How do airbags work?

In 1969, *Popular Science* raved about a new-fangled invention called "air pillows," which promised to revolutionize car safety. But these pillows became hotly contested in the two decades that followed. Not because of the science behind them, but because of human psychology: Officials worried that the passive protection offered by these airbags would discourage people from buckling their seatbelts. As late as 1984, *PopSci* reported that airbags were still a rarity on the road: "Most auto makers strongly oppose installing air bags; only Mercedes currently offers one." Today they are ubiquitous, showing up in 190 million vehicles in the U.S..

The idea behind the airbag is to take advantage of the physics of a crash. In the case of a head-on collision, a car usually stops fast. The body of the driver, of course, doesn't. It follows Newton's second law: its momentum continues until an outside force (usually the steering wheel, dash board or windshield) brings it to a stop. An airbag doesn't just soften the blow. It actually lowers the impact by stretching it out over a longer period of time. It also spreads the impact over a larger area of the body. That way, no single area (forehead, chin, neck) bears the brunt of it. That's why airbags inflate and then quickly deflate—to gradually bring the driver's momentum from 60 mph to zero.

That's where airbags come in.

How airbags help

An airbag is more correctly known as a **supplementary restraint system (SRS)** or **supplementary inflatable restraint (SIR)**. The word "supplementary" here means that the airbag is designed to help the seatbelts protect you rather than replace them (relying on an airbag to protect you without fastening your seatbelt is extremely dangerous).

The basic idea is that the airbag inflates as soon as the car starts to slow down in an accident and deflates as your head presses against it. That's important: if the bag didn't deflate, your head would just bounce back off it and you'd be no better off.

Warren Gretz courtesy of US Department of Energy/National Renewable Energy Laboratory (DOE/ NREL).

How effective are airbags?

Airbags sound like they must be a good idea, but scientists like hard evidence: is there any proof that they reduce fatalities? In 1995, Adrian Lund and Susan Ferguson published a major study of road traffic accidents over eight years from 1985 to 1993. They found that airbags reduced fatalities by 23–24 percent in head-on crashes and by 16 percent in crashes of all kinds, compared to cars fitted only with manual safety belts.

That's obviously a huge improvement, but it's important to note that airbags are violently explosive things that present dangers of their own. The biggest risk is to young children, though adults also face a small risk of eye injury and hearing loss. If an airbag saves your life, you probably consider a slight risk of injury a price well worth paying. Even so, it's clearly important to study the potential dangers of airbags so we can make them as safe and effective as possible. Modern airbags (installed since the late 1990s) fire with less force than older designs, and there's compelling evidence that this has reduced accidental deaths, especially among children, without compromising passenger safety.