Levers

A ***lever*** is a simple machine, perhaps the simplest machine. It can be used to move (often to lift) an object (called the *load*) because it reduces the force (called the *effort*) that is needed to do that. Archimedes once said, 'Give me a lever long enough and a fulcrum on which to place it, and I shall move the world' (Handley, Coon & Marshall, 2013, p. 76). Every lever consists of a rigid body (e.g. a beam or rod) that is pivoted at a fixed hinge (called the *fulcrum*) so that it can be rotated around that fixed point.

Based on the location of the fulcrum, load, and effort, we can distinguish three different types of levers.

Figure 1 shows a ***type 1 lever***. It has the fulcrum between the load and the effort.

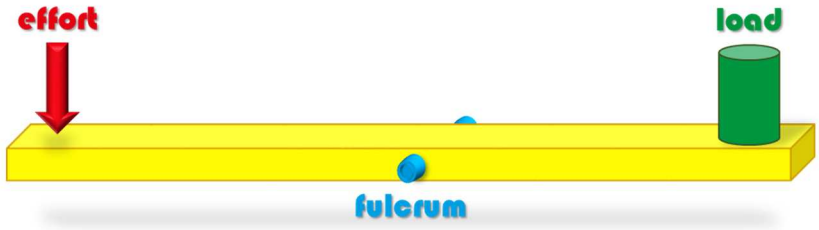

Figure 1: A type 1 lever

Usually, the load has a shorter distance to the fulcrum than the effort. This allows moving a heavy load with a small force. Examples are a crowbar, an oar, and scissors. On a seesaw, we can adjust the distance on either side of the fulcrum in order to balance different weights. For a classical beam balance, it is essential that the distance is the same on both sides because we want the effort (the standard weight that we use for measuring) to be the same as the load (the unknown weight that we want to measure).

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Figure 2 shows a ***type 2 lever***. It has the load between the effort and the fulcrum.

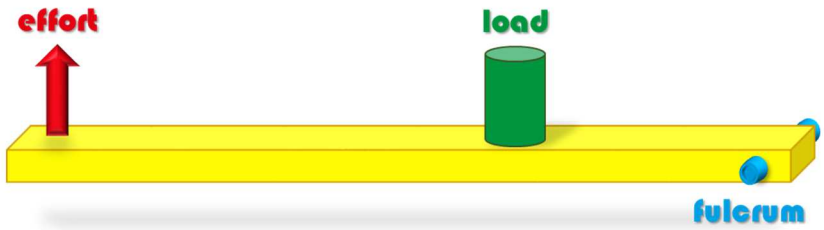

Figure 2: A type 2 lever

The effort has a larger distance from the fulcrum than the load. Therefore, the force needed to lift the load is smaller than the weight of the load. Examples are a wheelbarrow, a nutcracker, a bottle opener, and our *Drawbridge,* shown below.

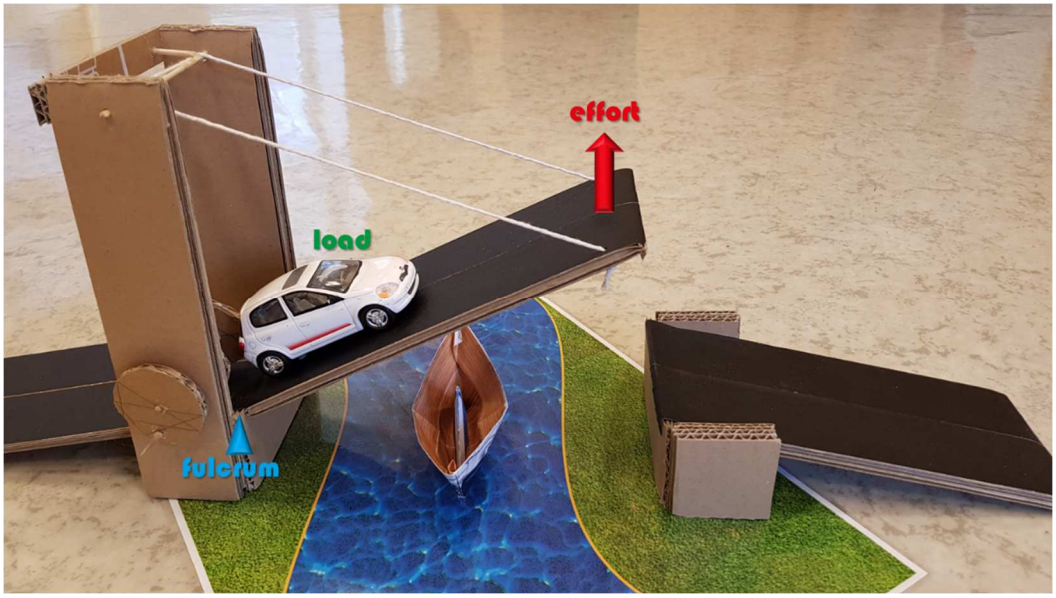

Figure 3: A drawbridge is a type 2 lever

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Figure 4 shows a ***type 3 lever***. The effort is between the load and the fulcrum.

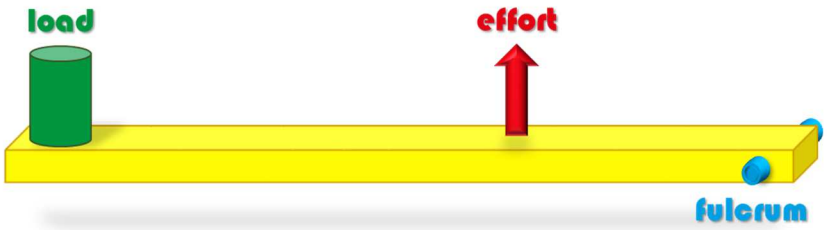

Figure 4: A type 3 lever

Since the distance between the load and the fulcrum is larger than the distance between the effort and the fulcrum, a stronger force is needed to move the load. Thus, the aim of the type 3 lever is not to decrease the force but to increase speed, the speed of the load. This is used in our *Catapult*, shown below.

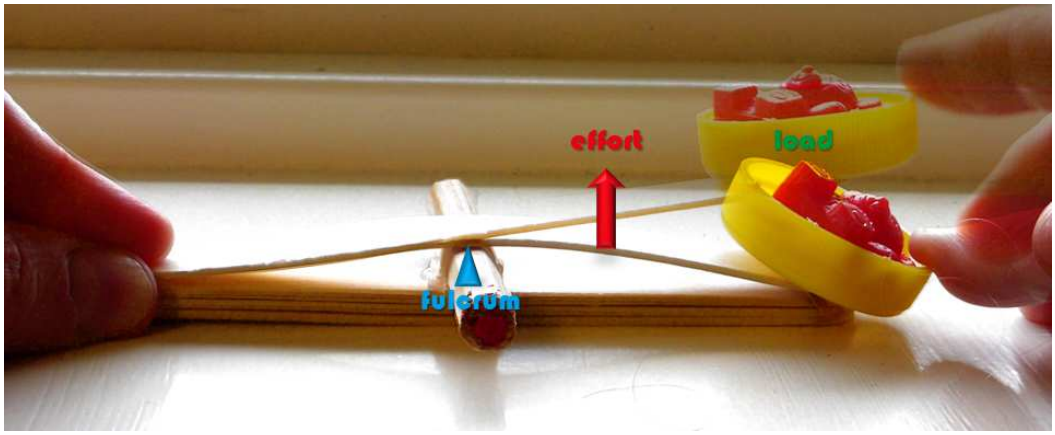

Figure 5: A catapult is a type 3 lever

References

Handley, B., Coon, C., & Marshall, D. M. (2013). *Principles of Engineering*. Delmar: Cengage Learning.

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