We already showed that the torque about a point can also be thought of as a decomposition.

We take the vector from the point P to the center of mass and apply all the forces acting on the particle at the center of mass.

And we can calculate the torque about the center of mass due to the action of some forces where we're having forces acting about the center of mass.

Now if we choose the point P to equal the center of mass, then we know that the vector r center of mass to the center of mass is 0.

So the torque about the center of mass is just equal to the forces about that point.

We know that torque is always just Lcm/dt.

Now, again, how could we justify that statement that because we're only calculating the torque about the center of mass, it's only the rotational angular momentum about the center of mass that's changing.

We saw before that if we thought of Lp, again, as a translational and a rotational angular momentum-- I'm sorry, rotational angular momentum, omega-- and the point p was equal to the center of mass, then this first piece would be 0.

And L about p is only Icm omega and dLp/dt is equal to Icm alpha for a fixed axis.

And that's exactly equal to dLcm/dt.

And so the point here is that when we're applying problems involving rotation and translation, we can just analyze the torque about the center of mass and only consider how the angular momentum about the center of mass is changing.

And then for the center of mass motion-- so this gives us our rotational dynamics.

And for our linear dynamics, we will still apply F equals the total mass times Acm.

So that's our linear dynamics.

And this is our overall decomposition of rotational motion.

To analyze it, we study the rotational dynamics and the linear dynamics.