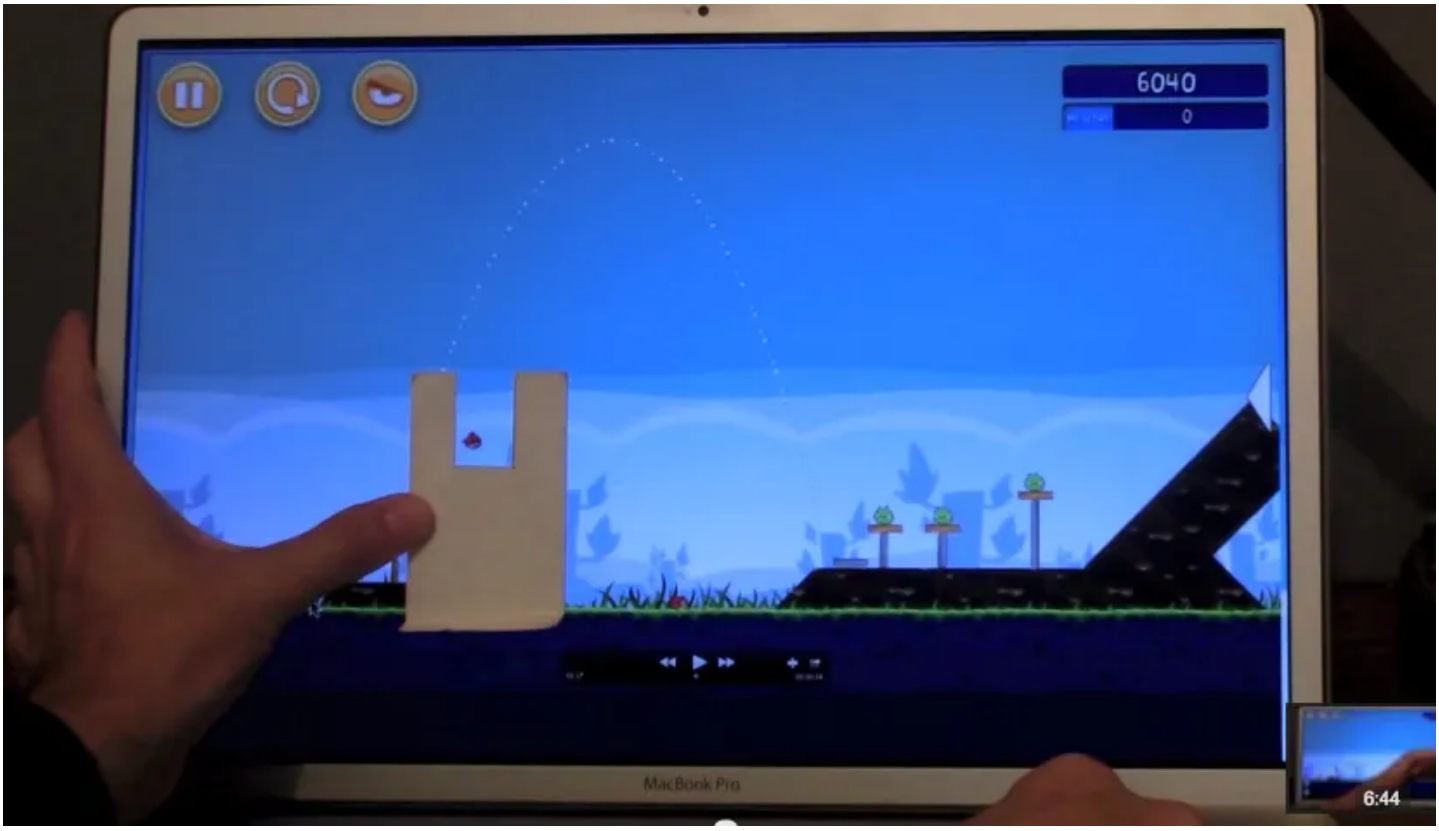
RHETT ALLAIN SCIENCE JUN 19, 2013 8:31 AM

Angry Birds: Vertical Velocity

Of course you already love the Angry Birds game, I know – it's ok to admit it. The basic motion of the bird after it is shot from the sling shows some really great physics. Let's go over this basic experiment from my National Geographic book: Angry Birds Furious Forces, which takes a fun look [...]



SAVE

OF COURSE YOU already love the Angry Birds game, I know – it's ok to admit it. The basic motion of the bird after it is shot from the sling shows some really great physics. Let's go over this basic experiment from my National Geographic book: Angry Birds Furious Forces, which takes a fun look at some basic physics principles using our Angry Birds friends to help.

What do you need?

Well, you first need to play Angry Birds. There are very many ways to do this. You can play it on your iPod or tablet or phone or even in your browser. Ok, now that we have that covered, what else do you need?

For this experiment, the most difficult part might be making a video of a bird that is shot in the air. I did this with some screen capture software – there are many options to choose from on a computer (both Mac OS X and in Windows). I will just recommend one free option for both platforms – Jing. If you don't want to do that, you can use the – video that I made on youtube. Oh, I forgot one other simple way... Point a video camera at your phone or tablet or computer. But be careful. You don't want the camera to move at all or it will make your job difficult.

If you make your own video, be sure to zoom all the way out in the game before you fling the bird. Otherwise, the background in the game will be moving and make your measurements difficult.

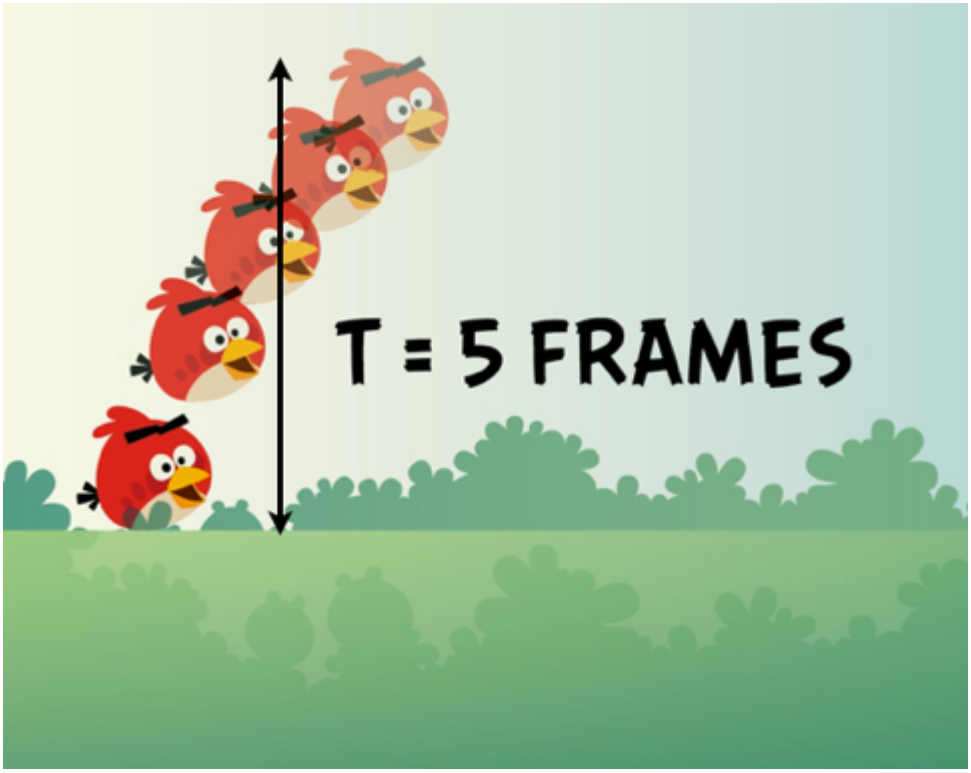
Now that you have a video (hopefully), you need something to measure with. In the example above, I used a small card with a 2 cm slit cut in it. It doesn't really

have to be 2 cm, but I found that this distance worked well for me. Just play around with the size a little bit. You want to be able to count around 5-10 video frames for the beginning motion of the bird.

The last thing you need for the experiment is a video player. If you use the youtube video, you are all set. Just watch the video in youtube. You want to be able to count frames. You can do this in youtube by pressing the forward arrow key on your keyboard. With each keystroke, the video will advance one frame.

The experiment.

What happens to the vertical velocity of the bird after it leaves the sling shot? Take your measuring card and place it on the screen so that the bottom of the slit lines up with the bottom of the Angry Bird. Now advance the video and count frames until the bird passes above the top of the slit. Record the number of frames this took and that is your time. What about the vertical velocity?



Since you know the distance (the width of your slit) and the time, you can calculate the vertical velocity as

$$v_y = \frac{\Delta y}{\Delta t}$$

In the example above, the average vertical velocity would be 2 cm in 5 frames or 2/5 cm/frame. Yes, it's ok to have weird units for velocity. It is still distance per time.

Important point: this is actually the *average* velocity over this time interval. I just wanted to point that out to be clear.

Now, for the horizontal direction, you can do the same thing expect the slit will be turned so that it is vertical. Record your values for the average velocity as the bird goes along it's path.

What should you find and why?

As you see in the video above, you should see that the vertical velocity decreases as the bird goes up (decreased velocity would be an increase in the time to get across the slit).

If you look at the horizontal velocity, you should find that it is constant. Why? This is really a great example of the fundamental connection between forces and motion. What do forces do to an object? The answer is that they CHANGE the motion of the object. After the bird leaves the sling shot, what forces are acting on the bird? Well, nothing is touching the bird so the only force acting on the bird would be the gravitational force. This force pull straight down - but not in the horizontal direction.

Since there isn't a horizontal force, the horizontal velocity doesn't change. However, there is a vertical force and the vertical velocity changes.

Homework.

What? You thought since this was a game you wouldn't have any homework. Wrong.

You can try the following.

- What happens if you launch the bird at different angles? What does this do to the horizontal velocity?

- If you launch at a steeper angle, what happens to the starting vertical velocity?
- Is there a way to determine the change in vertical velocity between two measurements? See if you can come up with a way to get a value for the vertical acceleration.

If you want to play Angry Birds while doing your homework, that's ok in this case.

Rhett Allain is an associate professor of physics at Southeastern Louisiana University. He enjoys teaching and talking about physics. Sometimes he takes things apart and can't put them back together.

CONTRIBUTOR

TOPICS ACCELERATION ANGRY BIRDS FORCES PROJECTILE MOTION

MORE FROM WIRED

A New Proof Moves the Needle on a Sticky Geometry Problem

A deceptively simple math proposition known as the Kakeya conjecture underpins a tower of other questions in physics, number theory, and harmonic analysis.

JORDANA CEPELEWICZ

The Rapid Intensification of Hurricane Lee Is a Warning

Fueled by warm water and humidity, hurricanes can quickly turn into life-threatening monsters. Get ready for more of this phenomenon as the planet warms.

MATT SIMON

A Pair of Sun Probes Just Got Closer to Solving a Solar Enigma

The solar corona is hotter than expected, and scientists are using European Space Agency and NASA spacecraft to figure out why.

RAMIN SKIBBA

Radiation Is Everywhere. But It's Not All Bad

Although radiation sounds scary, it isn't necessarily harmful. Here's what to know about the four types.

RHETT ALLAIN

DART Showed How to Smash an Asteroid. So Where Did the Space Shrapnel Go?

Last year's NASA mission proved it was possible to knock an incoming near-Earth object off course. But that creates debris—which might also be a threat.

RAMIN SKIBBA

Why Rain Is Getting Fiercer on a Warming Planet

Extreme rain is getting more extreme as temperatures rise. That may seem counterintuitive, but the underlying physics is crystal clear.

MATT SIMON

A New Map of the Universe, Painted With Cosmic Neutrinos

Physicists finally know where at least some of these high-energy particles come from, which helps make the neutrinos useful for exploring fundamental physics.

THOMAS LEWTON

Burying Power Lines Prevents Wildfires. But There's a Cost

Investigators are eying the Lahaina wildfire as yet another deadly blaze started by electrical equipment. Putting lines underground would help—at a steep cost.

MATT SIMON