PhET Tips for Teachers — Projectile Sampling Distributions

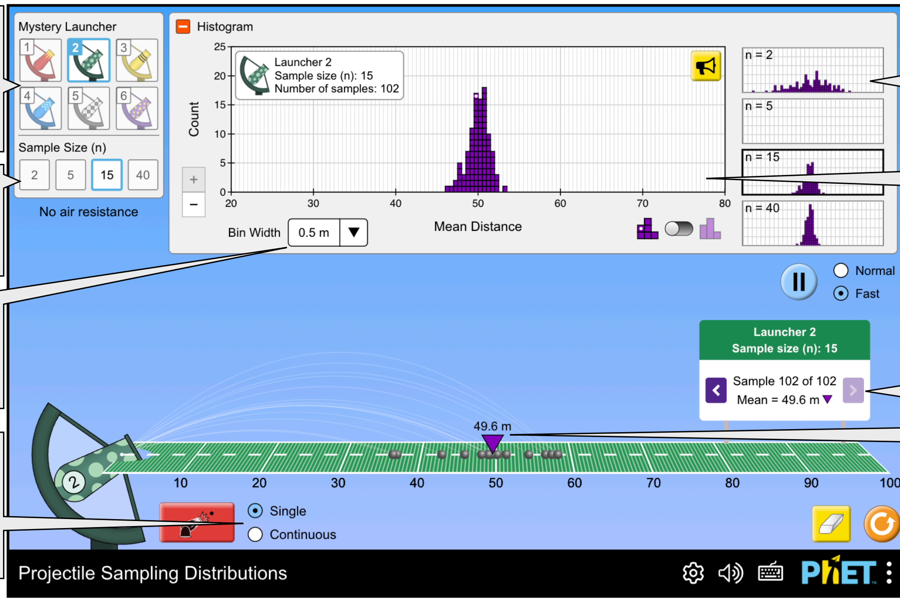
The ***Projectile Sampling Distributions*** simulation allows students to engage in hands-on data collection and analysis through the rich context of launching projectiles. Explore how different launch parameters create a variety of distributions as you watch the Central Limit Theorem come to life!

INVESTIGATE different parent distributions

CHOOSE sample size

GROUP data in different ways

CREATE and **VISUALIZE** samples



COMPARE sampling distributions

VISUALIZE distribution of means

SCROLL through sample means

CONNECT sample mean to histogram

Insights into Student Use

- Unless prompted, students may not notice they can scroll through previous samples and watch the mean of each sample bounce around on the field.
- Students may not realize the samples can be launched at normal or fast speed.
- When on continuous sampling mode, the samples immediately land on the field with the mean shown. Continuous mode allows for faster creation of the sampling distributions.

Suggestions for Use

- Each launcher is preset to have different parameters for the launch angle and launch speed, providing six unique parent distributions from which each sampling distribution is created. You can leverage this design feature to reinforce the Central Limit Theorem holds true regardless of the shape of the parent distribution.
- Use the field sign to scroll through previous samples quickly as you watch the mean bounce around. With the sound on, you can hear the difference in variability for each sample size.

Sample Challenge Prompts

- Explain to a neighbor how a dot in the histogram appears for any sample size.
- Describe your confidence in predicting the mean of any ‘next’ sample when you have zero data points on the histogram? Five dots on the histogram? As you increase the number of dots on the histogram in general?
- Describe your confidence in predicting the mean from a sample as the sample size changes.

Blackman and Carter, April 2024

- For launcher 4, sample size 2, launch many samples. Estimate the probability of the next sample having a mean of 47 m or lower. Repeat for samples of size 5, 15, and 40. Explain how your estimates changed, and why they may have changed in this way.

Customization Options

Query parameters allow for customization of the simulation, and can be added by appending a '`?`' to the sim URL, and separating each query parameter with a '`&`'. The general URL pattern is:
`…html?queryParameter1&queryParameter2&queryParameter3`

To run this in Spanish (`locale=es`), the URL would become:
https://phet.colorado.edu/sims/html/projectile-sampling-distributions/latest/projectile-sampling-distributions_all.html?locale=es

⚙ Indicates this customization can be accessed from the Preferences menu within the simulation.

Query Parameter and Description	Example Links
⚙ `autoGenerateData` - makes it so the launch button generates a full data set. Default is `false`.	`autoGenerateData=true`
⚙ `audio` - if muted, audio is muted by default. If disabled, all audio is permanently turned off.	`audio=muted` `audio=disabled`
⚙ `launchSound` - the pitch of the launch sound can represent either the initial `speed` or `angle` of the projectile, or can be turned off with `none`. Default is `speed`.	`launchSound=angle`
⚙ `playLandingSound` - specifies whether a sound is played when a projectile lands. Default is `true`.	`playLandingSound=false`
⚙ `locale` - specify the language of the simulation using ISO 639-1 codes. Available locales can be found on the simulation page on the Translations tab. Note: this only works if the simulation URL ends in "_all.html".	`locale=es` (Spanish) `locale=fr` (French)
`allowLinks` - when `false`, disables links that take students to an external URL. Default is `true`.	`allowLinks=false`
`supportsPanAndZoom` - when `false`, disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is `true`.	`supportsPanAndZoom=false`

See all published activities for Projectile Sampling Distributions here.
For more tips on using PhET sims with your students, see Tips for Using PhET.