Accepting the Null

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There are situations in which the researcher might be interested in accepting the null hypothesis. For example, if the researcher was examining sex differences (or cultural differences), there may be some areas where men and women (or people from different cultures) would be expected to obtain very similar means. Similarly, if a researcher was examining a subgroup of people (e.g., people who are educationally disadvantaged, exceptionally bright, extremely poor or wealthy, mentally or physically ill), there may be some areas where these people would be expected to perform at average levels.

Arguments against ever accepting the null:

1) The null hypothesis is never strictly true.
2) We cannot control Type II errors adequately.
3) Failure to reject the null is not good evidence that it is true.

Arguments for sometimes accepting the null:

1) The null hypothesis may sometimes be true.
2) We can control Type II errors; it's just hard. If Beta is very small (such as less than .05) for a very small effect size, then we can be quite confident that we have not made a Type II error.
3) To refuse to conclude that the null hypothesis is true, no matter what the data says, is unscientific.

A compromise:

1) Instead of asserting that the null hypothesis is true, assert that we are very sure that it is very small.
2) Calculate confidence intervals, and demonstrate that the largest the effect size could be is quite small (especially if result is statistically significant).
3) Conduct power analyses, and demonstrate that we would have had lots of power to detect a very small effect size (especially if result is not significant).

Note: You will likely be able to make the strongest case that the effect size is very small when you have a large sample size. If you have a large sample size, you are likely to find statistically significant results. These two facts are NOT contradictory.

Example 1

	$\overline{X}$	s	n
Women	3.75	.25	500
Men	3.70	.25	500

95% Confidence Interval

$S_p = .25$

$$S_{\overline{X}_1-\overline{X}_2} = \sqrt{S_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)} = \sqrt{(.25)^2\left(\frac{1}{500}+\frac{1}{500}\right)} = .00025$$

$$\left(X_1 - X_2\right) \pm S_{\overline{X}_1-\overline{X}_2}(t_{crit}) = .05 \pm .00025*1.96 = [.0495, .0505]$$

Note: Result is statistically significant, $p < .001$.
Conclusion: Difference may be as large as (.1)*(s), a small effect size.

Power Analysis

Small effect size = $\gamma = .1$

$$\delta = \gamma\sqrt{\frac{n}{2}} = .1\sqrt{\frac{500}{2}} = 1.58$$

Power = .36

Small to Medium effect size= $\gamma = .25$

$$\delta = \gamma\sqrt{\frac{n}{2}} = .25\sqrt{\frac{500}{2}} = 4.0$$

Power = .98

Example 2

	$\overline{X}$	s	n
Women	3.75	.5	200
Men	3.70	.5	200

95% Confidence Interval

$S_p = .5$

$$S_{\overline{X}_1-\overline{X}_2} = \sqrt{S_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)} = \sqrt{(.5)^2\left(\frac{1}{200}+\frac{1}{200}\right)} = .05$$

$$\left(X_1 - X_2\right) \pm S_{\overline{X}_1-\overline{X}_2}(t_{crit}) = .05 \pm .05*1.96 = [-.148, .048]$$

Note: Result is not statistically significant.
Conclusion: Difference may be as large as (.3)*(s), a small to medium effect size.

Power Analysis

Small to Medium effect size= $\gamma = .25$

$$\delta = \gamma\sqrt{\frac{n}{2}} = .25\sqrt{\frac{200}{2}} = 2.5$$

Power = .71

Medium effect size= $\gamma = .5$

$$\delta = \gamma\sqrt{\frac{n}{2}} = .5\sqrt{\frac{200}{2}} = 5.0$$

Power = .99