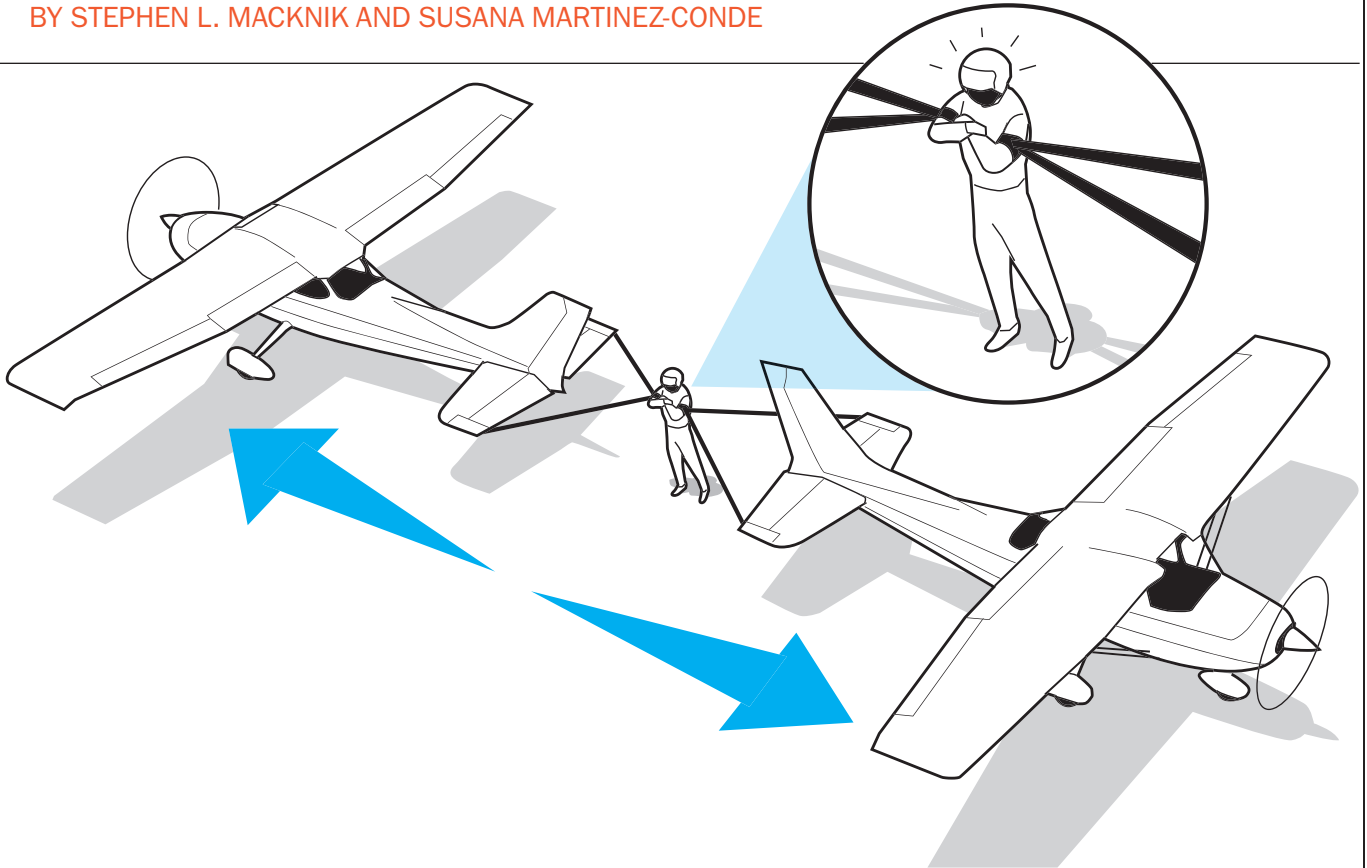


No Brain, No Pain

Pain is an emotion

BY STEPHEN L. MACKNIK AND SUSANA MARTINEZ-CONDE



We are more often frightened than hurt; and we suffer more from imagination than from reality.

—Lucius Annaeus Seneca

DENNIS ROGERS is an unassuming guy. He's on the short side. And though muscular, he doesn't come across as the kind of towering Venice Beach, muscle-bound Arnold that you might expect from someone billed as the World's Strongest Man. Rather he has the kind of avuncular intensity you find in a great automobile mechanic—a mechanic who happens to be able to lift an engine with one hand while using the fingertips of

the other hand to wrench the spark plugs out. Like it's nothing. Rogers, who has been known to keep two U.S. Air Force fighter planes from blasting away in opposite directions by holding them back with his bare hands, performed at the most recent Gathering for Gardner—a conference that celebrates the interests of one of *Scientific American's* greatest columnists, the late mathematician Martin Gardner. We asked Rogers about the source of his incredible powers after the show, and we were surprised to learn that he did not know. Bill Amonette of the University of Houston-Clear Lake found that Rogers could recruit an abnormally high number of

STRONGMAN

Dennis Rogers holds two planes still as they attempt to fly away in opposite directions. Do not try this stunt at home!

muscle fibers. But was this ability because of a freak genetic mutation? Another possibility, which Rogers thinks is more likely, is the way he processes pain when he strains those muscles.

What if, instead of superpowered muscles, Rogers has a normal—though extremely well exercised—body, and his abilities arise because he can withstand more pain than most mere mortals? He claims that he does feel pain and is actu-

(What if, instead of from **superpowered muscles**, his abilities arise because he can withstand more muscular pain?)

(illusions)

ally scared of dentists. In fact, during one stunt in which he held back four souped-up Harley motorbikes with straps, he bit down so hard he split a tooth from top to bottom. Rather than taking his chances at the dentist, he reached into his mouth, clamped his viselike fingertips onto the broken tooth, and extracted it, root and all.

Rogers reasons that, unlike in the dentist's office—where he has no control over the pain that is inflicted on him—he has direct executive control over pain that he inflicts on himself. “I know it's coming, I have an idea of what to expect and I can decide to ignore it,” he says. Confronted with severe pain, most people fear that they will damage their body permanently if they persist, so they stop well before they are in real danger, Rogers explains. He does not

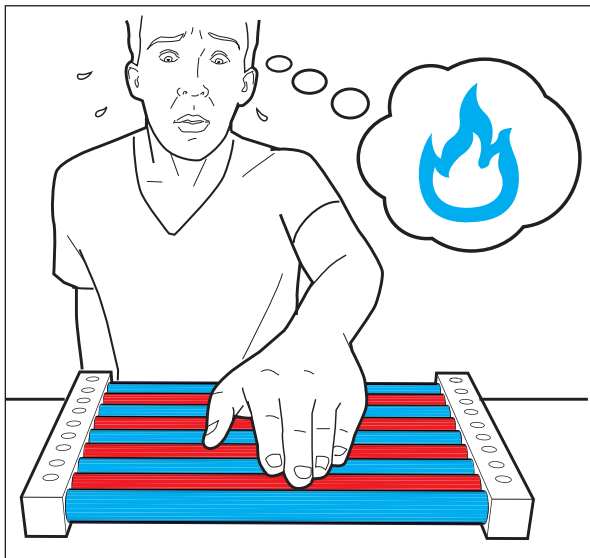
stop and only rarely gets seriously hurt.

Maybe Rogers's muscle cells are normal, and he experiences pain as most of us do but chooses to disregard it when he feels in command. If so, he has become strong not because he was born on a planet with a red sun like Superman or was trained in the Danger Room of Charles Xavier's School for Gifted Youngsters like an X-Man but because, when he has a job to do, he *doesn't care* that it hurts.

An illusion is a perception that does not match the physical reality. Is pain, then, as with illusions, a mind construct that some people can decide to turn off? As you will see in the studies that follow, pain varies as a function of mood, attentiveness and circumstances, lending support to the theory that pain is an emotion. These studies show that empa-

thy also extends to pain, just as it does to other emotions, even when the victims are fake strangers. And the research indicates that people can experience pain for the wrong reasons or fail to experience it when it would be very reasonable to do so. Moreover, when pain is disconnected from the physical reality, it is an illusion, too. **M**

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PAIN IS RELATIVE

Our colleague at the Barrow Neurological Institute, Arthur “Bud” Craig, is a pain neuroscientist who discovered the neural mechanisms underlying the terrifying “thermal grill illusion,” in which no damage occurs, but it feels as if it does. Think of it as waterboarding wired directly into your pain system. The device consists of a grill in which every odd horizontal tube is cold (not painful but cold), and every even tube is hot (not painful but very warm). When a subject's hand rests simultaneously on both sets of tubes (cold plus hot), excruciating pain results. This is an illusion; the hand is not damaged, and its actual temperature remains unchanged because the cold and hot tubes cancel out each other thermodynamically. The effect occurs in part because the hand's heat-burn sensors cancel the cold-freeze sensors, creating an imbalanced and painful sensation of burning cold within the brain. But by themselves, the coldness and hotness are not painful, so the subjective perception of hurt is simply incorrect: no damage, high pain.

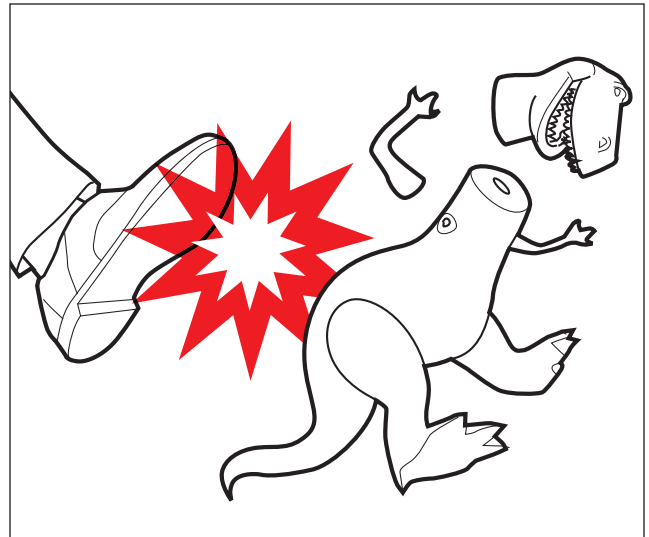
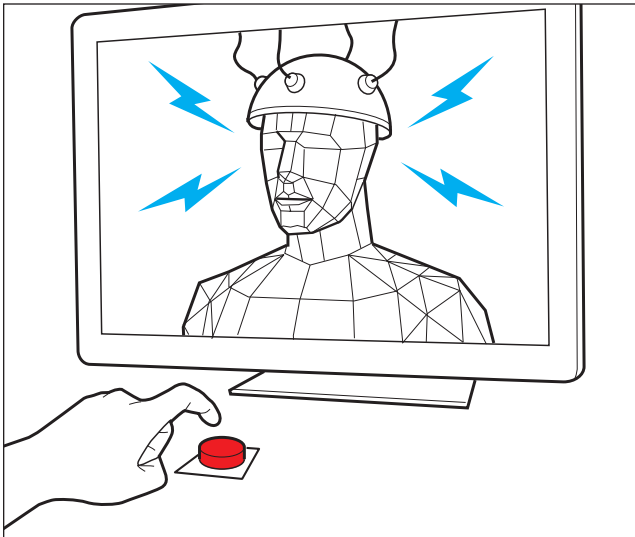
Craig has put forward the revolutionary proposal that your brain processes pain like an emotion. If you are tackled while playing the annual family football game before Thanksgiving dinner, it can be fun. But the same tackle, out of the blue, while crossing the park on the way to your promotion review, can hurt like you-know-what: same damage, different pain.



THIS IS GONNA HURT

Henrik Ehrsson and his colleagues, then at the Institute of Neurology and the University of Oxford, scanned the brains of subjects while threatening a fake hand that appeared attached to the participants. The anterior insula, a brain area that is critical to awareness of your body and, Craig argues, is also critical to all emotional awareness, lit up like crazy in brain imaging. The threat of damage, even to a fake appendage, causes brain activity that predicts pain.

When the turning of a dial gave an electric shock **to a virtual character**, observers experienced great stress.



HURTS ME MORE THAN YOU

Brothers Elliot and Michael motivated their sister, Gertie, in the movie *E.T. the Extra-Terrestrial* by twisting her doll's arm behind its back until Gertie submitted. Why did she care? Two research groups have explored this question recently, both with computer-generated characters and with toy robots. Mel Slater and his colleagues at University College London had subjects turn a dial at the command of an authority figure. The turning of the dial gave an electric shock to a virtual character, who appeared to react in

pain. The experimental subjects experienced great stress from inflicting this fictional pain.

Astrid Rosenthal-von der Pütten and her group at the University of Duisburg-Essen in Germany scanned people's brains as they watched movies of toy robot dinosaurs being mistreated by a human actor. Scientists found significant activity in the limbic areas of the brain, which presumably underlie the feeling of empathy. The same areas lit up even more when research subjects watched movies of humans being abused.



ILLUSION DIMINISHES PAIN

Severe burn victims must have their healing skin pulled and prodded daily to keep it from shrinking like plastic wrap, thus maximizing their mobility. Hunter Hoffman, David Patterson and Sam Scheerer of the University of Washington developed a virtual-reality game called *Snow World*, in which patients in burn units who are undergoing such painful treatments are distracted as they shoot Frosty and his penguin minions with a snowball BB gun. Virtual immersion in the frozen environment reportedly works better than morphine at counteracting the pain: massive damage, low pain.

(Further Reading)

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- ◆ **A Virtual Reprise of the Stanley Milgram Obedience Experiments.** M. Slater, A. Antley, A. Davison, D. Swapp, C. Guger, C. Barker, N. Pistrang and M. V. Sanchez-Vives in *PLOS ONE*, Vol. 1, No. 1, article e39; December 20, 2006.
- ◆ **Humans Show Empathy for Robots.** Tanya Lewis in *LiveScience*; April 23, 2013. www.livescience.com/28947-humans-show-empathy-for-robots.html