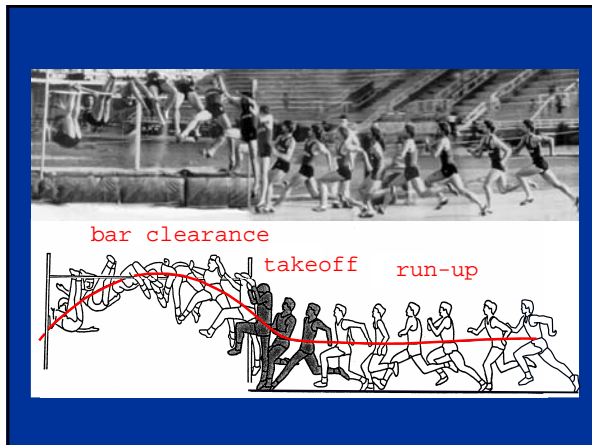
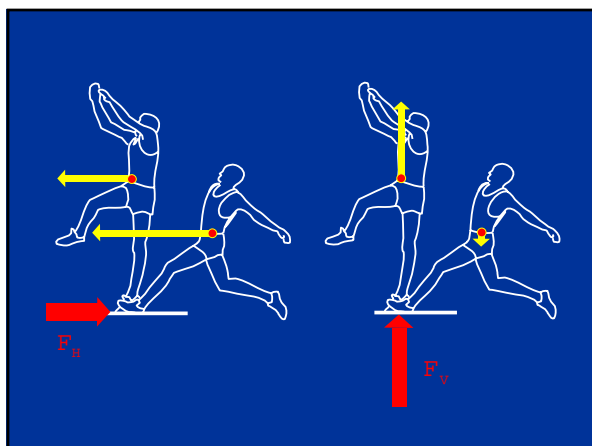


Biomechanics of High Jumping

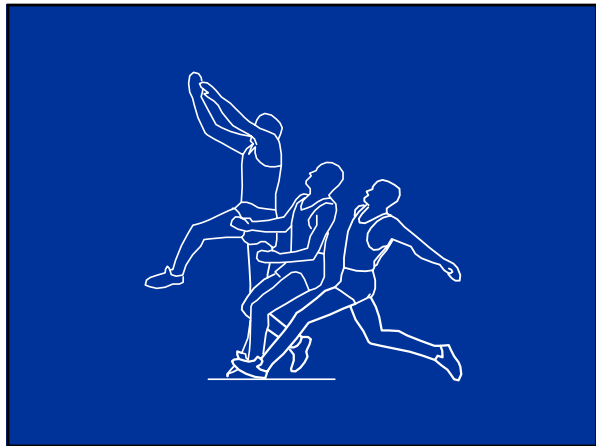
Jesús Dapena
Department of Kinesiology
Indiana University
U.S.A.

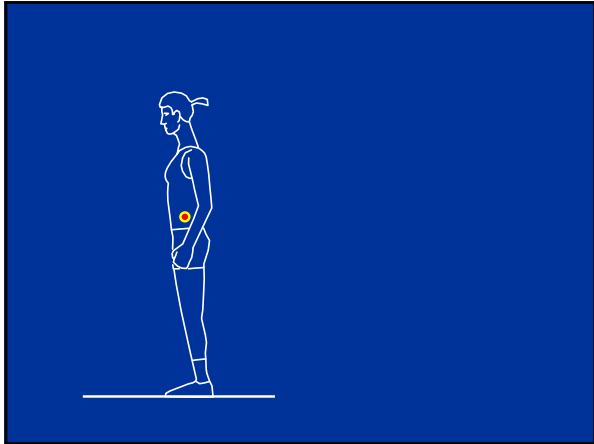


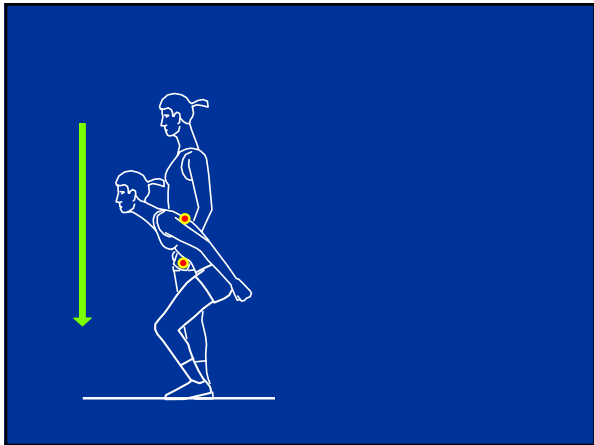


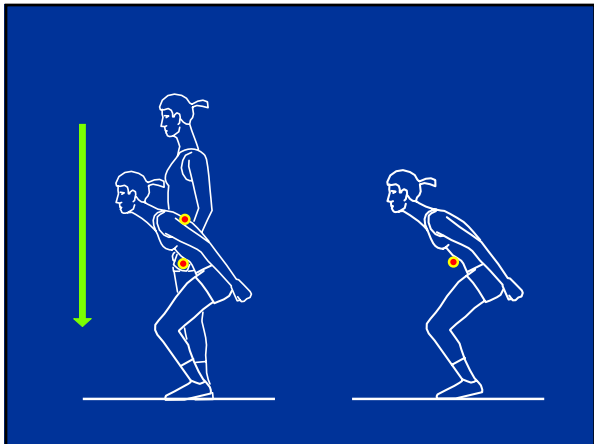


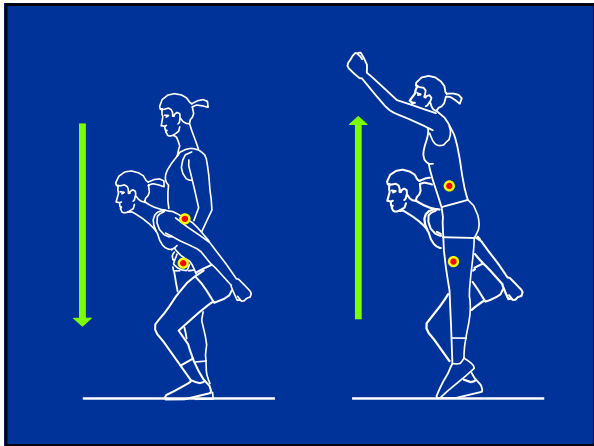
large vertical
long time

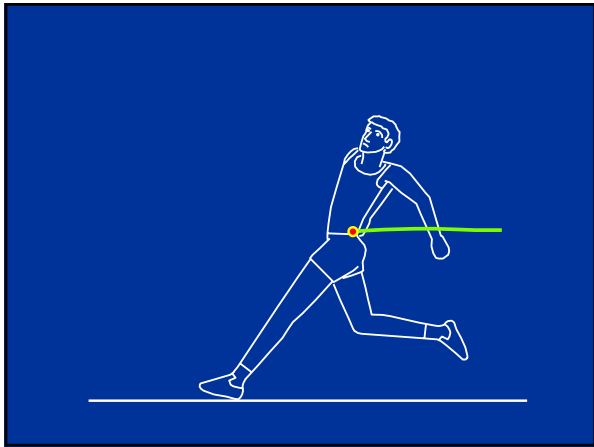


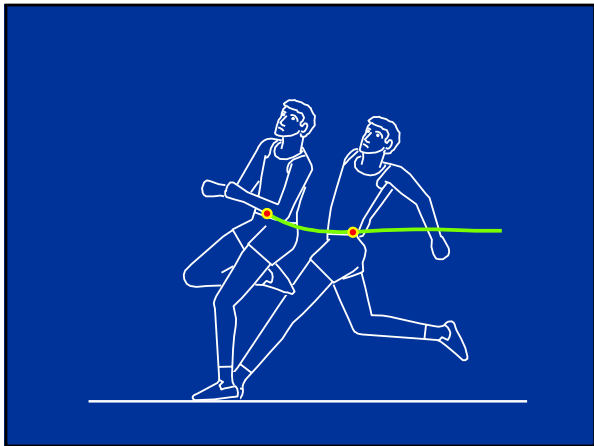


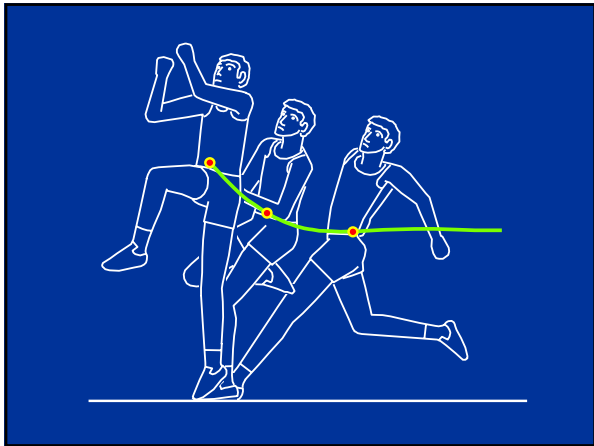


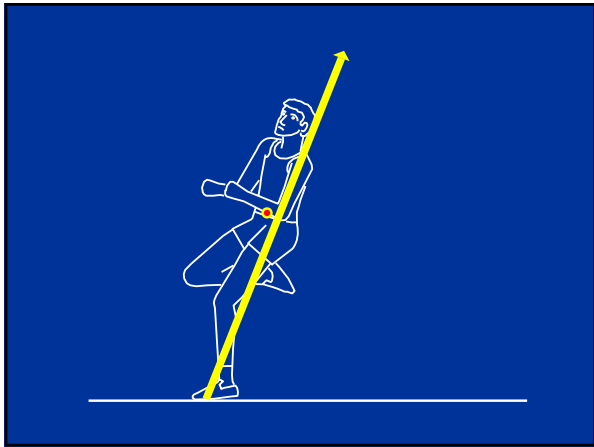


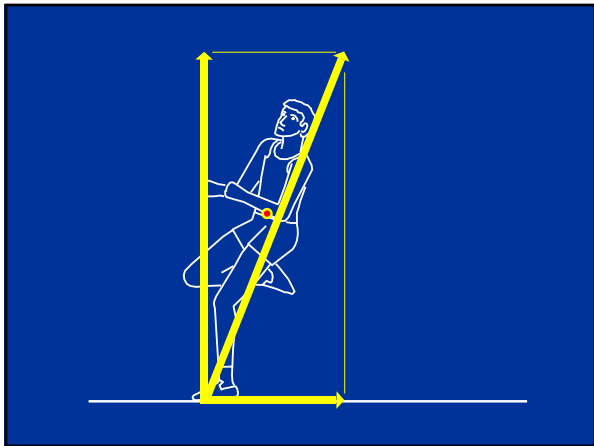


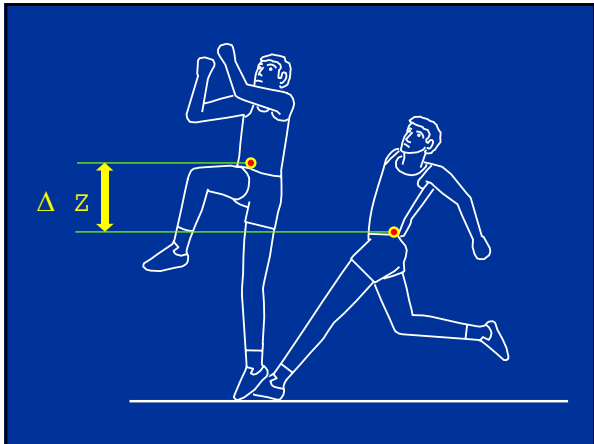




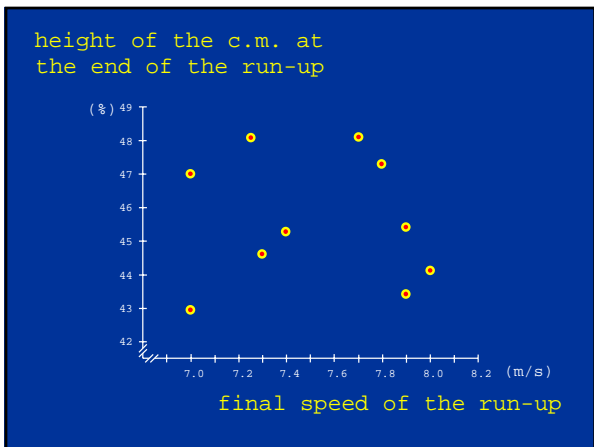




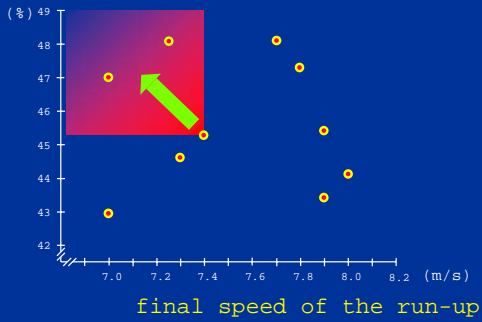




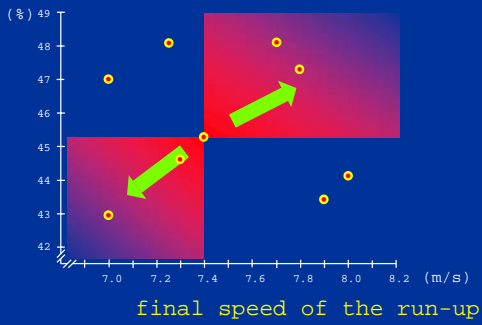




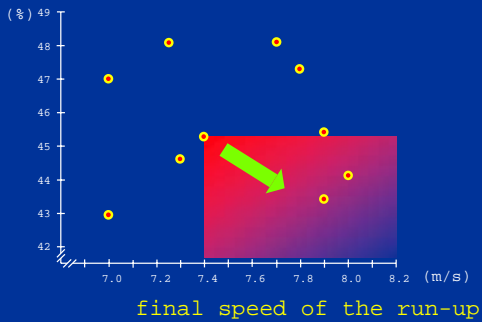
height of the c.m. at the end of the run-up

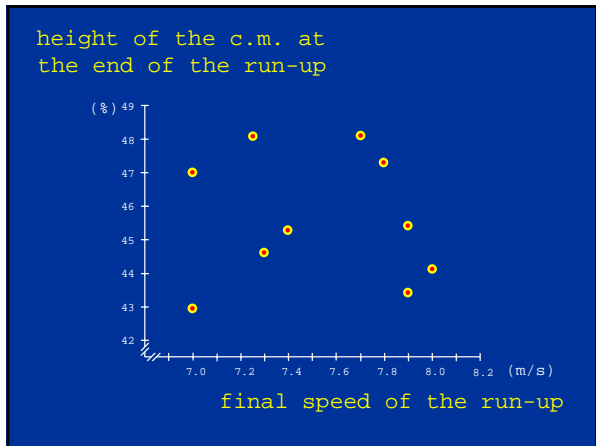


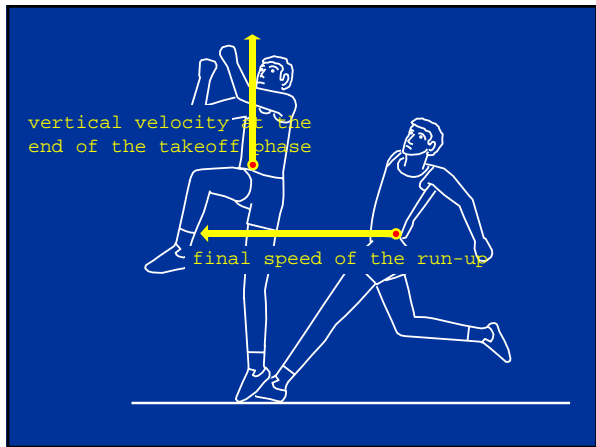
height of the c.m. at the end of the run-up

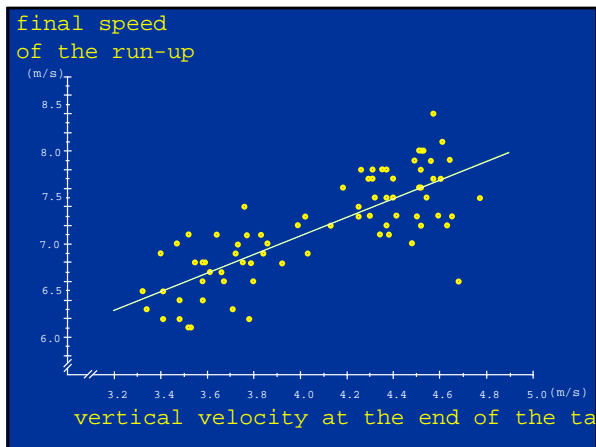


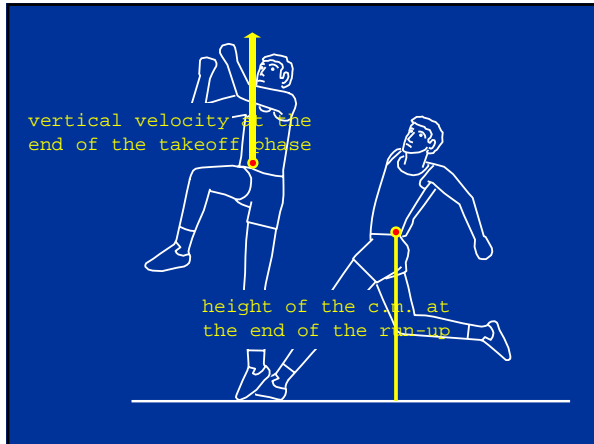
height of the c.m. at the end of the run-up

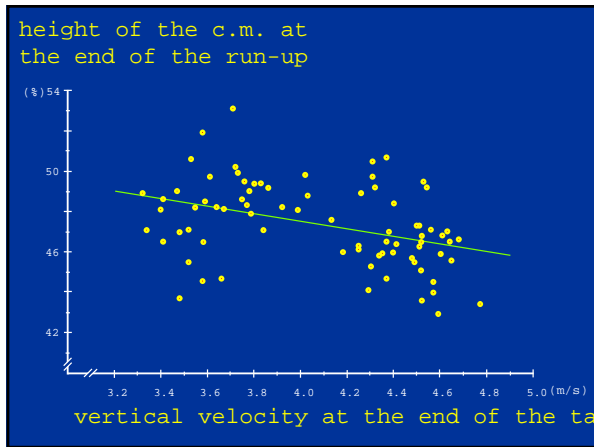




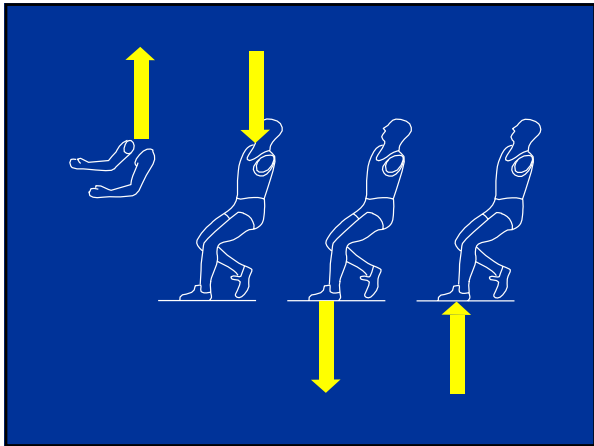


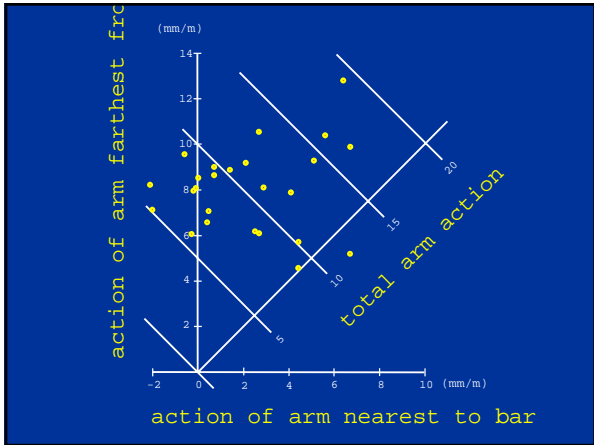












ankle pronatio

QuickTime™ and a
Sorenson Video 3 decompressor
are needed to see this picture.

video courtesy Dr. Bart Van Gheluwe

bar clearanc

actions in the
translati

angular momentum

actions in the
rotational

possible reasons for
bar clearance:

- * insufficient angular momentum
- * insufficient arching
- * bad timing of arching/un-arching

The airborne motions
high jump are essenti
twisting somersault.

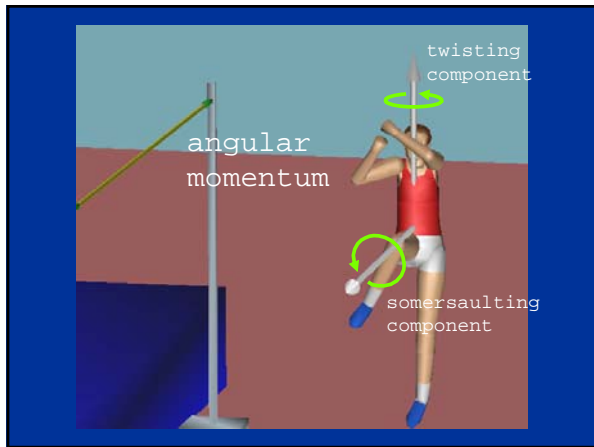
twist rotation

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

somersault rotation

QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

Let's see these rotations in an actual jump ...



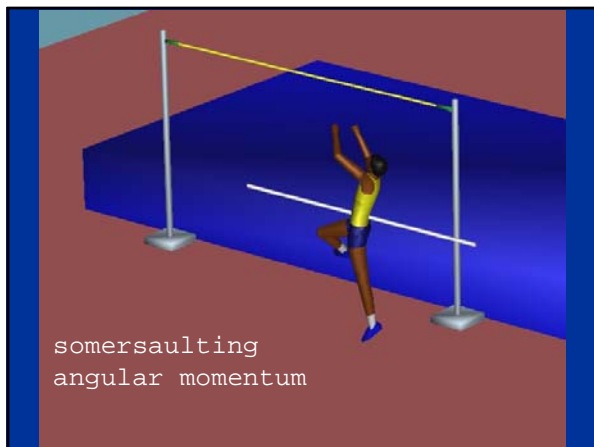
We will look first at the twisting component of angular momentum

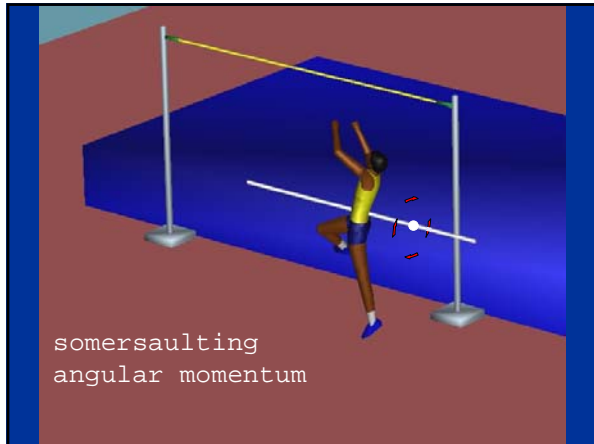
QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

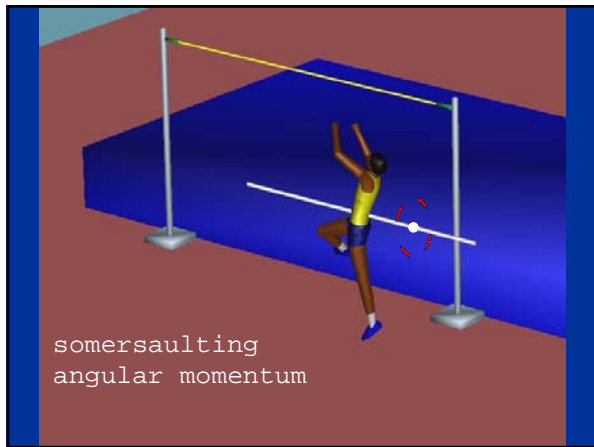
We will look at how angular momentum is generated in an actual jump ...

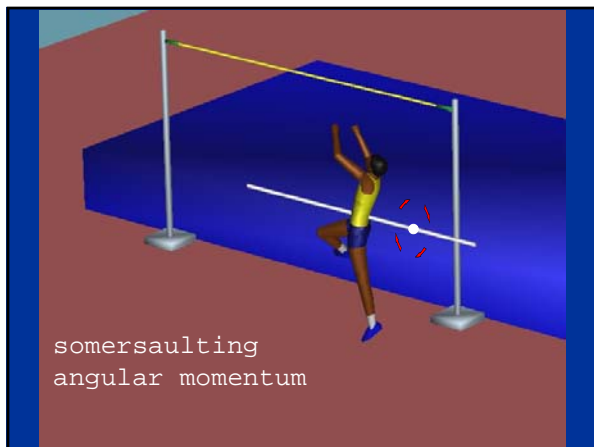
We will now look at the somersault component of angular momentum.

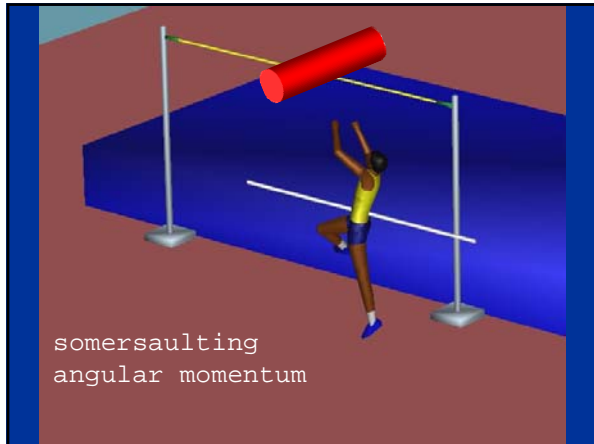
QuickTime™ and a TIFF (LZW) decompressor are needed to see this picture.

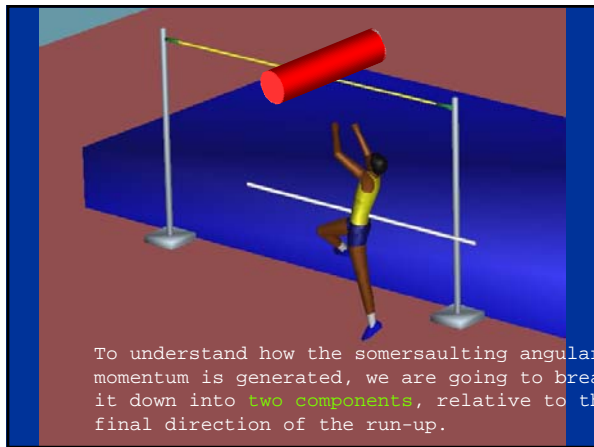


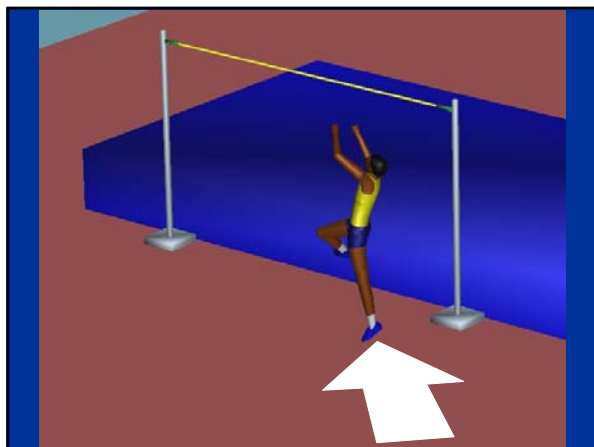


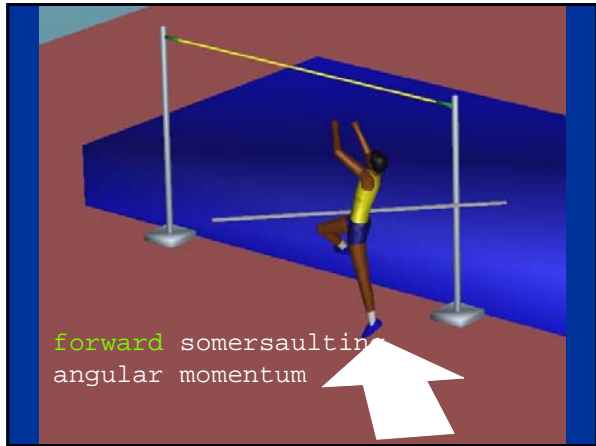


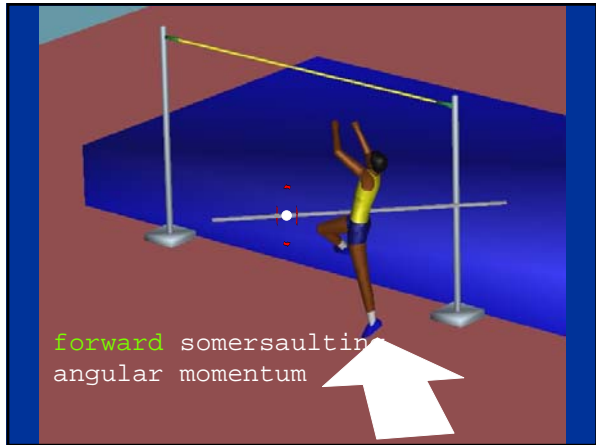


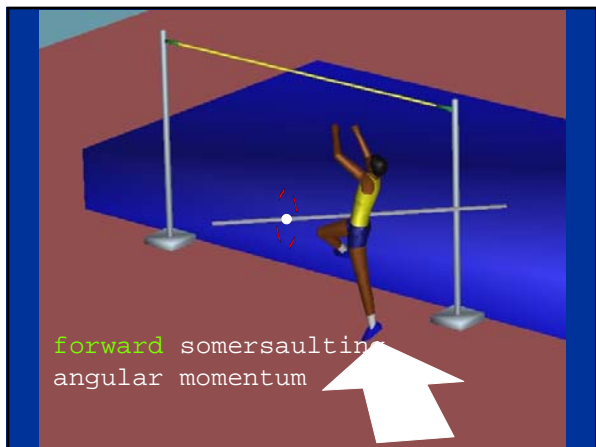


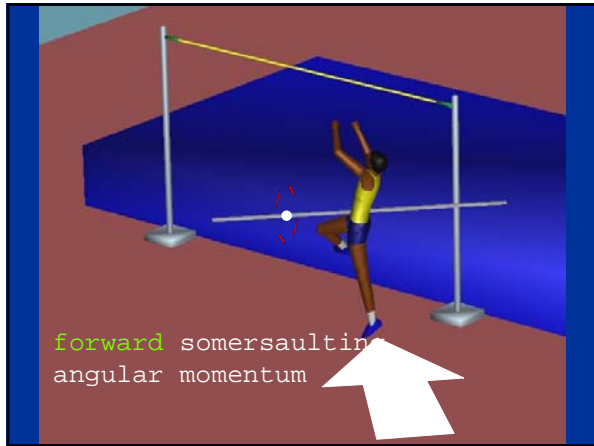


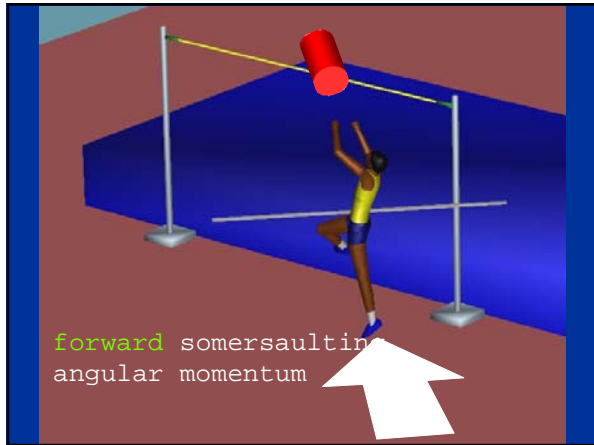


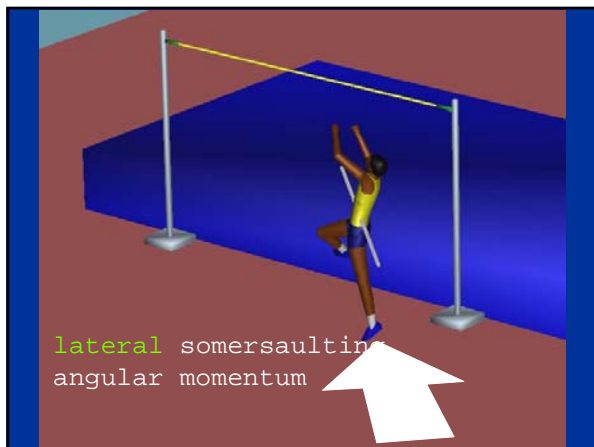


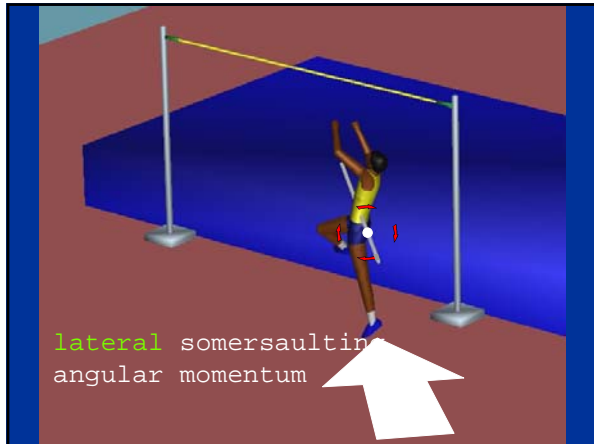


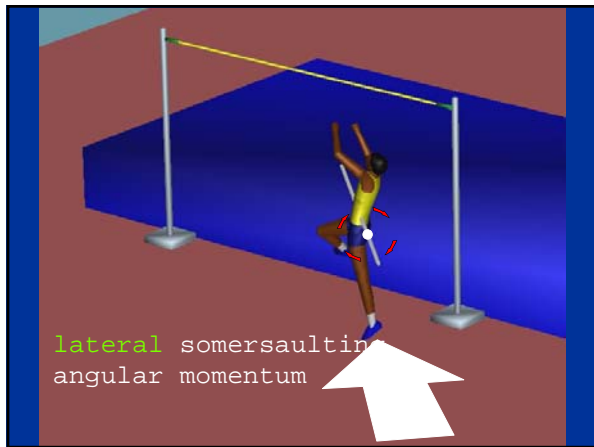


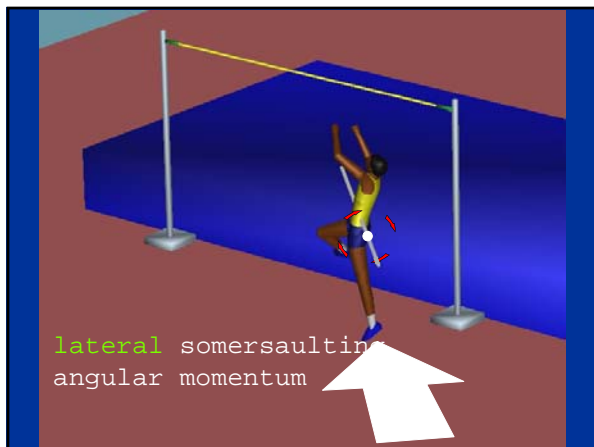


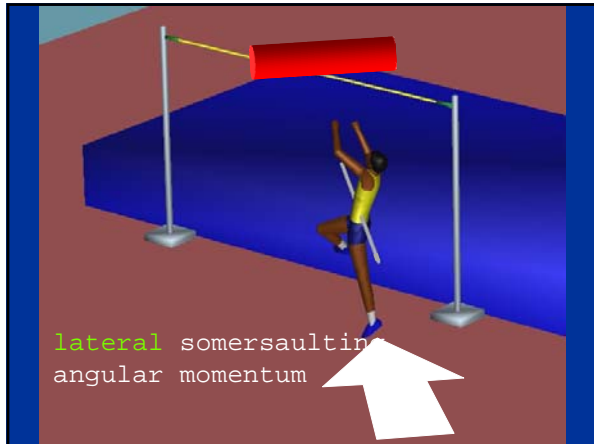


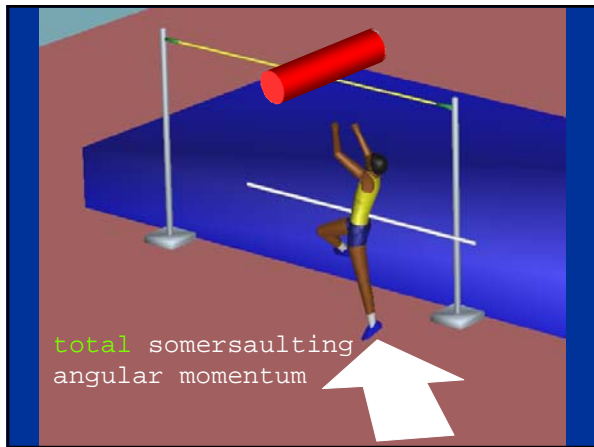












Let's look first at
forward somersaulting
angular momentum ...

Now, let's look at the
lateral somersaulting
angular momentum ...

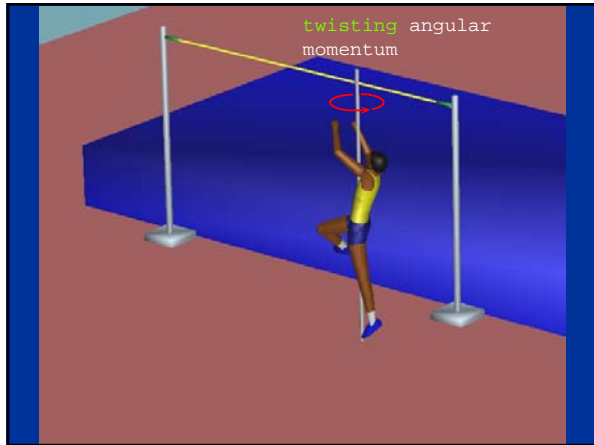
The lean during the run-up
is affected by two factors:

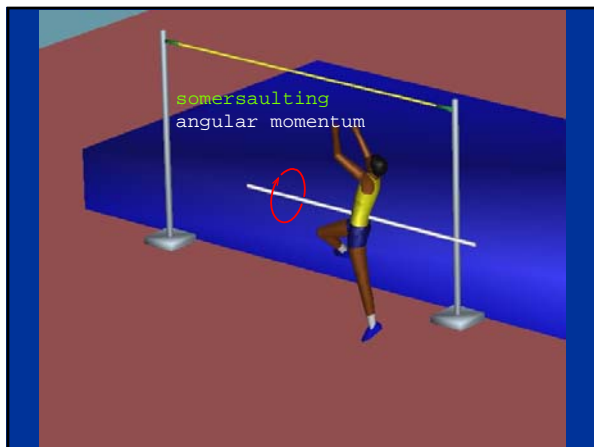
- * the radius of the curve
- * the speed of the run-up

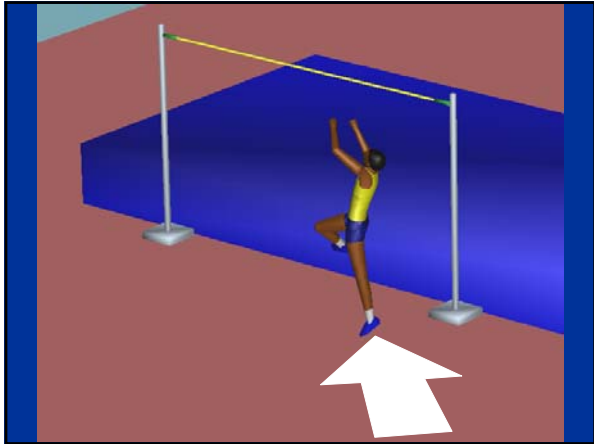
The curve has two purposes

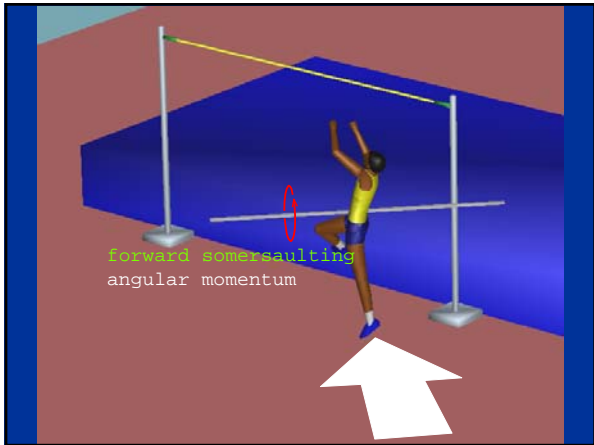
- * to make the athlete have a
greater distance from the bar at the point of
clearance
- * to lower the c.m. without having
to flex the legs very much

Summary of angular momentum:

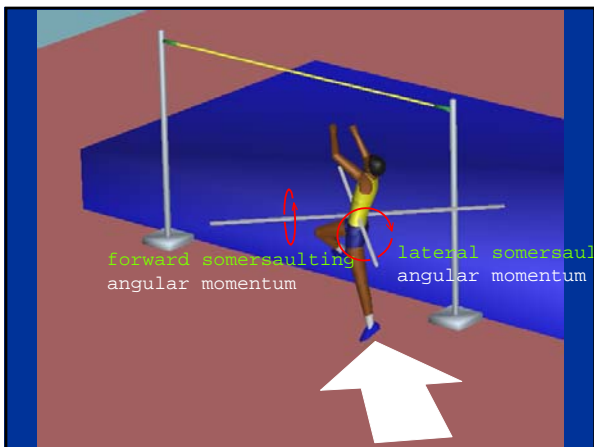








forward somersaulting
angular momentum



forward somersaulting
angular momentum

lateral somersaulting
angular momentum

The sum of the two is the somersaulting angular momentum, which we can see best in a view along the b

After the takeoff is completed, a lot of things are fixed:

The path of the c.m. is fixed.

Angular momentum is fixed.

But you still have a certain amount of freedom ...

It's also possible to sometimes a little bit faster by reducing the moment of inertia about an axis parallel to the bar.

This can be done through changes in the configurations of the torso or of the legs ...

One last thing:

There can be problems for the rotation over the bar when an athlete uses a strong double-arm and lead leg action during the takeoff phase ...

needed for good technique:

- *fast run-up
- *low hips at end of run-up
- *strong arm and lead leg action
- *generate appropriate angular momentum
- *body vertical at end of takeoff

The End
