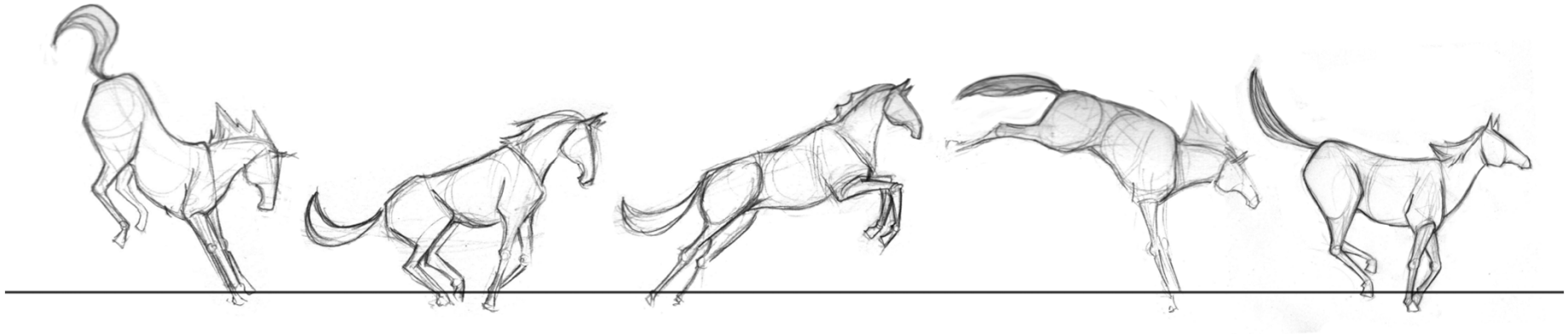
Inertia & “Drag”

Animation
Physics

“Drag” in Animation

Animators call “drag” the effect seen when a soft material, such as hair or cloth, trails behind the rest of the motion, as in this dancer’s skirt and the tail of the horse.

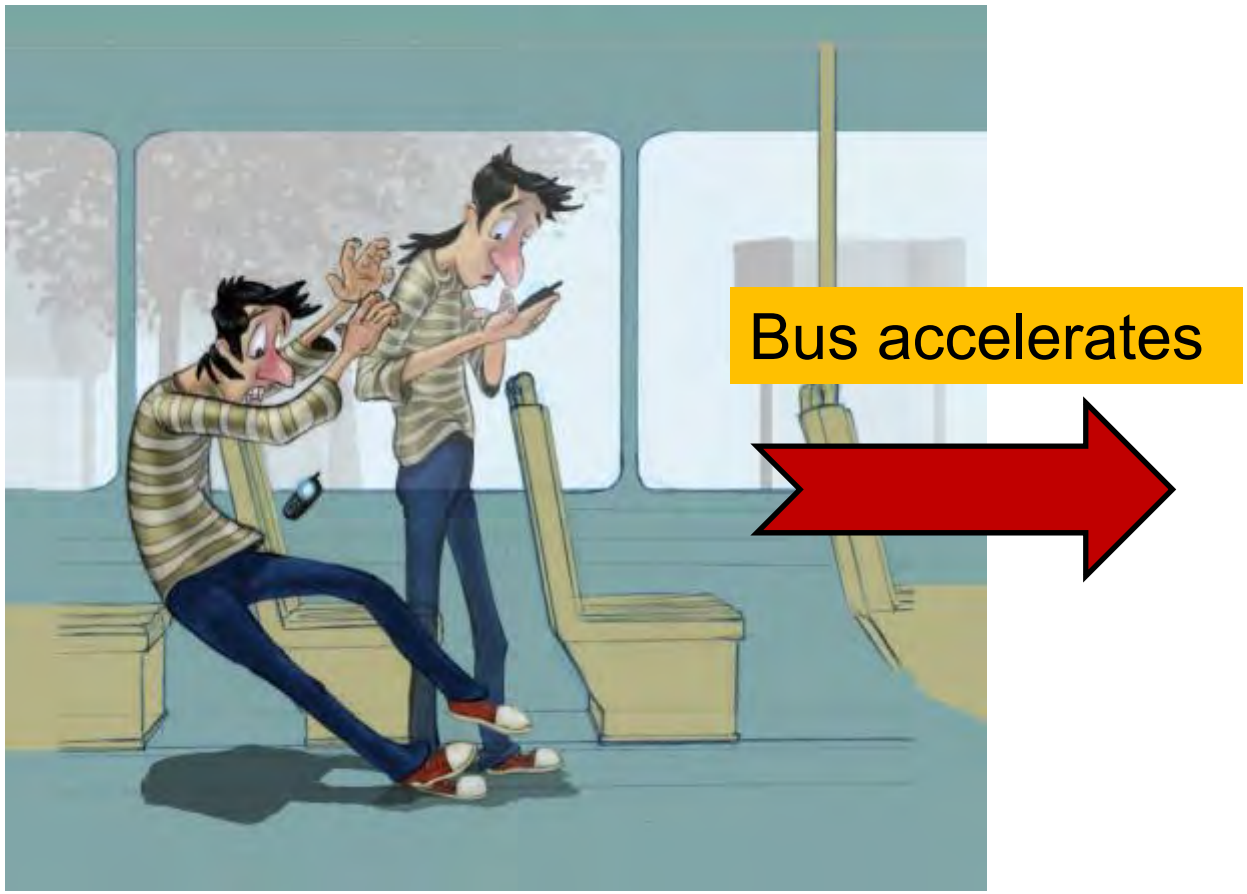


Hula Skirt

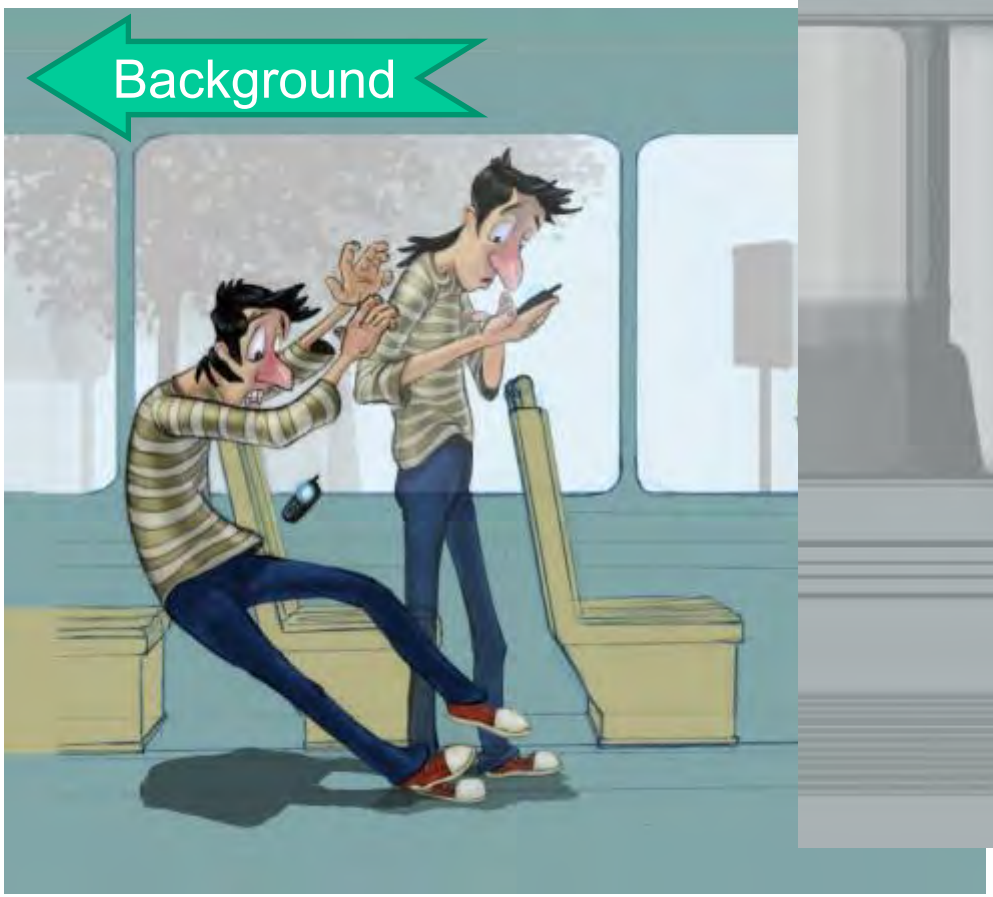
Drag & The Law of Inertia

Drag in animation is entirely due to the inertia of an object and explained by the Law of Inertia.

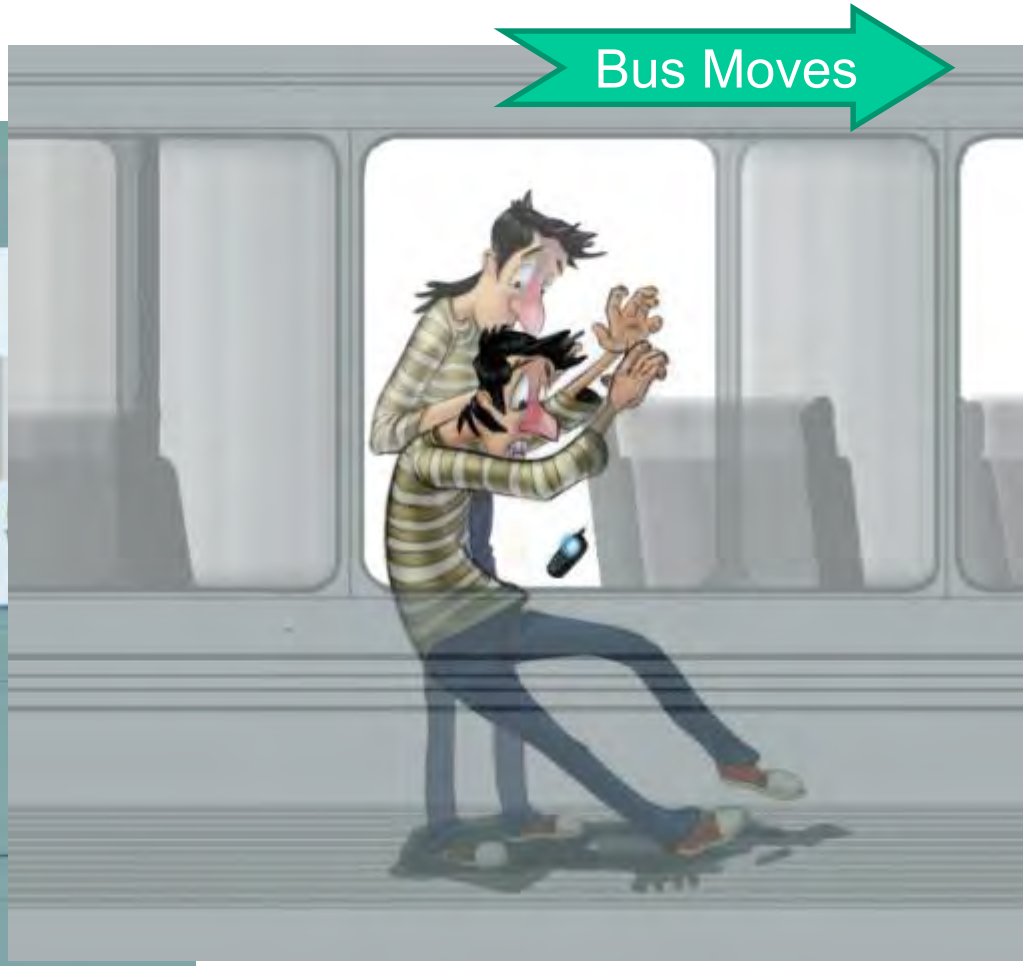
Character "drags behind" when the bus accelerates forward.



Frame of Reference



As seen by observer sitting in the bus

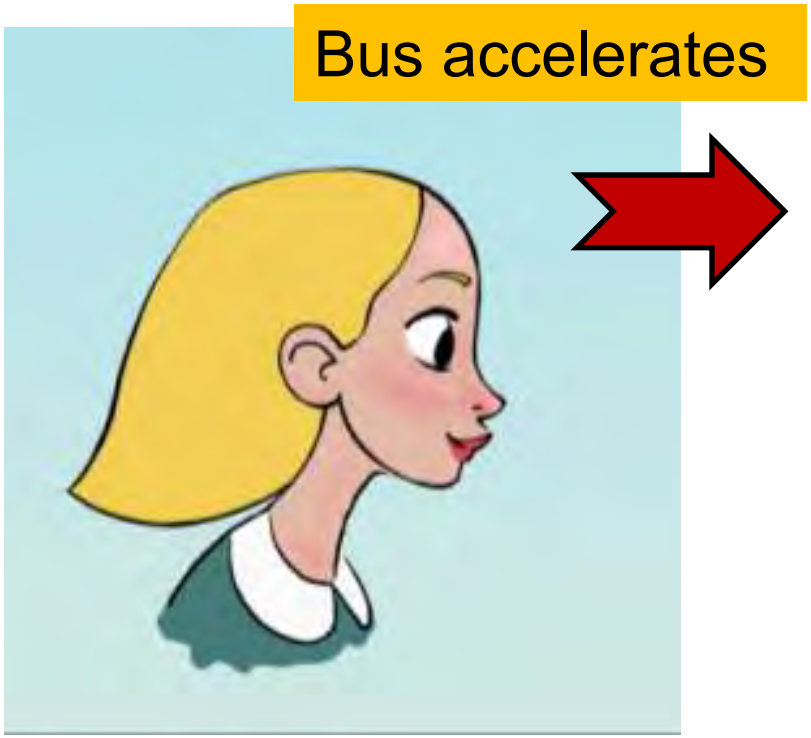


As seen by observer on the street

Inertia & Drag

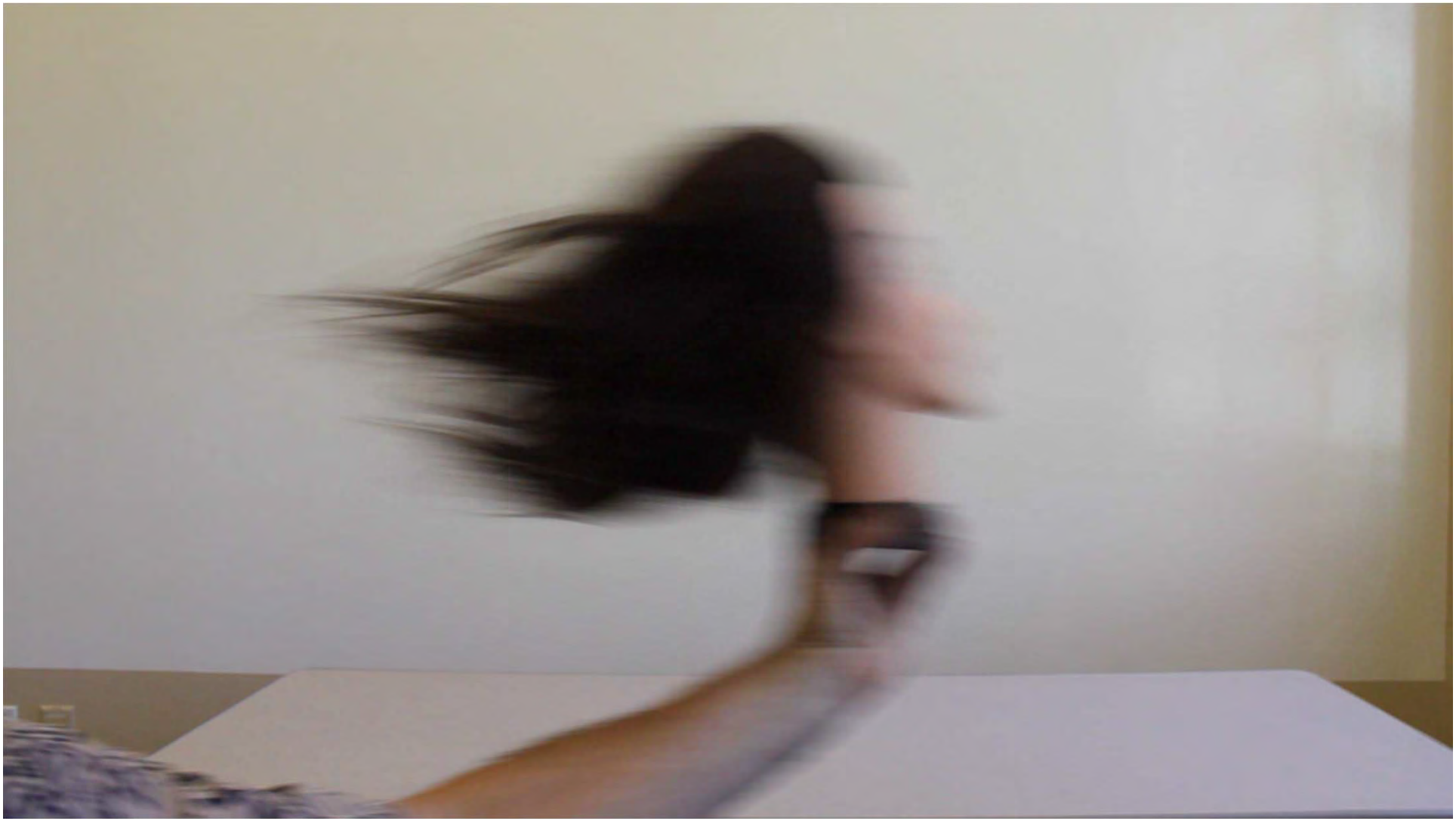
When the bus accelerates forward, the character's hair drags behind due to inertia.

Before the bus starts



Just after it starts

Inertia & Drag



Inertia & Follow-through

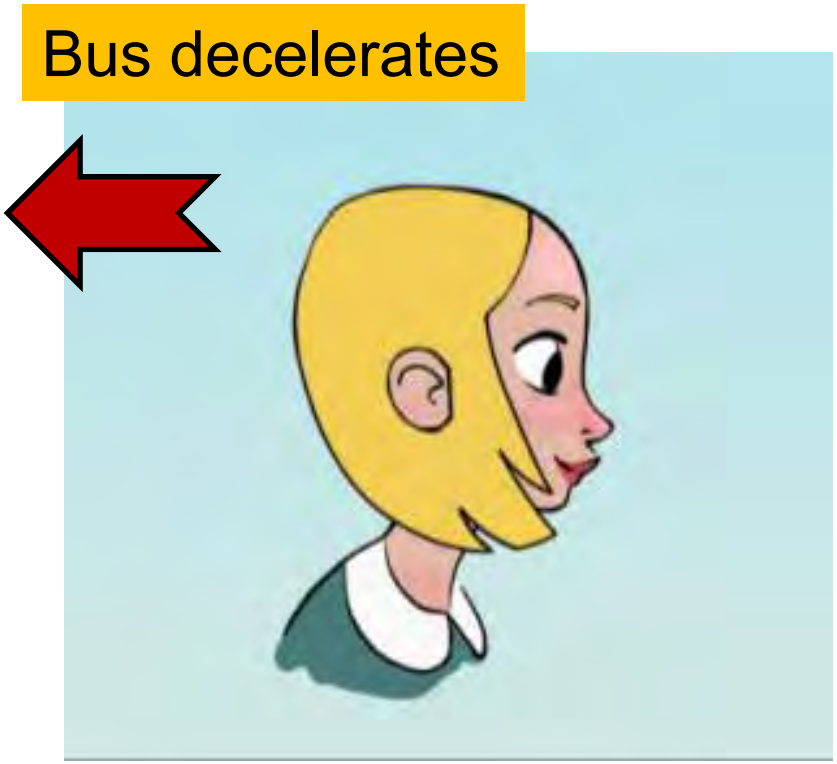
Bus decelerates

Character has “follow-through” when the bus comes to a sudden stop.

Inertia & Follow-through

Hair remains in motion even after the head stops moving, which is follow-through due to inertia.

Before the bus stops moving

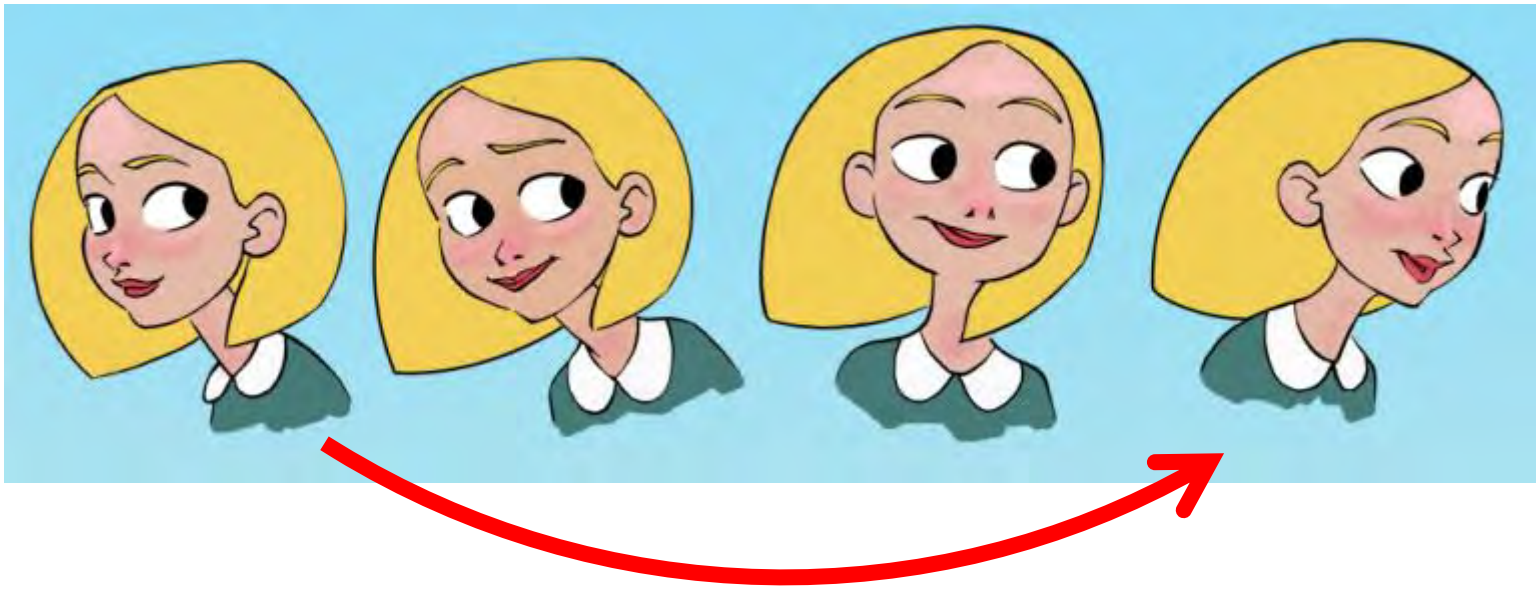


Just after it stops

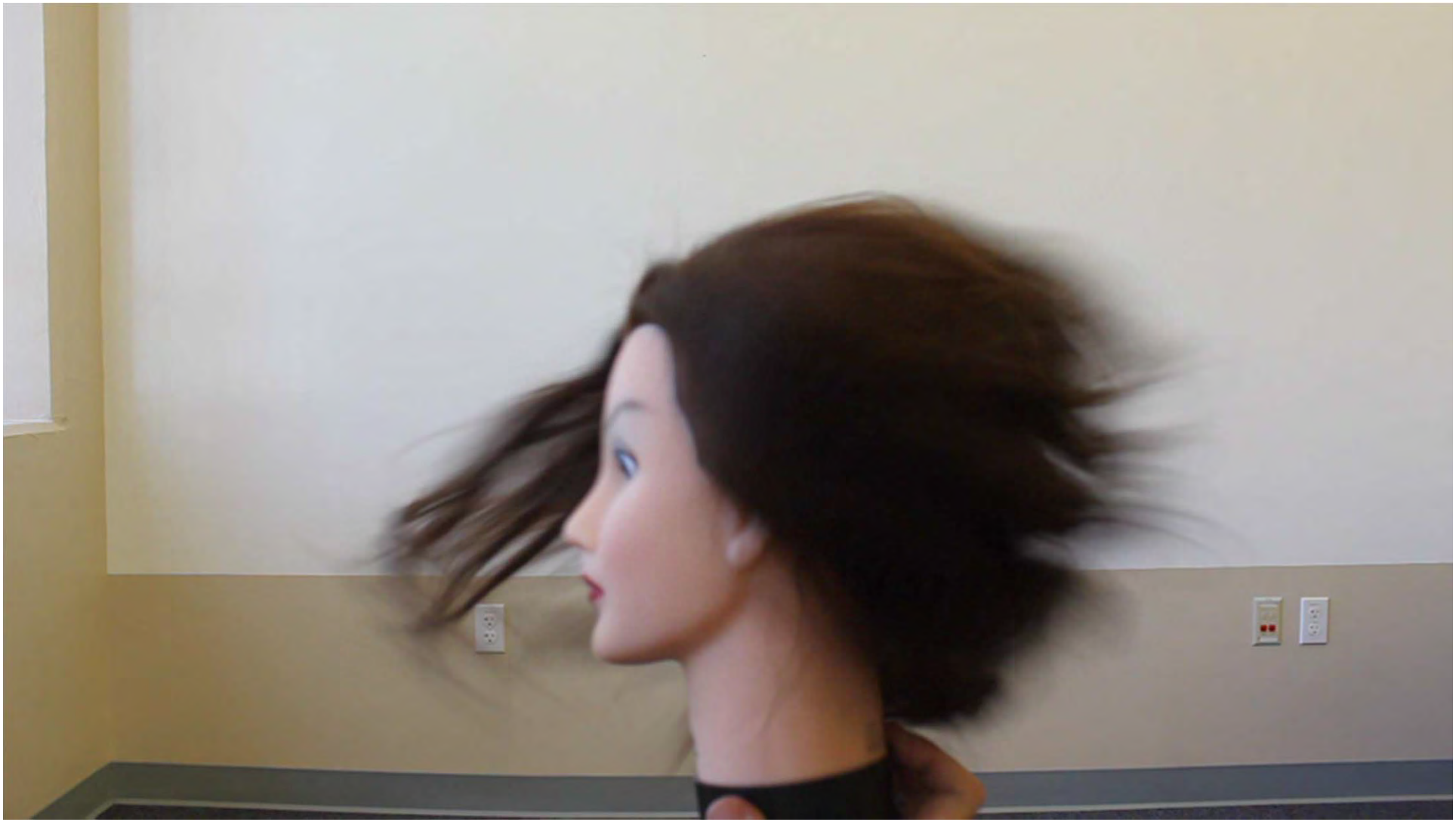
Inertia & Follow-through

Inertia & Drag

Drag also occurs when the character quickly turns her head; again this is due to the Law of Inertia.

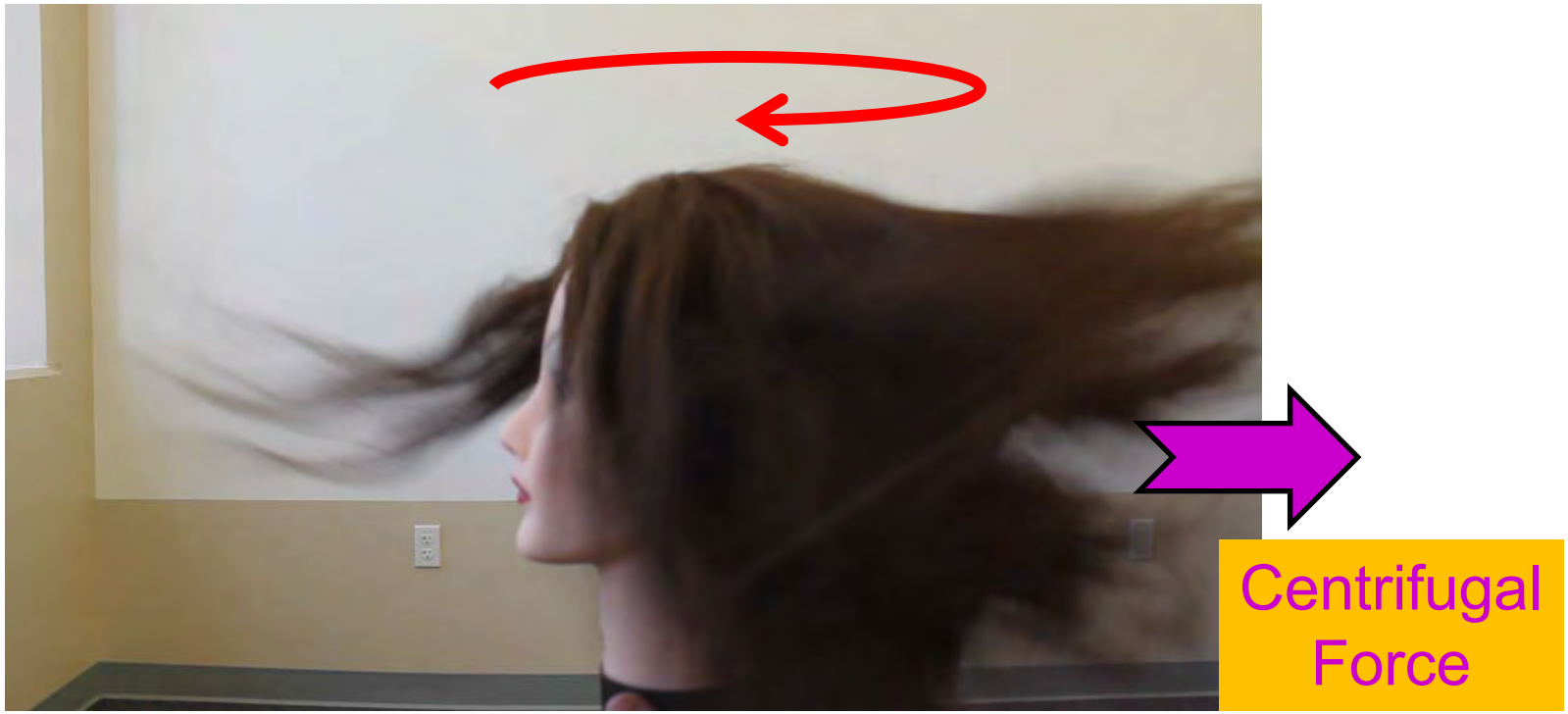


Inertia & Drag



Centrifugal “Force”

Besides dragging, the hair also moves outward as if pulled by a centrifugal “force.”

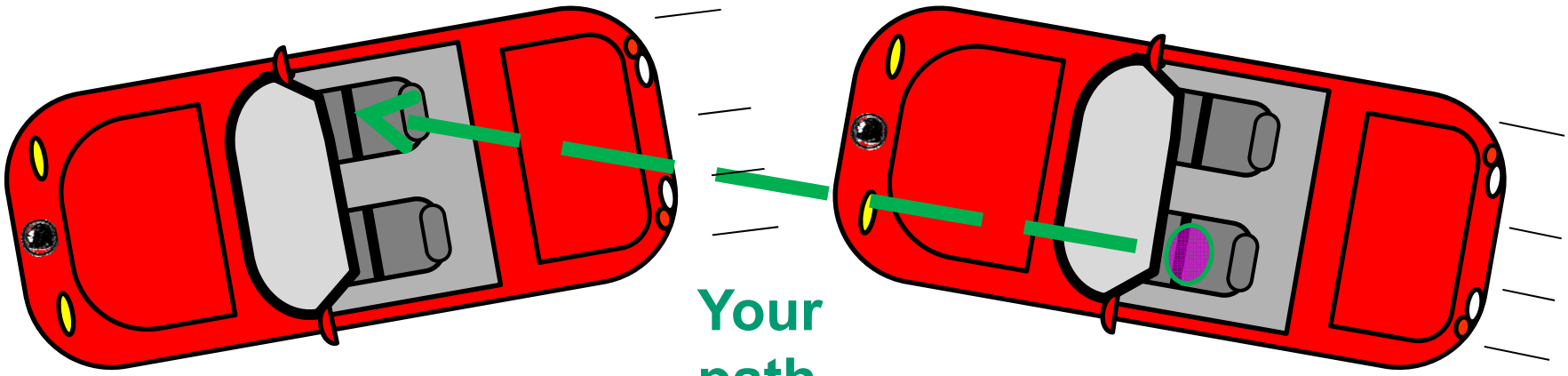


This “force” is actually another example of inertia.

Centrifugal Force & Inertia

The centrifugal force you experience on taking a sharp curve is nothing more than inertia keeping you moving forward in a straight line.

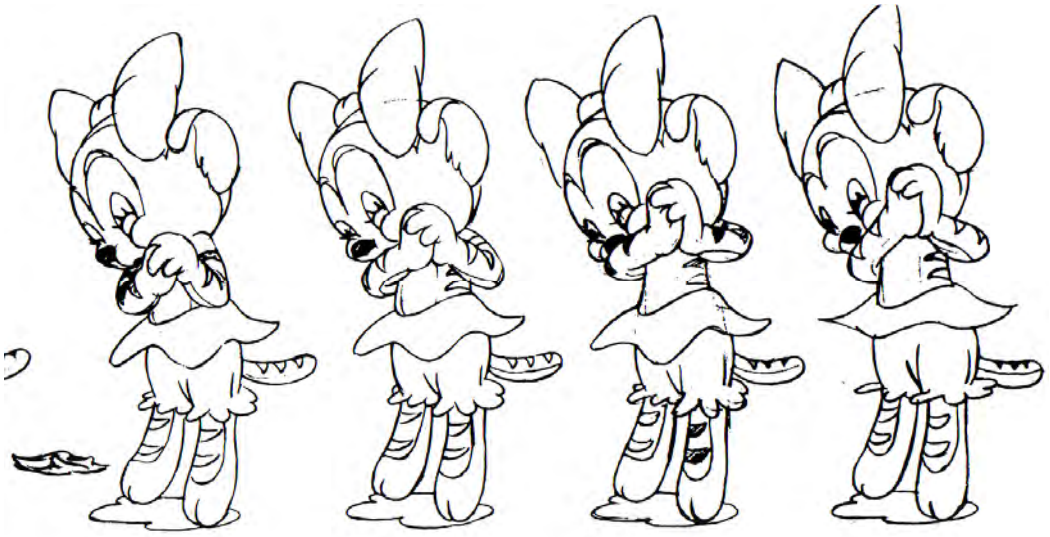
It feels as if you're pulled to the outside bank of the curve.



Importance of Follow-through & Drag

"Now we could use follow-through on the fleshy parts to give us the solidity and dimension, we could drag the parts to give the added feeling of weight and reality. It all added up to more life in the scene. The magic was beginning to appear."

From *The Illusion of Life - Disney Animation*



By Ham Luske

Notice the subtle follow-through in the hands, skirt, and pant legs for the last drawing of the Moving Hold.

Summary

- Animators call “drag” the effect seen when a soft material, such as hair, flesh, or cloth, trails behind the rest of the motion of the character.
- Drag and follow-through are explained by inertia: anything that’s not moving will remain at rest and anything that is moving continues moving until acted on by an unbalanced force.
- The apparent outward pull that we attribute to centrifugal force is also due to inertia since objects move uniformly in a straight line until acted on by an unbalanced force.