How to Avoid Being Attacked in the Shower

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Abstract

Like millions, perhaps even billions, of people, David Schmidt of Amherst, Mass., takes a shower every morning. For the last few years, between first spritz and final drain, a question has vexed him: why does the shower curtain suck in?

Today, thanks to $28,000 worth of high-powered computer software, a Ph.D. in engineering and too much free time, Dr. Schmidt, 31, a mechanical engineering professor at the University of Massachusetts, believes he has an answer. It has to do with why airplanes fly, hurricanes twist and apples fall.

True, the mystery of the sucking shower curtain does not rank high on the ladder of mankind's challenges, and he himself never encountered a sucking curtain until he showered one day at his mother-in-law's house. There, with the showerhead hissing away, the corner of her gossamer-thin shower curtain billowed in and clung clammily to his leg. 'It sucked beautifully,' he recalled.

For years, apparently, engineering cognoscenti and amateur scientists have wrestled with clinging shower curtains. In 1994, Mr. Schmidt encountered the seemingly humdrum problem on his doctoral examinations at the University of Wisconsin. One camp favors something called the Bernoulli principle, which holds that as water, air and other fluids accelerate, their pressure drops, leading to lift. Like an airplane wing, the shower curtain moves, the Bernoulli backers say, because water from the showerhead accelerates air on one side, letting air rush in and move the curtain.

Another camp favors the buoyancy theory. Hot air on the shower side rises, leading to cooler air pushing the curtain in. But no single theory clinched the question. Curtains, for example, still billow in cold showers.

Enter Professor Schmidt, with an industrial-strength computer program he has helped develop. He is an expert in the computer modeling, or imaging, of sprays, which is useful in diesel engines and the like. First, he drafted a computer image of his mother-in-law's bathtub, with its typically curved shapes, then filled it with 50,000 tetrahedral cells, or pyramid-like structures, that sense velocity and pressure in three dimensions. Finally, the 'shower' flowed for 30 seconds at about eight gallons per minute, a bracing blast.

In the end, Dr. Schmidt's home computer crunched numbers for the better part of two weeks, or 1.5 trillion calculations, leading to some surprising answers — surprising, at least, for engineers.

The shower's water droplets decelerate under the influence of aerodynamic drag, transferring energy to the bathtub's air, which begins to twist like a miniature hurricane turned on its side. As in the eye of a hurricane, the pressure in the center of this disturbance is low, pulling on the shower curtain. Curtain rods keep the top of the curtain in place, but below the showerhead the bottom of the curtain... sucks in.

A shower door, heavy shower curtain, or no curtain at all, solves the problem, Professor Schmidt acknowledges. But you knew that already.

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