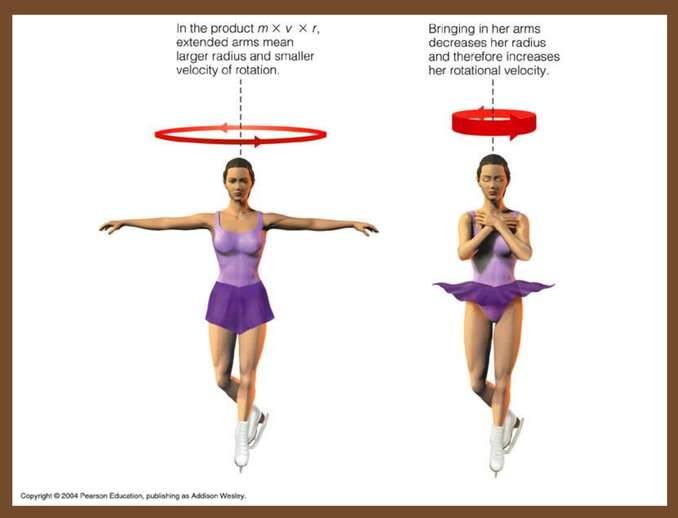
BYU applied biomechanics engineering laboratory

DYNAMIC AXES OF ROTATION

BRIGHAM YOUNG UNIVERSITY · FOUNDED BYU 1875 · PROVO, UTAH

Background:
An object moving through the air has three axes about which it is most likely to rotate. These are called the **principle axes** of rotation. While airborne, a human has the ability to change the orientation of these axes and thereby change the orientation of their spin. This is accomplished by moving different parts of their body to change the **moment of inertia** of the body.

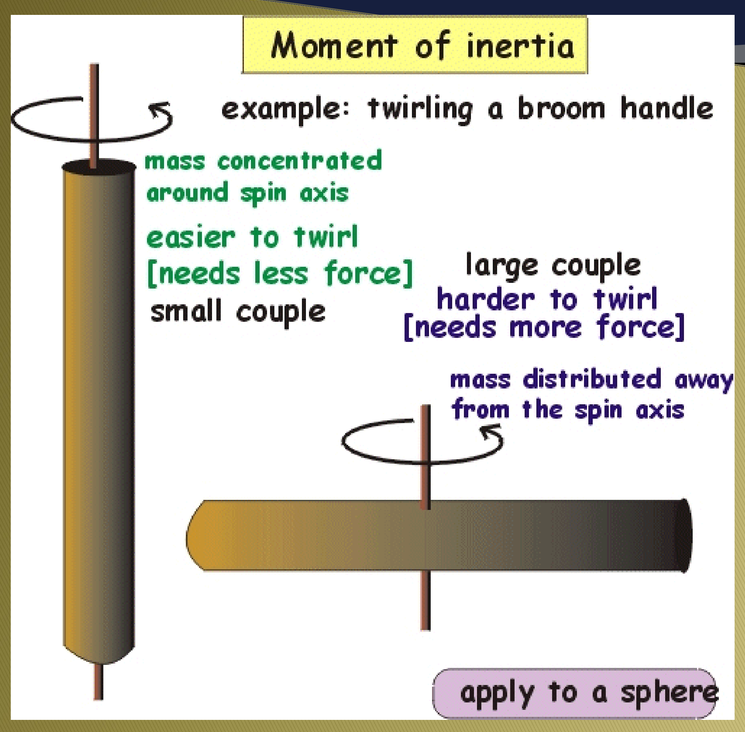


Moment of Inertia:
The moment of inertia of a body is defined as its ability to resist rotation or twisting. The moment of inertia of an object changes depending on which axis about which it is rotated.


http://www.flickr.com/photos/jibbert/3573662132/


http://www.flickr.com/photos/22826964@N07/2242581031/

Stable vs. Unstable Axes of Rotation: Of the three principle axes of rotation, there are two stable axes and one unstable axis. The stable axes have the highest and smallest moments of inertia, and the unstable axis is somewhere in between. Rotations about the unstable axis will be random and unpredictable. Can you find the unstable axis of the block?



http://www.see.leeds.ac.uk/structure/dynamicearth/internal/moment/index.htm

Discussion:
When a person in free airborne motion moves a part of their body away from their original position, they are changing their moment of inertia. This change in moment of inertia can transform vertical motion into a rotational or flipping motion and vise versa.