



Dear Cecil:

I recently watched a karate/tae kwon do demonstration of breaking boards, and once again I wondered: What is the important part in making the board (or brick) break? Is it the speed with which the martial artist moves his hands/feet/elbows, according to the laws of physics, meaning every other trained sportsman who achieved that same speed could do the same? Or is it mostly concentration, summoning of chi, etc, as martial artists claim?

— Constanze W., Germany

Considering what an exercise in participatory science this turned out to be, you might guess I started by consulting ancient masters and visiting martial arts shrines to get a handle on the subject. Nah. I googled it. Topping the results was a paper promisingly entitled "The Physics of Karate Strikes" by Jon Chananie at the University of Virginia. On enquiry I learned that Jon, a good fellow who's now a UVA law student, had been an undergraduate writing in the short-lived e-pub *Journal of How Things Work*, a venue that didn't inspire the same confidence as, say, the *Acta Gynecologica Scandinavica*. Then again, other *JOHTW* articles included "How a Cruise Missile Works" and "Crafty Connie's Hot Glue Gun Experience," so I figured, hey, maybe this guy's OK.

He was. Jon had done his homework, among other things citing a genuine (in my book) ancient master, my friend Jearl Walker, who'd expounded on the subject in 1975. His article informs us that karate is governed by such axioms of physics as $F = ma$, $p = Ft$, and so on, the practical significance of which is that the *karateka* (karate artiste) should hit the boards as fast as possible, minimizing the contact surface of the blow so as to maximize impact. No mention is made of chi, concentration, or any such; Jon merely observes, "Karate black belts often advise white belts [rookies] . . . not to try to break the board, but to break the floor under the board. This is to ensure that the hand does not decelerate prior to contact with the target." No disrespect to Jon, but imagining one's civilization-softened hand encountering a stack of kiln-dried two-by-fours at bone-shattering speed, one thinks: There's gotta be more to it than that.

Back to the Internet. Ten more minutes of browsing elicited the following additional insights: (1) In the typical karate demonstration--strictly speaking, the typical karate demonstration as performed by a physics teacher--the boards aren't packed solid but rather are separated by pencils, meaning that you don't strike the boards en bloc, as it were, but rather one at a time. (2) The boards aren't two-by-fours laid lengthwise; instead, they're six-inch pieces of one-by-twelve (nominal; true thickness three quarters of an inch) laid so that the blow strikes parallel to the grain.

Now we were getting somewhere. Time to repair to the lab. I bought some one-by-twelve pine board and a box of #2 pencils, sawed the former into pieces of the requisite dimension, and upended a couple concrete blocks to serve as a platform. Never one to be accused of rashness, I started with one board. Easy. Three. Knife through butter. Five. I'd had more trouble swatting gnats.

Seven. Well. Advantageously grained and interpolated with pencils though they may be, seven boards is a formidable stack of lumber. I reviewed my sparse knowledge of karate. Chi is not a thing readily summoned on short notice. Likewise, while it's fine to speak of breaking the floor under the board, landing the blow inside your opponent's body, etc, it's something else to actually do it. I pretty much just hauled back and let fly.

Shoot. I split five boards, cracked the sixth, left the seventh intact--call it five and a half. Recuperating briefly, I tried again. Same result. Thinking that my low platform was preventing me from getting enough back into the project, I got a couple more concrete blocks, made the thing higher, and on my next try endeavored to uncoil my physical being in stages so as to maximize the velocity of the blow. This time I cleanly split six boards, but the seventh remained unscathed.

I called it a night but in the morning resolved to have at it again. Two more attempts, the second using both hands. (Hey, I was on deadline.) No go. Mrs. Adams sweetly suggested having one of the little researchers try, reasoning that, being taller and younger, he would have the advantage of leverage and a fresher supply of testosterone. Ha. The kid split three, cracked two, and left two on the table. Once more for the old man, this time with six boards. I split five.

Am I quitting? No, merely taking a breather till the swelling goes down. Verdict so far: It's likely just physics, but if somebody has a line on some chi, I'm game to give it a go.

— Cecil Adams