# Chapter 8 - Power

**8.1** Peer pressure study:

**a.**

$$
\begin{aligned}
d &= \frac{\mu_1 - \mu_0}{\sigma} \\
&= \frac{520 - 500}{80} \\
&= .25
\end{aligned}
$$

**b.** $f(n)$ for 1-sample t-test = $\sqrt{n}$

$$
\begin{aligned}
\delta &= d\sqrt{n} \\
&= .25\sqrt{100} \\
&= 2.5
\end{aligned}
$$

**c.** Power = .71

**8.3** Changing power in Exercise 8.1:

**a.** For power = .70, δ = 2.475

$$
\begin{aligned}
\delta &= d\sqrt{n} \\
2.475 &= .25\sqrt{n} \\
n &= 98.01 \approx 99 \text{ (Round up, because students come in whole lots)}
\end{aligned}
$$

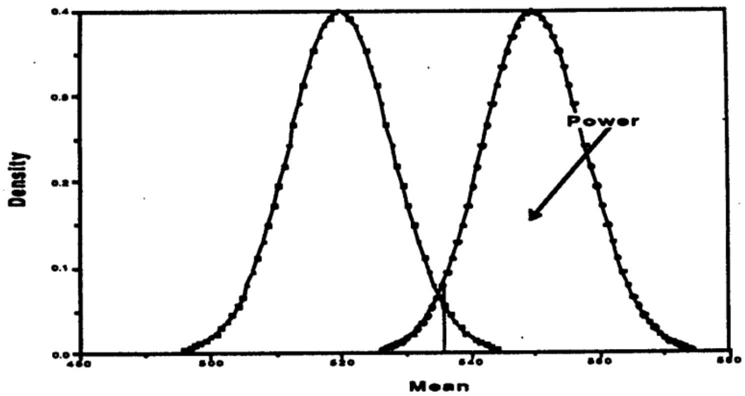
**b.** For power = .80, δ = 2.8

$$
\begin{aligned}
\delta &= d\sqrt{n} \\
2.8 &= .25\sqrt{n} \\
n &= 125.44 \approx 126 \text{ (Round up)}
\end{aligned}
$$

**c.** For power = .90, δ = 3.25

$$
\begin{aligned}
\delta &= d\sqrt{n} \\
3.25 &= .25\sqrt{n} \\
n &= 169
\end{aligned}
$$

**8.5** Sampling distributions of the mean for the situation in Exercise 8.4:




**8.7** Avoidance behavior in rabbits using 1-sample t test:

**a.**

$$d = \frac{\mu_1 - \mu_0}{\sigma} = \frac{5.8 - 4.8}{2} = \frac{1}{2} = .50$$

For power = .50, $\delta = 1.95$

$$\delta = d\sqrt{n}$$

$$1.95 = .5\sqrt{n}$$

$$n = 15.21 \approx 16$$

**b.** For power = .80, $\delta = 2.8$

$$\delta = d\sqrt{n}$$

$$2.8 = .5\sqrt{n}$$

$$n = 31.36 \approx 32$$

**8.9** Avoidance behavior in rabbits with unequal *N*s:

$$d = .5$$

$$n = \bar{n}_h = \frac{2n_1 n_2}{n_1 + n_2}$$

$$= \frac{2(20)(15)}{20 + 15} = 17.14$$

$$\delta = d\sqrt{\frac{n}{2}} = 5\sqrt{\frac{17.14}{2}} = 1.46$$

power = .31

**8.11** $t$ test on data for Exercise 8.10

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$

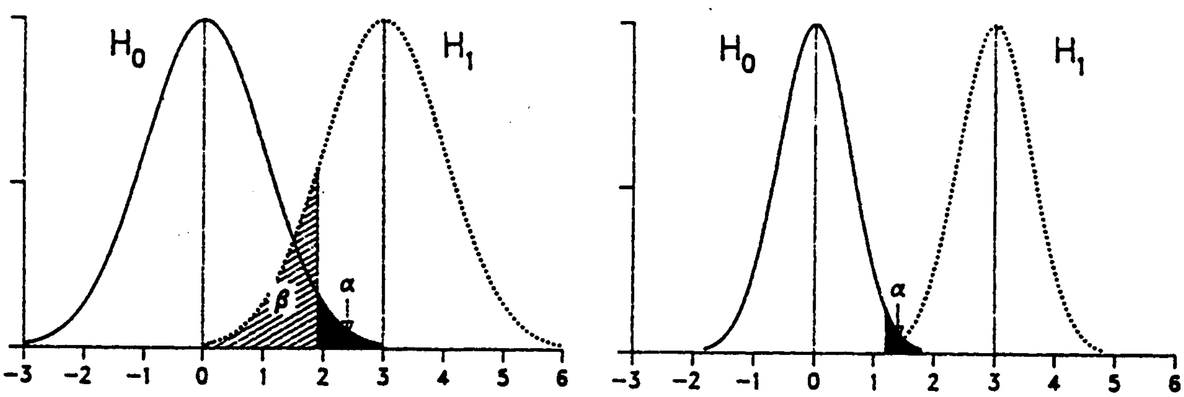
$$= \frac{25 - 30}{\sqrt{\frac{64}{20} + \frac{64}{20}}}$$

$$= -1.98$$

[$t_{.025}(38) = \pm 2.025$] Do not reject the null hypothesis

**c.** $t$ is numerically equal to $\delta$ although $t$ is calculated from statistics and $\delta$ is calculated from parameters. In other words, $\delta$ = the $t$ that you would get if the data exactly match what you think are the values of the parameters.

**8.13** Diagram to defend answer to Exercise 8.12:




With larger sample sizes the sampling distribution of the mean has a smaller standard error, which means that there is less overlap of the distributions. This results in greater power, and therefore the larger $n$'s significant result was less impressive.

**8.15** Social awareness of ex-delinquents--which subject pool would be better to use?

$\bar{X}_{\text{normal}} = 38$ $n = 50$

$\bar{X}_{\text{H.S. Grads}} = 35$ $n = 100$

$\bar{X}_{\text{dropout}} = 30$ $n = 25$

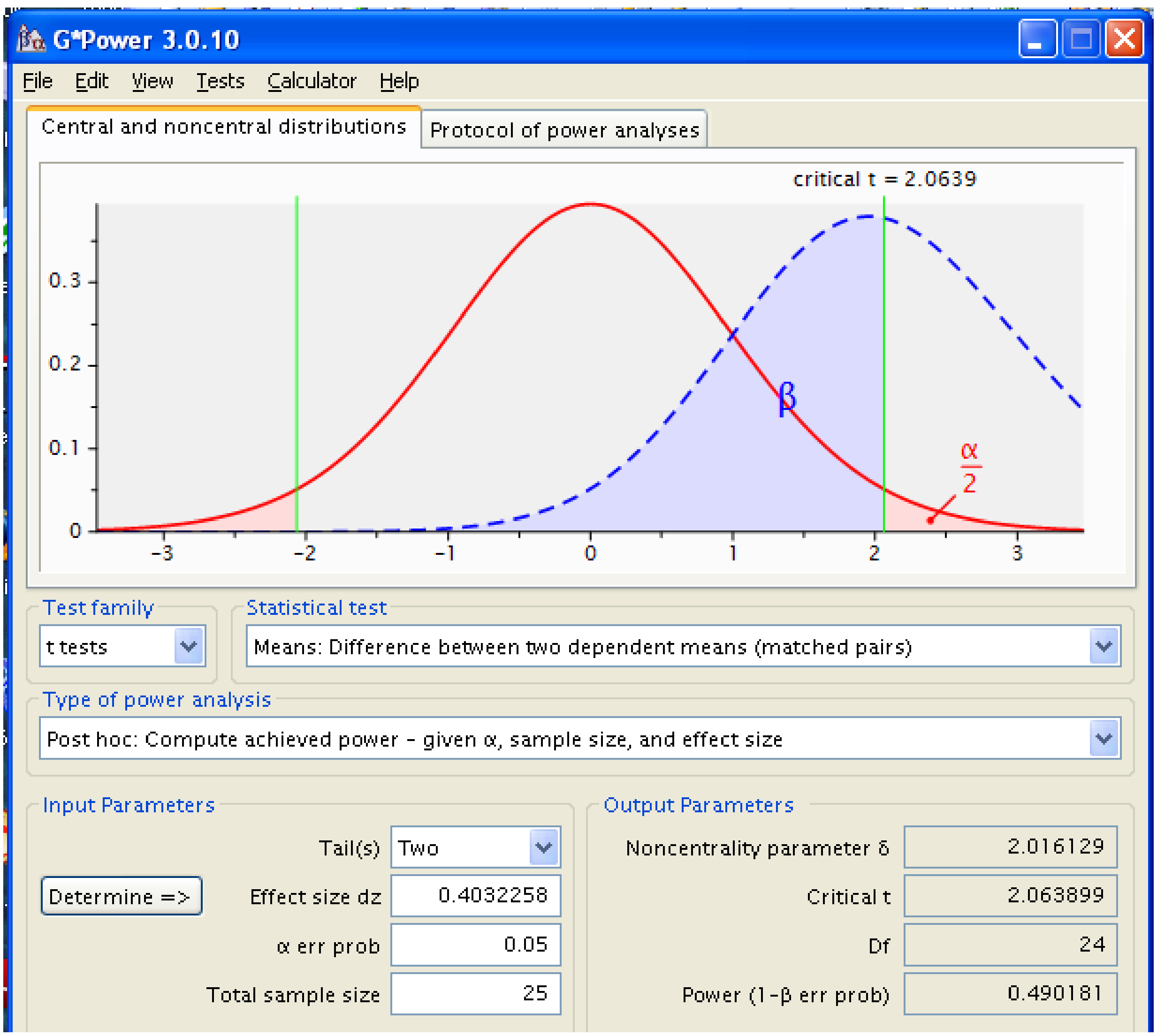
$$d = \frac{38 - 35}{\sigma} \qquad\qquad d = \frac{38 - 30}{\sigma}$$

$$\bar{n}_h = \frac{2(50)(100)}{150} = 66.67 \qquad\qquad \bar{n}_h = \frac{2(50)(25)}{75} = 33.33$$

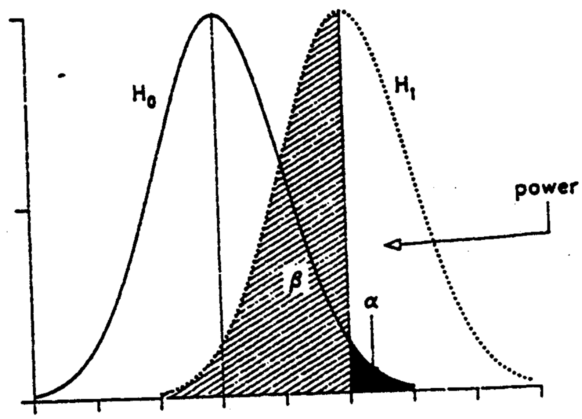
$$\delta = \frac{3}{\sigma}\sqrt{\frac{66.67}{2}} = \frac{17.32}{\sigma} \qquad\qquad \delta = \frac{8}{\sigma}\sqrt{\frac{33.33}{2}} = \frac{32.66}{\sigma}$$

Assuming equal standard deviations, the H.S. dropout group of 25 would result in a higher value of δ and therefore higher power. (You can let σ be any value you choose, as long as it is the same for both calculations. Then calculate δ for each situation.)

**8.17** Stereotyped threat in women



Here the power is about one half of what it was in the study using men, reflecting the fact that our group of men had a stronger identification with their skills in math.




**8.19** When can power = β?
The mean under $H_1$ should fall at the critical value under $H_0$. The question implies a one-tailed test. Thus the mean is 1.645 standard errors above $\mu_0$, which is 100.

$$\begin{aligned}\mu &= 100 + 1.64\sigma_X \\ &= 100 + 1.645\left(15/\sqrt{25}\right) \\ &= 104.935\end{aligned}$$

When μ = 104.935, power would equal β.

**8.21** Aronson's study:

**a.** The study would confound differences in lab that have nothing to do with the independent variable with the effect of that variable. You would not be able to draw sound conclusions unless you could persuade yourself that the labs were similar in all other relevant ways.

**b.** I would randomize the conditions across all of the students in the two labs combined.

**c.** The stereotypes do not apply to women, so I don't have any particular hypothesis about what would happen.

**8.23** Both of these questions point to the need to design studies carefully so that the results are clear and interpretable.