**Bringing Physics Labs to Life!**
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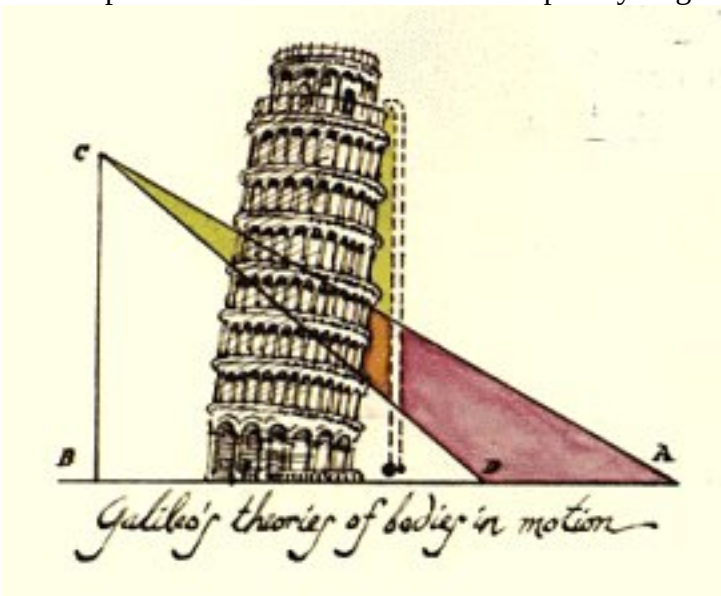
Understanding why objects move the way that they do is the fundamental question in Physics. Whether it's a small marble launched from a canon at a falling monkey or a vengeful monkey flying across a lab at the teacher target, students are loving high school Physics today. Students who integrate video technology with digital probeware in their labs are taking control of their learning. The beauty of Physics demonstrations is that they almost always work, and if they don't, it's easy to explain why not, make the necessary correction and repeat with success. Below are a couple of classic Physics problems that can be solved in the lab using digital science probes and cell phone videocameras:

**Question of Universality of Free Fall**: Do all objects fall at the same rate? (near Earth's surface, neglecting air friction)

Four hundred years ago--or so the story goes--Galileo Galilei started dropping things off the Leaning Tower of Pisa: Cannon balls, musket balls, gold, silver and wood. He might have expected the heavier objects to fall faster. Not so. They all hit the ground at the same time, and so he made a big discovery: gravity accelerates all objects at the same rate, regardless of their mass or composition. Physics teachers are still repeating this experiment today. With a photogate probe and a video camera, we can track two different objects released from the same height at the same time with amazing precision. Was Galileo right? Run the experiment to find out. Skeptical? Good! Link to Nasa's current lunar experiment to read all about the complexity of gravity.




http://science.nasa.gov/science-news/science-at-nasa/2004/06may_lunarranging/

**Question of Projectile Motion**: At what launch angle should the monkey aim his banana bazooka in order to hit the falling Physics professor?
A. Above the professor's baseball glove
B. Below the professor's baseball glove

C. At the professor's baseball glove
D. At the landing spot

Does Galileo's fundamental theory of freefall still apply in this problem?
Does the horizontal left to right motion of the banana effect how if falls vertically?
Consider the field that causes the force that is responsible for the motion.
Will the banana and the professor fall at the same rate?

If yes, than the simulation below should hit the target.
Visit University of Calgary's simulation applet to try it yourself:
http://canu.ucalgary.ca/map/content/accel/duegravity/simulate/monkey_hunter/

kineticbooks.com Software for Engineers and Scientists

A more accurate demonstration can be set up in the lab to test this question. This must be one of my student's favourite labs! First, they run the calculations to solve where a parabola meets a line, next they set their marble canon up, and finally they launch the projectile at a falling stuffed monkey released from the ceiling. Slow motion video replay reveals the path of intersection.

With the help of today's technology, Physics teachers are finding new and exciting ways

to engage their students. Digital probeware is becoming increasingly affordable. The two main companies selling digital probeware in Canada are Pasco and Vernier. The most popular probe is the motion detector that tracks objects in motion using simple sound wave technology, emitting a wave of known frequency through a speaker that waits for a reflected wave to be captured by a sensitive microphone. It is a very simple invention that delivers graduate school-level precision in less time than the traditional ticker timer tape apparatus of the 1970s. Now students finish a Physics lab in 10-20 minutes, leaving them plenty of time to repeat more trials, experiment by changing variables and analyze their data. Gone are the Physics labs of old where students spend an entire period collecting data that often disagrees with theory, racing against the clock to finish cleaning up before heading home to tackle higher order thinking questions independently.

Being an early adopter of new technologies, I encourage my students to use their smart phones in the classroom to capture their labs on film, play them back, label key forces and upload their labs to the web as they showcase their work. Some of our favourite Physics labs have been published on iTunes via podcasting software where students subscribe, download and carry their short lab video clips around on their iPods. We left out the falling and flying monkeys but managed to work in a Polly Pocket plotline to increase the entertainment value of this year's productions. I hope you enjoy!

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