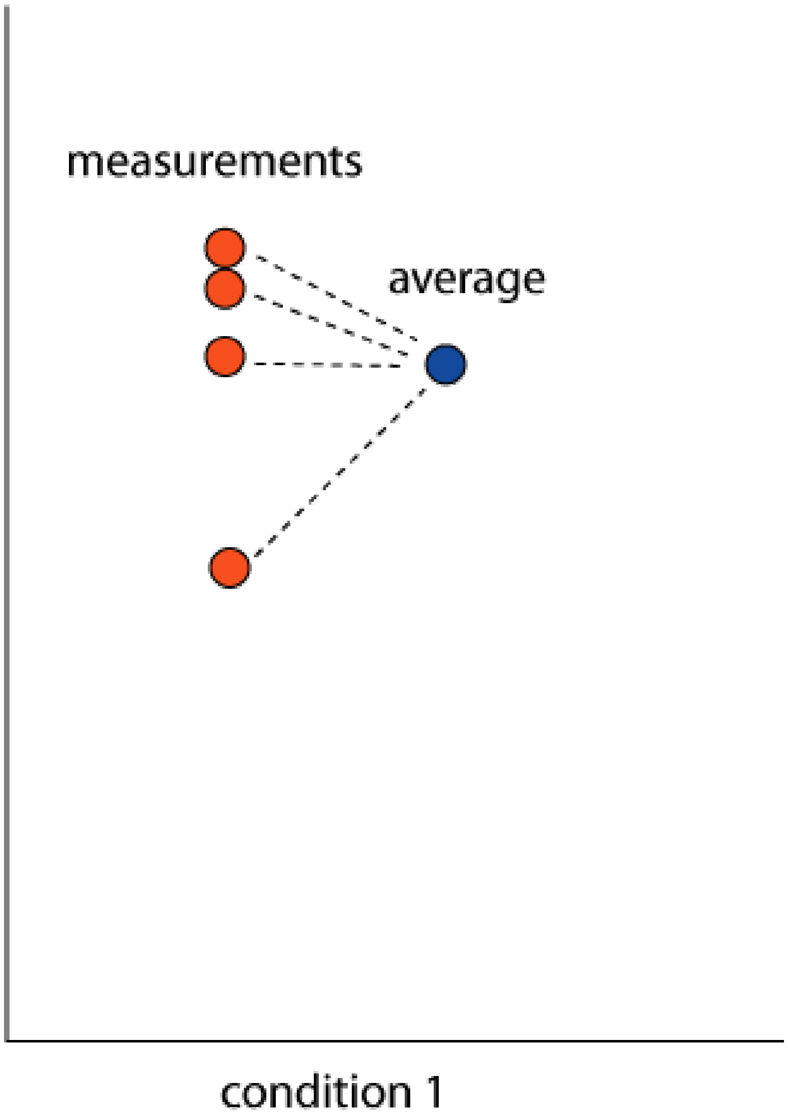
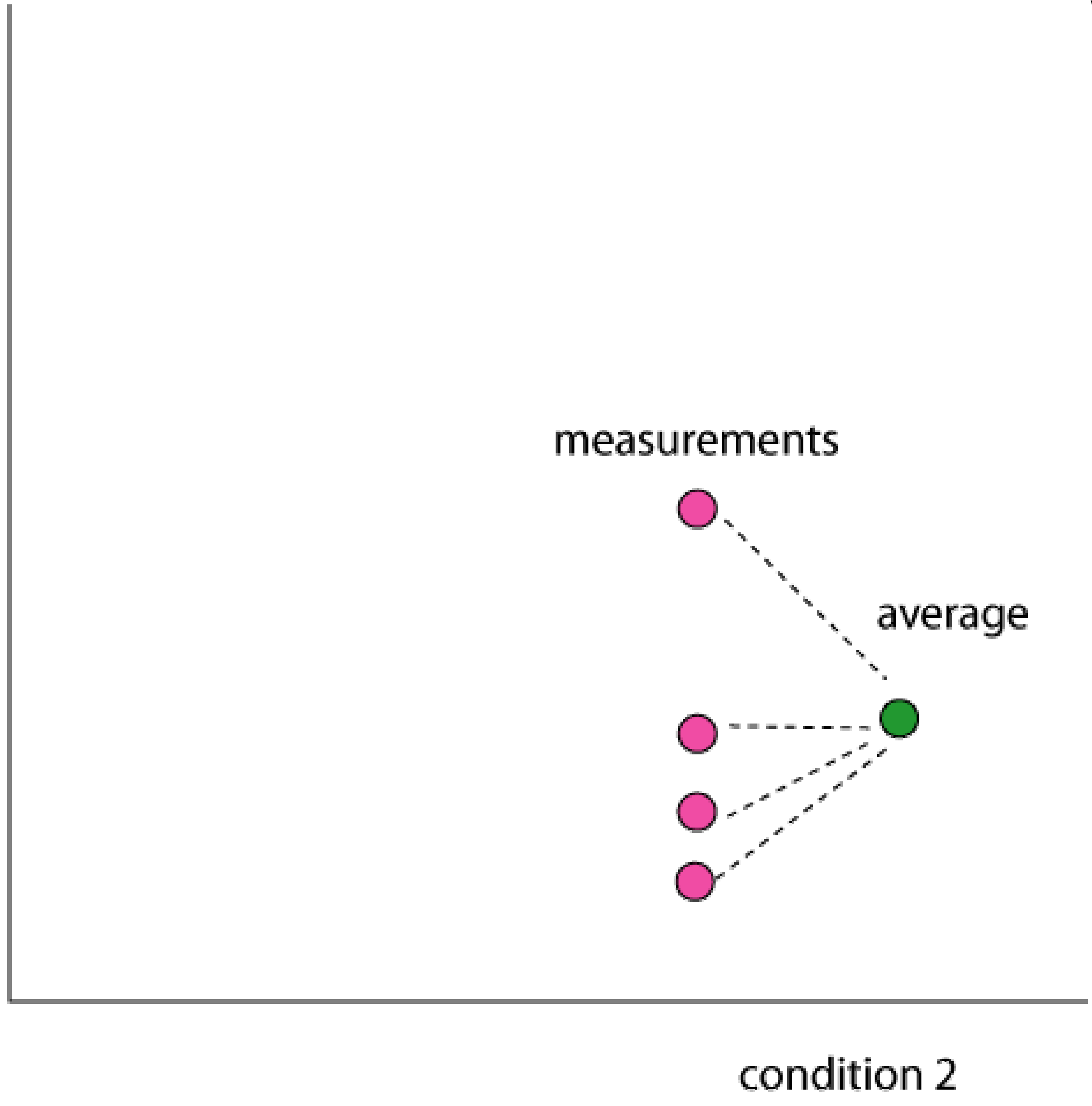
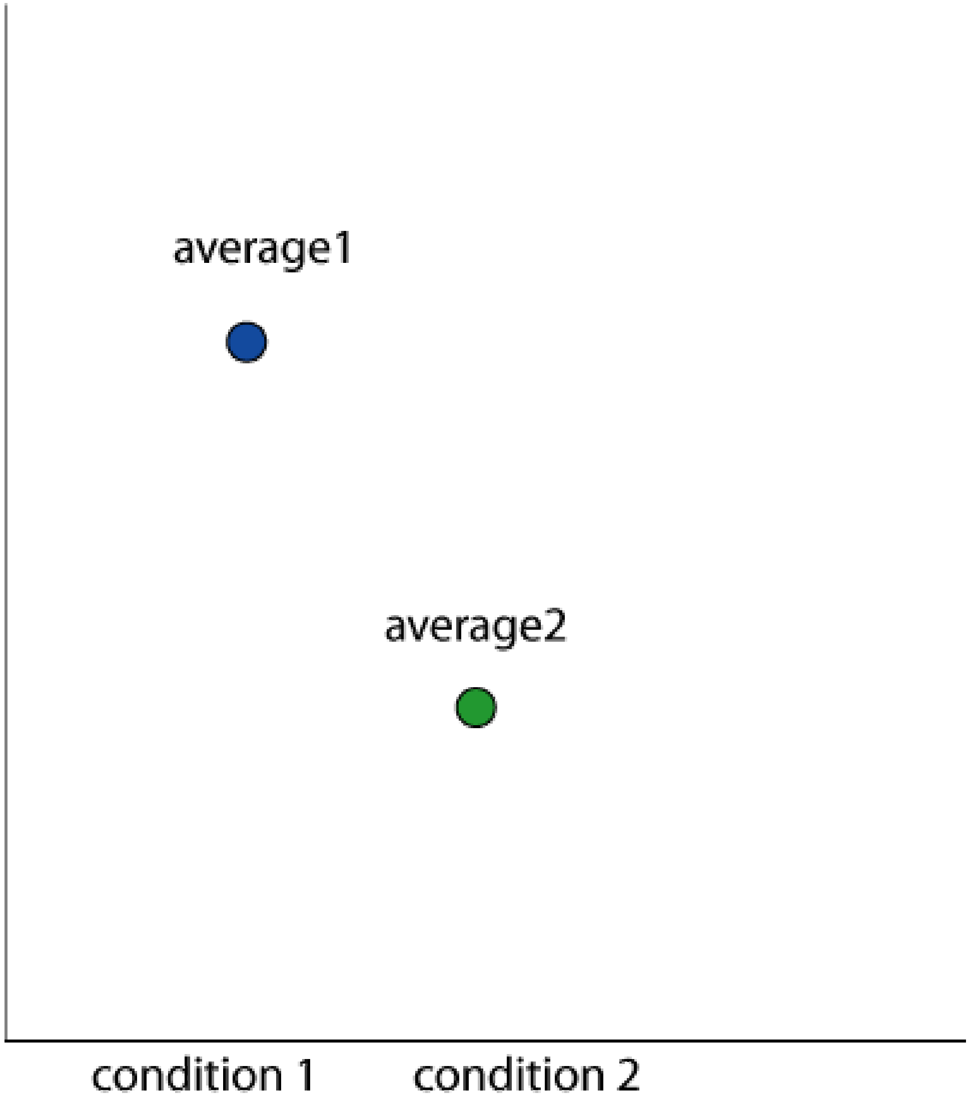


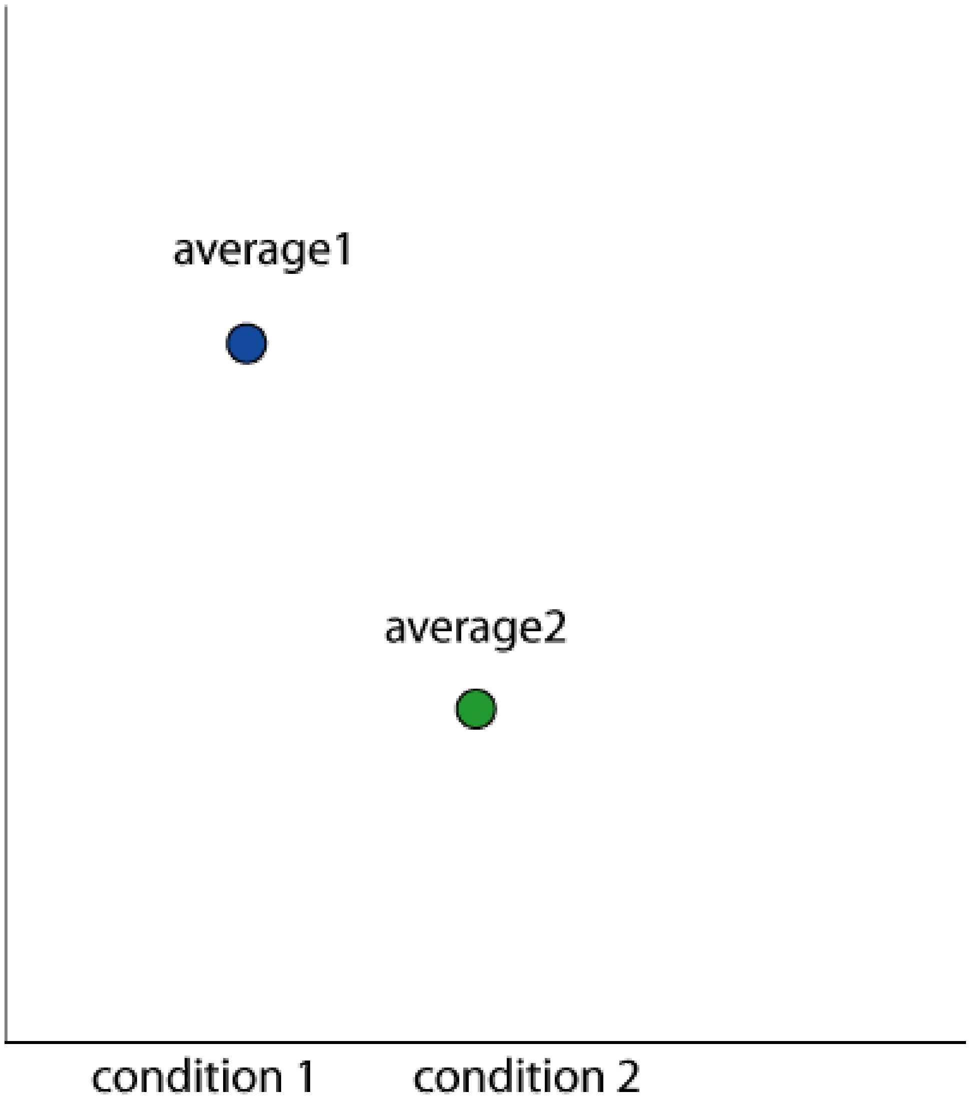
When we need an accurate measurement of something, we usually repeat the measurement several times and calculate an average value.

We go through the same process for our next measurement.



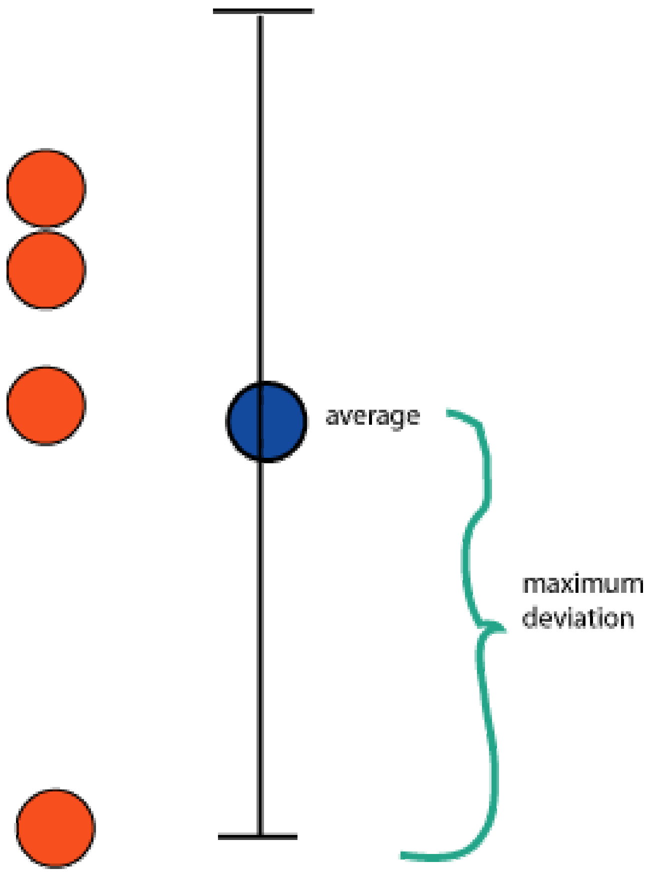


Sometimes we need to compare two measurements in order to decide if they are different. Comparing average values is more informative than comparing single measurements.



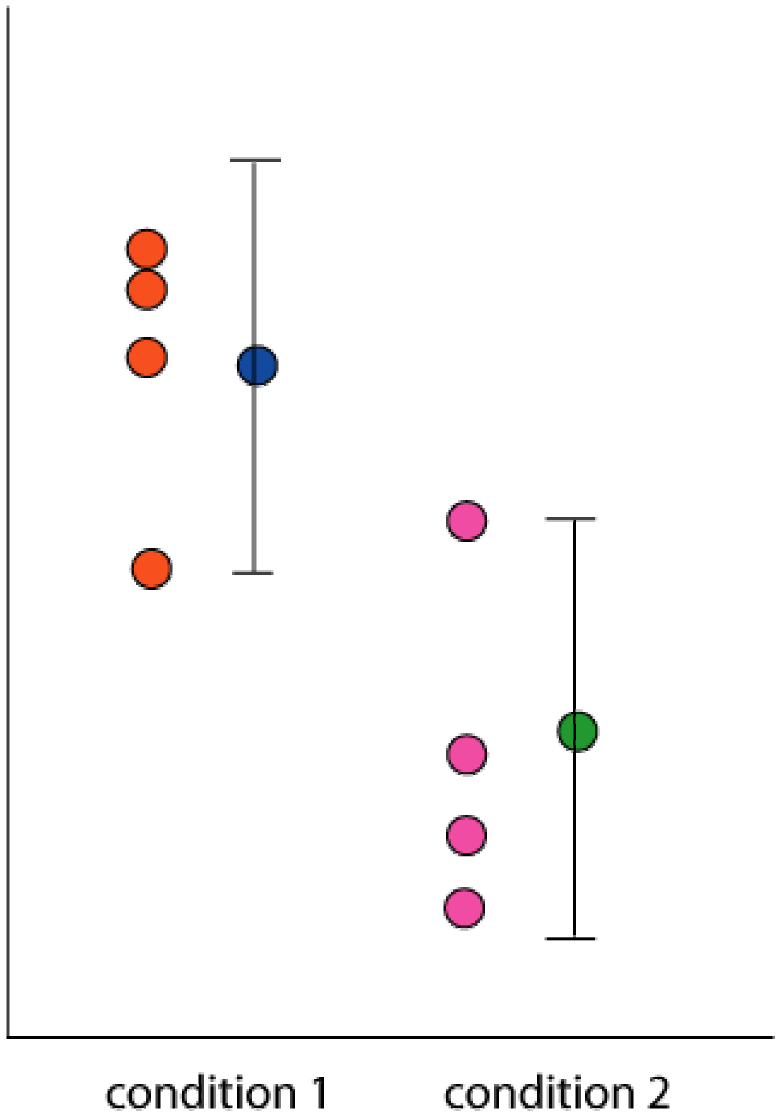
But how can we be sure these values are really different?

Perhaps our measurements aren’t very precise…

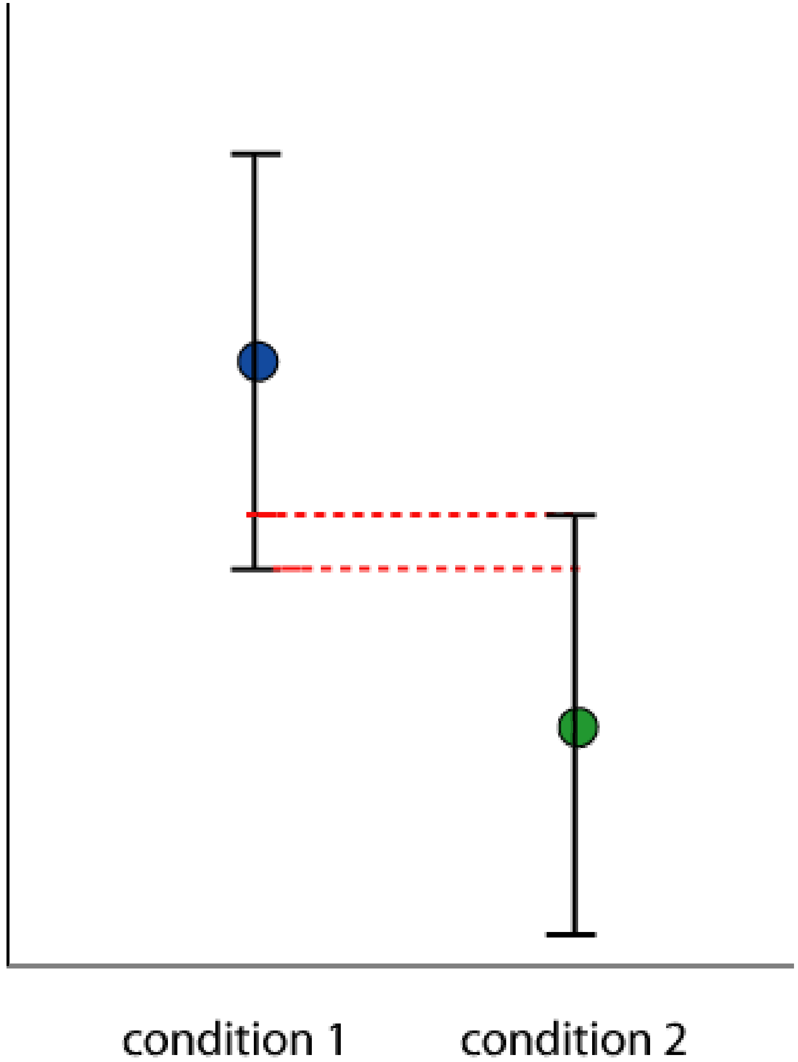


One way to take into account measurement accuracy is to draw ERROR BARS for each average value.

A simple way to construct an error bar is to use the MAXIMUM DEVIATION of a single data point from the average.

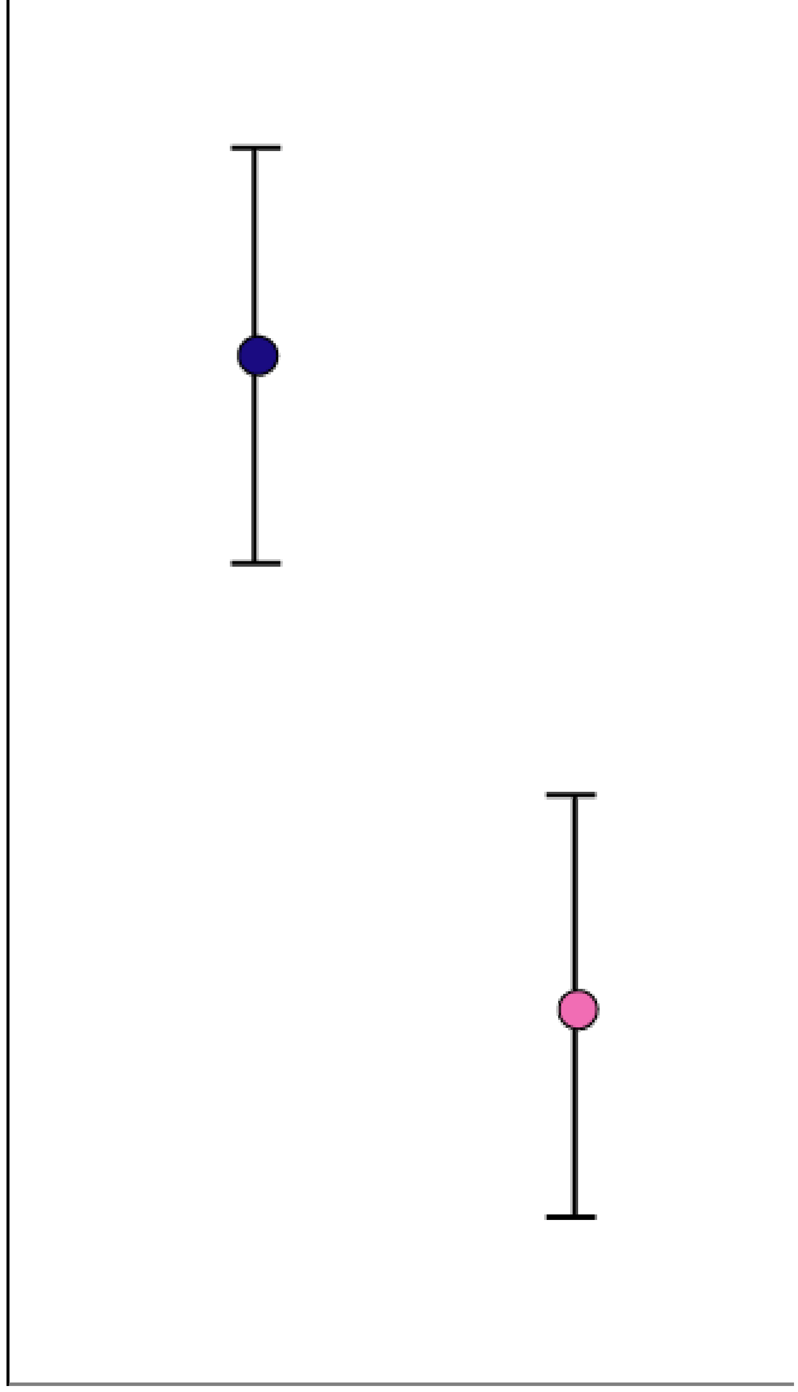


We construct error bars for each repeated measurement.



If the error bars for two measurements overlap, then we cannot conclude that the values are truly different.

In this case, we say the values are NOT SIGNIFICANTLY DIFFERENT.



If the error bars for two average values don’t overlap, a conclusion that they are different is justifiable.

The STANDARD DEVIATION is a more sophisticated indicator of the precision of a set of *n* measurements:

$$s = \sqrt{\frac{(avg - x_1)^2 + (avg - x_2)^2 + \cdots + (avg - x_n)^2}{n-1}}$$

The standard deviation is like an average deviation of measurement values from the average value. Often the standard deviation is used to draw error bars, instead of the maximum deviation.

In this experiment you may use either the maximum deviation or the standard deviation. You must state which you are using.