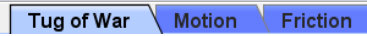





**Tips for controls:**

- Be sure to try all the different tabs of the simulation. 
- On the first tab, the “pullers” force is along the rope (ie. parallel to the surface). The puller size is relative to their ability to apply force. Small = 50 N, Middle = 100 N, Large = 150 N. The game **Tug of War** ends when one side’s first knot aligns with ^ on ground. 
- Use the controls on the bottom to **Pause** the sim. You can Step by pressing **Play** then **Pause** quickly (or **Pause/Go** on first tab). These tools might be helpful for predictions.
- The **Motion** tab is frictionless. The skateboard is there to help students understand “no friction”. The **Friction** tab adds the ability to vary friction from “none” to “lots”.
- Up to 3 objects can be stacked.
- Force is applied using the slider. You can also type a force value in and just click somewhere else to see it applied.
- The pusher is meant to help students make sense of how force might be applied. When the maximum force is applied – the pusher slides off the screen. 
- The speedometer is meant to help students with conceptual understanding and is not designed for measurements. 

**Important modeling notes / simplifications:**

- “Tug of War” tab: there is no friction, so the “pullers” are somewhat magical.
- “Motion Tab”: there is no friction. Changing mass does not affect the speed of the objects. We assume that an object dropped on an already moving object is in the same *reference frame* so that they are already both moving the same speed. For example, if you have the girl on the board and then put another object on her the motion will not change (in the frictionless environment). If there is friction, there will be a change in motion.
- “Friction Tab”: Kinetic and static friction have the same coefficient value. The “Friction” slider changes the coefficient of friction.

**Insights into Student use and thinking:**

- Whenever there is a net force, the cart will accelerate. If more pullers are added after the motion is started, students may have to run some tests to understand that the motion was already happening. This might be a great teaching moment around “An object at rest stays at rest and an object in motion stays in motion unless a net force acts.”
- Students may have some difficulty understanding why adding mass in the frictionless environment doesn’t change the motion.

**Suggestions for sim use:**

- There are more complex motion sims designed to be used in the following order: [Moving Man](#), [Forces & Motion](#), then [Ramp-Force and Motion](#).
- Two related sims are Ladybug Revolution and Ladybug Motion 2D.
- For tips on using PhET sims with your students see: [Guidelines for Inquiry Contributions](#) and [Using PhET Sims](#)
- The simulations have been used successfully with homework, lectures, in-class activities, or lab activities. Use them for introduction to concepts, learning new concepts, reinforcement of concepts, as visual aids for interactive demonstrations, or with in-class clicker questions. To read more, see [Teaching Physics using PhET Simulations](#)
- For activities and lesson plans written by the PhET team and other teachers, see: [Teacher Ideas & Activities](#)