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The thrill of the ride results from a perfect package of fear and illusion by M. A. Boldurian
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A heavy, padded bar falls across your lap, locking you into the tiny seat. There is no escape. You're propelled forward-transfixed by the seemingly endless track rising before you. Your stomach clenches. Clacking noises reverberate around you. The ascent goes on, and on-teasing you, testing you. And then, almost without warning, you're plummeting to Earth at such a dizzying speed you feel airborne. Your body is whipped to the left and then to the right. You're upside down. You're upright. Are you coming or going? A scream rips from the depths of your soul. You are on a roller coaster and having the time of your life.

An estimated 290 million people flock to amusement parks annually to experience this sensation. Last year, Pittsburgh's Kennywood Park hosted more than a million people, with 1,800 of them riding the Steel Phantom,

the park's largest coaster, every hour. "People like to experience fear... as in horror movies and haunted houses," says Bill Linkenheimer, a Pittsburgh resident and president of the American Coaster Enthusiasts. "Just as in those things, you know you aren't REALLY putting yourself in danger, but it's a way of going out of control at crazy speeds without risking your life."

Adds Mary Lou Rosemeyer, Kennywood Park's publicity director, "[Rollercoasters] get the adrenaline going and there's a challenge in it-- overcoming your fear."

Explore this love/fear relationship at Carnegie Science Center's new exhibit, Scream Machines: The Science of Roller Coasters. This 6,000-squarefoot exhibit, with 11 multi-station interactive components, has all the heart-pounding, stomach-churning, and head-spinning experience of any roller coaster ride.

What exactly does happen to you, scientifically speaking, on a roller coaster? For one thing, you are subject to new effects of the laws of gravity. Right now you are experiencing a 1 Gforce-the normal gravitational pull that holds you to that couch. But if you go fast enough, in a car or a roller coaster, you're pushed with a force equal to the weight you normally feel due to Earth's gravity. Ever felt as if you were being thrown sideways in a car that was turning too fast? Then you've experienced greater than 1 G-force. Once your body begins moving it will continue in a straight line until something forces it to change-such as a roller coaster curve or loop. Your body resists the change, so you feel thrown outward. That's centrifugal force, G-force or, as astronauts say, "pulling Gs."

The Revolution roller coaster at Six Flags, Magic Mountain in Valencia, California, gives you a whopping 4.9 Gs-1.5 more than a shuttle launch. Double that and jet pilots begin to black out.

Confused by all these Gs? Climb on *Scream Machines' "G-Force!"*, a bicycle ride that circles an 18-foot loop, and feel high and low G-forces as well as free-fall-that weightless sensation (negative Gs) of going over a thrill ride hill-when the G-force upward cancels gravity's normal 1 G downward.

Roller coasters create thrills primarily through a sense of illusion and the psychology of fear. Think about it. The average duration of a coaster ride is only two and a half minutes, and the roller coaster begins losing momentum once it hits the bottom of a hill. So you're never going faster than you go after the roller coaster's biggest drop. But while shooting through the ride it seems like you've been going faster than the speed of light forever. That's illusion. As you nervously prepare for take-off in any typical-sized roller coaster, such as *Kennywood Park's Steel Phantom*, the track is about 3,000 to 4,000 feet long-- but add loops and turns, and it seems like miles. That's fear. Inverted roller coasters, where seats dangle below the track, add an even deeper sense of fear

Roller Coaster Timeline