

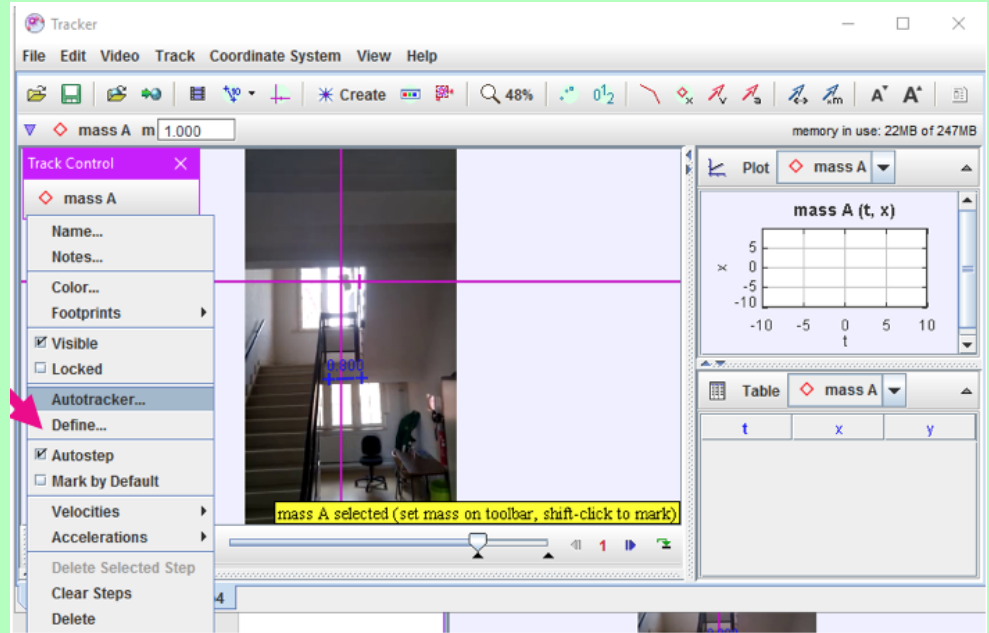
Case Study

Starting point	 Taking a parachute jump is not so risky if your parachute does its job, but what makes a parachute a good parachute? In this experiment the pupils are investigating the effect the surface of a parachute has on the velocity of the fall.
Purpose	The purpose of this activity is to let the learners derive the relation between the surface size and shape of a parachute and falling velocity. Concepts in this activity are: - velocity and acceleration - gravity - uniformly accelerated motions
Overview of activities	1. The pupils make a parachute and attach it to a weight. We used playmobile characters. 2. The pupils drop their parachute and film its trajectory. 3. Finally they analyse the speed of the parachute using Tracker software on a laptop. Tracker is a free video analysis and modeling tool designed to be used in physics education.
Reflection	This activity was carried out by two student teachers in a middle school in Belgium. Here is their reflection: <i>We performed this workshop with 40 pupils around the age of 16, divided in groups of 4-6 people. We only had about 20 minutes per group, which unfortunately was not enough to let the students do the ICT-part of the</i>

	<i>workshop because the Tracker program needs some familiarisation before it can be used fluently. It would be optimal to have about 30 minutes to let the learners do every step themselves. We had to do the tracking on the computer ourselves because getting to know the program would have taken the pupils too long. Nevertheless the workshop was a success, the students were very engaged and every group got a few usable measurements.</i> <i>There were no problems during the first step of the activity. There were some creative solutions from the learners. By not limiting the options in making the parachute you get some very interesting designs, some of which work, others fail miserably. But this is all part of the exploration.</i> <i>During the second step we did the filming to make sure there was good footage, with more time this would also be something the pupils could have done themselves.</i> <i>The third step was mostly done by us. With more time the pupils could do this themselves which would add some ICT skills to the purpose of the activity. The pupils could also easily derive that more surface area resulted in a slower falling velocity.</i> <i>Overall, this is a very good activity for pupils to explore velocity and exploration in an interactive manner, especially if you have a little more time.</i>
Resources	1. For the first activity each group needs some kind of mass to attach to the parachute. They could use big plastic bags as material for the parachute, together with rope to attach the parachute to the weight. 2. You need to launch the parachutes from a building with a window on the first or second floor or a hallway with a high stairway. The students also need a device for filming. The higher the quality the film, the easier it will be to derive the velocity with tracker, but most smartphones will work out well. 3. For the data analysis you need a computer or laptop with Tracker installed (http://physlets.org/tracker/) and the video the students made in step 2. Tracker may be a bit hard to use if you don't know it's interface already. There is a simple introduction on how to use tracker for this activity on the Padlet below.
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Lesson Plan: parachutes and falling velocity

The big picture	
We are going to learn	The pupils are learning about velocity and acceleration. They are going to learn this by using the context of a parachute jump.
Differentiation	The pupils make their own parachute. When we did this in class we saw a lot of different ways of connecting the parachute to the character. The pupils can make a more creative parachute or just stick to the basic parachute if they feel more comfortable with that. It is best to leave this choice to your pupils. It is nice to have some different sizes though, as this means that you can demonstrate the link between parachute size and falling velocity.



The program tracker is a little hard to use for young pupils. Depending on the technological skills of the pupils they will need more or less help with the filming and with using tracker.

Demonstrate
your learning





Key vocabulary

Velocity
Acceleration
Surface area

Review, evaluate, discuss

After analysing the movie they made the pupils discuss which parachute did the best job and reflect on its characteristics. They investigate the link between falling speed and the surface area of the parachute.

They also evaluate whether they might have made measuring errors and if it would be possible to avoid them in the future.

Taking it further

You could challenge your pupils to build a better parachute. Divide into teams and alter the materials and design of the parachutes whilst using identical objects as the jumper. Investigate whether height or size make a difference.

Or you could challenge your pupils to prove Galileo's discovery that gravity accelerates all objects at the same rate, regardless of their mass. You can investigate this idea with different types of balls or crumpled up pieces of paper. You can guide them to discover that air resistance and friction are what cause changes in acceleration. What would happen if there was no air? The goal of a parachute is to make more air resistance.

Here is a practical activity from Science Buddies: [Skydiving Science: Does the size of a parachute matter?](#)

