

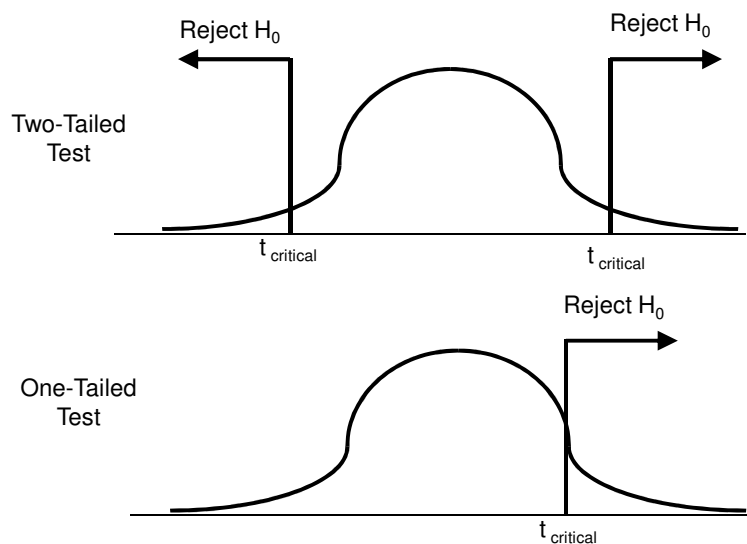
PSY 3020 the t -Statistic

- Agenda
 - One vs. two tailed t tests
 - Single sample t in APA format
 - Effect Size
 - JASP

But the age of chivalry is gone -- That of sophisters, economists, and calculators has succeeded; and the glory of Europe is extinguished for ever.

-- Edmund Burke (1790)

One vs. Two Tailed Tests ($\alpha = .05$)



Studies have shown IQ tests are increasing about 7 points per decade. Researcher obtains an IQ test from 1980 standardized to produce population mean of $\mu = 100$. Administers today to $n = 16$ high school students, sample mean $M = 121$ with $SS = 6000$. Is this result sufficient to conclude that today's sample scored significantly higher than would be expected from a population with $\mu = 100$? Use a one-tailed test with $\alpha = .01$.

reporting t in APA format

- Generic Format
 - A _____ test showed that _____ scores ($M = \underline{\hspace{1cm}}$) were significantly/not significantly greater/less than _____ scores ($\mu = \underline{\hspace{1cm}}$), $t(df) = \underline{\hspace{1cm}}. \underline{\hspace{1cm}} \underline{\hspace{1cm}} \underline{\hspace{1cm}}$, $p \underline{\hspace{1cm}}$, _____ tail.
- Leading Zeros
 - Report a 0 before a decimal only when the value can exceed 1.

Sample

- A single sample t test showed that current IQ scores of 121 were significantly higher than the 1980 average of 100, $t(15) = 4.200$, $p < .01$, one-tailed, $r^2 = .54$.

Assumptions & Power

- Assumptions
 - random sampling
 - normality
- Factors that increase power ($1-\beta$)
 - larger effect size (difference between μ_0 and μ_1)
 - larger n (sample size)
 - smaller σ^2 (variability in the population)
 - choose a lower level of α (alpha)

Two Different Concerns

- Statistical Significance – what caused the change
 - What is the probability of getting a mean this high or low due to sampling error alone when the H_0 is true (and the treatment does nothing)
 - That is, did sampling error cause my effect.
- Effect Size – how much change
 - How large a change is associated with the independent variable?
 - How much of what I see is due to what I did and how much is due to stuff I didn't examine?

Measures of Effect Size for t

- Cohen's d

$$\text{Cohen's } d = \frac{\text{mean difference}}{\text{sample standard deviation}}$$

- r^2
 - Percentage of variance Explained

$$r^2 = \frac{t^2}{t^2 + df}$$

Interpreting d

based on Cohen's (1988) Effect sizes for Correlations

Magnitude of d	Evaluation of Effect Size
0.2	Small effect
0.5	Medium effect
0.8	Large effect

Generic Sentence for Interpreting d

- The effect size was $d = \underline{\hspace{2cm}}$.
According to Cohen (1988),
this is a small/medium/large
effect.

Interpreting r^2

based on Cohen's (1988) Effect sizes for Correlations

Magnitude of r^2	Evaluation of Effect Size
$.01 < r^2 < .09$	Small effect
$.09 < r^2 < .25$	Medium effect
$r^2 > .25$	Large effect

Generic Sentence for Interpreting r^2

- 33% (r^2) of the differences in TCAP science scores is associated with the ability to read complex words. According to Cohen (1988), this is a large effect.

Single Sample t in SPSS

- Digit Span. <http://cognitivefun.net/test/7>
- Compare the sample with the population from the WAIS-IV (Wechsler, 2008). The values from WAIS-IV test manual, ages 20-24, are as follows: LDSF ($\mu = 6.9$, $\sigma = 1.3$), LDSB ($\mu = 5.1$, $\sigma = 1.3$).
- Data File:
 - SPSS S2014 Memory Span Full.sav
 - $n = 29$ students from research methods, tested twice, 1 month apart

Compare digits FWD to $\mu = 6.9$

- Use JASP
- Open the file DIGIT SPAN JASP provided on D2L
- Compare Digits FWD Time 1 vs. Test Value 6.9

Step 1: Open the File

- Download the data file from D2L
- Open the file in JASP
- Notice digits FWD...that's the column we will use

Digit Span JASP

	Semester	Age	Gender	Digits FWD	Digits BWD
1	F2013	22.0001	Female	6.0001	6.0001
2	F2013	22	Male	9	6
3	F2013	20	Female	7	6
4	F2013	28	Male	8	8
5	F2013	19	Female	7	6
6	F2013	28	Male	5	5
7	F2013	25	Male	7	6
8	F2013	22	Female	11	8
9	F2013	22	Female	8	7
10	F2013	23	Male	7	6
11	F2013	22	Female	5	5
12	F2013	22	Female	7	7
13	F2013	21	Female	7	5
14	F2013	26	Male	7	7

Step 2: One sample t test

- Choose one sample from the t test menu
- Move the item "digits FWD" to the right column
- Enter the test value of 6.9
- Click "effect size" to get Cohen's d and descriptives to get M and SD

Digit Span JASP*

File Common

Descriptives T-Tests ANOVA Regression Frequencies

Age Digits BWD Digits FWD 2 Digits BWD 2 Blocks FWD Blocks BWD Semester Gender

Digits FWD

Test value: 6.9

Additional Statistics

☐ Mean difference

☒ Effect size

☐ Confidence interval

Interval 95 %

OK

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Step 3: Write APA Format Sentence

T-Test ▼

One Sample T-Test ▼

	t	df	p	Cohen's d
Digits FWD	0.985	28.00	0.333	0.183

Note. All tests, hypothesis is population mean is different from 6.9

Descriptives

	N	Mean	SD	SE
Digits FWD	29.00	7.172	1.490	0.277

A single sample *t* test showed that forward digit span in the sample ($M = 7.17$, $SD = 1.49$) was not significantly higher than the WAIS-IV test manual score ($\mu = 6.9$), $t(28) = 0.985$, $p = .333$, two-tailed, $d = 0.183$.