Precision and Accuracy

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Accuracy

We talk about *accuracy* when the question we ask is:

How close is the *experimentally measured* value to the *accepted* value?
Precision

We talk about *precision* when the question we ask is:

How close is the **experimentally measured** value to the other **experimentally measured** values?
Why is this confusing?

- Precise, is often used non-scientifically to mean exact (which sounds a lot like accurate!)
- It is all relative!
  - When can we say if something is “accurate” or “precise”
    - Easy solution is to compare rather than give a value judgement
    - This sample is more accurate/precise than another because...
  - What happens when we need to say if something is accurate or precise enough?
    - Not an easy solution
    - Learn statistics
- What makes precision and accuracy hard for you?
Assuming the center bull's-eye is our accepted value:
Who is the most accurate at throwing darts?
Who is the least precise?

Describe John’s precision and accuracy to the other dart throwers.

Example: Pete’s darts are less accurate and less precise than Matt’s, less accurate and more precise than John’s, and more accurate and more precise than Dan’s.
Example: Three students weigh a sample of known weight (4.50 g), four times each

Donovan: 4.56 g, 4.55 g, 4.76 g, 4.58 g
  » Average = 4.6125 g
  » Range 0.21, Standard Deviation = 0.099

Mike: 4.55 g, 4.56 g, 4.66 g, 4.53 g
  » Average = 4.575 g
  » Range 0.13, Standard Deviation = 0.058

Kevin: 4.77 g, 4.78 g, 4.76 g, 4.79 g
  » Average = 4.775 g
  » Range 0.03, Standard Deviation = 0.013

• Who is the most accurate?
  – Mike is 0.08 g off, Donovan is 0.11 off, and Kevin is off by 0.28 g
  – Mike is the most accurate because he is the closest to the true value

• Who is the least precise?
  – Donovan has the highest standard deviation and the largest range, therefore he is the least precise.