



predictum

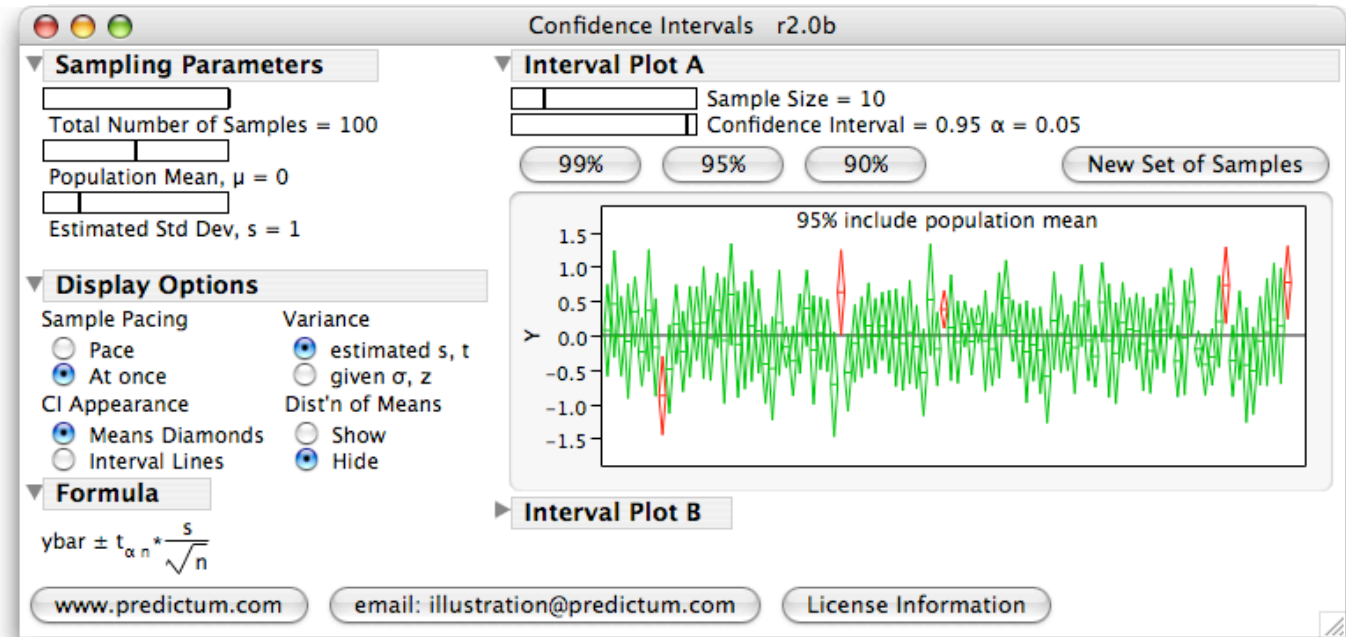
Confidence Intevals

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minimum requirements:  
JMP v 7.02 + curiosity  
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## Learning Objectives

- Explore Type I Errors
- Determine the proportion of Confidence Intervals that miss the true average
- Understand the effect sample size,  $n$ , has on proportion of Confidence intervals that miss the true average
- Appreciate the effect  $\alpha$  has on the proportion missing the true average
- Realize the need to employ multiple comparison techniques (e.g. Tukey HSD) with more than 2 group, N-way ANOVA
- Compare t versus z-based confidence intervals
- Understand the effect sample size,  $n$ , has on variation in sample means



not to scale

From making simple comparisons to identifying significant variables in multiple regression Confidence Intervals are fundamental to a large number of statistical methods. This dynamic illustration makes it easy to explore and apply confidence intervals.

The illustration calculates confidence intervals from samples drawn repeatedly from a population with a specified mean and variance.

Adjust the number of samples (confidence intervals), standard deviation and mean

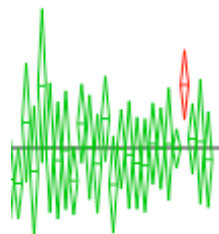
A variety of display options allowing you to pace the addition of samples, how intervals should be represented, choose between t and z and show the distribution of means.

Formula changes to according to the Variance radio button.

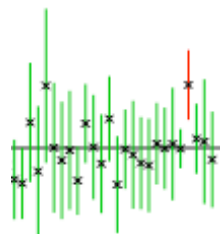
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Confidence Intervals - those in red indicate Type I errors.

Select sample,  $n$ , size and  $\alpha$ .



Means Diamonds



Interval Lines



Set the Mean and Standard Deviation to reflect a situation of interest.

Confidence Intervals r2.0b

**Sampling Parameters**

Total Number of Samples = 100

Population Mean,  $\mu = 0$

Estimated Std Dev,  $s = 1$

**Display Options**

Sample Pacing

Pace

At once

Variance

estimated  $s, t$

given  $\sigma, z$

CI Appearance

Means Diamonds

Interval Lines

**Formula**

$$\bar{y} \pm t_{\alpha n} * \frac{s}{\sqrt{n}}$$

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Interval Plot A

Sample Size = 10

Confidence Interval = 0.95  $\alpha = 0.05$

99%    95%    90%    New Set of Samples

95% include population mean

Interval Plot B

not to scale

The scale automatically adjust according to the selected mean and standard deviation.

The horizontal line appears at the selected Mean.

Open the reveal icon for Interval Plot B and compare the effects of different sample sizes and  $\alpha$  settings.

**Confidence Intervals r2.0b**

**Sampling Parameters**

Total Number of Samples = 100

Population Mean,  $\mu = 0$

Estimated Std Dev,  $s = 1$

**Display Options**

Sample Pacing:  Pace,  At once

Variance:  estimated s, t,  given  $\sigma$ , z

CI Appearance:  Means Diamonds,  Interval Lines

Dist'n of Means:  Show,  Hide

**Formula**

$$\bar{y} \pm t_{\alpha n} \cdot \frac{s}{\sqrt{n}}$$

**Interval Plot A**

Sample Size = 10

Confidence Interval = 0.95  $\alpha = 0.05$

99% 95% 90% New Set of Samples

95% include population mean

**Interval Plot B**

Sample Size = 50

Confidence Interval = 0.95  $\alpha = 0.05$

99% 95% 90% New Set of Samples

95% include population mean

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Select Show Distribution of Means

Note that the higher the sample size,  $n$ , the tighter the confidence intervals, for a given  $\alpha$ , and the tighter the distribution of the means.

Confidence Intervals r2.0b

**Sampling Parameters**

Total Number of Samples = 100

Population Mean,  $\mu = 0$

Estimated Std Dev,  $s = 1$

**Display Options**

Sample Pacing:  Pace,  At once

Variance:  estimated  $s, t$ ,  given  $\sigma, z$

CI Appearance:  Means Diamonds,  Dist'n of Means,  Interval Lines,  Show,  Hide

**Formula**

$$\bar{y} \pm t_{\alpha n} * \frac{s}{\sqrt{n}}$$

**Interval Plot A**

Sample Size = 10

Confidence Interval = 0.95  $\alpha = 0.05$

99% 95% 90% New Set of Samples

95% include population mean

**Interval Plot B**

Sample Size = 50

Confidence Interval = 0.95  $\alpha = 0.05$

99% 95% 90% New Set of Samples

95% include population mean

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Reduce the Total Number of Samples to mimic an N-Way ANOVA

Confidence Intervals r2.0b

**Sampling Parameters**

Total Number of Samples = 3  
Population Mean,  $\mu = 0$   
Estimated Std Dev,  $s = 1$

**Display Options**

Sample Pacing:  Pace,  At once  
Variance:  estimated  $s, t$ ,  given  $\sigma, z$   
CI Appearance:  Means Diamonds,  Interval Lines  
Dist'n of Means:  Show,  Hide

**Formula**

$$\bar{y} \pm t_{\alpha n} \frac{s}{\sqrt{n}}$$

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Repeated collect a New Set of Samples and note how frequently Type I errors occur. Under the null hypothesis all groups are from the same population so they should straddle the true average. That they sometimes do not indicate the occurrence of Type I errors.

Increase the number of groups in this N-way ANOVA and sample repeatedly. Note that as the number of groups increases, so too the occurrences of Type I errors motivating the need for applying multiple comparison techniques such as Tukey HSD.

Confidence Intervals r2.0b

**Sampling Parameters**

Total Number of Samples = 8  
Population Mean,  $\mu = 0$   
Estimated Std Dev,  $s = 1$

**Display Options**

Sample Pacing:  Pace,  At once  
Variance:  estimated s, t,  given  $\sigma$ , z  
CI Appearance:  Means Diamonds,  Interval Lines  
Dist'n of Means:  Show,  Hide

**Formula**

$$\bar{y} \pm t_{\alpha n} \frac{s}{\sqrt{n}}$$

**Interval Plot A**

Sample Size = 10  
Confidence Interval = 0.95  $\alpha = 0.05$

99% 95% 90% New Set of Samples

75% include population mean

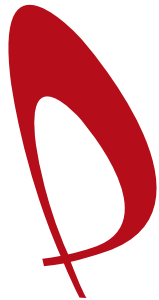
**Interval Plot B**

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