

Straightening the Curve in Shotokan

While the title of this article makes it sound like some mystical process to do the impossible, there's actually some science behind what we'll discuss. Firstly, we need to understand a couple of the basics. Let's have a look at the difference between a thrust and a snap technique in Shotokan.

What is meant by snap and thrust techniques is examined in detail by Richard Amos in issue 83 of SKM – "SNAP AND THRUST TECHNIQUES: A DISCUSSION." In this article there is clear articulation of the different mechanisms used to generate power for each of these techniques. In essence the thrust technique drives the attacking weapon (hand or foot) into the target, with body weight behind it, in a straight line between attacker and target (shortest distance). This generates linear power (slower acceleration, greater effective mass). On the other hand, the snap technique sets a pivot point (elbow or knee) and then uses the whip effect to amplify the acceleration of the attacking weapon with the circular attack coming from a direction outside the opponent's direct line of sight. This generates rotational power (faster acceleration, lower effective mass). The snap technique is usually characterised by sharply returning the attacking weapon to the point from which it was deployed and this is easier to do without the full committed body weight into the attack. Therefore, if we look back at the basic principles of power generation, we either make things have a greater effective mass (thrust techniques) or greater acceleration (snap techniques). The principles of body dynamics are well understood, however, in this article I want to explore how we can get the best of both worlds.

Let's start by looking at the very familiar technique of *mae geri*. We are taught to lift the knee high so that the top part of the leg is pointing directly at the place on the opponent where we want the kick to land. This is setting the hinge, with the hinge in this example being the knee joint. As the upper leg quickly moves the hinge into place, where it remains, the lower portion of the leg "snaps out" to the target and returns to where it started from; this whip effect defines the *mae geri* as a snap technique (Figure 1). However, the effective mass in this kick is only that of the lower portion of the leg. Also note that *mae geri kekomi* exists to make a pure thrust technique by lifting the knee beyond the line of the attack allowing the foot to be driven in a straight line to the target.

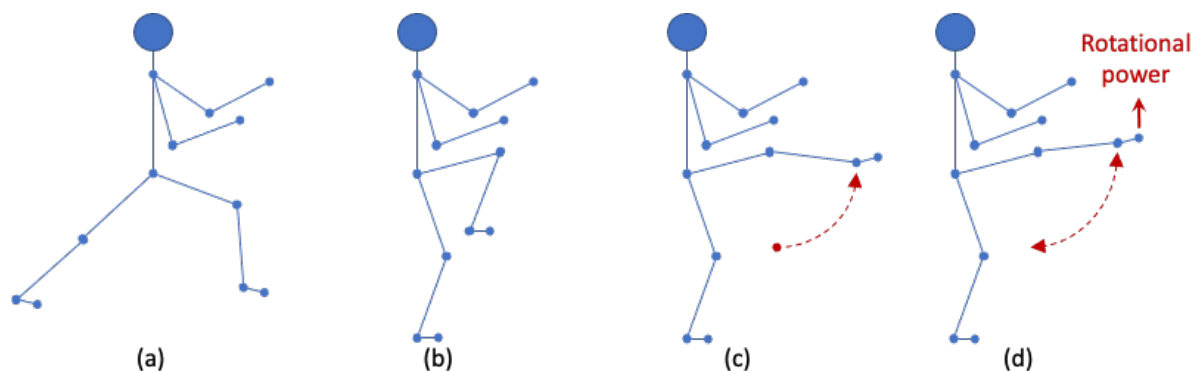


Figure 1

It is interesting to note that we are also taught to thrust the hips at the very end of the *mae geri*. This subtle movement, that requires expert timing, puts a different perspective on “snap techniques”. This is what I call “straightening the curve” (Figure 2). If we examine how the foot travels when moving around the pivot of the knee, it will move in a circular motion. Therefore, at the point of impact the rotational energy of the kick is not going into the target, but is travelling upwards. As a pure snap, or rational technique, *mae geri* can have value if applied to vulnerable areas, for example *kin geri*. However, to ensure the kick travels directly into the target, making the kick more versatile, we thrust with the hips (from the *hara*) towards the opponent. This adds linear power at the end of the technique adding to the rotational power already generated at the start of the kick. This has the benefit that we are now using the body weight to drive the kick directly into the target (increased effective mass) and this is the very definition of a thrust technique.

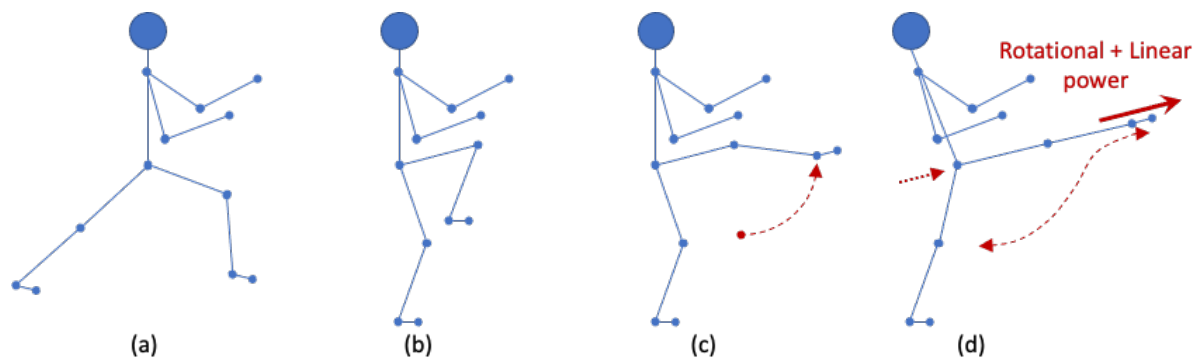


Figure 2

As mentioned in Richard’s article, just because we have a thrust technique doesn’t mean that it stays extended. It can return very quickly (along the same trajectory), therefore some can think this looks like a snap technique. So, using the thrust action at the end of the *mae geri* does not slow this kick down and it can still retract quickly. There is, however, a fine balance between fully committing the body weight making recovery more difficult and recovering the attack to such a point that you retain full control.

Looking at *mae geri* now as a hybrid of a snap and thrust technique, or as a more advanced thrust technique, gives us a unique perspective with which to examine other techniques. I believe that *yoko geri keage* is a technique that can benefit from this different perspective. In my experience, this technique is mainly taught as a pure snap technique aiming for vulnerable parts of the opponent – groin, knee, inner thigh, throat, armpit and others. However, I believe the same principles often applied to *mae geri* are also applicable here and I have come across this kick being taught this way. For beginners this kick is taught in six parts: lift knee to the side facing target with the foot tracking up the supporting leg (foot in the *sukuto* position), rapidly lift the hinge joint (the knee) towards target and set the hinge, from there whip the foot towards target and strike, then return along the same path. This initial lifting of the knee joint is what creates the whip effect of the technique. Based on our analysis of *mae geri*, this would mean that on the point of contact, the foot would be travelling upwards since the hinge is fixed at the point of contact and the only effective mass is that of the lower part of the leg. Now if the foot was travelling up into the groin area, solar plexus (if the opponent was bent over) or into throat then this would be an effective strike.

However, these specific target areas do restrict the versatility of this technique. If we “straighten the curve” for this kick, using a small drive with the hip towards the target at the end of the technique, we transition from a rotational to a linear trajectory therefore adding linear energy to the existing rotational energy upon impact. This means that this technique can be used to attack any target area effectively. So, “straightening the curve” essentially thrusts the hinge point of the attacking weapon directly towards the target right at the end of the move with committed body weight. Figure 3 shows the difference “straightening the curve” makes to this kick.



Yoko geri keage – upward power on impact

Figure 3

Yoko geri keage – straightening the curve

These two side kicks are designed to show the beginner how to use the body to either increase the effective mass or acceleration of the attack. For *kekomi*, “chambering” the attacking limb and accelerating it through the full linear range towards the opponent shows how to apply “heaviness”. The *keage* kicks accelerate quickly and can provide real advantage to the right target area. Often speed is of the essence and, in the right circumstances, we should aim to be the bullet and not the wrecking ball (speed over effective mass)! However, the advanced *karateka* can combine these techniques to get the attack quickly to target without the need to “chamber” it. The use of a thrust technique at the end, although over a much shorter distance, increases the effective mass and adds to the speed of the snap technique. Whilst each of the different ways of delivering power has its advantages, being able to combine both effectively creates the ultimate weapon.

Combining rotational and linear power generation can also be clearly seen in other advanced kicks, for example *yoko geri kekomi* done to the front. The first part of this kick follows the same trajectory as the *mae geri*. As the kick nears full extension, we “straighten the curve” in a slightly different way to *mae geri* in that we rotate and drive the hip rather than keeping the hip square, but essentially this is also a combination of snap followed by thrust.

Another example of a snap kick is *mawashi geri*. For this kick it is difficult to add full body weight behind it and turn it into a linear attack. However, the correct timing of rotational body weight from the *hara* explosively drives the hinge of the knee to the final position as the lower leg reaches full extension thus using both speed and rotational “heaviness”. We

have to note here that the hinge for *mawashi geri* is not thrust towards target but is set using rotation in the same direct as the kick itself. So, whilst not technically “straightening the curve” we are still able to add rotational effective mass to techniques striking an opponent from the side.

We have extensively explored the principle of “straightening the curve” for kicks, but does it also apply to hand techniques? The main rotational hand techniques in Shotokan are *uraken, tetsui, shuto uchi, haito uchi*. The advantage of many of these techniques is that the circular motion of the attack means the opponent does not have direct line of sight for the coming attack. Like snap kicks, the hand techniques use the body to set the hinge (the elbow or shoulder in these cases) and then whip the (lower) arm around that pivot point. At the point of contact, the only effective mass could be that of the lower arm, therefore the power generated depends predominantly on speed. However, the attacker could use rotation of the body timed with the strike to add rotational body weight to the attack, similar to *mawashi geri*. Depending on how much “weight” can be added to these techniques, the target of the attack should be somewhere “heaviness” is not needed and the effect is more to stun, distract or strike vulnerable areas rather than to do outright damage.

“Straightening the curve” on hand techniques is not so common but can still be used. Examining some of our *kata*, there are techniques that start out circular and finish with a linear drive towards target using the body weight. For example, in *Heian Nidan*, the third move of the kata could be a *tsuki* or a *tetsui* depending on when the body and hips are used. If the body straightens up and drives the hinge towards the target before the lower arms is extended then the attack will be circular (*tetsui*). If the lower arm moves first in a circular fashion and just before the point of full extension the body is used to drive the fist direct to target over the last few inches, this “straightens the curve” and make the technique linear (*tsuki*).

Finally, if we look at what are traditionally taught as blocks (*gedan barai, age uke, soto uke, uchi uke*) these can also be viewed through a lens of “straightening the curve”. All these techniques have a circular trajectory using the shoulder or elbow as the pivot; however, we use the body at the end of the technique to either add “weight” to the technique or drive it forward as an attack into the opponent. “Straitening the curve” for these techniques allows them to not only be used for blocking but also as a strong attack in the right situations (Gedan Barai – a Different Perspective – SKM Issue 153).

What are the advantages and disadvantages of both snap and thrust techniques? Snap, or circular techniques on their own have great value depending on the target area being struck, the speed of the attacking weapon (using the whip principles) and the fact that the attack is usually initiated out of the opponent’s direct line of sight. The disadvantage of the snap technique is that it doesn’t have the body weight behind it, therefore it’s not as “heavy” as a thrust technique. However, without committing the body weight to the attack and bringing the weapon back to the point from which it began, there is an argument that these techniques allow the attacker more control at the end of the technique. Thrust, or linear, techniques also have value on their own. They are “heavy”, as they have body weight behind them. To make these efficient the body weight has to be committed to the

attack with the centre of gravity being sent towards the target. On connection, a thrust technique is difficult for an opponent to stop head on as it carries a lot of power. The disadvantage is that if the full body weight is committed to the attack, regaining control can be difficult. Also, it takes time to “chamber” the weapon for that linear drive from the start and so this type of technique is traditionally slower than snap techniques even though it travels a shorter distance.

Having looked at the difference between snap and thrust, and their advantages and disadvantages, the conclusion is that when used practically we will mix and match these styles of generating power and use the ones most applicable for any given situation. I do not believe that any techniques are purely snap or thrust and everything uses elements of both, to differing degrees.

Having started by looking at *mae geri*, which I believe is a hybrid of rotational and linear power generation, we have been able to see that all techniques we do in Karate can have varying degrees of both types of power generation. “Straightening the curve” is the principle of using the best of both worlds; the accelerated speed generated by the whip effect with the right timing to straighten the curve at the end of the techniques thus driving the weapon home with body weight behind it. For the advanced *karateka*, even though the thrust technique is used over a much shorter distance, it has the same effect as doing it over the full range (thrust technique) but with the added benefit of the existing speed from the whip effect.

We have looked at this from a Karate practitioners’ point of view – clean technique, impact on full extension and so on. This is what we expect to see in *kihon*, *kata* and most basic partner work. We have to be very careful that our muscle memory does not only ever employ *kime* at this full extension. As described in “The Block-Control-Strike Principle” in SKM issue 154, the application of *kime* can be triggered at any point along the trajectory of the attack and should always be initiated as a reaction to tactile feedback. When “straightening the curve” we must ensure it is done as a reaction to this same contact and immediately precedes *kime*.

In conclusion, we have snap (rotational) techniques and thrust (linear) techniques. However, “straightening the curve” allows the advanced practitioner to use the best of both to create devastating power. When we analyse our Karate techniques, it is interesting to see all the places where this principle is used to increase power generation. Ultimately, physics guides us in the best ways to increase the power of our techniques without compromising speed. However, there is an additional human aspect that a good *karateka* can overlay onto this and that is when to use what. Thanks to Nick Shaw for being my *uke* and for help with the photographs.