Power

Psychology 3256

Introduction

- We care quite a bit about Type I error
- we set α
- Our software gives us exact p values
- Why is Type I error “more important” than Type II error?

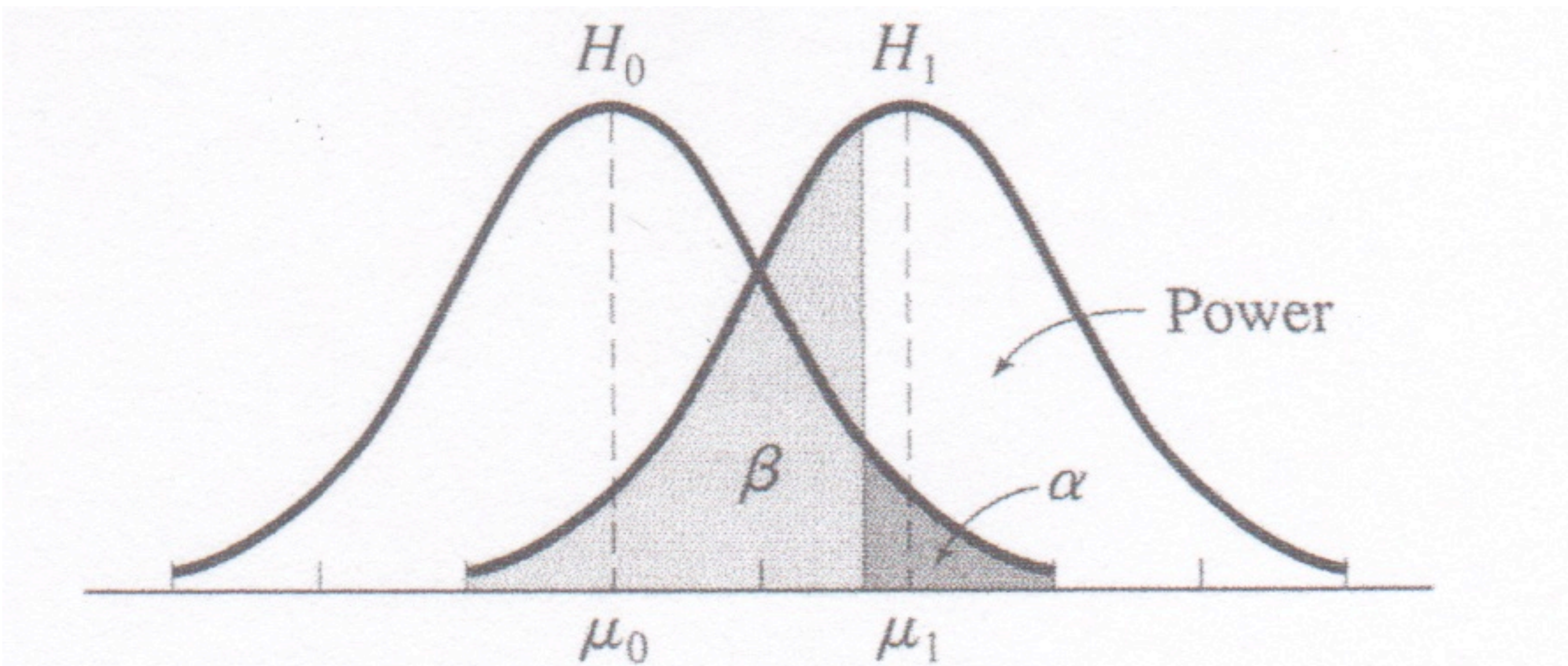
well..

- Historically, Fisher and the null hypothesis
- easier, all of our methods are set up that way
- easy to set up a situation where nothing happened (the null)
- For Ha we must know how big the effect is too

In the best of all possible worlds

- We would minimize α β and have the most power we could
- power is p(reject Ho|Ha true)

A picture is worth a thousand words….



- Decrease σ

Variance is our best bet

- So,making the variance smaller will tighten up the distribution
- This will mean less overlap
- $\sigma_{\bar{x}}^2$ is a function of n, so just increase n

Effect Size

- $\mu_1 - \mu_0$
- Well we have to standardize this
- $d = (\mu_1 - \mu_0)/ \sigma$
- hmmm
  - prior research
  - how big is big enough?

Cohen's Method

Size	d	% overlap
Small	0.2	85
Medium	0.5	67
Large	0.8	53

Now what...

- We combine this info with the effect of sample size
- The δ statistic
- $\delta = d(f(n))$
- f(n) is how n affects a given test, so for a t test, $f(n) = \sqrt{n}$

this is not that bad..

- if you ‘know’ d you can figure out the sample size needed for a given power.
- ok, let’s say we ‘know’ d is .5
- (BTW, usually you would pick .5)
- say we want a power of .8
- Look it up in appendix Power

Just using another table

- d = .5
- (1-β) = .8
- α = .05

APPENDIX POWER: POWER AS A FUNCTION OF δ AND SIGNIFICANCE LEVEL (α)

	α for Two-Tailed Test			
δ	.10	.05	.02	.01
1.00	.26	.17	.09	.06
1.10	.29	.20	.11	.07
1.20	.33	.22	.13	.08
1.30	.37	.26	.15	.10
1.40	.40	.29	.18	.12
1.50	.44	.32	.20	.14
1.60	.48	.36	.23	.17
1.70	.52	.40	.27	.19
1.80	.56	.44	.30	.22
1.90	.60	.48	.34	.25
2.00	.64	.52	.37	.28
2.10	.68	.56	.41	.32
2.20	.71	.60	.45	.35
2.30	.74	.63	.49	.39
2.40	.78	.67	.53	.43
2.50	.80	.71	.57	.47
2.60	.83	.74	.61	.51
2.70	.85	.77	.65	.55
2.80	.88	.80	.68	.59
2.90	.90	.83	.72	.63
3.00	.91	.85	.75	.66
3.10	.93	.87	.78	.70
3.20	.94	.89	.81	.73
3.30	.95	.91	.84	.77
3.40	.96	.93	.86	.80
3.50	.97	.94	.88	.82
3.60	.98	.95	.90	.85
3.70	.98	.96	.92	.87
3.80	.98	.97	.93	.89
3.90	.99	.97	.94	.91
4.00	.99	.98	.95	.92
4.10	.99	.98	.96	.94
4.20	—	.99	.97	.95
4.30	—	.99	.98	.96
4.40	—	.99	.98	.97
4.50	—	.99	.99	.97
4.60	—	—	.99	.98
4.70	—	—	.99	.98
4.80	—	—	.99	.99
4.90	—	—	—	.99
5.00	—	—	—	.99

Source: The entries in this table were computed by the author.

Do the math

$$n = (\frac{\delta}{d})^2$$

$$n = (\frac{2.80}{.5})^2$$

31.36

If we increase the power

- Let's make it .99 instead of .8
- The δ value now from the table is 4.20

$$n = (\frac{\delta}{d})^2$$

$$n = (\frac{4.20}{.5})^2$$

70.56

What the hell is δ?

- It is called the noncentrality parameter
- We assume Ho right?
- Under Ho E(t)=0
- i.e., how likely is it that we will find a value of δ that is > $t_{.05}$

$$\delta = \frac{\bar{x} - \mu}{s / \sqrt{n}} \neq 0$$

Do Power Calculations!