

# Thumbler

The light-up fidget toy

## The Physics behind your Thumbler The Light-up Fidget Toy

Thumbler is a totally addictive fidget toy but also a fascinating science gadget invented by an astrophysicist.



## Everyone loves a spinning top!

Children and adults love playing with spinning tops. Their motion is mesmerizing! At first, a rapidly spinning top appears to be motionless. Eventually the top begins to wobble, slowly at first, and then gradually it wobbles faster before finally falling over. Now, with Thumbler you can enjoy a whole new way of making a top spin and keep it spinning as long as you like!

To understand the physics of the Thumbler, we need to first define a few important words:

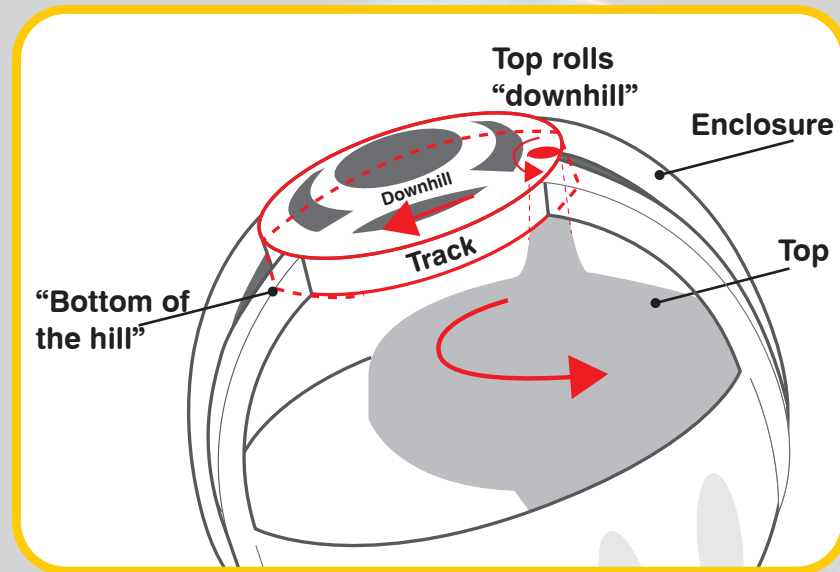
A **torque** is any twisting influence – for example, the “twist” you have to apply with your hand to turn a doorknob, or the twist you apply with your thumb and forefinger to spin a small top.

**Newton’s second law of rotation** states that the spin rate of a symmetric object, like a typical top, will increase if a torque is applied around that axis.

**Precession** is a word that physicists use to describe the wobble of an object spinning in space (think of a poorly thrown rugby ball wobbling as it moves through the air) and it can have many causes. The familiar wobble (**the precession**) of a slowing top is caused by the force of gravity acting to tip the top over. But spinning objects behave strangely! Instead of tipping straight over, their axes wobble or **precess** for a while before eventually falling over.

## So what about my Thumbler?

Your Thumbler is a new step in the development of the traditional spinning top. By placing the top inside of a specially designed enclosure, you can apply a continuous accelerating swirling motion – or **torque** – to the top.



## How does it work?

The diagram above shows the top spinning inside the enclosure. The upper end of the axle leans against a circular track and the lower end is confined to a small area in the base. By tilting the enclosure, the upper end of the top begins to **precess** or roll “downhill” while its lower end is fixed. As it rolls, its spin speed increases.

This is the same principle that causes a ball to spin faster and faster as it rolls down a hill. If you continually change the direction of the tilt by twirling your Thumbler’s housing in a circular motion, the top never finds the “bottom of the hill” - it is like it is rolling down a never-ending hill! This causes the top to spin faster and faster, until it is “synchronized” with the swirling motion of the housing, but about ten times faster.

## How fast is my Thumbler spinning?

If you rotate your Thumbler housing two times per second, which is typical for most users, the top inside the Thumbler is spinning at about 20 times per second.

## Fun fact!

The Earth’s axis of rotation precesses every 26,000 years due to the influence sun and the moon. This causes the seasons to drift – 13,000 years from now, winter in the Northern Hemisphere will occur between June and September!

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