**Background:** Researchers in the Psychology Department at Yale University investigate the development of moral, social and cognitive behaviors in infants as a way of gaining insight into the underpinnings of human behavior.

In an introduction to a famous study published in Nature in 2007, Yale researchers wrote, "The capacity to evaluate other people is essential for navigating the social world. Humans must be able to assess the actions and intentions of the people around them, and make accurate decisions about who is friend and who is foe, who is an appropriate social partner and who is not."[1]

The following summary of this study is from Science Daily[2]

"The 2007 study by Yale University researchers provided the first evidence that 6- and 10-month-old infants could assess individuals based on their behavior towards others, showing a preference for those who helped rather than hindered another individual. ... In the original experiment, infants watched a wooden toy (i.e., the "climber") attempt to climb a hill. They viewed two social interactions; one in which a "helper" toy nudged the climber up the hill, and another in which a "hinderer" toy nudged the climber down the hill.

After viewing these two scenarios, the infants were presented with a tray; on one side of the tray was the helper and on the other side was the hinderer. Amazingly, the majority of infants picked the helper over the hinderer. To further elucidate infants' moral reasoning abilities, a "neutral" toy (i.e., a toy that neither helped nor hindered) was pitted against the helper or hinderer. When the neutral character was paired with the helper, the infants preferred the helper; when paired with the hinderer, they preferred the neutral character. ... The paper concluded that the experiments show that infants can evaluate individuals based on how they interact with another individual, and that their ability to do this is 'universal and unlearned'."

If you are interested in seeing short videos of this experiment, here is a link: http://www.yale.edu/infantlab/socialevaluation/Helper-Hinderer.html

In the Yale study, the infants watched the videos several times. Afterwards, when the infants were shown a tray with two pieces of wood, one shaped like the helper and the other shaped like the hinderer in the video, 14 of the 16 infants chose the helper over the hinderer. The Yale researchers concluded that infants prefer the helper toy and that this implies that infants have an innate ability to evaluate individuals based on how they interact with another individual.

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[1] http://www.nature.com/nature/journal/v450/n7169/full/nature06288.html
[2] http://www.sciencedaily.com/releases/2012/08/120815093230.htm

But wait … how do we know that infants really prefer the helper toy when we only have results from a single sample? Could these results occur if infants are just arbitrarily choosing a toy? What's the probability that this happens? We will conduct a simulation to answer these questions and see if simulation supports the conclusions reached by the Yale researchers.

**Simulation:** The StatCrunch applet simulates flipping a coin. It makes sense to use a coin flip in the simulation because in the experiment the infants had a choice between two toys (helper and hinderer).

Let's assume that the population of all infants does <u>not</u> have a preference. If this is true, then their choices can be simulated with a coin flip.

In the simulation each coin toss will represent one infant's choice. A head tells us that the infant chose the helper toy. A tail tells us that the infant chose the hinderer toy. Set up the applet as shown here.

<u>Setting up the simulation</u>: Log into StatCrunch. Choose Open StatCrunch. Choose Applets, Simulation, Coin Flipping.

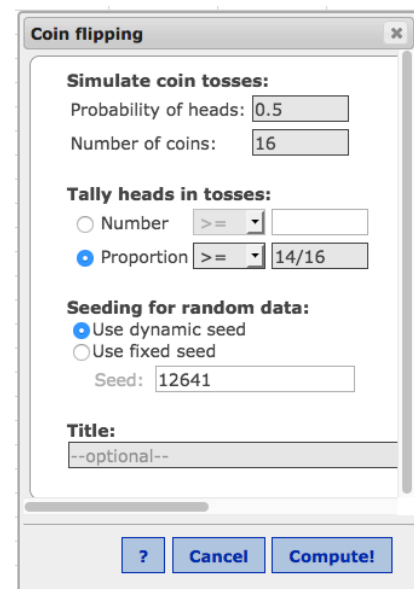Set up the simulation as shown below:

**Probability of heads: 0.5** (Because we are assuming that the infants are arbitrarily choosing, in the long run we expect 50% to choose the helper toy.)

**Number of coins: 16** (There are 16 infants in each sample)

**Tally heads in tosses: Proportion >= 14/16 = 0.875** (Because we want to see if the results from the Yale study are unusual, we want to find the probability that a sample will have a proportion of 14/16 or greater.)

Hit Compute!

Click on "1 run" and watch what happens. Repeat this three or more times until you understand how the simulation works.

**Questions about the distribution of sample proportions:**

1) Here are the results from one sample of 16 coin tosses.

    a) What is the sample proportion for the 16 coin tosses pictured?

    b) Write a sentence to explain the meaning of the sample proportion in the context of infants and toys.



2) Here is the graph from a simulation of 10,000 samples (called "runs" in the StatCrunch applet.)
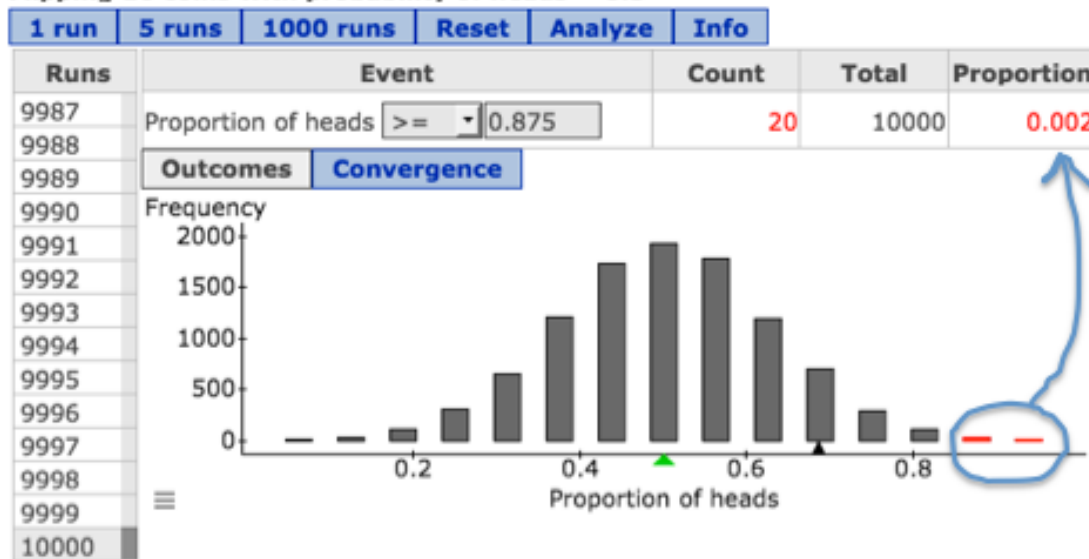


    a) If we had a dot plot instead of a histogram, there would be 10,000 dots. What would a dot represent? (One infant, a sample of 16 infants, a sample of 10,000 infants, or other?)

    b) In the graph the horizontal axis says "proportion of heads". Write a more accurate label for these values in terms of babies and toy preference.

c) For these 10,000 samples, apply the theory you learned to estimate the mean and the standard deviation of the distribution of sample proportions. Explain or show how you got your estimates.

d) Is a normal model a good fit for this distribution? Why or why not?

**Questions about making an inference based on a distribution of sample proportions:**

3) In the Yale experiment, 14 out of 16 infants chose the helper toy. This a sample proportion of 0.875.

a) Is 14 out of 16 unusual in a random sample if we assume p=0.5? Explain how you know.

b) What is the probability that in a random sample of 16 infants, 14 or more will choose the helper toy? Explain how you determined the probability.

c) The Yale researchers claim that infants recognize, and make judgments about, other individuals based on how they interact with each other. To show this, their experiment must produce strong evidence that the infants are not arbitrarily picking one toy over the other. Does their experiment provide strong evidence in support of their claim that infants have a preference for the helper? Why or why not?

4) Researchers in the Department of Psychology at the University of Otago in New Zealand have challenged the findings from the Yale study. Read the short article from Science Daily and describe the confounding variables that are the focus of the New Zealand critique. Summarize what the New Zealand researchers did to investigate the effects of these confounding factors.

http://www.sciencedaily.com/releases/2012/08/120815093230.htm