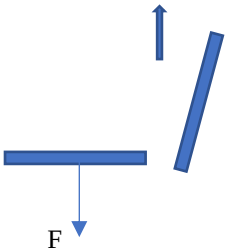
Let's crack skating!

There are different ways in which ski skating can be taught and learnt, but the following, which concentrates on balance and proper skating actions, and which de-emphasises the idea of the 'skate push', is possibly among the best for beginners and intermediates, and is also useful for advanced skiers wishing to hone their technique.

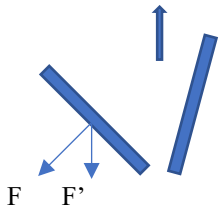
Ask many people where the lower body power comes from in skating and many, more particularly beginners, will say that it comes from the 'skate push', i.e. outwards and backwards. There are even things on the internet which say exactly the same, see https://youtu.be/CUBGWDUM4Ck as an example. While this is true of speed skating, it is only part of the story for ski skating because, otherwise, why wouldn't skiers develop the huge thigh muscles of a speed skater instead of staying fairly thin? If that wasn't proof enough, let's do a little maths (actually, I'm only going to do one basic calculation so, maybe, for our North American listeners, I'm finally going to do math).

Take one skier, desirous of accelerating him or herself (she will be a he from now on) straight down a track like this:

This person exerts a force, F, which applies perpendicular to the length of his skis, and the only thing he can vary is the angle of the pushing ski to the direction of travel. I will assume, for simplicity, that he applies the same force F irrespective of the angle, and he starts with one ski at 90° to the direction of travel (1):



(1)



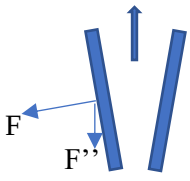
(2)

Pushing straight back, the full force F of Figure (1) is used to accelerate our skier forwards. In Figure (2), though, our skier, tired of the pain in his hip, only turns his ski to 45° to the direction of travel, and this is where the math comes in because, to find the force pushing him forwards, F', we have to use the formula:

$$F' = F \cos 45^\circ$$

Cosine (cos) 45° = 0.707, so F' = 0.707 F, i.e. only a little more than two thirds the force of (1).

Our skier now decides to attend a Snowsport England coaching course (coach: that lovely A.A. Pervert), who tells him that he should keep his 'kicking' leg as close to straight forward as possible, and he achieves 10°:



(3)

The same equation applies, so now $F'' = F \cos 80^\circ$ meaning F'' = 0.174 F, so less than 20 % of F. We know, though, that the fastest skiing comes with the skis pointing more or less straight forwards, and yet this gives us the lowest force pushing us forwards of all. Although the above is a gross simplification (and might not actually be physically possible), what is going on? How does the smallest 'push' correspond to maximum speed?

I think that we need to do three things:

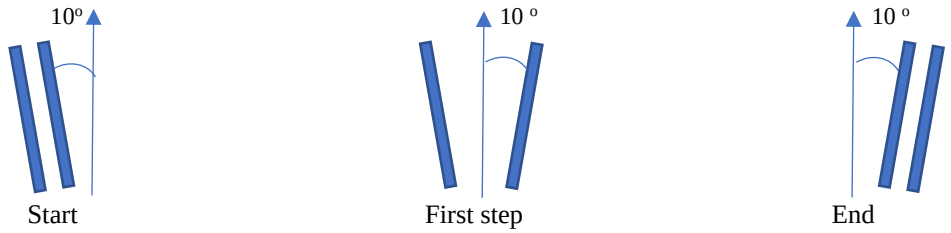
1) forget the idea of 'kicking out and back' (at least for the moment),
2) consider that the leg action of skating is not 'out and back' but, rather, each foot moves in a flattened ellipse, with the ellipse angled away from the direction of travel,
3) accept that there is not one, but two, essential balance positions in skating:

This one, the extended one

And this one, the tight, upright one

Now let's go through a series of drills to get to 'proper skating', and we'll explain as we go along. All drills are done on rollers (or skis) but without poles, on a flat, smooth surface.

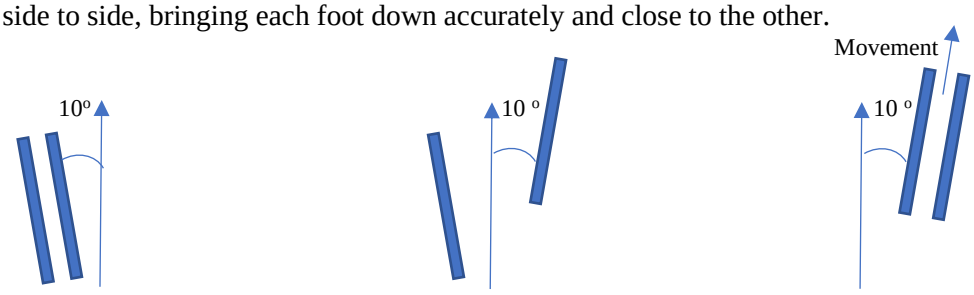
Drill 1: imagine a line going straight ahead. Start with both skis (or rollers), on one side of this line, at an angle of about 10º. Step (but keeping the ski low to the ground) the inner ski across the 'line', to land at 10º on the other side of the line, then bring the second foot across to land parallel to it. Move back across the line and then continue stepping across and back across the line – you will not move forward.



Continue until teatime, or until you are certain that your steps are always accurate and, in particular, that the second ski comes down close to and parallel to the first.

Drill 2: the same basic action as Drill 1 but, this time, as the second ski comes in parallel to the first, hold it off the ground for a few seconds before placing it down. To be able to hold the second foot up, your weight will need to be fully over the first ski, which needs to be flat, and the second ski needs to come in so that the two are about 10 cm apart. If the first ski is edged inwards and/or if your second foot doesn't come in close enough, your body weight will pull you down onto both skis very quickly. When you get this action right, though, you will have got the first stage of the tight, upright balance position shown above.

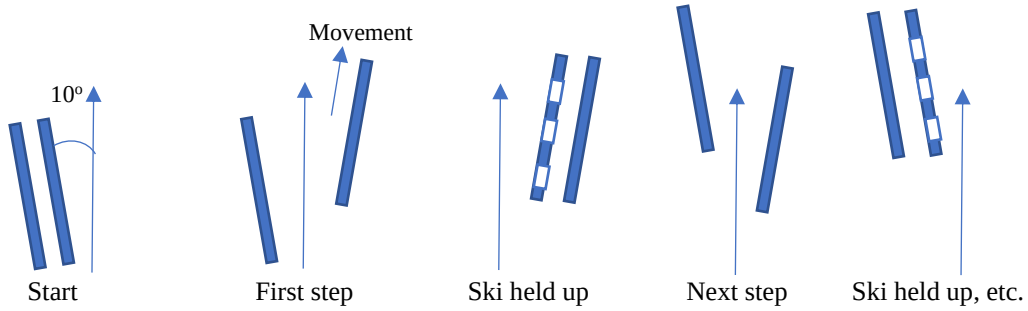
Drill 3: the same starting position as Drill 1 but now, instead of stepping across the line, step across and forwards, landing the first ski about 30-50 cm ahead of the first. This will make you start to glide forwards. Step the second ski across to come down close to and parallel with the first, so that you're now gliding on two feet at 10º to the direction of the line. Step the original second foot back across the line and forwards, then repeat from side to side, bringing each foot down accurately and close to the other.



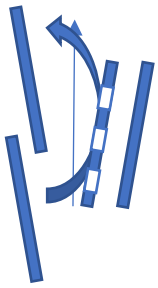
Start First step Skis gliding parallel

Drill 4: As Drill 3, but with the same variation as Drill 2, i.e. when the second ski comes in close to and parallel with the first, hold it off the ground so that you're now gliding but on one leg, i.e. exactly the balance position, but moving, of the tight, upright position shown above.

Drill 5: Moving on from Drill 4, the second ski comes in close to and parallel with the first (held slightly off the ground) but, this time, instead of coming down onto the ground, the second ski swings out to step forwards and back across the line. The same continues on both sides and you're now moving continuously forward.



Many people, at this stage, revert to what they believe is 'normal skating', but it is important, for future mastery of the whole technique, that the second ski still comes across the line and close to and parallel with the first ski, before swinging forwards. The action of the second ski is a continuous swing, in an arc from back to front:



Drill 6: The actions of Drill 5 are repeated and continuous, with just one variation; the second ski does not come across the line, it comes in parallel to the line and then swings forwards, which will probably lead to an angle of about 10º, which was what we were aiming for. This is why, in Drill 5, it was important that the two skis came parallel because, if they don't, two things happen: the skis don't come close enough for balance in the upright, tight position, and the skis tend to swing out at too-wide an angle.

Doing Drill 6, you should notice a few things, especially if doing it for the first time:

1) you're moving effortlessly at maybe 10-15 km/h,
2) you are gliding on a flat ski for the whole time your second leg is swinging forwards, not prematurely falling onto two legs as your body weight pulls you down,
3) the 'skate kick' has been largely forgotten, and it takes care of itself,
4) you can use this same, easy technique for the whole of the rest of your career, even up the steepest hills, the only difference is that, as the hill gets steeper, you don't have the time or strength to bring the second leg close in. But you don't change how close the skis come on purpose just because it's hilly, the hill comes and you accept that the skis come as close as you are able to get them,
5) you can accelerate, without using extra force, keeping exactly the technique of Drill 6 but 'extending' it and doing it with more speed but *not* with more power (the two are not the same),
6) you can reintroduce the 'skate kick', to accelerate or to climb hills, and it acts to drive the second leg forwards. But now the 'skate kick' is used to accelerate you from 15 km/h to 20 km/h whereas, previously, you'd used it to get to 15 km/h,
7) You can go to the Olympics or Masters World Championships and, when you do exceedingly well, you can mention A.A. Pervert in your celebratory post-race interviews. Simples!