Snowboard superstar


Olson rockets off a cliff in British Columbia, Canada.

Leslee Olson's idea of a good time is to strap herself onto a snowboard and rocket down a snow-caked mountain at speeds over 73 kilometers (45 miles per hour). Whoa! Is she kidding? Not at all. "It feels so natural and it's fun," says the Bend, Oregon, native.

Olson's confidence isn't surprising. In January 2000, she nabbed first-place competing at the world's largest extreme sports championship, the Winter X Games. Last August, she launched her own snowboard company--Chorus--the first ever to exclusively design snowboards for women. Now she's training for a spot on the U.S. Olympic snowboarding team, to compete in February's 2002 Winter Olympic Games in Salt Lake City, Utah.

OLSON'S ALLY

What makes 23-year-old Olson so good on her board? Experience, for one. She's been snowboarding since she was 9 and competing since age 11. She also has a secret ally on the slopes--Sir Isaac Newton. The great English physicist (1642-1727) may be long gone, but Newton's Laws of Motion help explain the physics behind Olson's audacious snowboard tricks.

For example, Olson loves to compete on the halfpipe, a 3.7 to 4.6 meter (12 to 15 foot)-high U-shaped structure made of hard-packed snow. She pushes off the top of one side of the U, flies down the pipe, and up the other side. Then she lunges into the air and performs her favorite stunt, the Rodeo flip--a 720-degree sideways somersault--before swooping down into the pipe and up the opposite wall again.

Helping her maneuver is Newton's First Law of Motion (1): An object at rest remains at rest, and an object in motion continues at a constant speed and in a straight line unless acted on by an outside force. Thanks to the law, Olson has soared as high as 2.5 m (8 ft) in the air during a halfpipe competition!

But an outside force pulls Olson down fast--the force of gravity, or Earth's downward pull on all objects. How does gravity work? Every object in the universe exerts gravity on every other object. The amount of gravitational force between objects depends on their mass, the amount of matter an object contains. The greater an object's mass, the greater its gravitational pull. Because Earth is so huge, its gravitational pull is strong enough to tug Olson back into the pipe.

CARVING A TURN

Besides the halfpipe, Olson also loves the boarder-cross event, a three to eight person, 800 m (0.5 mi)-race over a downhill obstacle course littered with 18-m (60-ft) jumps, gated turns, tunnels, water trenches, and moguls. The first racer to cross the finish line--intact--wins. Since speed is critical, Olson must make razor-sharp turns. "The best way to do that is to `carve' your turns," she says. Carving is leaning into a turn so the snowboard glides downhill on one edge, like a knife blade carving the snow. This reduces friction, an opposing force between the board and the ground that slows Olson down (see "Fact or Friction").

Carving illustrates Newton Second Law of Motion (2): An external force on an object causes the object to accelerate, or speed up, in the direction of the force. When Olson leans into a turn, the weight of her body creates an inward force that propels her snowboard toward the direction of the turn. If Olson wants to turn left to swoop around a gate, she leans her body to the left and the snowboard swoops in the same direction.

FINISH LINE

Whether she spins in the air above the halfpipe or zigzags around gates in a bordercross race, Olson likes to perform on her snowboard. But every snowboarder has to stop--and that's where Newton's Third Law of Motion roles (3): For every action, there is an equal and opposite reaction.

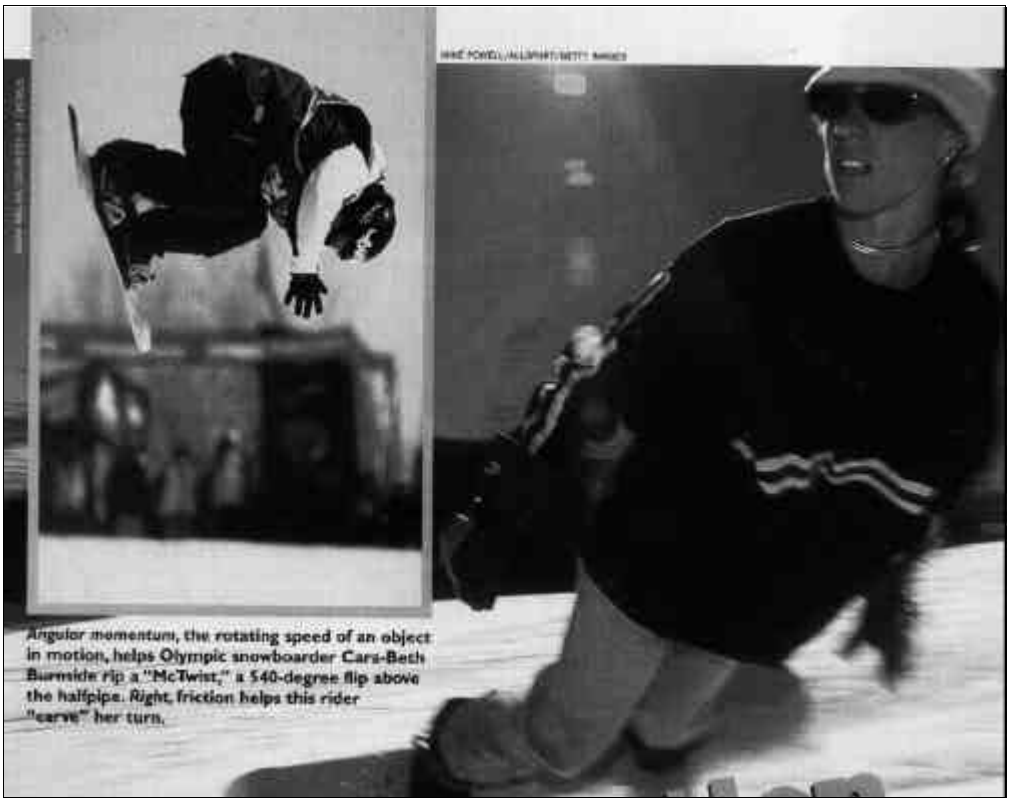
Olson stops quickly through a fast, sharp, perpendicular, or sideways turn. This prevents her from falling over. "If you start to turn gradually, you're going to have trouble maintaining your balance," says Jearl Walker, a physics professor at Cleveland State University "You need to suddenly turn the board and grind into the snow." According to Newton's Third Law, when Olson pushes into the snow, the snow pushes back with equal force. The collision between the snowboard and the snow brings her to an abrupt halt.

Here's where the First Law of Motion kicks back in. Remember, an object at rest remains at rest unless acted on by an outside force After a tiring day on the slopes, no outside force can budge Olson--not even her coach.

FACT OR FRICTION

On her snowboard Leslee Olson works with and against friction. Friction is the invisible force between two surfaces rubbing against each other that slows down motion.

If you run down a school hallway, friction between your sneakers and the floor stops you from sliding like a snowboarder. Likewise, at the end of a run, friction between microscopic bumps on Olson's snowboard and irregularities in the snow help stop her cold.



Angular momentum, the rotating speed of an object in motion, helps Olympic snowboarder Cars-Beth Burnside rip a "McTwist," a 540-degree flip above the halfpipe. *Right*, friction helps this rider "carve" her turn.

When it comes to downhill racing, friction also slows Olson's speed. To overcome friction, she relies on snowboard design. The base, or bottom, of a snowboard is covered with P-Tex, a high-density polyethylene, or light plastic, that's easy to lubricate with wax. Snowboards are waxed to create a smooth, fast trip down the slopes.

The less contact there is between surfaces, the less friction. That's why Olson "carves" her snowboard when whipping turns. She angles the board so only one edge slices through snow, like a knife slicing butter.

The biggest source of friction is air. When Olson flies out of a halfpipe for an "air-raising" stunt, air pushes her back and slackens her speed. She crouches and "hugs" her board to reduce the surface area of her upright body pushing against air. The result: slick sailing, plus high points for a smooth stunt.