

# Using Applets to Develop Statistical Understanding

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## I. Simulation-based inference

[www.rossmanchance.com/applets/ChiSqShuffle.html?dolphins=1](http://www.rossmanchance.com/applets/ChiSqShuffle.html?dolphins=1)

### *Medical Study: Dolphin Therapy?* (from a workshop with Allan Rossman)

Swimming with dolphins can certainly be fun, but is it also therapeutic for patients suffering from clinical depression? To investigate this possibility, researchers recruited 30 subjects aged 18-65 with a clinical diagnosis of mild to moderate depression. Subjects were required to discontinue use of any antidepressant drugs or psychotherapy four weeks prior to the experiment, and throughout the experiment. These 30 subjects went to an island off the coast of Honduras, where they were randomly assigned to one of two treatment groups (15 subjects per group). Both groups engaged in the same amount of swimming and snorkeling each day, but one group (the animal care program) did so in the presence of bottlenose dolphins and the other group (outdoor nature program) did not. At the end of two weeks, each subjects' level of depression was evaluated, as it had been at the beginning of the study. For each subject, the researchers determined whether they showed "substantial improvement" in reducing their level of depression (Antonioli and Reveley, 2005).

### Analyzing Two-way Tables

Sample Data (2x2: ☒)

	dolphins	control	Totals
improved	10	3	13
didnot	5	12	17
Totals	15	15	30

Use Table

Clear

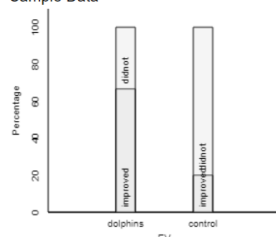
Show Table ☐

Statistic:

Show  $\chi^2$  output ☐

☒ 95% CI(s) for difference in proportions dolphins - control: (0.1538, 0.7795)\*

Sample Data



Success:  (dolphins - control)

Observed Diff(improved)=0.467

Show Shuffle Options ☒

Number of Shuffles

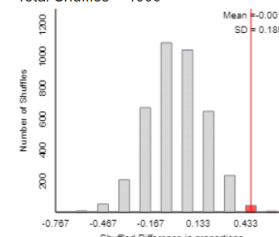
☒ Shuffle ☐ Cards ☐ Data ☐ Plot

Most Recent Shuffle



Most Recent Shuffle Difference in proportions =0.067

Total Shuffles = 4000



☐ Show previous

Count Samples   Count

Count= 49/4000 (0.0123)

☐ Overlay normal distribution

## II. Power of a Test

<https://istats.shinyapps.io/power/>

### Errors and Power in Significance Testing

Select null hypothesis value  $p_0$ :

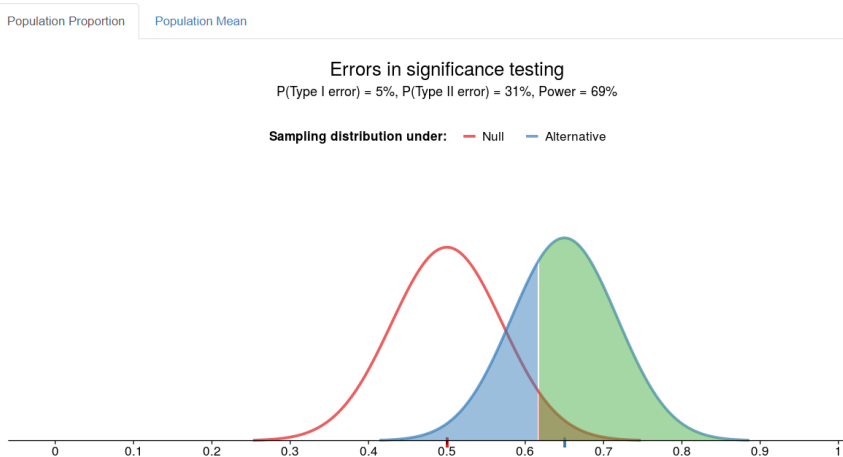
Type of alternative hypothesis:  
☒ greater ☐ not equal ☐ less

Show:  
☒ Type I error ☒ Type II error ☒ Power

True value of  $p$ :

Sample size  $n$ :

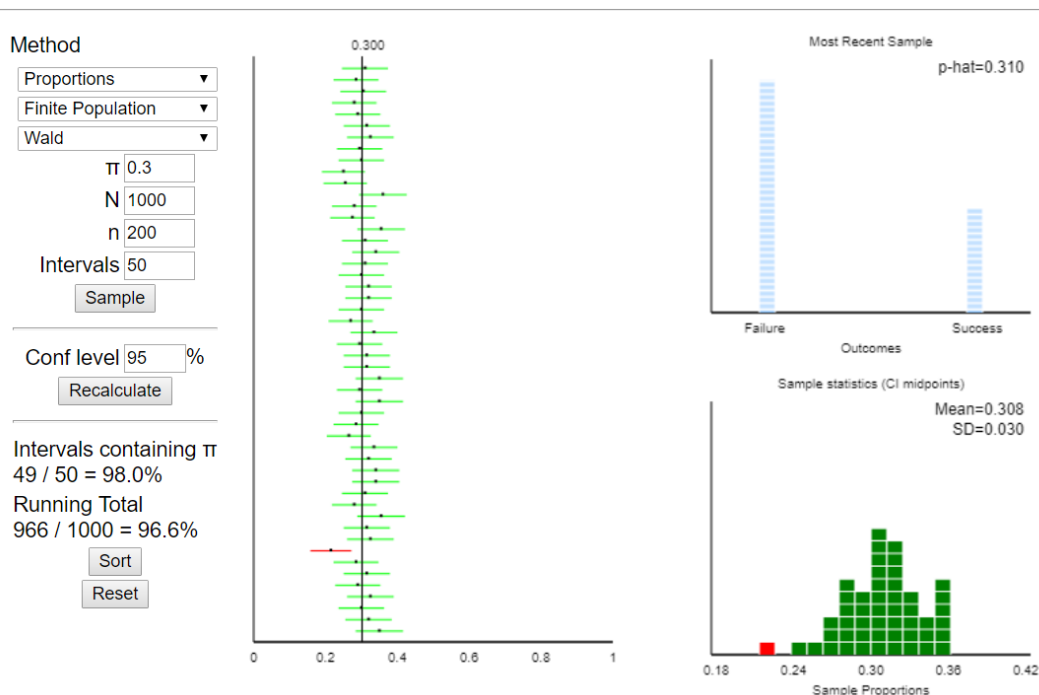
Type I Error  $\alpha$ :



## III. Confidence intervals and confidence levels

[www.rossmanchance.com/applets/ConfSim.html](http://www.rossmanchance.com/applets/ConfSim.html)

### Simulating Confidence Intervals



## IV. Choosing the correct inference procedure

[www.ltcconline.net/greenL/java/Statistics/catStatProb/categorizingStatProblemsJavaScript.html](http://www.ltcconline.net/greenL/java/Statistics/catStatProb/categorizingStatProblemsJavaScript.html)

The music industry is interested in estimating the percentage of all music played that has been legally purchased. They investigate 500 randomly selected songs on people's music players.

- ☐ Confidence Interval for a Population Mean
- ☐ Confidence Interval for a Proportion
- ☐ Confidence Interval for the Diff. Between 2 Means (Independent Samples)
- ☐ Confidence Interval for Paired Data (Dependent Samples)
- ☐ Confidence Interval for the Difference Between 2 Proportions
- ☐ Prediction for a Single Value of y for a Fixed x
- ☐ Hypothesis Test for a Population Mean
- ☐ Hypothesis Test for a Population Proportion
- ☐ Hyp. Test for the Difference Between 2 Means (Independent Samples)
- ☐ Hyp. Test for Paired Data (Dependent Samples)
- ☐ Hyp. Test for the Difference Between 2 Proportions
- ☐ Chi-Square Goodness of Fit Test
- ☐ Chi-Square Test for Independence
- ☐ Chi-Square Test for Homogeneity
- ☐ 1-Way ANOVA

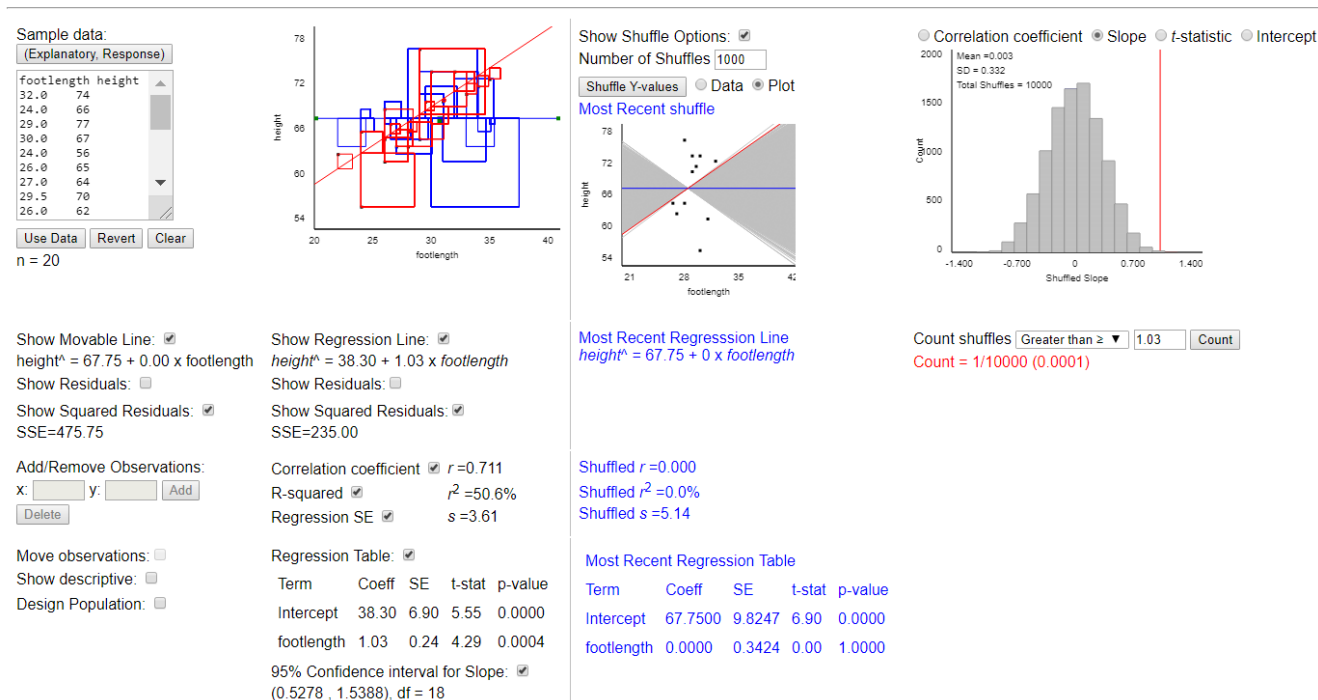
Choose the confidence interval or hypothesis test that will help with the above research.

## V. Relationships between two quantitative variables

[www.rossmanchance.com/applets/Reg.html](http://www.rossmanchance.com/applets/Reg.html)

footlength	32	24	29	30	24	26	27	29.5	26	26.5	28	28	26	35	30	31	29	34	33	22
height	74	66	77	67	56	65	64	70	62	67	66	64	69	73	74	70	65	72	71	63

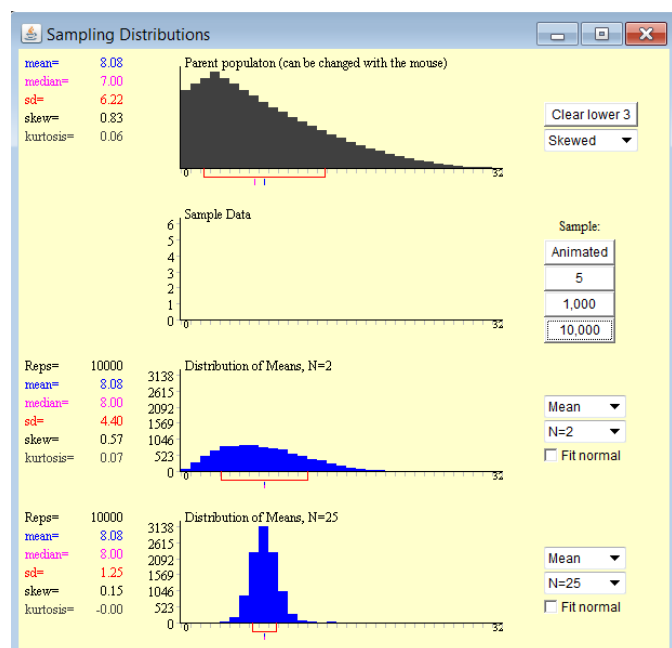
### Analyzing Two Quantitative Variables



## Other Terrific Applets to Develop Statistical Understanding

### VI. Sampling distribution of a mean—and more!

[onlinestatbook.com/stat\\_sim/sampling\\_dist/index.html](http://onlinestatbook.com/stat_sim/sampling_dist/index.html)



### VII. Statistical applets to replace graphing calculator

[www.stapplet.com](http://www.stapplet.com)

### VIII. StatKey simulation-based inference applets

[www.lock5stat.com/StatKey](http://www.lock5stat.com/StatKey)

### IX. Art of Stat interactive web applets

[www.artofstat.com/webapps.html](http://www.artofstat.com/webapps.html)

### X. Confidence interval for a mean (cute!)

[www.zoology.ubc.ca/~whitlock/Kingfisher/CIMean.htm](http://www.zoology.ubc.ca/~whitlock/Kingfisher/CIMean.htm)