(4) a) As the difference between the sample means increases, the value of the independent-measures t ~~statt~~ statistic increases

b.) As the variability of the scores in the two samples increases, the value of the independent measures t statistic decreases

Pop. means $\begin{cases} \mu_1 = \text{mean awake group} \\ \mu_2 = \text{mean rested group} \end{cases}$

(10)

1) $H_0: \mu_1 - \mu_2 \le 0$ (Fatigue does not increase errors)

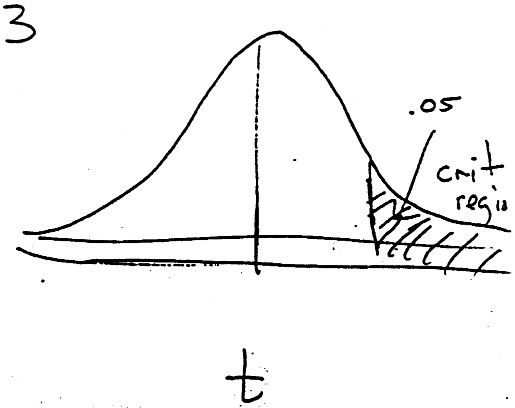
$H_1: \mu_1 - \mu_2 > 0$ (Fatigue increases errors)

$\alpha = .05$

2) $n_1 = 5 \quad n_2 = 10 \quad \therefore df = 4 + 9 = 13$

crit. region

$t > 1.771$



3) Compute t statistic for sample data

$$t_{obt} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_{\bar{X}_1 - \bar{X}_2}}$$

$$s_{\bar{X}_1-\bar{X}_2} = \sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}} \qquad s_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$$

$$= \sqrt{\frac{30}{5} + \frac{30}{10}} \qquad = \frac{120 + 270}{13}$$

$$= \sqrt{6+3} = \sqrt{9} = 3 \qquad = 30$$

$$t_{obt} = \frac{(35-24) - (0)}{3} = \frac{11}{3} = 3.67$$

4) Reject H_0 because t_{obt} of 3.67 is in the critical region.

5) Conclusion. Fatigue significantly increased the number of errors made, $t(13) = 3.67$, $p < .05$

OR

Better: The fatigue group made more errors on average ($M = 35$, $SD = 5.5$) than the rested group ($M = 24$, $SD = 5.5$). This difference was statistically significant, $t(13) = 3.67$, $p < .05$

Rats	Polluted Cage	Clean air Cage
	$\bar{X}_1 = 478$ day life span	$\bar{X}_2 = 511$
	$SS_1 = 5020$	$SS_2 = 10,100$
	$n_1 = 10$	$n_2 = 20$

Step 1: $H_0: \mu_1 - \mu_2 = 0$ (Pollution does not affect life expectancy)

$H_1: \mu_1 - \mu_2 \neq 0$ (Pollution affects life expectancy)

$\alpha = .01$

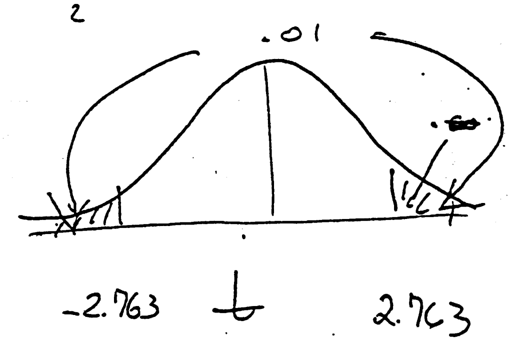
Step 2 Find crit region $df = df_1 + df_2 = 9 + 19 = 28$

Critical Region

$t > 2.763$

or

$t < -2.763$



Step 3 Compute t-statistic for sample data

$$t_{obt} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{S_{\bar{X}_1 - \bar{X}_2}}$$

Step 3.

$$S_{\bar{X}_1-\bar{X}_2} = \sqrt{\frac{S_p^2}{n_1} + \frac{S_p^2}{n_2}} \qquad S_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$$

$$S_{\bar{X}_1-\bar{X}_2} = \sqrt{\frac{540}{10} + \frac{540}{20}} \qquad = \frac{5020 + 10,100}{28}$$

$$= 540$$

$$= \sqrt{54 + 27}$$

$$= \sqrt{81} = 9$$

$$t_{obt} = \frac{(478 - 511) - (0)}{9}$$

$$= -3.67$$

Step 4 Reject H_0 because t_{obt} of -3.67 is in the critical region

5) Conclusion: Pollution ~~significantly~~ has a significant effect on life expectancy, $t(28) = -3.67$, $p < .01$

or

Life expectancy for the rats in the polluted cages was lower on average ($M = 478$, $SD = 23.6$) than the average life expectancy for the rats in the unpolluted cage ($M = 511$, $SD = 23.0$), a significant difference, $t(28) = -3.67$ $p < .01$

17) visits to doctor

Control Group

x	x^2
12	144
10	100
6	36
9	81
15	225
12	144
14	196
$\Sigma x = 78$	$926 = \Sigma x^2$

Dog Owners

x	x^2
8	64
5	25
9	81
4	16
6	36
$\Sigma x = 32$	$\Sigma x^2 = 222$

$\bar{X}_1 = 11.14$

$\bar{X}_2 = 6.4$

$$SS_1 = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 926 - \frac{78^2}{7} = 926 - 869.14 = \underline{56.86}$$

$$SS_2 = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 222 - \frac{32^2}{5} = 222 - 204.8 = 17.2$$

Step 1

$H_0: \mu_1 - \mu_2$ (no difference in # doctor visits for dog owners versus non-owners)

$H_1: \mu_1 - \mu_2$ (There is a difference in # doctor visits for dog owners versus non-owners

$\alpha = .05$

Step 2: Find critical region

$df = df_1 + df_2 = 6 + 4 = 10$

crit region

$t > 2.228$
or
$t < -2.228$

.05

Step 3 Obtain sample data & compute t-statistic

$$t_{obt.} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{S_{\bar{X}_1 - \bar{X}_2}}$$

$$t_{obt} = \frac{(11.14 - 6.4) - (0)}{1.59}$$

$$= \frac{4.74}{1.59} = 2.98$$

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

$$S_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$$

$$= \frac{56.86 + 17.2}{10}$$

$$= 7.406$$

$$S_{\bar{X}_1 - \bar{X}_2} = \sqrt{\frac{7.41}{7} + \frac{7.41}{5}}$$

$$= \sqrt{2.511}$$

$$1.585$$

$$\approx 1.59$$

Step 4 Reject H_0 because t_{obt} of 2.98 in crit region

5) Conclusion: Dog ~~[illegible]~~ owners make fewer visits to the doctor on average ($M = 6.4$, $SD = 1.04$) than non-owners ($M = 11.14$, $SD = 1.26$), a significant difference, $t(10) = 2.98$, $p < .05$.

(18) # Errors

Stimulus Poor Group X	X^2	Stimulus Rich Group X	X^2
37	1369	18	324
27	729	24	576
26	.	27	.
31	.	23	.
35	.	31	.
43	.	29	.
40	.	20	.
36	.	33	.
28	.	25	.
39	1521	30	900
$\sum x = 342$	$\sum x^2 = 12010$	$\sum x = 260$	$\sum x^2 = 6974$

$n_1 = 10$ $\quad$ $\bar{X}_1 = 34.2$

$n_2 = 10$ $\quad$ $\bar{X}_2 = 26.0$

$$SS_1 = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$= 12010 - \frac{342^2}{10}$$

$$= 12010 - 11696.4$$

$$313.6$$

$$SS_2 = \sum x^2 - \frac{(\sum x)^2}{n}$$

$$= 6974 - \frac{260^2}{10}$$

$$= \cancel{6760}\ 214$$

Step 1 $\quad H_0: \mu_1 - \mu_2 = 0$ (No difference in errors for stim-rich rats versus stim poor rats)

$H_1: \mu_1 - \mu_2 \neq 0$ (There is a difference between the stim-rich rats & the stim-poor rats)

$\alpha = .01$

Step 2 Crit Region $df' = df_1 + df_2 = 9 + 9 = 18$

$t < -2.878$ or $t > +2.878$

$$df = df_1 + df_2 = 9 + 9 = 18$$

Step 3 Collect sample data & compute t

$$t_{obt.} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{s_{\bar{X}_1 - \bar{X}_2}}$$

$$= \frac{(34.2 - 26.0)}{2.42}$$

$$= -3.39$$

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

$$s_p^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$$

$$= \frac{313.6 + 214}{18}$$

$$= 29.3$$

$$= \sqrt{\frac{29.3}{10} + \frac{29.3}{10}}$$

$$= 2.42$$

Step 4 Reject H_0 because t_{obt} of -3.39 is in crit. region

Conclusion

Rats raised in a stimulus-rich environment make fewer errors on average ($M = 26$, $SD = 4.88$) than rats raised in a stimulus-poor environment ($M = 34.2$, $SD = 5.9$), $t(18) = -3.39$, $p < .0$