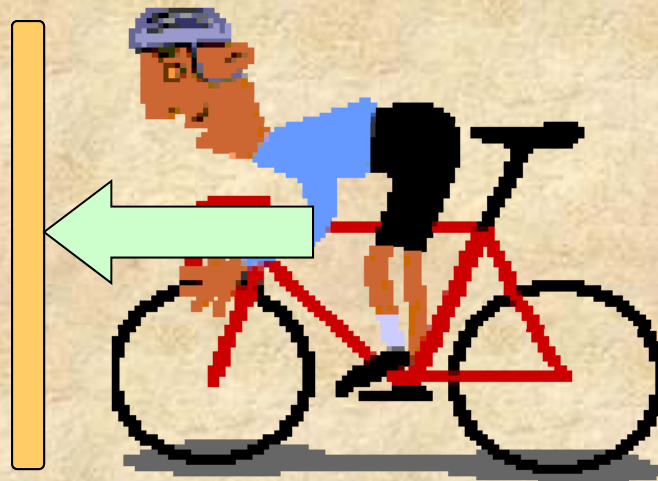


What Can Mathematics Tell Us about Bicycle Accidents?

By Jen and Lorenzo
Period 4

What affects the severity of a bicycle crash?



Who or what impacts harder:

- A child, teen, or an adult?
- A fast bicycle or a slow bicycle?

Momentum is used to
measure motion
(and the resulting impact).

Momentum = mass x velocity

$$M = mv$$

To determine if a child or an adult impacts hardest, substitute various weights in the momentum equation and solve it for a constant speed.

For example, if the speed is 10 mph then the equation becomes

$$M = 10 m$$

The domain is the set of all possible rider weights.

Weight to Momentum Table

Weight	Speed	Relative Momentum
Child 50 lbs	10 mph	500 lb mph
Teen 100 lbs	10 mph	1,000 lb mph
Adult 150 lbs	10 mph	1,500 lb mph

What the Weight to Momentum Table Tells Us

- If the domain is 50 to 150 lbs, then the range is 500 to 1,500 lb mph.
- For a given speed, the momentum increases with the weight of the bicyclist.
- An adult impacts harder than a child.

To determine if a fast bicycle or a slow bicycle impacts hardest, substitute various speeds in the momentum equation and solve it for a constant weight.

For example, if the rider weighs 100 lbs, then the equation becomes

$$M = 100 v$$

The domain is the set of all possible bicycle speeds.

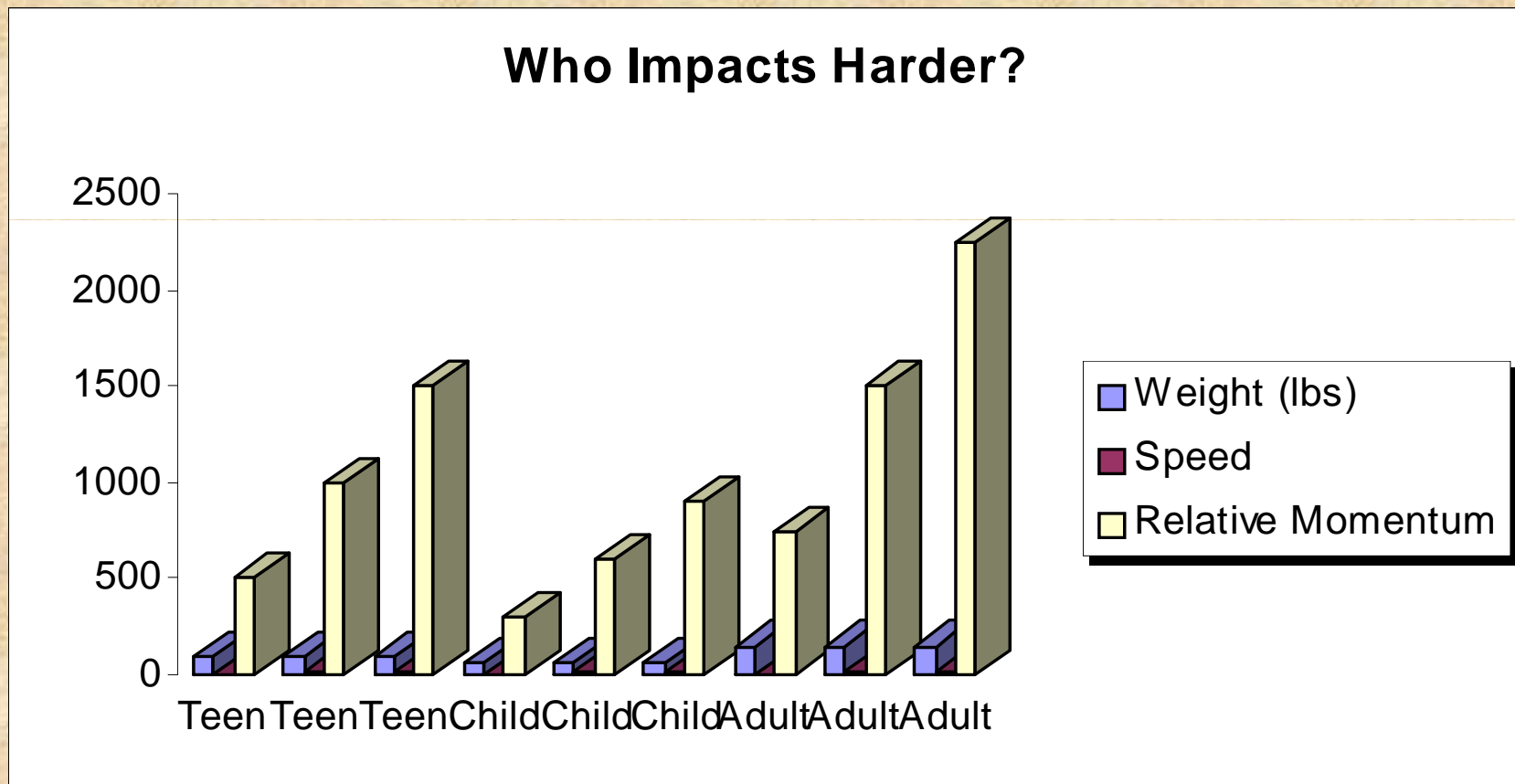
Speed to Momentum Table

Weight	Speed	Relative Momentum
Teen 100 lbs	5 mph	500 lb mph
Teen 100 lbs	10 mph	1,000 lb mph
Teen 100 lbs	15 mph	1,500 lb mph

What the Speed to Momentum Table Tells Us

- If the domain is 5 to 15 mph, the range is 500 to 1,500 lb mph.
- For a given weight, the momentum increases with the speed of the bicycle.
- A fast bicycle impacts harder than a slow bicycle.

Who Impacts Harder? Chart

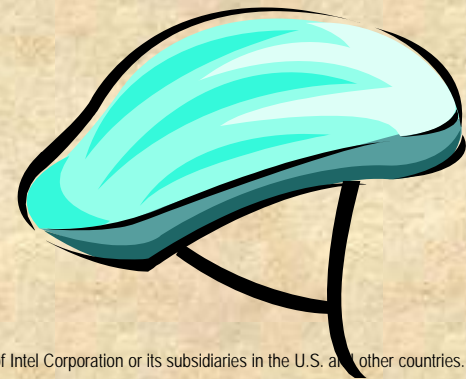


What the Chart Tells Us

- For a given weight, the momentum increases with the speed of the bicycle.
- A fast bicycle impacts harder than a slow bicycle.
- Adults impact harder than teens, and teens impact harder than children.
- The more weight, the harder the impact.

Extending to Everyday Living

Does this analysis answer the question, Is it as important for an adult to wear a bicycle helmet as it is for a child?



Wearing Bicycle Helmets

- As I have shown, an adult impacts even harder than a child. Therefore, it is at least as important for an adult to wear a bicycle helmet as it is for a child.
- More than 20 states and 87 localities in the United States, all of Australia, and parts of Canada require bicycle helmets.

For more information see:

Bicycle Helmet Safety Institute

www.helmets.org

Citizens for Safe Cycling

www.cfsc.ottawa.on.ca

Bike Tricks, Stunts, and Bones

<http://library.thinkquest.org/J003263/index.htm>