

Stat 101L: Lecture 38

Example

- * Alcohol and Reaction Time
- * Experiment run as a block design with participants as blocks.
- * A pair of reaction times (seconds) for each participant.

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Participant	No Alcohol	Alcohol	Difference Alc - No Alc
1	6.7	7.4	0.7
2	7.0	7.0	0.0
3	7.0	7.7	0.7
4	7.3	7.5	0.2
5	7.2	7.0	-0.2
6	7.4	7.6	0.2
7	6.2	7.4	1.2
8	6.4	7.5	1.1
9	6.6	7.2	0.6
10	7.7	7.4	-0.3
11	7.7	7.7	0.0
12	6.5	7.4	0.9

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Summary of Differences

$$n = 12$$

$$\bar{d} = \frac{(\sum d)}{n} = \frac{5.1}{12} = 0.425$$

$$s_d = 0.5083$$

$$SE(\bar{d}) = \frac{s_d}{\sqrt{n}} = \frac{0.5083}{\sqrt{12}} = 0.1467$$

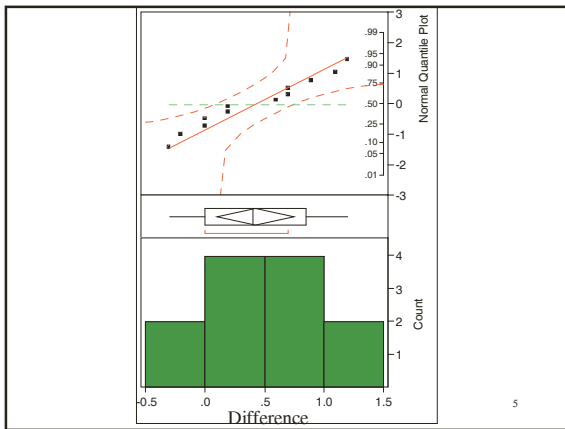
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Conditions & Assumptions

- *Randomization Condition
 - Paired data
- *Nearly Normal Condition
 - The differences could have come from a population whose distribution is a normal model.

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Confidence Interval for μ_d

$$\bar{d} \pm t^* SE(\bar{d})$$

$$SE(\bar{d}) = \frac{s_d}{\sqrt{n}}$$

t^* from Table T;

$$df = n - 1$$

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Table T

df					
1					
2					
3					
4					
⋮					
11			2.201		
Confidence Levels	80%	90%	95%	98%	99%

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Confidence Interval for μ_d

$$\bar{d} \pm t^* SE(\bar{d})$$
$$0.425 \pm 2.201(0.1467)$$
$$0.425 \pm 0.323$$
$$0.102 \text{ to } 0.748$$

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Interpretation

- * We are 95% confident that the mean difference in reaction time is between 0.102 and 0.748 seconds.
- * On average, a person's reaction time increases from 0.102 to 0.748 seconds after drinking this amount of alcohol.

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Test of Hypothesis for μ_d

*Step 1: Null and Alternative Hypotheses.

$$H_0 : \mu_d = 0$$

$$H_A : \mu_d > 0$$

*Step 2: Check Conditions

–See earlier slides.

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Test of Hypothesis for μ_d

*Step 3: Test Statistic and P-value

$$t = \frac{\bar{d} - 0}{SE(\bar{d})} = \frac{0.425}{0.1467} = 2.897$$

P – value is between 0.005 and 0.01

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Test of Hypothesis for μ_d

*Step 4: Use the P-value to make a decision.

–Because the P-value is small, reject the null hypothesis.

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Test of Hypothesis for μ_d

- *Step 5: State a conclusion within the context of the problem.
 - The population mean difference in reaction time, with and without alcohol, is not zero.

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Comment

- *This agrees with the confidence interval. Zero was not in the confidence interval and so zero is not a plausible value for the population mean difference.

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JMP

- *Data in two columns
 - Reaction time with no alcohol.
 - Reaction time with alcohol.
- *Create a new column of differences
 - Cols – Formula

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JMP

- * Analysis – Distribution
 - Differences
- * JMP Starter – Basic
 - Matched Pairs

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Analysis - Distribution

Distributions

Difference

Moments

Test Mean=value

Mean	0.425	Hypothesized Value	0
Std Dev	0.5083395	Actual Estimate	0.425
Std Err Mean	0.146745	df	11
upper 95% Mean	0.7479835	Std Dev	0.50834
lower 95% Mean	0.1020165	t Test	
N	12	Test Statistic	2.8962
		Prob > t	0.0145
		Prob > t	0.0073
		Prob < t	0.9927

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Matched Pairs

Matched Pairs

Difference: Alcohol-No Alcohol

Alcohol	7.4	t-Ratio	2.896181
No Alcohol	6.975	DF	11
Mean Difference	0.425	Prob > t	0.0145
Std Error	0.14674	Prob > t	0.0073
Upper95%	0.74798	Prob < t	0.9927
Lower95%	0.10202		
N	12		
Correlation	0.20195		

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