

Strange Spinning

Tops are fun, but these spinners can do truly amazing things.

WHAT TO DO

Spin the various tops, eggs and Rattlebacks. Observe what happens.

WHAT'S HAPPENING?

Spinning is just rotational motion, and Newton's First Law of Motion says that an object in motion will tend to remain in motion (both speed and direction) unless acted upon by another force. So while a spinning top will try to keep spinning in the same direction, when other forces like friction or gravity interfere, things can get pretty complicated!

Tippy-tops have a round bottom and when spun very fast they will flip upside-down and spin on their handle instead, even though this should be much less stable! A *hard-boiled egg* will similarly flip from spinning about its shortest axis to stand up and spin about its longest axis. A *Rattleback* (the long semi-ellipsoidal shape) will spin easily counter-clockwise. But if you try to spin it clockwise instead it will stop, wobble a bit, then slowly begin rotating counter-clockwise by itself, which appears to completely violate the laws of physics.

Why these seemingly simple tops behave the way they do is actually quite complicated (Nobel laureates have debated the Tippy-top physics), but has something to do with friction creating instabilities which, due to their shapes, lead to very dramatic changes in motion. You can find more info on the internet if you're interested, or just enjoy the fun!

Benham's Disks have a pattern of black arcs on a white background, but when spun colors seem to appear! Spinning at different speeds changes the colors perceived. This optical illusion has to do with the way the red, green and blue cones in our eyes send information about color to the brain. If all three cones are not perfectly synchronized a pattern which flashes rapidly between white and black can cause our brain to mistake this for various colors.