

## 10.4: Bias and Variability Simulation

### Learning Objectives

- To explore various aspects of sampling distributions

This simulation lets you explore various aspects of sampling distributions. When it begins, a histogram of a normal distribution is displayed at the top of the screen.

The distribution portrayed at the top of the screen is the population from which samples are taken. The mean of the distribution is indicated by a small blue line and the median is indicated by a small purple line. Since the mean and median are the same, the two lines overlap. The red line extends from the mean one standard deviation in each direction. Note the correspondence between the colors used on the histogram and the statistics displayed to the left of the histogram.

The second histogram displays the sample data. This histogram is initially blank. The third and fourth histograms show the distribution of statistics computed from the sample data. The number of samples (replications) that the third and fourth histograms are based on is indicated by the label "Reps=."

### Basic operations

The simulation is set to initially sample five numbers from the population, compute the mean of the five numbers, and plot the mean. Click the "Animated sample" button and you will see the five numbers appear in the histogram. The mean of the five numbers will be computed and the mean will be plotted in the third histogram. Do this several times to see the distribution of means begin to be formed. Once you see how this works, you can speed things up by taking 5, 1,000, or 10,000 samples at a time.

### Choosing a statistic

The following statistics can be computed from the samples by choosing from the pop-up menu:

1. Mean: Mean
2. SD: Standard deviation of the sample ( $N$  is used in the denominator)
3. Variance: Variance of the sample ( $N$  is used in the denominator)
4. Variance ( $U$ ): Unbiased estimate of variance ( $N - 1$  is used in denominator)
5. MAD: Mean absolute value of the deviation from the mean
6. Range: Range

### Selecting a sample size

The size of each sample can be set to 2, 5, 10, 16, 20 or 25 from the pop-up menu. Be sure not to confuse sample size with number of samples.

### Comparison to a normal distribution

By clicking the "Fit normal" button you can see a normal distribution superimposed over the simulated sampling distribution.

### Changing the population distribution

You can change the population by clicking on the top histogram with the mouse and dragging

This page titled [10.4: Bias and Variability Simulation](#) is shared under a [Public Domain](#) license and was authored, remixed, and/or curated by [David Lane](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.