

**POLITICAL SCIENCE 205**  
INTRODUCTION TO RESEARCH METHODOLOGY

T-Tests  
Wednesday, October 25  
Week 4, Day 1

**Agenda**

- I. Hypothesis testing
- II. T-Tests for Independent Samples
- III. What's significant?
- IV. Starting the activity

Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

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**Lecture Question**

How do we use SPSS to start evaluating hypotheses?

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**Hypothesis Testing**

The process of using sample data to *evaluate the credibility* of a hypothesis about a population.

**Our tests:**  
T-tests  
ANOVAs  
Chi-square  
Correlations  
Regressions

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**How do we test hypotheses?**

One of the distinguishing factors in hypothesis testing refers to the two types of hypotheses.

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**Review: Types of hypotheses**

**Directional hypotheses:** Reflects a difference between groups, but a direction is specified.

**Non-directional hypotheses:** Reflects a difference between groups, but no direction is specified.

**Null hypotheses:** A statement that there is no relationship between concepts.

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**Review: Types of hypotheses**

As the GDP of a country increases, the life expectancy of that population also increases. **Directional**

There is no difference between poor and rich people in their levels of political participation. **Null**


There is a difference between males and females regarding their opinions about abortion. **Non-directional**

There is a difference between Trump voters and Clinton voters regarding their levels of political knowledge. **Non-directional**

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Critical Values



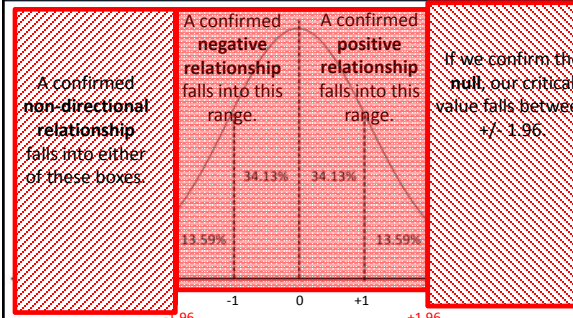
A **critical value** is given for every statistical test we conduct.

It is based on the normal curve, giving us a value that allows us to either accept or reject the null hypothesis.

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One-tail vs. Two-Tails



A confirmed **non-directional relationship** falls into either of these boxes.

A confirmed **negative relationship** falls into this range.


A confirmed **positive relationship** falls into this range.

If we confirm the **null**, our critical value falls between  $\pm 1.96$ .

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T-Tests



A **t-test** is an examination of *two means* from two sets of numbers.

**Two types:**

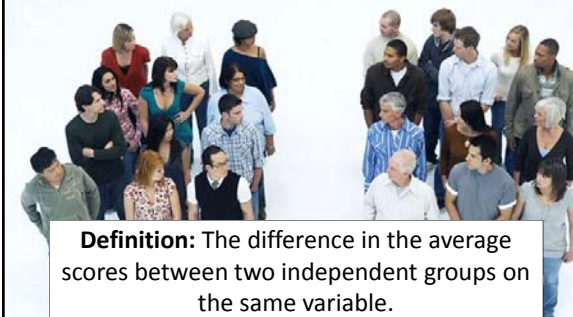
- 1) Independent samples Always used for non-directional hypotheses
- 2) Dependent samples

A **t-test** yields a critical value that allows you to accept or reject your null hypothesis.

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T-Tests for Independent Samples



**Definition:** The difference in the average scores between two independent groups on the same variable.

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Terrorist Attacks




**Hypothesis:** There is a difference between the number of kills that occur in **political** terrorist acts and the number of kills that occur in **non-political** terrorist acts.

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Assumptions for this T-Test



- 1. Your independent variable will only have **TWO** categories
- 2. Your dependent variable *has* to be interval-ratio

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**Terrorism Causalities**

Political Acts			Non-Political Acts		
15	12	11	11	9	10
10	7	9	4	5	7
11	19	8	2	3	4
9	11	8	9	7	8
14	13	7	11	12	9
14	8	7	10	10	12

$\bar{X}_1 = 10.72; s_1^2 = 10.31; n_1 = 18$   $\bar{X}_2 = 7.94; s_2^2 = 9.39; n_2 = 18$

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**T-Test Equation**

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left( \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \right) \left( \frac{n_1 + n_2}{n_1 n_2} \right)}}$$

**Political Acts** **Non-Political Acts**

$\bar{X}_1 = 10.72; s_1^2 = 10.31; n_1 = 18$   $\bar{X}_2 = 7.94; s_2^2 = 9.39; n_2 = 18$

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**Political Acts** **Non-Political Acts**

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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

**T-Test Equation**

$$t = \frac{10.72 - 7.94}{\sqrt{\left( \frac{(18 - 1)10.31 + (18 - 1)9.39}{18 + 18 - 2} \right) \left( \frac{18 + 18}{18 \times 18} \right)}}$$

**Political Acts** **Non-Political Acts**

$\bar{X}_1 = 10.72; s_1^2 = 10.31; n_1 = 18$   $\bar{X}_2 = 7.94; s_2^2 = 9.39; n_2 = 18$

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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

**T-Test Equation**

$t = -2.581$

How do we interpret this t-test statistic?

**Political Acts** **Non-Political Acts**

$\bar{X}_1 = 10.72; s_1^2 = 10.31; n_1 = 18$   $\bar{X}_2 = 7.94; s_2^2 = 9.39; n_2 = 18$

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Degrees of Freedom



$n - k$

$n = \text{number of observations}$

$k = \text{number of parameters}$

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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

Interpreting the T-Test

$t = -2.581$

We need to calculate the degrees of freedom:

Use the appendix on page 403 to find the critical value needed to reject the null hypothesis

$df = (n_1 - 1) + (n_2 - 1)$   
 $df = (18 - 1) + (18 - 1)$   
 $df = 34$

**Hypothesis:** There is a difference between the number of kills that occur in **political** terrorist acts and the number of kills that occur in **non-political** terrorist acts.

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Table B.2 (Continued)

df	One-tailed Test			df	Two-tailed Test		
	0.10	0.05	0.01		0.10	0.05	0.01
23	1.312	1.714	2.5	23	1.714	2.070	2.808
24	1.310	1.711	2.492	24	1.711	2.064	2.797
25	1.317	1.708	2.485	25	1.708	2.056	2.788
26	1.315	1.706	2.479	26	1.706	2.056	2.779
27	1.314	1.704	2.475	27	1.704	2.052	2.771
28	1.313	1.703	2.467	28	1.703	2.049	2.764
29	1.312	1.699	2.462	29	1.699	2.045	2.757
30	1.311	1.698	2.458	30	1.698	2.044	2.75
35	1.306	1.69	2.438	35	1.69	2.03	2.724
40	1.303	1.684	2.424	40	1.684	2.017	2.705
45	1.301	1.68	2.412	45	1.68	2.014	2.69
50	1.299	1.676	2.404	50	1.676	2.009	2.678
55	1.297	1.673	2.396	55	1.673	2.004	2.668
60	1.296	1.671	2.39	60	1.671	2.001	2.661
65	1.295	1.669	2.385	65	1.669	1.997	2.654
70	1.294	1.667	2.381	70	1.667	1.995	2.648
75	1.293	1.666	2.377	75	1.666	1.992	2.643
80	1.292	1.664	2.374	80	1.664	1.99	2.639
85	1.292	1.663	2.371	85	1.663	1.989	2.635
90	1.291	1.662	2.369	90	1.662	1.987	2.632
95	1.291	1.661	2.366	95	1.661	1.986	2.629
100	1.29	1.66	2.364	100	1.66	1.984	2.626
Infinity	1.282	1.645	2.327	Infinity	1.645	1.96	2.576

Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

Interpreting the T-Test

$t = -2.581$

We need to calculate the degrees of freedom:

Use the appendix on page 403 to find the critical value needed to reject the null hypothesis

$df = (n_1 - 1) + (n_2 - 1)$   
 $df = (18 - 1) + (18 - 1)$   
 $df = 34$

$t = -2.03$

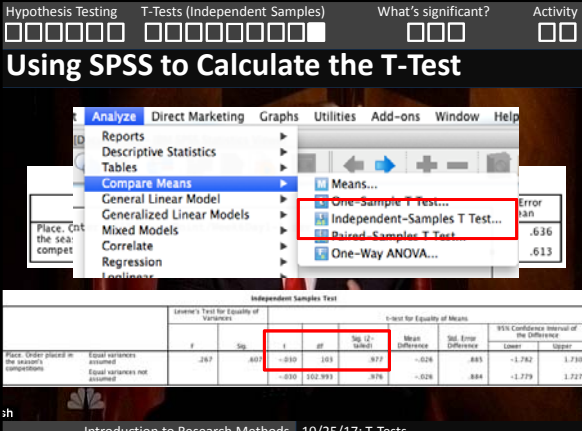
**Hypothesis:** There is a difference between the number of kills that occur in **political** terrorist acts and the number of kills that occur in **non-political** terrorist acts.

This is our value needed to reject the null hypothesis

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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

Using SPSS to Calculate the T-Test



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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

Significance Values

Significance values (or **p-values**) tells us if our hypothesized relationship is due to random chance.

**Three rules:**

- 1)  $0 < \text{Significance Values} < 1$
- 2) Relationships exist only if your significance value is under .05.
- 3) If your significance value is above .05, then the relationship does not exist.

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### Significance Values Examples

**Significance value: .033**  
This relationship is **significant** as it is under .05.  
There is a 3.3% probability this relationship is due to chance. We confirm the hypothesis.

**Significance value: .510**  
This relationship is **not significant** as it is over .05.  
There is a 51.0% probability this relationship is due to chance. We confirm the null hypothesis.


**Significance value: .000**  
This relationship is **significant** as it is under .05.  
There is a 0.0% probability this relationship is due to chance. We confirm the hypothesis.

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Hypothesis Testing T-Tests (Independent Samples) What's significant? Activity

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### Activity



**Hypothesis: There is a difference between males and females in our class on their thermometer score for Hillary Clinton.**

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### Activity 3, Part C



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