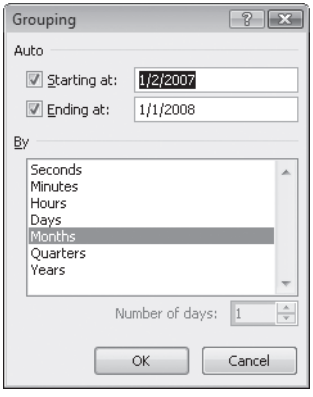


Figure 22-23 Excel gives you lots of ways to group by date.

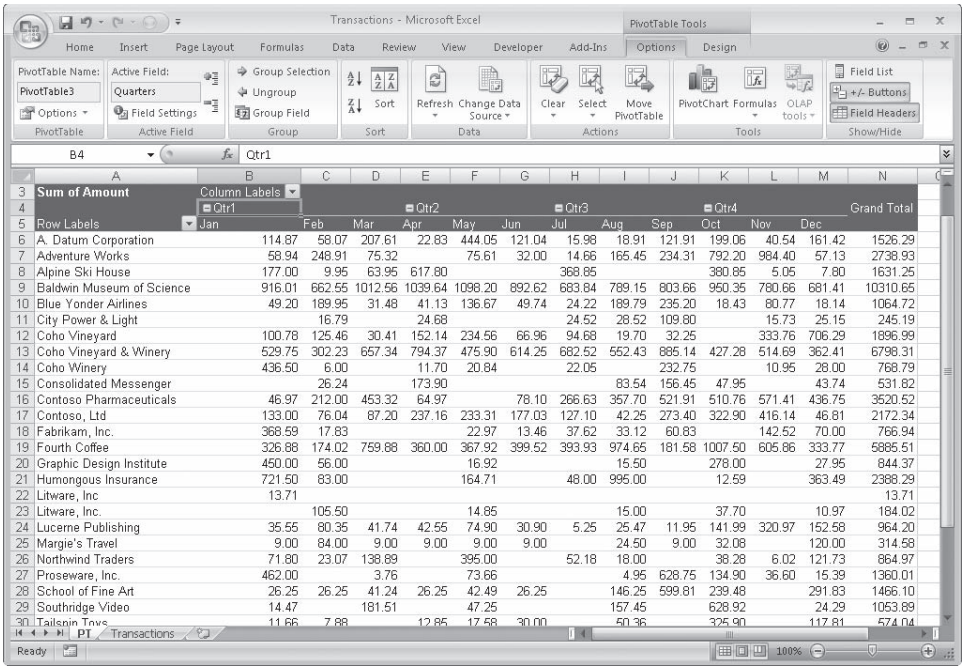
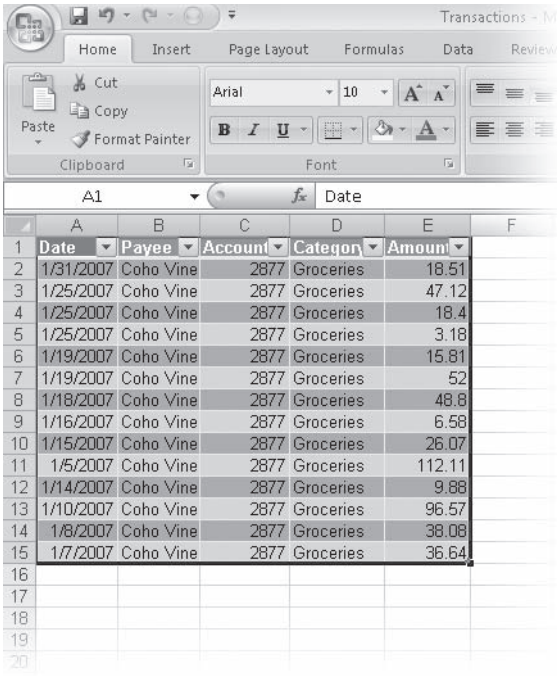


Figure 22-24 In this table, daily data is grouped by months and then by quarters.

Displaying the Details Behind a Data Value

If you double-click any PivotTable value that represents a summary calculation, Excel displays the details behind that calculation on a new worksheet. For example, in Figure 22-24, cell B13 informs us that we spent $529.75 at Coho Vineyard & Winery during the month of January. Double-clicking B13 reveals the details, as shown on the next page.



Creating PivotCharts

PivotCharts, like PivotTables, summarize tabular information and allow for easy transposition of fields and axes. They're a great way to study or present elements of your data set.

You can create a PivotChart directly from your source data by selecting a cell in the original data range, clicking the Insert tab, clicking the arrow beneath PivotTable in the Tables group, and then clicking PivotChart. After you specify or confirm your data source and indicate where you want the new PivotChart to reside (in a location either on the existing worksheet or on a new worksheet), Excel presents both a PivotTable layout and a blank chart canvas, along with a PivotChart Filter Pane (see Figure 22-25). Excel creates a PivotTable at the same time it creates a PivotChart—and hence you see a blank table layout. The PivotChart Filter Pane doesn't really add any capability that isn't available via the PivotTable Field List window, so you might want to close one or the other to make more room on the worksheet.

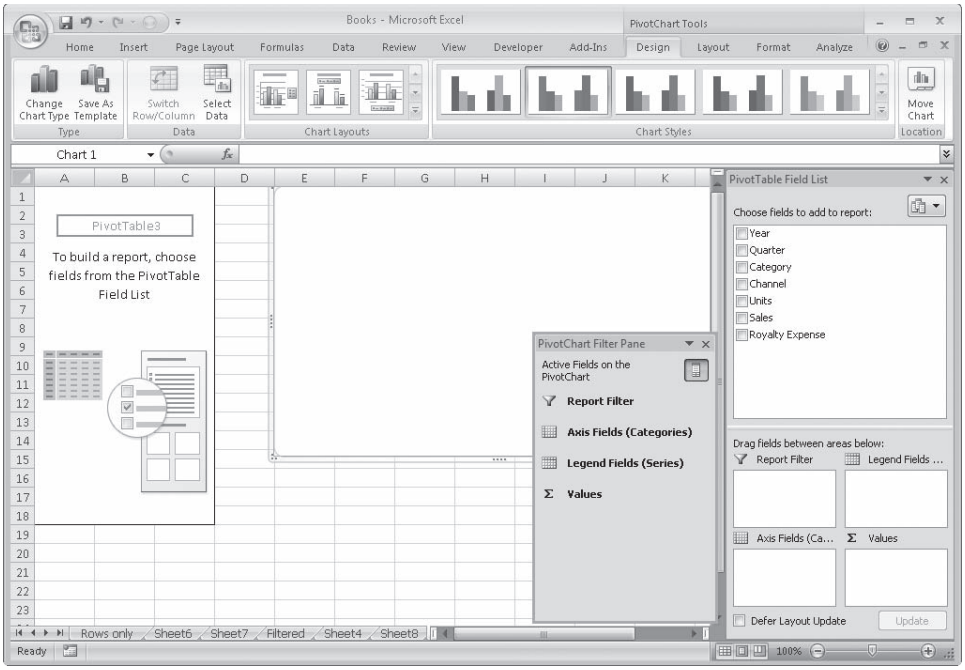


Figure 22-25 When you create a new PivotChart, Excel draws a blank chart canvas as well as a blank table layout. The program creates a PivotTable at the same time it creates the PivotChart.

Figure 22-26 shows a simple PivotChart created from this chapter's Books table. Because charts are generally most effective when applied to a modest amount of data, we've used the Report Filter box to restrict the presentation to a single category (Children), and we've filtered the Channel field to show international and mail order sales only. We've also tidied up a bit by closing the PivotTable Field List window and dragging the PivotChart Filter Pane to a less obtrusive position.

As you can see, when you select a PivotChart, Excel adds a new set of tabs on the Ribbon, under PivotChart Tools. With these tabs, you can manipulate and format your PivotChart the same way you would an ordinary chart. (For details about working with charts, see Chapter 19, "Basic Charting Techniques," and Chapter 20, "Charting Beyond the Ribbon.")

A PivotChart and its associated PivotTable are inextricably linked. You can manipulate fields and axes in either, and the other stays in step.

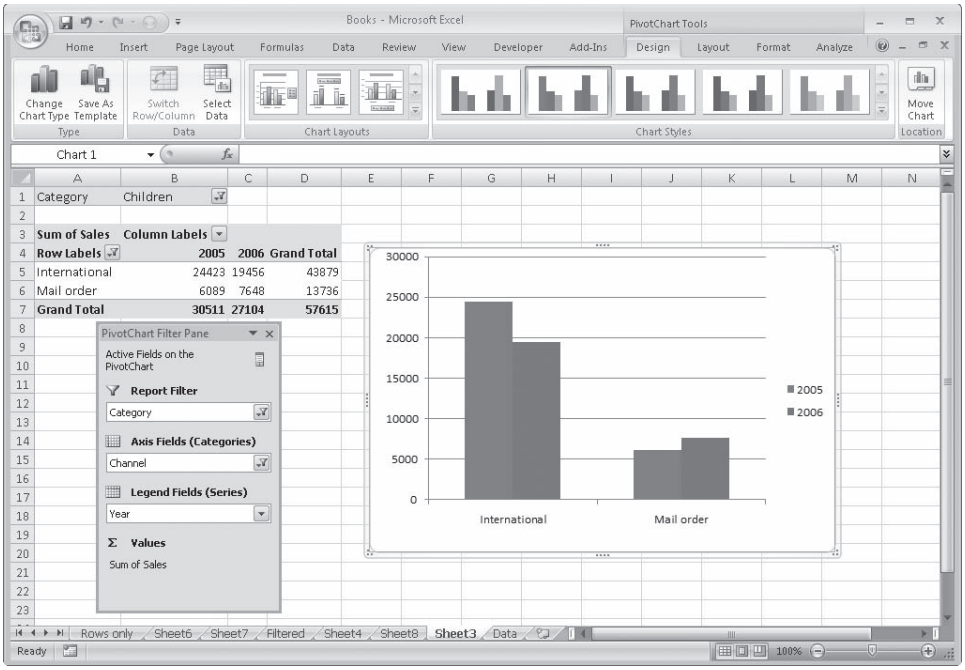


Figure 22-26 We've used a PivotChart to plot two distribution channels for one book category.

In Figures 22-25 and 22-26, we created a PivotChart directly from the source data. You can also create one from an existing PivotTable. Select any cell in the PivotTable, click the Options tab under PivotTable Tools, and then click PivotChart in the Tools group.