After creating an "adjbias.txt" file (see paragraph 4 in "Convert EDF files.txt"), and verifying that RD can read in the data file (covered in "How to RD data"), you are now ready to calibrate the data by using the "cal" routine. It is a graphical interface, combined with the command window, that guides you through the steps necessary to determine the offset and scaling values. This program is easy to use, as long as you pay attention to what it is telling you to do.

1. You will be asked to select which channel's data you want to calibrate.

2. Next, you will be asked the following question:

   How many calibration point pairs (e.g. ±15 = one pair)?

If your calibration data was taken by having the subject alternate fixation between 0 and +/-15 degrees, then the answer is "1". If you performed a more detailed calibration there will be more point pairs. For example, our standard calibration goes from 0 to +/-15, +/-20, +/-25 and +/-30 degrees. This is 4 pairs of calibration points.

3. A new figure window will open (using the "zoomtool" program), containing the data channel you selected. From this point on, pay close attention to the prompts that appear in the command window, especially making sure that you use the proper cursor ("zoomtool" provides two cursors -- "cal" requires that you use cursor 1). If you don't, bad things will happen. Same goes for clicking on the "x,y" button (right side of the figure window, about 3/4 of the way to the bottom) in "zoomtool". If you click on the "x" button, "cal" will not let you go to the next step.

4. In brief, you will:
    - Select the zero point, i.e., where you think the subject was looking when supposedly fixing on the target at zero degrees. Cal will allow you to change your mind and select a new point, if you are not happy with the result of your initial choice.
    - Select the rightward calibration value(s), in INCREASING order and their corresponding places in the data record. As before, you will have as many opportunities to refine your choice until you are satisfied with the result.
    - Select the leftward calibration value(s). Same story here.

5. When "cal" finishes running, it will print out a formatted string containing the values "cal" just calculated. Modify "adjbias.txt" accordingly, making sure that you are entering these values for the data channel you selected, and in the proper order.

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A bit of practical philosophy regarding the practice of calibration, and why anything but MONOCULAR calibration is at best misleading, and likely to be less than useful:

While most people are nominally conjugate, i.e., their eyes move together, this is not ironclad. Even normal subjects have small discrepancies in conjugacy (which can be seen when, for example, they make saccades). Usually this difference is pretty small, and of no practical consequence.

However, when we want to make accurate eye movement recordings, we must know where each eye is really looking. Many people have misalignments of their eyes, known as "tropias" (when both eyes are open), or "phorias" (that are exposed when one eye is behind cover). If you attempt to calibrate such a person, you are going to run into difficulties, because you will not know WHICH EYE THEY ARE VIEWING WITH at any given time, since the eyes are not aimed at the same spatial point. They will often repeatedly switch their viewing eye, not even aware that they are doing so, and unable to control this behavior.

It should be apparent that NOT taking monocular calibration data will most likely lead to confusion and poor calibration. Fortunately, monocular calibration is easy to perform, and will go a long way towards guaranteeing that the subject is looking where they are supposed to, and that the resulting data will be valid.

To begin, you will need a way to occlude the subject's eye WITHOUT BLOCKING THE SENSORS or your recording apparatus. In other words, find something (I use a big piece of stiff cardboard, bent into a "U" shape, that goes AROUND THE OUTSIDE of the IR diodes, or the video cameras that are aimed at the subject's eyes. If you block the sensors, you will lose data about the subject's alignment of the non-viewing eye.

(For the sake of brevity, I will discuss only HORIZONTAL calibration. It should not be too difficult to extend what follows to include vertical calibration, too.)

We will take three records using the identical stimulus, which for simplicity's sake will be reported here as viewing targets at 0, +15 and -15 degrees horizontally, for at least 5 seconds at each position. In the first record, the subject views the targets with their RIGHT EYE (OD), i.e., the left eye is occluded. In the second record, they view with the LEFT EYE (OS). Finally, in the third record, the subject is allowed to use BOTH EYES (OU). Of course, they may very well choose to use just one eye, or even switch between right and left, but at least you will now have a fighthing chance at interpreting this behavior, by this record to the monocular ones.

After these three records are completed, continue taking data according to the paradigm planned for this experiment.

When it is time to calibrate the data (and you have created an "adjbias.txt" file, as described elsewhere), load the first record (OD viewing), run "cal", and select the "rh" (RE, horizontal) channel from. Follow the interactive, on-screen instructions that "cal" provides (discussed above), and calibrate the right eye. Then clear the data from memory, load the second record (OS viewing), and run cal again, selecting the "lh" (LE horizontal) channel.

With both eyes calibrated monocularly, take the calibration results provided by "cal" and enter them into their respective places in the "adjbias.txt" file. Now to test how well things went: copy the RH results from record 1, and the LH results from record 2 into record 3. Load this data and examine it. In the very best case, a subject with good conjugacy, the RH and LH traces should coincide most of the time. If not, you have just quantified the subject's misalignment.

If you are satisfied that you have achieved a good calibration, you can now copy the RH and LH calibration values to all the other records in "adjbias.txt". That's it.