

Speed vs. Mass

By Rich Hale

Speed, in relation to the martial arts, is mostly overrated and misunderstood. To truly appreciate speed we need to break it down into three separate categories - perceptual speed, mental speed and physical speed. These are the three categories of speed as defined by Ed Parker in his Encyclopedia of Kenpo.

Perceptual Speed: Refers to the quickness your senses monitor a stimuli, interpret that stimuli, and speed information is conveyed to the brain, so that the Mental Speed can determine a response.
Mental Speed: Mental speed is the quickness of the mind to select the appropriate movements to effectively deal with the perceived combat situation.
Physical Speed: Refers to the speed of physical movement - the speed of your response to a given stimuli. It's the speed of the actual execution of a technique.

Now that we have several different types of speed, how should they be prioritized? Prior to learning that there are actually more than one kind of speed to even consider, speed was generally associated only with physical speed. This may be because, as an observer, physical speed is all we can see. We can't see into the brain and follow the very thoughts, feelings and calculations it has to make before the body can act or react to a stimulus. If we could, we may be surprised to see how slow the perceptual and mental speed process can be.

When I was in high school the boys and I were out having a few beers . . . not that I condone that type of behavior, but boys will be boys, as they say. Well, as the evening progressed one of the guys, who I knew but not well, started feeling the machismo associated with alcohol. At one point he comes walking up to me with a peculiar look on his face. He didn't look angry, but he didn't look friendly either. He wasn't tense, but definitely not relaxed. When he gets about a foot away he stops, stares at me for a brief moment, then bam! He hit me with a sucker punch. Obviously, my perceptual speed was pretty much nonexistent. I didn't have a clue that I was about to get punched, but during the punch itself, I did make a mental note – so “that's” what someone looks like just before they sucker punch you!

Okay, now I've just been punched in the face and it's time to retaliate. Damn, my mental speed was just as bad as my perceptual speed, because all I could think to do was . . . ask this guy why he hit me. Well I was lucky, because all he had to say was “I thought you were someone else.” Bottom line is this; the guy was likely no faster than I was on a physical level. Even if he was, I had a good five or ten seconds between the time I saw him strutting in my direction and the time he got there. Even after he punched me he just stood there with his hands down to his sides. I could've dropped a heavy elbow across his jaw . . . had I known that elbows were such formidable weapons. I just had no perception as to what was going to happen and I couldn't think of a thing to do after it did. The point being, it doesn't matter how fast you are physically, if your perceptual and mental speed are lagging behind.

Now that I've made my argument for priority of perceptual and mental speed over physical speed, let's look at physical speed itself for a moment. In my time as a martial artist I've seen some of the fastest guys in the business. Not just physically, but the whole package. They perceive your next move before you do. They have a mental inventory of things to hit you with that's staggering and they're as fast as Quick Draw McGraw. But they don't all scare me. Why not? Simple, I'm not afraid of people who can hit me, I'm afraid of people who can hurt me.

In the art of Kenpo we have four major power generating principles:

Backup Mass (momentum)
Centrifugal Force (torque)
Gravitational Marriage
Physical Speed

The first three are various methods of utilizing body mass to generate power, so for the moment we'll go ahead and clump them together and refer to them, jointly, as mass. Surely, at one time or another, all of us have heard the mathematical equation for kinetic energy is one half mass times velocity squared. “Kinetic energy being an expression of the fact that a moving object can do damage to anything it hits, therefore quantifying the amount of damage the object could do as a result of its motion.” Big words and very impressive sounding, but what does that actually mean?

What it means is this; from the day we sign up for karate class our body mass stays relatively constant. If anything,

the vigorous exercise of karate training may actually decrease our body mass. The speed we move at, on the other hand, can increase through training. So, given the two choices - increasing our speed seems the logical choice for increasing our power. But even if it were true and speed was the only way to increase our power; to what degree can we increase our speed and therefore power? Can you double it, triple it? According to the formula if you double your speed you'll have four times the power.

Before going further, we need to quantify the power a martial artist can gain through an increase in speed alone. I expect there's lots of scientific equipment available for this, but let's keep it simple and approximate one's ability to increase power through speed based on something that's totally relevant to martial arts training - the art of speed breaking. Keep in mind there are two types of speed breaking. First, is one's ability to break an object using maximum speed and minimum mass. Typically this is demonstrated by breaking a 1" x 10" x 12" pine board that's tossed into the air. The other type of speed breaking is a competition to break as many boards, bricks, etc., as possible in the shortest amount of time (or within an allotted amount of time). This is not the type of speed breaking I'm referring to, because the competitor generally uses their body mass, as a major power generating force, for each break. The speed aspect is only in how quickly they can break one object, move to the next, break it, move to the next and so on. The winner is the person who has broken the greatest number of objects in either the shortest amount of time or during the allotted time.

The first type of speed breaking is a true test of one's ability to generate breaking power through speed alone. Over the years I've seen many impressive examples of this speed breaking; from relative new comers to bona fide masters of the art. I've seen white belts toss a 1 inch thick pine board in the air and quickly snap it in two with a punch. I've also seen Master He Il Cho toss a 1 inch thick pine board in the air, then totally shatter it with a jump spinning back wheel kick - while blindfolded! I'm not trying to take anything away from Master Cho's amazing ability. Without doubt he's the greatest kicker and board breaker I've had the pleasure of witnessing first hand. But, what I've not seen is anyone tossing a 2 inch thick board in the air and breaking it. Not that it hasn't been done, I'm sure it has, but it's certainly not a common practice - even among black belts at the top of their game.

Now let's take a look at the other side of the equation - mass. Most people think to themselves, "Well I've weighed basically the same amount for the past ten years, so with my mass being constant, the only way I can increase my power is through speed." I'm not picking on anyone in particular, but I've heard that most humans only use about ten percent of their brain power, so what makes us think we just "automatically" use one hundred percent of our body mass? What I do see fairly often are showmanship martial artists using a hundred percent of their striking speed - backed up with about ten percent of their body mass.

As another comparison, take the typical hammerfist to the back of an opponent's neck. I see people swinging their arms down to the back of someone's neck all the time. They're using control, of course, but they're totally confident if they had hit as hard (and fast) as they could, it would have been a killing blow. Note the average adult male arm weighs about eight pounds. Occasionally I see someone hook their wrist, anchor their elbow, and drop their full body weight into hammerfist, but not very often. Note the average weight of adult male body is about a hundred and eighty nine pounds.

So, let's do a little math in our head. The average arm weighs eight pounds and the average body weighs a hundred and eighty nine pounds. So if we can totally lock our bodyweight into the action, it's like hitting our opponent with an arm that weighs . . . a hundred and eighty nine pounds. This sounds down right scary. By the way, your speed will still increase as you practice your techniques utilizing momentum, torque and gravity, whereas none of these three power generating sources will necessarily increase with speed training. This is why I consider the pursuit of power through the proper use of body mass to be a more effective tool than doing so through speed.

Backup Mass: The utilization of body mass on a horizontal plane.

Backup mass is a term that Mr. Parker used to describe the use of body weight directly behind the action that's taking place. In conventional terms backup mass can be compared to momentum, which can be described as the product of mass and velocity of an object in motion. The power generated through momentum is determined by its mass and velocity. But this is only part of the story. Another consideration is Newton's First Law of Motion, which tells us that an object in motion tends to stay in motion. This is why you can get hit in the face by a butterfly at twenty miles an hour and the butterfly dies - and if you get hit in the face by a Mac truck at twenty miles an hour you die. This is also why we attempt to align as much of our body mass as possible directly behind our punches, kicks, elbow, etc. The greater "backup mass" we have, the more damage we can do. Why do you think a quick head-butt to the face is so much more devastating than a slap to the face? The average weight of an adult human head is eleven pounds while the average weight of a human hand is only fourteen ounces. Combine that fact with the head being a much more solid object (a point we're coming to) and the advantages of a head-butt, over a face

slap, is more than obvious.

Gravitational Marriage: The utilization of body mass on a vertical plane.

Some people will argue that there's no such thing as gravitational marriage, or marriage of gravity, as it's also called. They have a point as they've told me they tried looking it up in the dictionary and didn't find it. I guess they're right . . . so I suggested they look their own name up in the dictionary and if they didn't find it, they should take that as proof "they" didn't exist. Gravitational Marriage is a term Mr. Parker used to describe the process of uniting of mind, breath, and strength while simultaneously dropping your body weight along with the execution of your natural weapon(s). One could argue that this is simply gravity and not gravitational marriage, so let's put it to the test. First find a willing volunteer and have him stand motionless as you stand on one of his feet, with one of your feet, resting your full body weight on his foot. Did it hurt? Now I want you to jump into the air and land on his foot, with your foot. Did it hurt this time? Gravitational marriage goes back to Newton's First Law of Motion again, where an object in motion tends to stay in motion. Combine this (or marry it) with our body weight (as determined by earth's gravity) and you have Gravitational Marriage.

Centrifugal Force: A force that tends to make rotating bodies move away from the center of rotation. (E.P.)

There are also people who'll tell you that centrifugal force doesn't exist either . . . and they're right. Centrifugal force, Latin for "center fleeing" does not (technically) exist. When mud is flung off a tire, or a child is flung off a merry-go-round, they're not being forced off. What's actually happening is the object they were resting upon was forced out from under them. The force itself is on the object being moved, not the object being left behind. Here's another example. We've all had something sitting on the dash of our car that shot across the dash as we made a sharp turn. But the object didn't actually move across the dash, the entire car (including its dashboard), moved out from under the object. I know the first thought may be, then why did the object keep moving after the car moved out from under it? In other words why did it fly out the window and keep going? This is because the object was in motion, but not do to "centrifugal force". It was in motion because it was riding in a moving vehicle and, again, an object in motion tends to stay in motion. Only what we perceive as a horizontal direction of travel, before and after it leaves the car, is really a straight line. We see it as traveling outward, because we're, in fact, traveling inward. This rather self-centered perception to direction is graphically apparent while skydiving. When two skydivers are dropping straight down in a vertical position, they can exceed speeds of a hundred and seventy miles an hour. If one of these skydivers were to suddenly turn belly-to-earth, where the maximum velocity is around a hundred and twenty miles an hour, the remaining (vertical) skydiver would perceive his partner as having "shot upward". We call this corking, as it looks like they popped up like a cork. Of course the belly-to-earth skydiver didn't shoot upward at all, but is in fact still falling downward at a hundred and twenty miles an hour. But compared to his partner's downward speed of a hundred and seventy miles an hour, he appears to have shot upwardly at about fifty miles an hour.

So if centrifugal force isn't a force at all, what is it? Centrifugal force is a term Mr. Parker used to describe a force that tends to make rotating bodies move away from the center of rotation. As I have already explained, this is somewhat of a misnomer, but never-the-less it's only a term and one that Mr. Parker also used interchangeably with the terms like rotational motion, rotational velocity and torque. To simplify things I've chosen to use the term torque, with the understanding that any of these terms may be used interchangeably.

Torque: The measure of rotational force.

Torque can refer to either the force of a rotating object or the force it takes to rotate an object. Our concern, at this point, is the force of a rotating object, i.e. how can the rotation of our body mass contribute to power generation. The most common point of agreement I have ever heard in any martial arts school is, "The power in a punch, kick, throw, etc. comes from the hips." This has to be the most universally accepted principle in the martial arts. And what do the hips provide? Torque!

Speed: The utilization of body mass' velocity on any plane or axis.

All the above power generating principles can benefit through an increase in speed. I haven't been very kind to speed up to this point, but that's only because I wanted to put things back into perspective. Speed is essential, but no more so than momentum, marriage of gravity and torque. Those who move quickly, but without power are often referred to as "paper tigers". That's because they look ferocious, but they tear apart easily.

Solidity: The solidifying of ones entire body “upon impact” when executing a strike.

Technically, solidifying the body unit isn't on the list of power generating principles, because it doesn't actually generate any power. But, the principle itself is essential.

Back in the 70s the automotive industry introduced the spring loaded bumper, which came to be known as the 5 mile an hour bumper - it was a stroke of automotive genius. Instead of mounting the bumper directly to the car frame, they mounted the bumper with spring-loaded shocks. The object was to minimize the damage done by cars bumping into each other at 5 miles an hour or less. It worked amazingly well. So do Nerf balls, Wiffle bats and marshmallow guns. Anything you can do to make the object you're hitting with softer will lessen the impact of the blow. Herein lies the value of solidifying the body unit when delivering karate blows. Soft fists, spongy elbows, loose abdominals, etc., can take more away from the impact of a strike than can be added through doing everything else right.

If you would like to be fast and powerful, I suggest you:

- Learn Slow:** Bad form is the number one deterrent to creating power. Take your time when you're learning forms, techniques and sets. Your form is the foundation you'll be building everything else upon. If you have a weak foundation nothing of value can be built upon it, because it'll all be tumbling down when its foundation falls out from under it. Don't just memorize – visualize. Visualize your opponent in detail, every target you're striking and your opponent's reaction to it. Visualize where his hands are and where his feet are. Visualize the checks as well as the strikes. Visualize what-if scenarios and counters to counters. Visualize everything you can and practice slowly enough that you learn correctly instead of quickly. Train with a partner as soon and often as possible. Imaginary opponents (no matter how good your visualization is) pale in comparison to a real-life training partner.
- Practice Hard:** Once you can execute your movements with good form, put some meat into it. Training with a partner at this stage should look and feel more like controlled rage than anything else. This isn't a time to laugh and slap your partner on the back. This is a time to focus and practice the material like you mean it. A heavy bag is essential at this point. You have to deliver your weapons at full power in order to create more power. Training with a partner is still important, but partners can only take so much abuse so a heavy bag is a great alternative to maiming your training partner.
- Train Fast:** For now forget about your form and forget about your power. Focus on speed, lots of speed. Strange as may seem though, speed training (in my book) is less about how fast you can move and more about monitoring how fast you can move until you start screwing everything up. No one can move at full speed and keep it all together. Stances, targets, transitions, and timing – everything is going to come falling apart at some point. That's the point you're looking for and those are the items you'll want to take back to the drawing board.
- Repeat:** The learn slow, practice hard, and train fast scenario is cyclical in nature. In other words the cycle should continually repeat itself. The object is to work your way up to training fast, discover your weak points and take them back through the process again. This way you won't be making the same mistakes (but doing them faster) year after year. Remember a mistake that was done so quickly that no one saw it is still a mistake. Following this procedure, you'll be continually refining your technique while simultaneously increasing your speed and power.