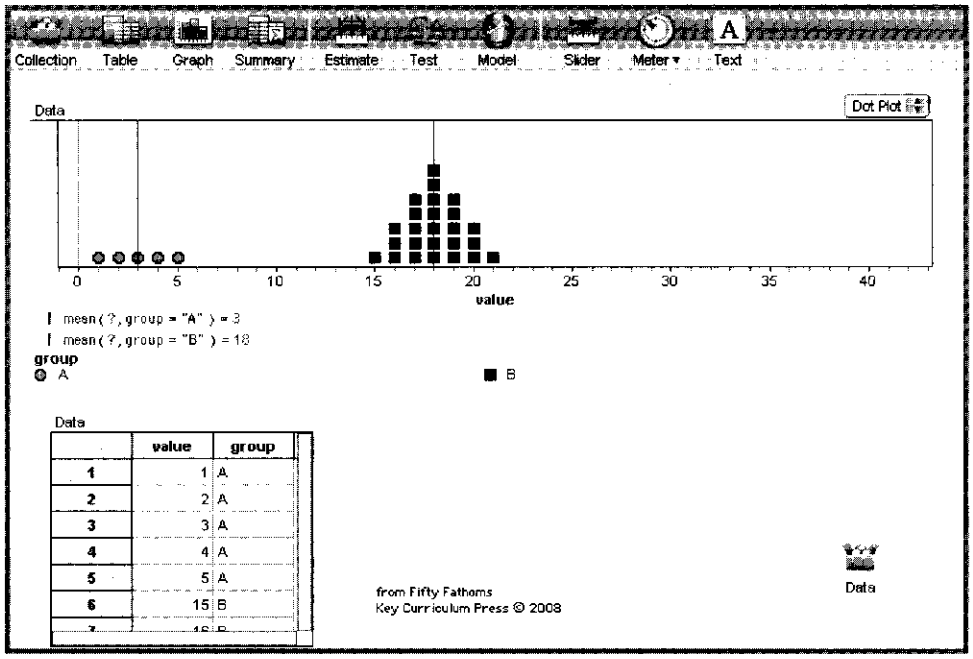
Demo 1: The Meaning of Mean

The mean • How individual values affect the mean

This simple demo helps you get some "feel" for how the mean works. You could just drag points and see what happens. The instructions, below, take you down a particular path; follow it as far as you like—then explore!



What To Do

▷ Open **Meaning of Mean.ftm.** It should look like the illustration.

The most important thing here is the graph—a dot plot—showing the values of some data points. They're in two groups, **A** and **B**—represented by circles and squares, respectively. The graph also displays the mean value of each separate group as vertical lines and as numbers, below. At the bottom, you can see a *case table* that shows the first seven values—all five in group **A** and the first two cases in group **B.**

▷ Grab the right-hand circle (at **value = 5**) and drag it. Notice that the mean changes and that its value changes in the table: Look in the fifth row.

Note: To get large points like the ones in the illustration, choose **Preferences** from the **Edit** menu and check **Use Large Fonts.**

▷ Figure out how far you have to move that fifth point to have the mean increase by one, that is, from 3 to 4. (If you can't get it exactly by dragging, you can get close, and then type the exact value into the fifth row of the case table and press **Enter.**)

▷ Put the point back at 5. (You can drag it there, type the value, or use **Undo** repeatedly.)

⇨ The shortcut for **Undo** is **⌘+Z** (Mac) or **Control+Z** (Windows).

▷ Drag a different point in group **A** and, again, change the mean from 3 to 4.

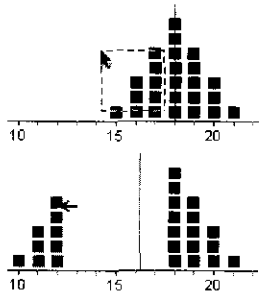
▷ Now let's look at group **B.** Begin with the lowest "square" point—the one at **value = 15.** How far do you have to move it to increase the **B** mean by one, from 18 to 19? (You may have to rescale the axis to move it that far. See "Rescaling Graph Axes.")

▷ Again, put your point back where it started, at 15.

© 2008 Key Curriculum Press

Moving Multiple Points

▹ Select several points in the **B** group by dragging a rectangle around them.



▹ Now drag the whole group (point at one of them and drag). See how far you have to move it to get the mean to change by one.

You should see that a point in a small data set has more influence on the mean than a point in a larger one. Similarly, moving more points moves the mean faster.

Note: This whole idea of "influence" requires both an actor (the moving point) and an act-ee (in this case, the mean). As you'll see in Demo 2, "Mean and Median," outlying points have *no* influence over the median when they change a little. In Demo 6, "Least-Squares Linear Regression," a moving point (the actor) acts on a linear regression line.

Sometimes students confuse "influential" with "outlier." In our case, every point has the same influence whether it's an outlier or not. With the regression line, a point right on the line—but far from the center of the cloud—has a lot of influence over the line's slope.

Extension

This extension will help you see the "balance point" meaning of the mean.

▹ Start with the file the way it started. You may need to re-**Open** it if you've done a lot.

▹ Click once on the graph to select it.

▹ Now choose **Plot Value** from the **Graph** menu. The formula editor opens.

▹ Enter **mean( )**. (The empty parentheses are correct.) Press **OK** to close the editor. A new line and value appear—the mean of the whole data set, both groups together. Note its value. (It should be 15.5.)

You should be able to see this point as the balance point for the whole data set; imagine all of the points as blocks on a board, and the new line as the fulcrum. Let's explore a little more:

▹ Stack all of the points from group **A** onto that group's mean (3). See if the group mean has changed.

▹ Stack all of the points from group **B** onto that group's mean (18). (To see all of the points, you will need to stretch the graph vertically.) Again, has the group mean changed?

⇨ To get these values to be *exactly* 3 or 18, just edit them in the case table.

Questions

If you are working through these demos on your own as a learner, these questions will help solidify your understanding. If you're a teacher using this as a demo for a class, these are suggestions for the kinds of questions you could ask your students.

1 How far is it from the **A** mean to the total mean? How far from the **B** mean to the total mean?

2 There are 5 points in group **A** and 25 in group **B**. How do those quantities relate to the distances from the mean? **Sol**

© 2008 Key Curriculum Press