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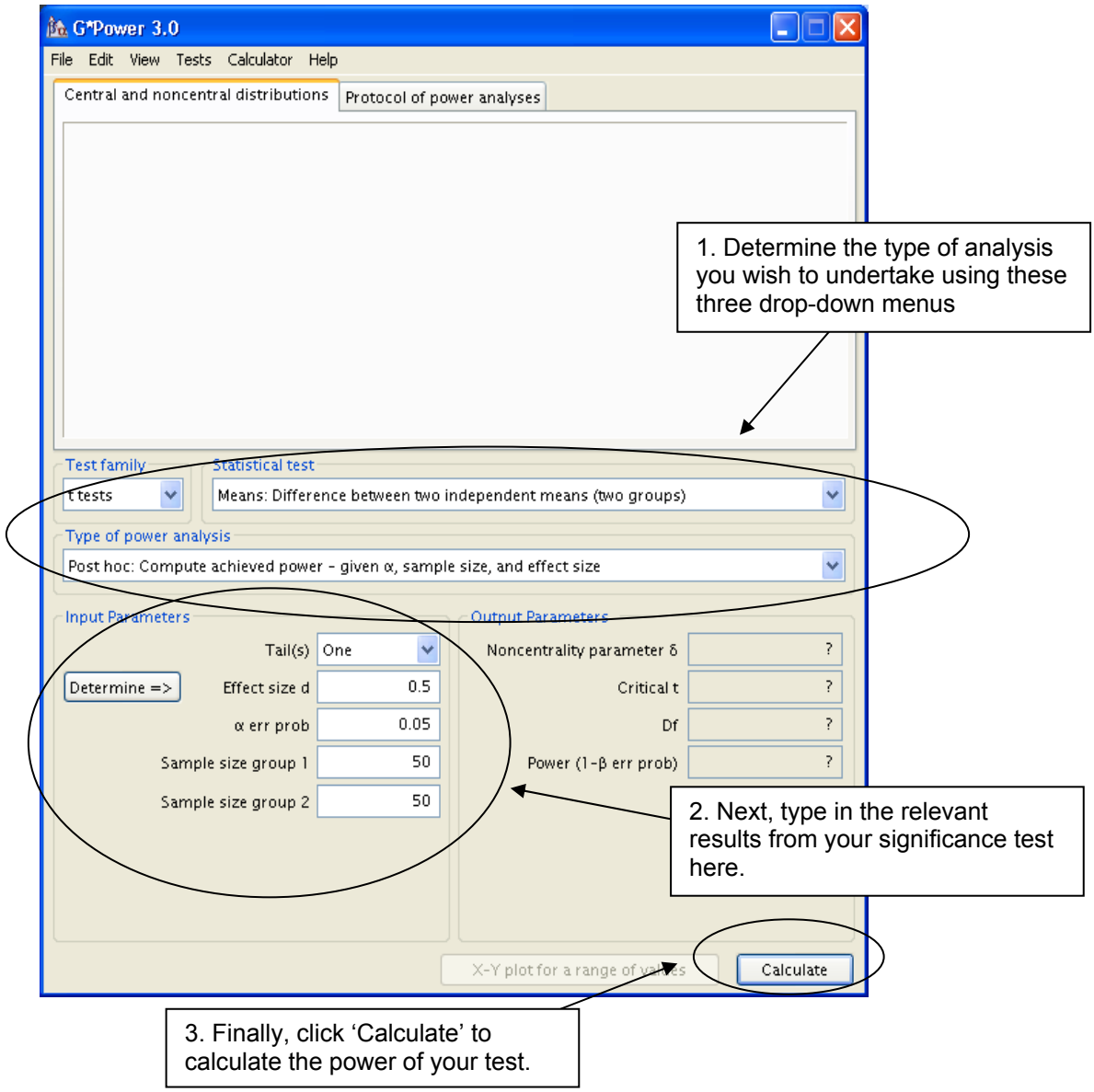
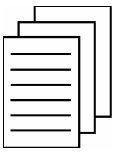
Example of a Statistical Power Calculation (p. 206)

This example uses the statistical power software package G*Power 3. I am grateful to the creators of the software for giving their permission to use screen captures of G*Power 3 below.[1] You can download a free copy of this software from the following website: http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3/

A link to this website is provided on the companion website (follow the links for 'Useful Websites' and then 'Resources in Book'). When you first open G*Power 3 you will get the window below:



[1] Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.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As can be seen, the first thing to do is to determine the type of analysis to conduct. G*Power 3 can do all sorts of calculations including 'a priori' calculations to determine what sized sample(s) is needed to achieve a certain level of power given what the effect size is anticipated to be. Have a look at the options from the drop-down menus to get a sense of what you can do with G*Power 3.

In this case we are wishing to calculate the power of the independent t-test we conducted in the book (see Output 6.10 on p. 204). As such we need to use the three drop-down menus to select:

- T tests
- Means: Difference between two independent means (two groups)
- Post hoc: Compute achieved power – given α, sample size, and effect size

Once we have done this we need to add in the results from our independent t-test. In this case we need to select:

- Tail(s): Two
- Effect size d: (See below)
- α err prob: 0.05
- Sample size group 1: 12
- Sample size group 2: 44

We are therefore choosing a two-tailed test and setting the significance level (α) at the conventional 0.05 level. As can be seen we have also added in the sample sizes for the two groups that were compared (which can be found in Output 6.10 in the book in the table headed 'Group Statistics').

The final thing we need to enter is the effect size found from our original analysis. Unfortunately, and as explained in the book, there are a number of different effect size measures available and the one used here (Cohen's d) is different to the one you have been shown how to calculate in the book (r, the point biserial correlation). However, there's no need to worry as G*Power 3 will calculate Cohen's d for you. All you need to do is to click on the button 'Determine =>' and this opens an additional window to the left of the main one as shown overleaf.

What you now need to do is to type in the means and standard deviations for the two groups (as provided in Output 6.10 in the table headed 'Group Statistics') and then just click the 'Calculate and transfer to main window' button to place the value for Cohen's d into the main window.

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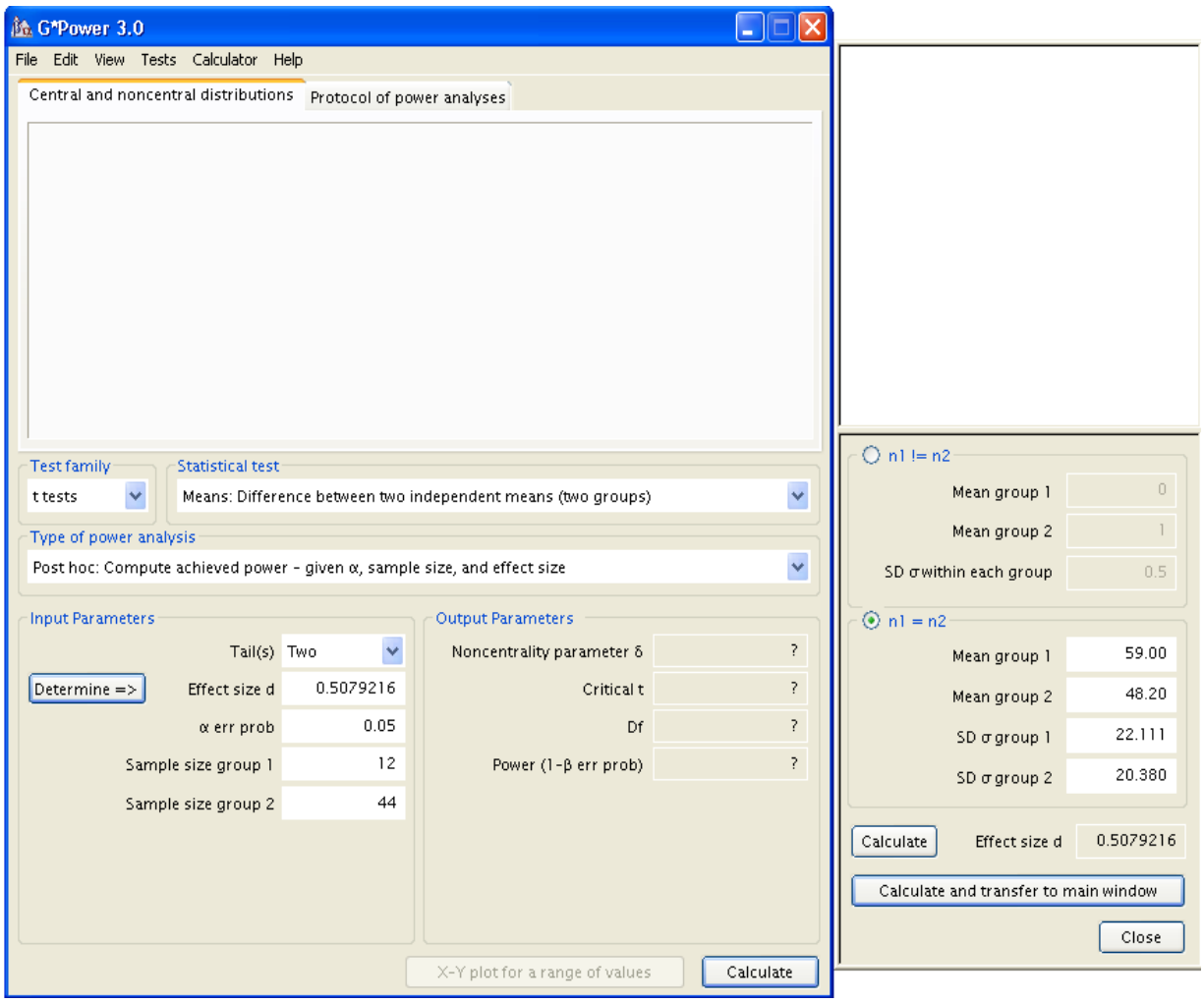

All you now need to do is to click the 'Calculate' button in the main window and you should get the results shown overleaf:

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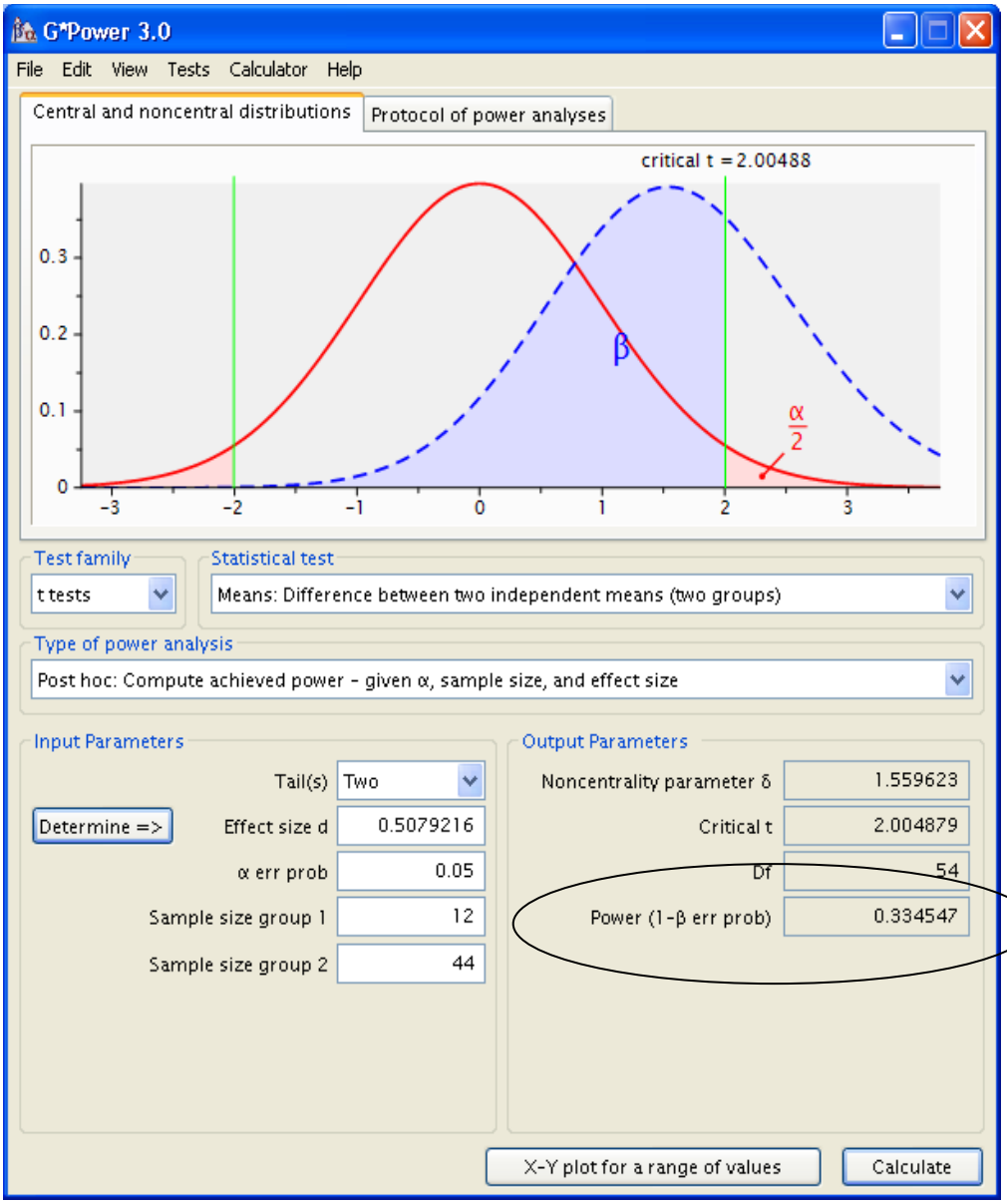
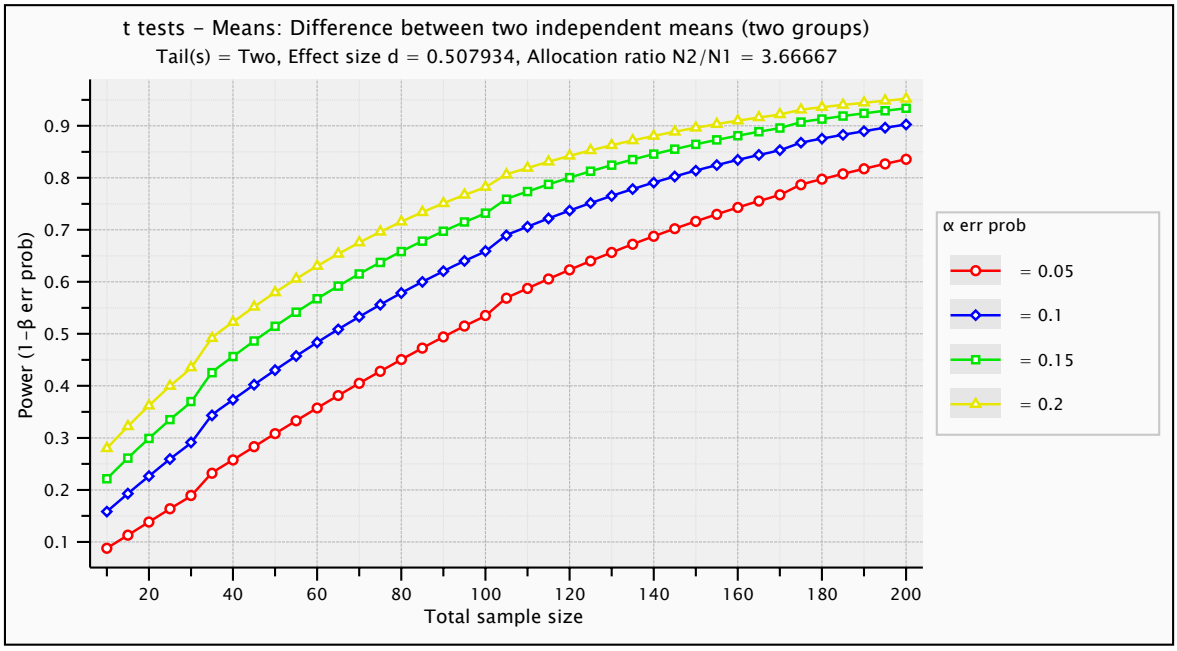


As can be seen, the main piece of information we are interested in is the calculated power of the test, 1 – β, which as can be seen is 0.335 or 33.5 per cent as reported in the book.

Finally, if you wanted to you can use G*Power 3 to calculate a range of different plots. One of these is provided overleaf that was created using the 'X-Y plot for a range of values' button in the main window.



As can be seen this is quite a useful plot as it shows how the power of this particular test would increase with an increase in sample size. The red line represents the traditional significance level of α=0.05. Interestingly, if we had wanted this particular statistical test to have the required power of 0.8 then it can be seen from the plot that this would have required a total sample size a little over three times what we had (i.e. 180 schools compared to just 56). This is assuming that the proportionate size of the two sub-samples remains the same i.e. 44 to 12 or a ratio of 3.66667 as indicated in the plot above.