

CENTRE OF GRAVITY AND CAVING HARNESSSES.

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I have lost count of how many times I have heard people say that a caving harness lowers your centre of gravity? Is this really the case though?

So, in this article I want to clarify what centre of gravity is and how it does NOT change with caving harnesses.

Centre of gravity definition

An objects centre of mass and centre of gravity lies at the same point. The centre of gravity is a point where in an object the distribution of weight is equal in all directions (Fig. 1).

In a solid object of uniform density, the centre of gravity is a fixed position irrespective of the objects orientation. So the object could be standing on end, upside down or flat and it will still have the same centre of gravity. In the image below, "G" is the centre of gravity (Fig. 2).

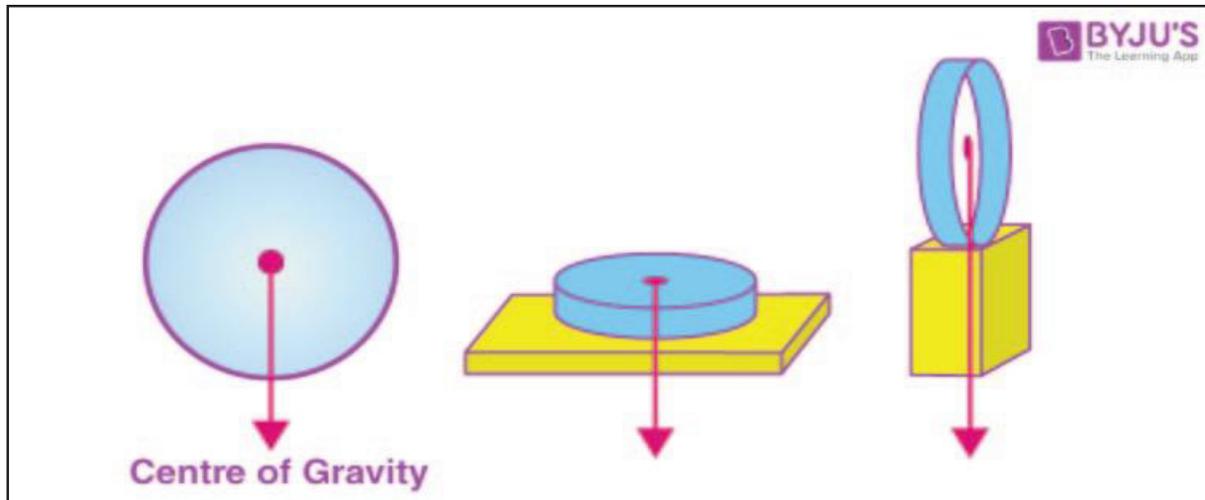
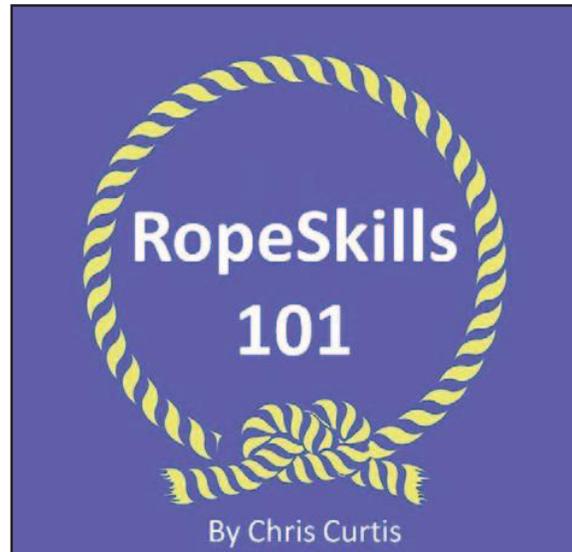


Figure 1: Centre of Gravity. Image: BYJU'S, the Learning App.

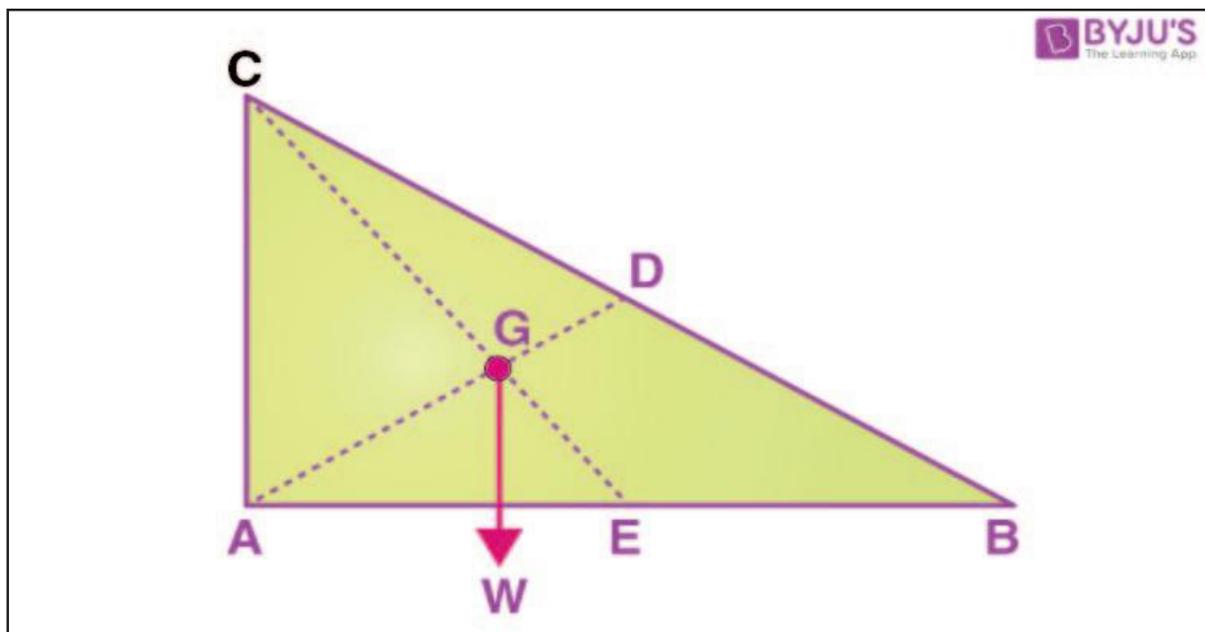


Figure 2: Centre of Gravity in a solid object. Image: BYJU'S, the Learning App.

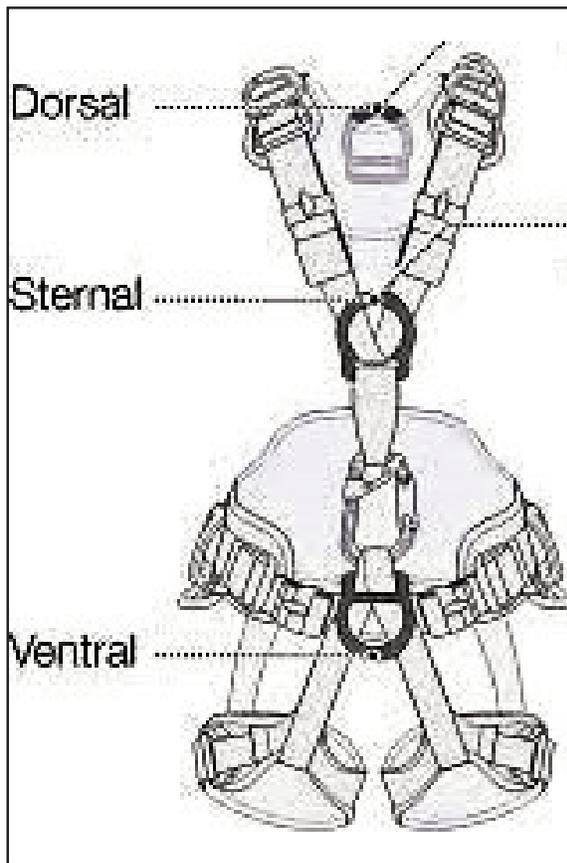


Figure 3: Industrial Harness. Image: From Petzel Catalogue. *Anon., n.d.*

With people however, we can slightly manipulate where our centre of gravity is by moving our limbs. As cavers, this is a really easy experiment to do. You have already done it without even fully understanding what's happening.

When you are hanging in your harness, let your arms and lower legs hang straight down. You will feel like you want to fall backwards. This is because the centre of gravity is not in-line with the

rope. The rope will always hang perfectly vertical towards the earth's gravitational pull.

If you then lift your arms and feet up and forward horizontally, you will feel less likely to fall backwards and maybe even fall forwards. This is because you have shifted your centre of gravity slightly higher, but more importantly, forward and closer to be in-line vertically with the rope.

Note that everyone has different body proportions and sizes, so the effect will be slightly different for everyone.

The difference between a typical climbing style harness and a caving specific harness is that the front attachment point (ventral attachment) is much lower. This is because when we ascend a rope the chest ascender works much more efficiently, we achieve more vertical gain with each step up.

With a lower attachment point, we feel like we want to fall backwards easier. This is because our centre of gravity (which hasn't changed) is now higher than the ventral attachment point on the harness compared to a climbing harness.

If our centre of gravity was in the exact same location as the harness attachment point, then you would not move, you would be in perfect balance.

If the attachment point was higher than our centre of gravity, it would be impossible to invert (hang upside down). This is why industrial harnesses have dorsal and sternal attachment points (Fig 3).

A caving harness merely lowers your attachment point, that's all it does. It creates a more efficient ascent at the compromise of you wanting to invert far more easily. So if you are only abseiling, probably best to stick with a climbing style harness.

JSSS

SPELEO SCENE SECTION.

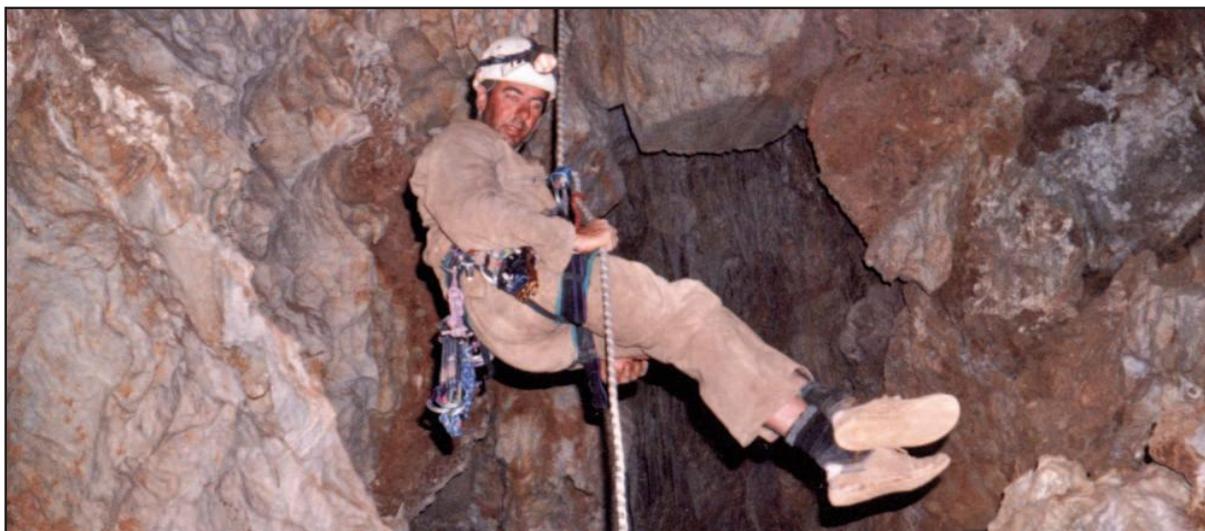


Photo 1: Peter Hodgkinson abseiling into Nice Cave, Wombeyan. **Photo:** *Ross Ellis, 2003.*