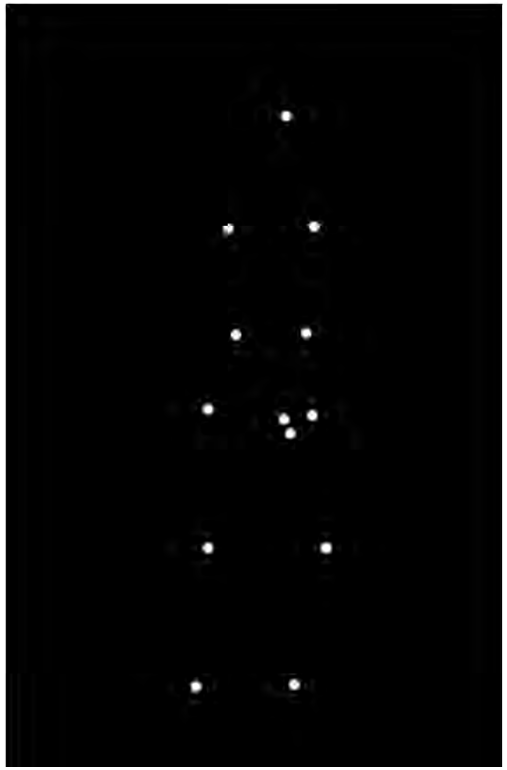
Walks – Overlapping Action

Overlapping Actions in Walks

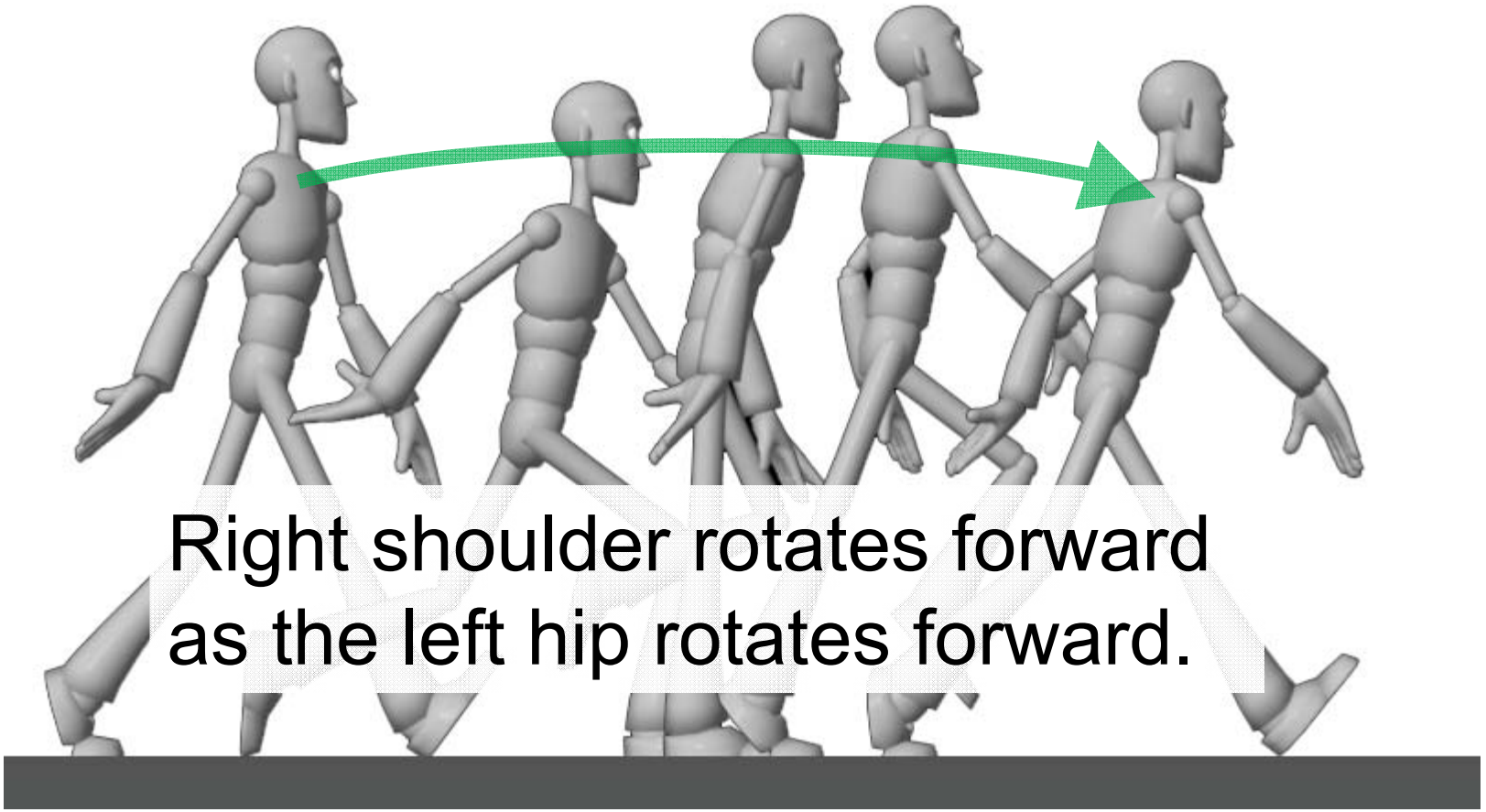
Psychology experiments have shown that we can recognize a human walk (including gender) even when shown only a handful of isolated points in motion.

This recognition comes from the timing of the overlapping action; if you pause the video the perception goes away.



Shoulder Rotation

Shoulders rotation is synchronized but out of phase with the pelvic rotation.



Right shoulder rotates forward as the left hip rotates forward.

Who Framed Roger Rabbit? (1988)

Notice the complementary, counter-rotating motion of Jessica's upper and lower body.

Rotation Balance

Moving your legs (and hips) as you walk requires a torque (rotational force) to turn them.

It takes less effort if you balance the rotation of the lower body with an opposite rotation of your upper body.

Katie Corna

Dancing The Twist

To understand rotation balance, try this demo:

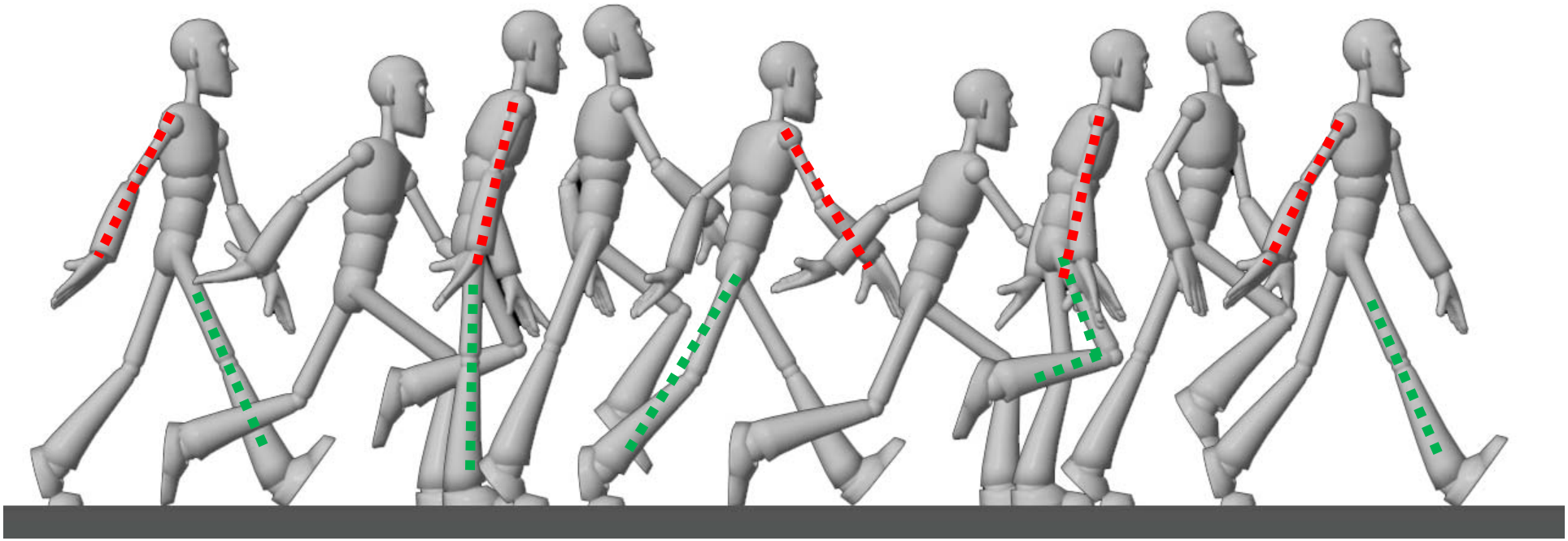
Dance *The Twist* in the normal way, moving the hips opposite from the shoulders.

Now try to dance moving the hips and shoulders together, back and forth.

The Twist with Rotation Balance

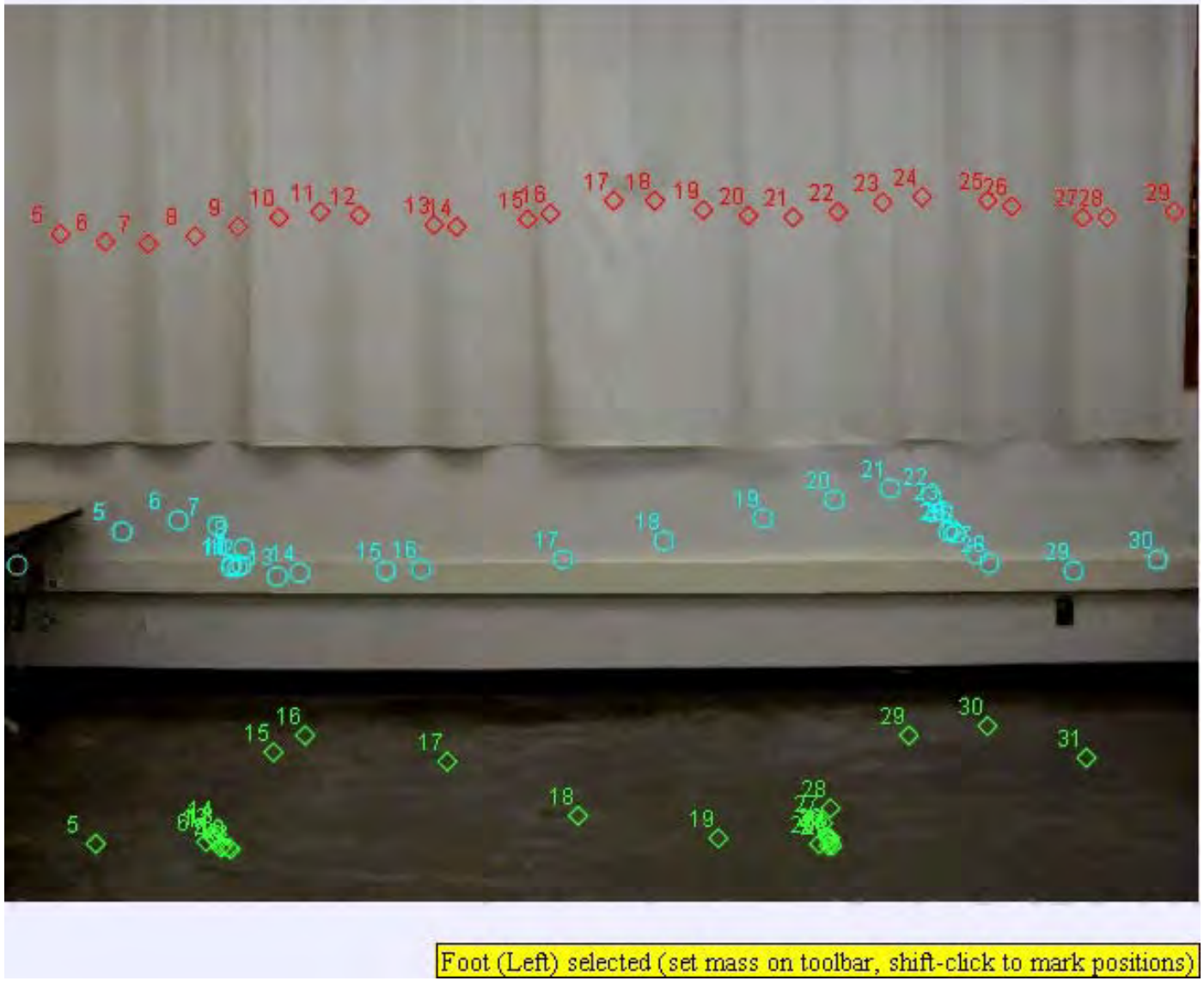
The Twist without Rotation Balance

Arm Swing

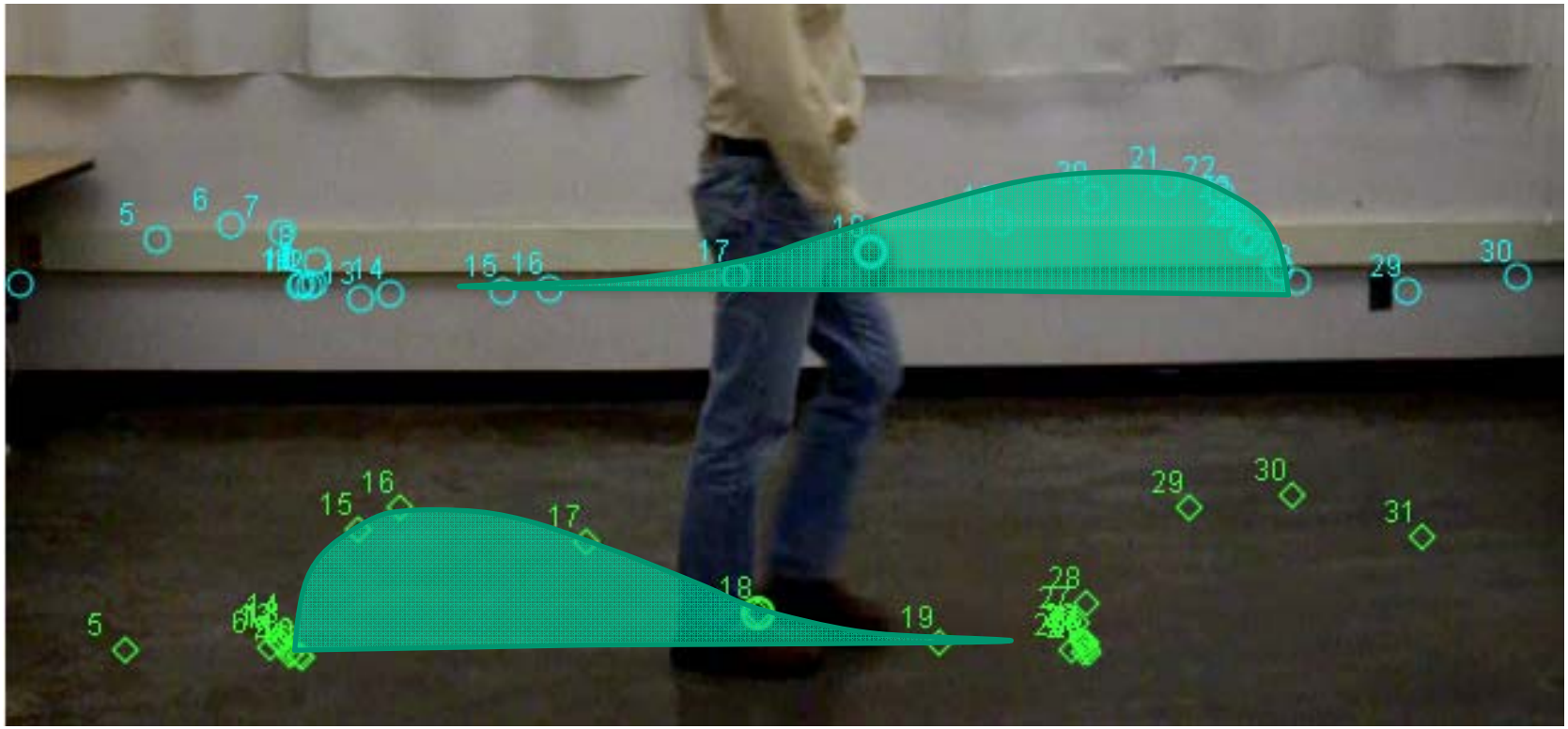


The arm swings back and forth, like a pendulum, roughly 180^{o} out of phase with the leg.
The arm and leg are roughly the same length so they swing with about the same natural frequency.

Video Analysis of Arm & Leg

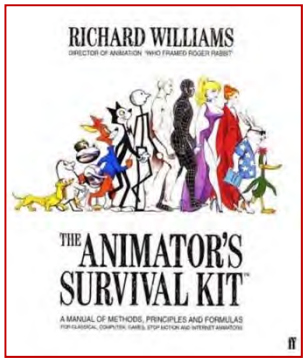


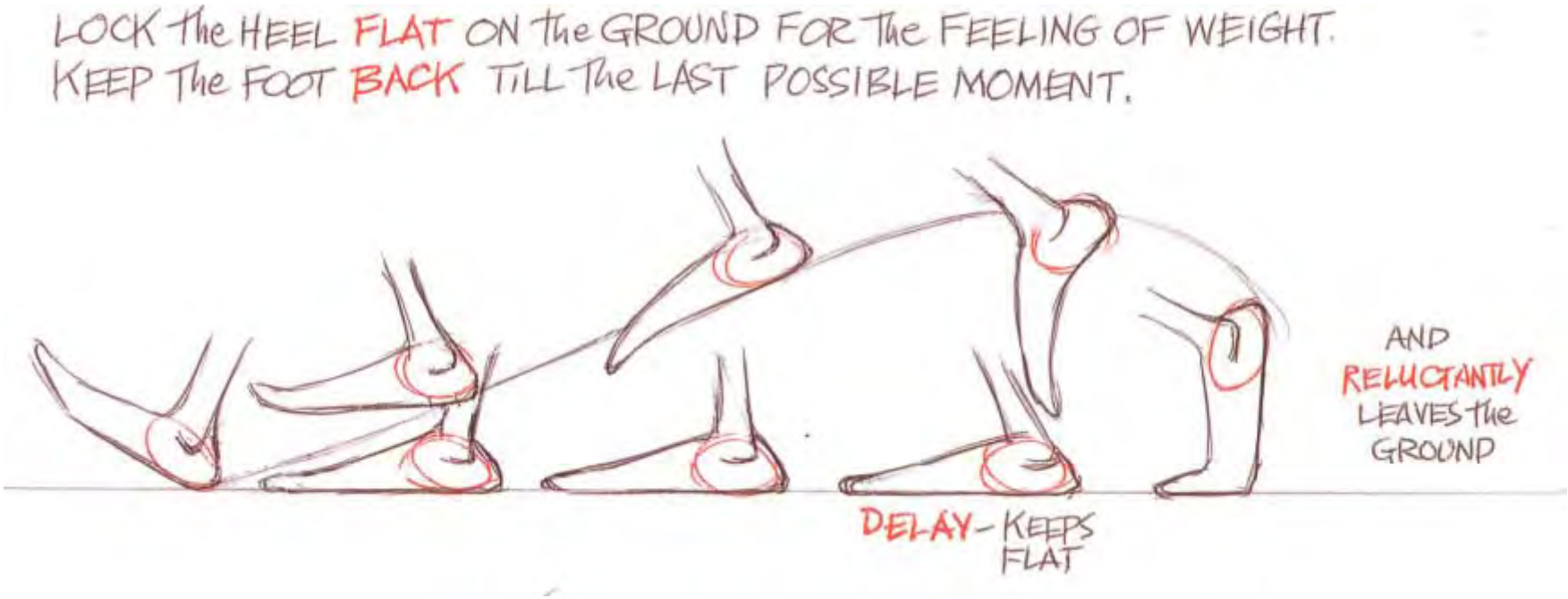
Hand and Ankle



Hand and ankle on opposite sides follow similar triangular or half-teardrop pattern.

Richard Williams' ASK





Williams shows a similar half-teardrop path of action in the motion of the ankle.

Swinging Ponytail

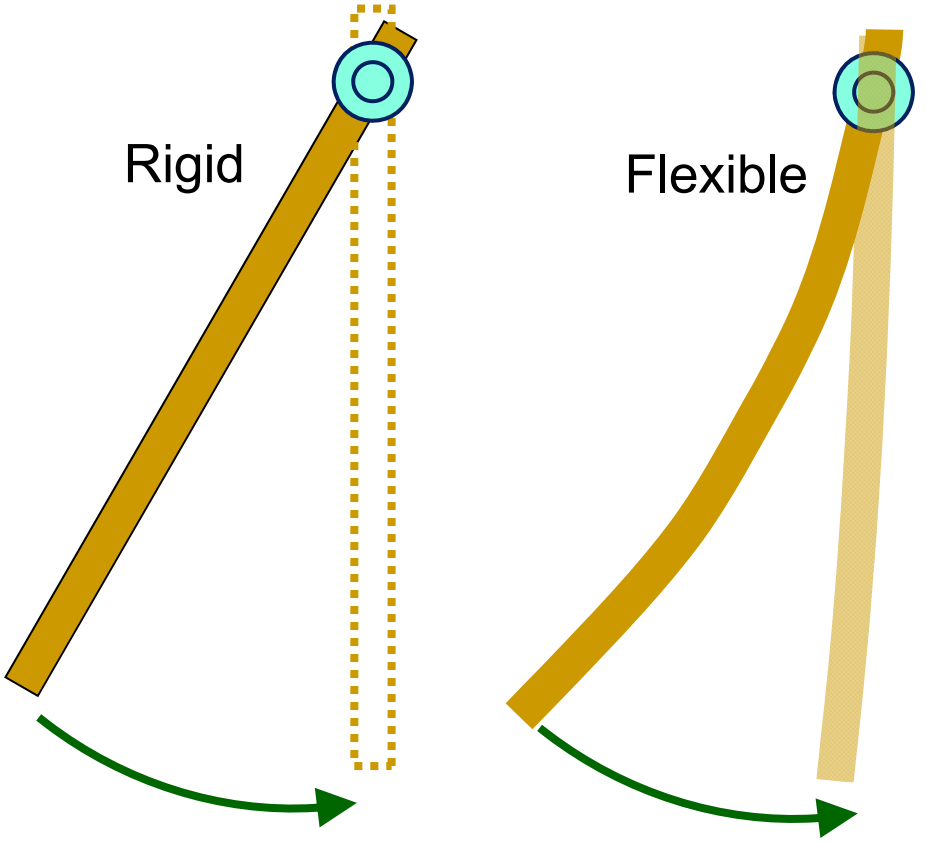
Watch this runner's swinging ponytail.

www.youtube.com/user/endlessreference

Rigid vs. Flexible Pendulum

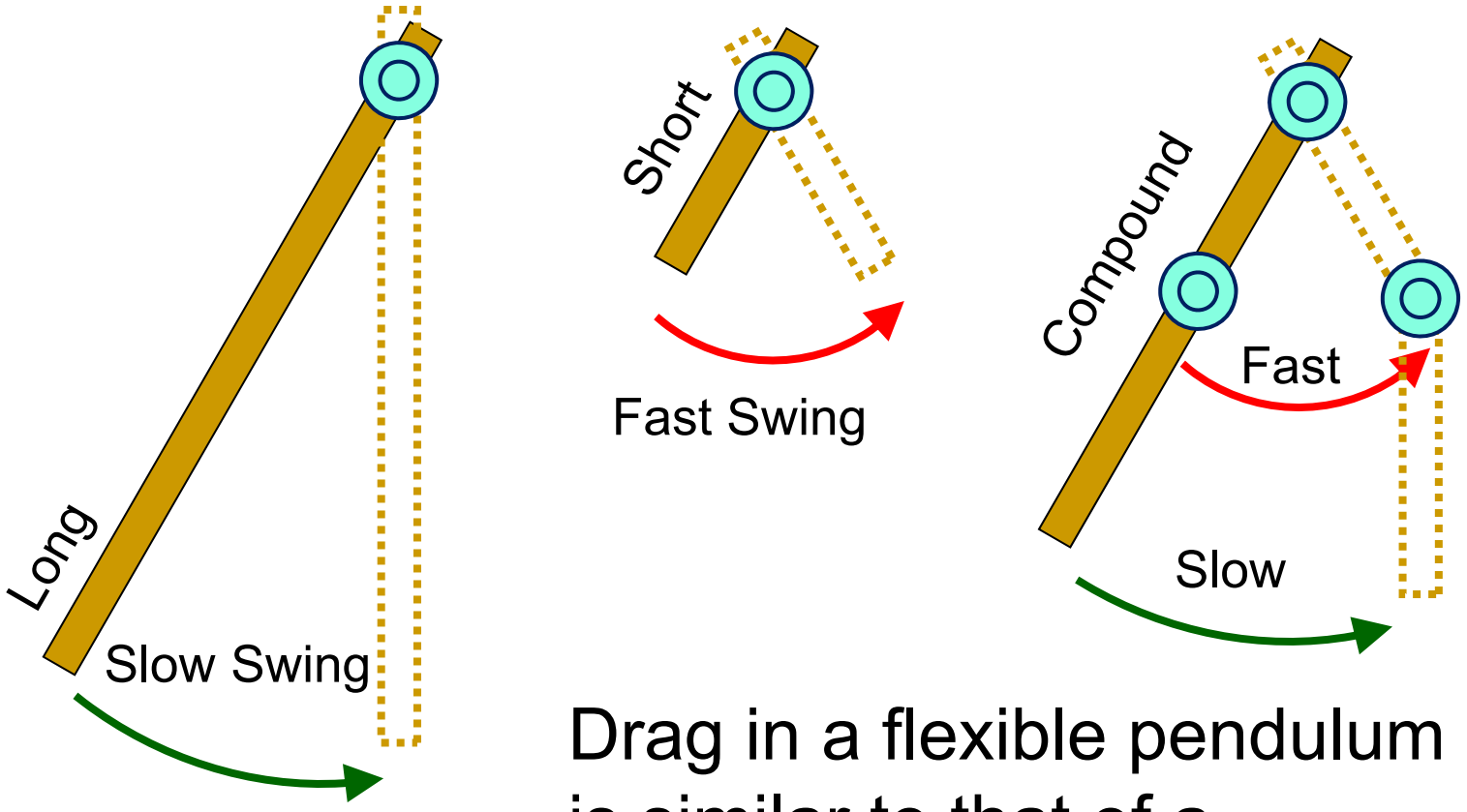
Swinging of a flexible pendulum (like a chain or a rope) has almost the same timing as a rigid pendulum.

Swing time for flexible pendulum about 15% slower.



Compound Pendulum

Compound Pendulum



Drag in a flexible pendulum is similar to that of a compound pendulum.

Parametric Resonance

Swinging motion of hair is due to the up/down motion of the body during walking or running.

If the step cycle frequency is twice the natural frequency of the swinging hair then the motion is in parametric resonance.

Ponytail Analysis

Running frequency:
3 Hertz
(= 3 steps per second)

Resonant ponytail frequency:
$^{3}/_{2}$ Hertz
(= 1.5 swings per second)

Length of a pendulum (ponytail) with this natural frequency:
14 inches

Summary

- Shoulders rotate out of phase with the pelvic rotation to keep rotation balance.
- Arms swing with the shoulders' rotation.
- Motion of the hand and ankle trace out a half-teardrop cycle during a walk.
- The body's up/down motion can induce swinging by parametric resonance.
- In parametric resonance the frequency of swinging is half of the up/down frequency.