I now want to calculate the moment of inertia of a rod uniform mass distribution. It's like a cylinder: it is a cylindrical rod, and I know the radius of the cylinder. It's very small compared to the length of the rod.

Here we have this rod: it has length l, the radius of the cylinder is little r, and the mass of the rod is m. I rotate about the center of this rod. About an axis perpendicular to the axis of symmetry, and r is much, much smaller than l. If we call this axis 1-- we already calculated it in a different segment-- that the moment of inertia about this axis equals 1/12 ml squared.

What, now, is the moment of inertia if I rotate about this axis, about the axis of symmetry? We also calculated that, because we can now apply our results that we found for a cylinder. The cylinder now doesn't have a thickness a as we had before, but it has this thickness l. Now, the moment of inertia with axis 2-- which, by the way, also goes through point c-- now equals 1/2 m times r squared.

Remember, the radius came into there, and the mass came into there. The thickness of the cylinder, l, did not enter into it except that when you double the thickness that the mass, of course, doubles. The reason why I want to show you this is that this is much, much smaller than this, because r is much, much smaller than l. The reason being is that most of the mass when you rotate about this axis is very close to this axis of rotation, whereas when you rotate about this axis, a lot of mass is far away, because l is much, much larger than r. This demonstrates once more that the moment of inertia can be very small in some cases, if you choose a particular axis of location, and it can be much larger for other axes of rotation.

If I come back to my potato-- here you have a potato. This potato is narrower in this direction than it is long, so the moment of inertia of rotation about this axis would definitely be larger than the moment of inertia rotation about this axis, because on average, the amount of matter is closer and a smaller distance to this axis than it is to this axis. Oh, to this axis! Of course, distance is very important, because the distance comes in as r squared.

The bottom line is that the moment of inertia depends very strongly on the geometry and how you choose your axis. One and the same object has many different modes of inertia depending upon what the location of the axis is, and what the direction of the axis is.