

In **Ratio and Proportion**, students explore the concepts of ratios and proportional reasoning by changing hand positions to find challenge ratios and maintaining ratios through movement.

## Discover Screen

Move the hands to find the three challenge ratios and try keeping the ratio by moving the hands together.

**MOVE** each hand to find the challenge ratio

**VIEW** tick marks to help position the hands

**CHANGE** the challenge ratio after exploring and finding a ratio

**ACCESS** sim controls (sound on/off, keyboard shortcuts) or add features (extra sounds, voicing)

## Create Screen

Set the challenge ratio and challenge yourself or others to find the and maintain the ratio.

**HIDE** the set challenge ratio

**LOCK** the hands to move continuously at the challenge ratio

**CHANGE** the range of the tick mark scale (if tick marks enabled)

**CHANGE** the antecedent (left hand) and consequent (right hand) for the challenge ratio

## 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 an '&'. The general URL pattern is:

```
...html?queryParameter1&queryParameter2&queryParameter3
```

For example, in Ratio and Proportion, if you only want to include the 1st screen (`screens=1`), with the audio muted (`audio=muted`) use:

[https://phet.colorado.edu/sims/html/ratio-and-proportion/latest/ratio-and-proportion\\_all.html?screens=1&audio=muted](https://phet.colorado.edu/sims/html/ratio-and-proportion/latest/ratio-and-proportion_all.html?screens=1&audio=muted)

To run this in Spanish (`locale=es`), the URL would become:

[https://phet.colorado.edu/sims/html/ratio-and-proportion/latest/ratio-and-proportion\\_all.html?locale=es&screens=1&audio=muted](https://phet.colorado.edu/sims/html/ratio-and-proportion/latest/ratio-and-proportion_all.html?locale=es&screens=1&audio=muted)

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

Query Parameter and Description	Example Links
<code>screens</code> - specifies which screens are included in the sim and their order. Each screen should be separated by a comma. For more information, visit the <a href="#">Help Center</a> .	<code>screens=1</code> <code>screens=2,1</code>
<code>initialScreen</code> - opens the sim directly to the specified screen, bypassing the home screen.	<code>initialScreen=1</code> <code>initialScreen=2</code>
⚙ <code>locale</code> - specify the language of the simulation using <a href="#">ISO 639-1</a> codes. Available locales can be found on the simulation page on the <a href="#">Translations tab</a> . Note: this only works if the simulation URL ends in “_all.html”.	<code>locale=es</code> (Spanish) <code>locale=fr</code> (French)
<code>audio</code> - if muted, audio is muted by default. If disabled, all audio is permanently turned off.	<code>audio=muted</code> <code>audio=disabled</code>
<code>allowLinks</code> - when <code>false</code> , disables links that take students to an external URL. Default is <code>true</code> .	<code>allowLinks=false</code>
<code>supportsPanAndZoom</code> - when <code>false</code> , disables panning and zooming using pinch-to-zoom or browser zoom controls. Default is <code>true</code> .	<code>supportsPanAndZoom=false</code>

## Model Simplifications

- When either hand is placed at 0, it is not possible to get success feedback. You can discuss with your students what it means for zero to be in the numerator or denominator of a ratio.
- When the tick marks are enabled (with or without numbers), the hands will snap to the lines when released near them. This allows students to get exact placement of the hands when using the tick marks to find challenge ratios.

## Suggestions for Use

### Sample Challenge Prompts

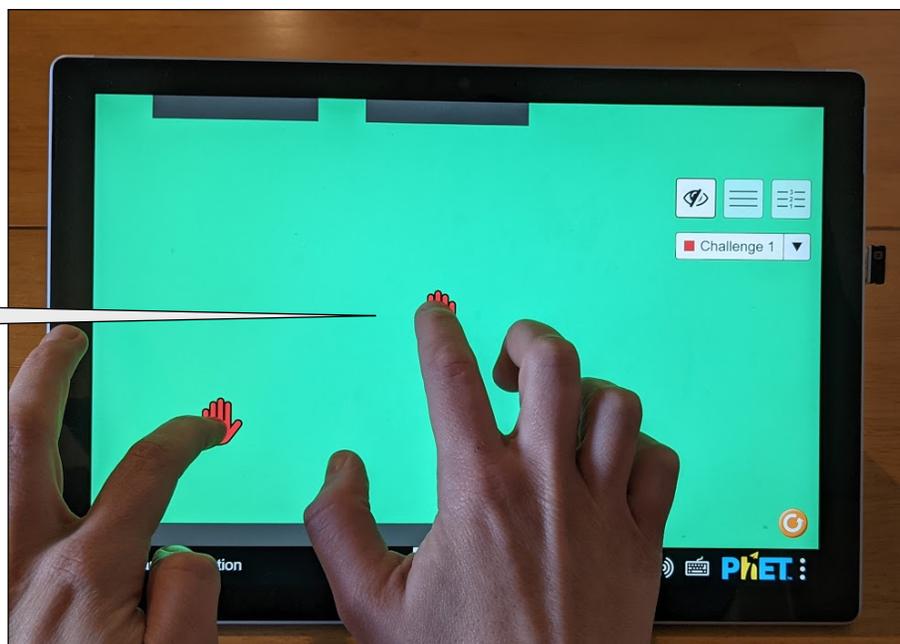
- Predict different hand positions where you will get success for each challenge ratio, then test each position and see if you right. Come up with a rule for finding new successful hand positions.
- Come up with a strategy for how you might move the hands up and down the play area to keep the challenge ratio and try to do it (best with a touchscreen)!

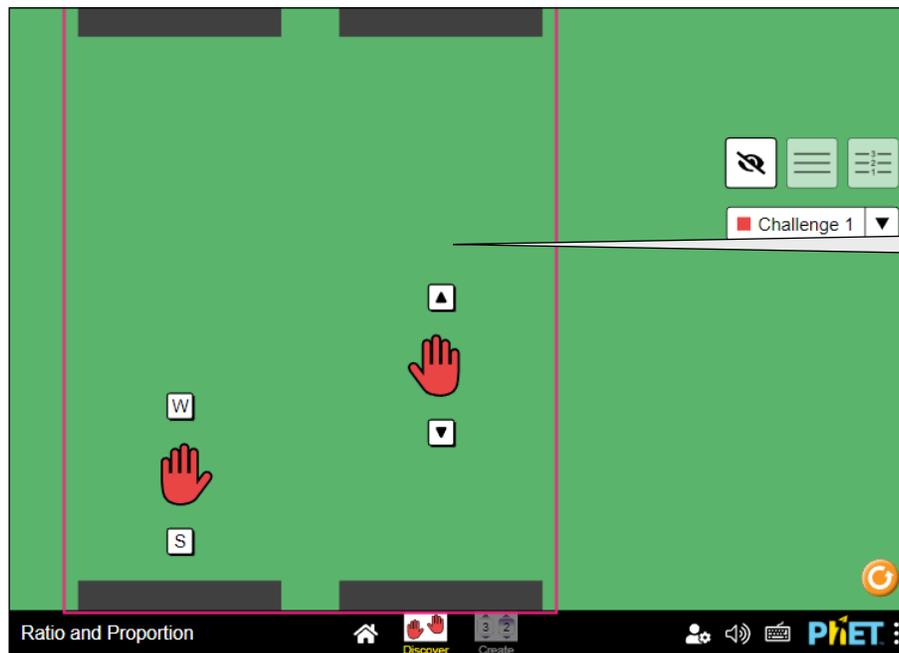
## Inclusive Features

### Alternative Input and Touchscreen Devices

- This simulation supports independent movement of each hand using a touchscreen device for exploring the continuous nature of the ratio through proportional reasoning.
- If a touchscreen is not available, the continuous nature of the ratio can be explored using a cursor or keyboard by enabled the Lock Ratio checkbox on the Create screen when at the challenge ratio.
- If using a keyboard, you can tab to the entire play area (third tab stop, shown below with a pink box highlight) and use the W/S keys to control the left hand and the Up/Down arrow keys to control the right hand for independent, simultaneous exploration. See the Keyboard Shortcuts dialog in the simulation for more information.

**MOVE** each hand simultaneously to find the challenge ratio and move both hands using a touchscreen device





**CONTROL** each hand independently & simultaneously using W/S and Up/Down arrow keys (third tab stop)

### Camera Input: Hands

- If a camera (e.g, webcam) is available on your device, you can enable a feature to *detect your own hand positions to move the hands in the Play Area*. This feature leverages the computer vision capabilities of the open-source [MediaPipe model](#). It does not collect any data/images.
- Add the query parameter `?cameraInput=hands` to the end of simulation URL.
- The feature requires two hands to be present in the detection window. This can be from two individuals for cooperative exploration!
- Default settings assume the camera is facing you. If your camera is placed elsewhere (e.g., above) or you feel the direction of simulation hand movement does not match your own, see additional options in the Input tab of the Preferences menu.
- This feature interacts with the Voicing feature. If Voicing is enabled, you can silence the current voiced statement by bringing your index finger and thumb together, forming an O-like gesture with your fingers.

#### Tips and Disclaimers

- The simulation will take longer to load the necessary resources for realtime hand detection.
- This feature is resource intensive and may have poor performance on some devices.
- This feature does not work offline.
- The vertical range of the simulation hands are mapped to the upper and lower bounds of your camera window. Try backing away from your camera for more range of motion. Add the query parameter `&showVideo` to the simulation URL for a resizable camera preview for troubleshooting.

### Sound and Sonification

- A plucking sound indicates how close the hands are to the challenge ratio. If the plucking sound is playing, keep moving until a happy chime plays to indicate success in finding the challenge ratio.
- A rewarding sound will play when you move the hands together in a way that keeps the challenge ratio. This sound will also play when moving the hands on the Create screen with the Lock Ratio checkbox enabled.

- The simulation can play a sound as you move a hand past a tick mark by enabling Extra Sounds in the Audio tab of the Preferences menu.
- See the [Sound Features Video](#) for more useful tips on how concepts and sound are integrated in this sim. See the published [Sound Design Documentation](#) for more details on all sounds in this simulation.

### **Interactive Description**

- This simulation features interactive description to support non-visual access, delivered only while using screen reader software. See the [Introduction to Interactive Description video](#) for more info on how to use this feature.
- Teachers can [access the A11y View here](#) to decide if this sim's interactive description meets their instructional needs. *Reminder: A11y View is not intended for student use and will not provide a good experience for learners using screen reader software.*

See the simulation page for all supported inclusive features.

See all published activities for Ratio and Proportion [here](#).

For more tips on using PhET sims with your students, see [Tips for Using PhET](#).