If you push the wall, will it move?

Ireland

For every action there is an equal and opposite reaction

Background

This uses a simple classroom optical lever to demonstrate Newton's Third Law and the microscopic flexures of masonry walls created by human-scale contact forces.

You will need...

- ✔ two metre sticks
- ✔ Blu-Tack
- ✔ a straight pin
- ✔ a small piece of mirror or CD (1 × 1 cm)
- ✔ a laboratory bin
- ✔ a laser pointer
- ✔ a retort stand
- ✔ a flat, smooth surface (e.g. hardback book)
- ✔ a masonry wall

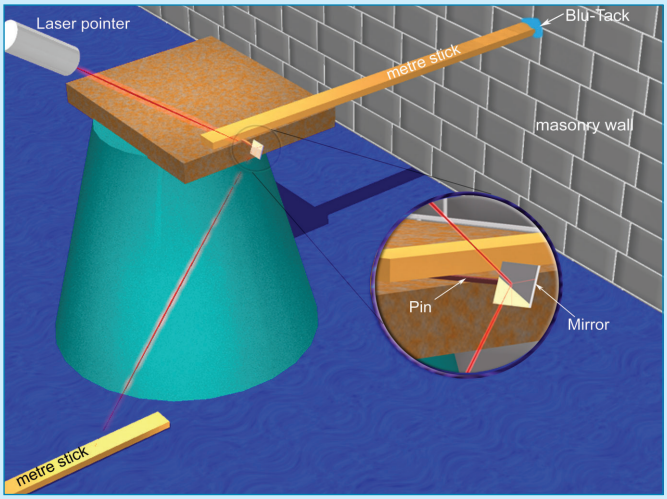
Follow these steps

1 Upturn the bin, place a flat, smooth surface on top of it and position it about 0.5 m from a masonry wall.
2 Attach the small mirror to the pin with Blu-Tack.
3 Place a metre stick on its edge on top of the flat surface, one end attached to the wall with Blu-Tack.
4 Rest the other end of the metre stick freely on top of the bin.
5 Place the pin and mirror between the metre stick and the flat surface so that the end of the stick rests freely on top of the pin and mirror.
6 Position the laser pointer in the retort stand, directing the beam onto the mirror.
7 Position a second metre stick, to act as a scale, in the line of the reflected beam.
8 Observe the reflected spot on the scale.
9 Get a student to push against the wall and watch the reflected spot move up and down on the scale.

So what happened?

According to Newton's Third Law, for every force (or action) between two bodies there is always an equal but opposite force (or reaction). So, as you push against the wall, the wall yields.

As the wall flexes, the first metre stick moves back and forth, rotating the pin and mirror and thus deflecting the laser spot at varying angles back to the scale.



What next?

Ideally, use a wall that you can both push and pull.

You can read more about this demonstration in

Daniel L MacIsaac and Michael Nordstrand 2001 Demonstrating and measuring the flexure of a masonry wall *Phys. Teach.* **39** 212.