

# Line Evolution: Survival of the Fastest

Ron LeMaster

The sequence below of Bode Miller winning the slalom at Adelboden, Switzerland, in 2002 demonstrates a trend in the evolution of line that started long ago and has accelerated since the new generation of skis arrived in the late 1990s. Tighter and tighter arcs are being carved, and their placement in relation to the turning pole is such that the racer is passing the pole closer and closer to the middle of the arc.

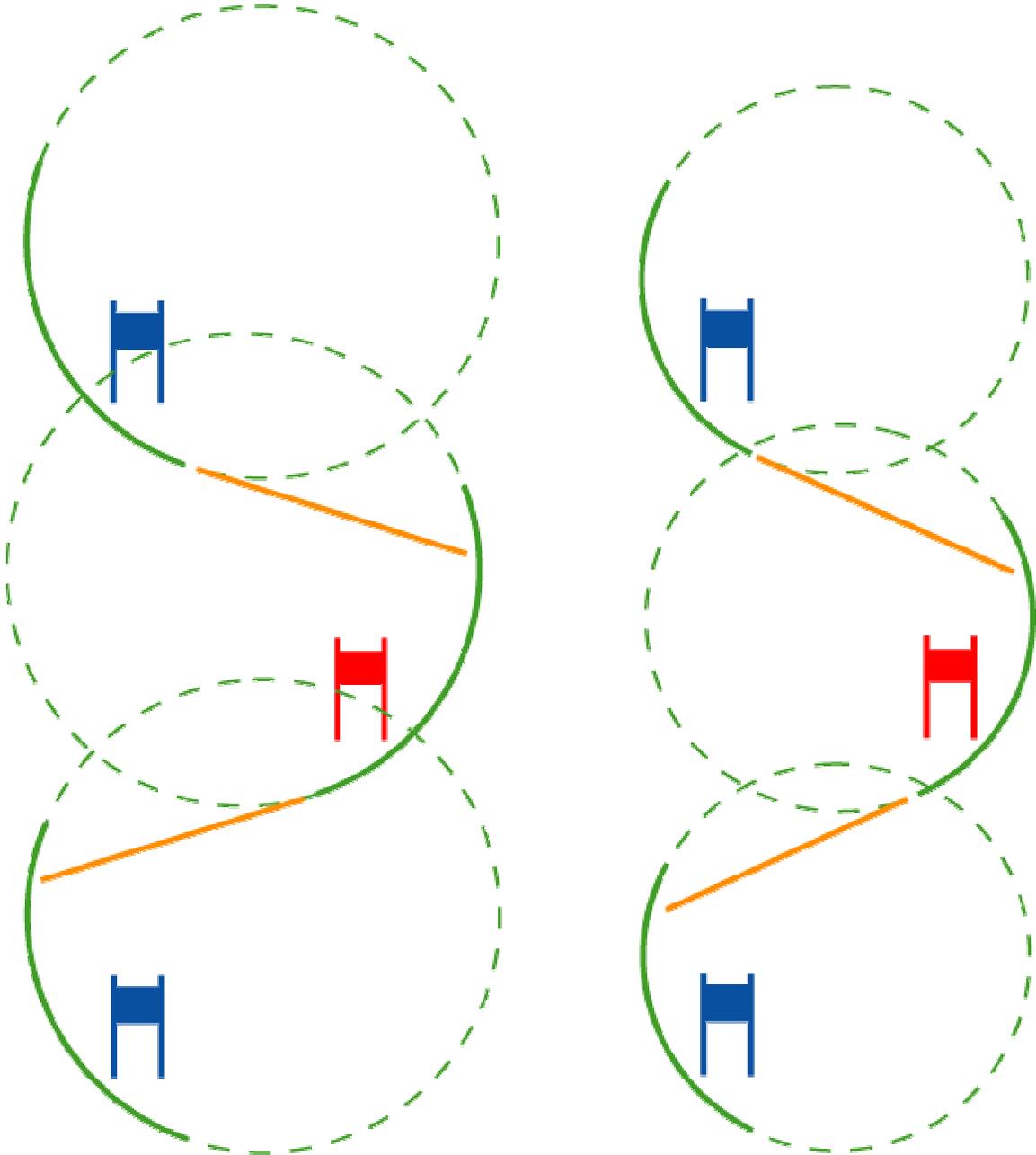


This photomontage of Tanja Poutiainen winning the Aspen giant slalom this season shows a similar tactical approach to the gate. Rather than setting up, turning above the gate and passing the pole in the latter third of the turn, she passes the pole in the fall line.



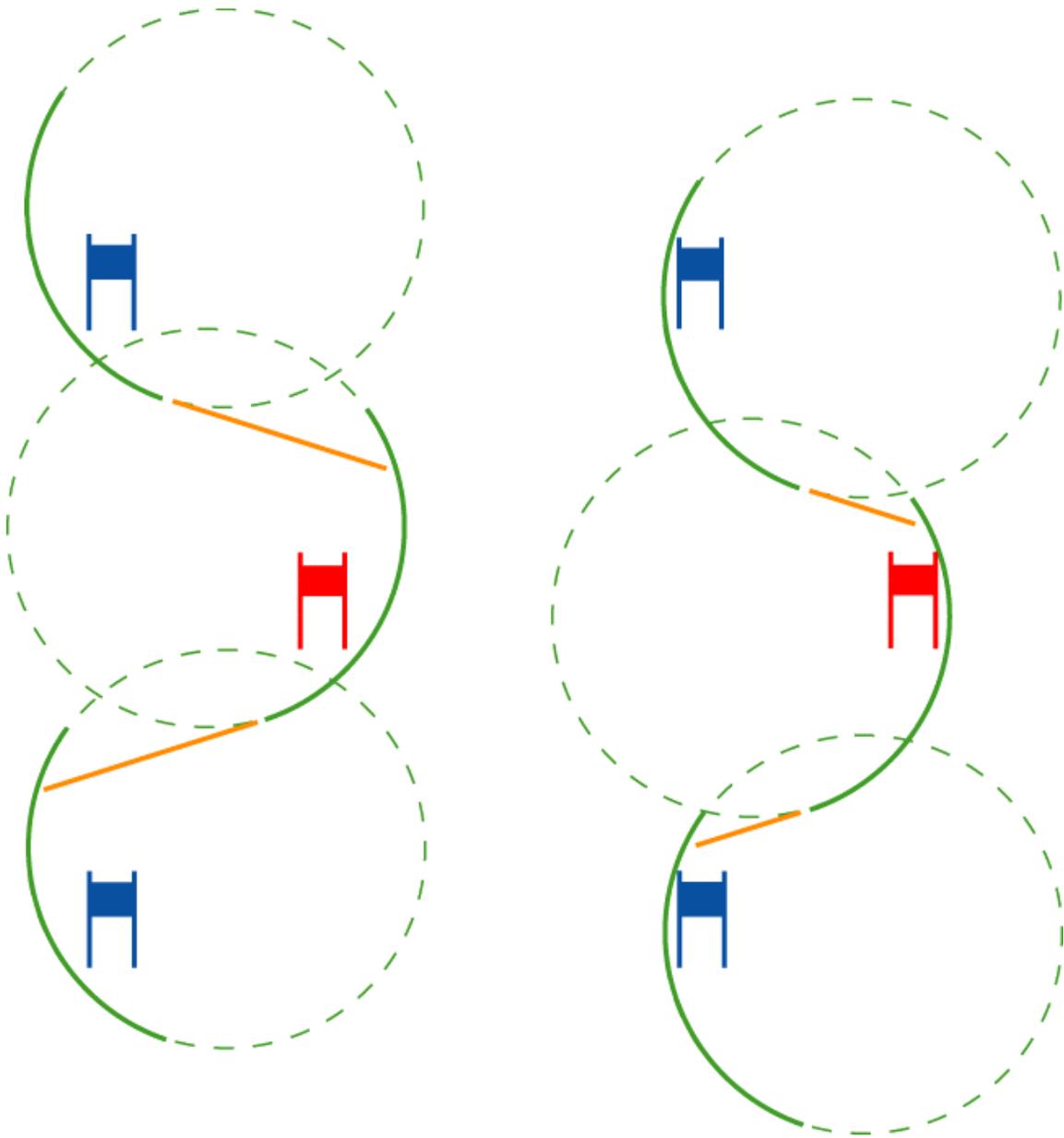
This evolution, and why it is fast, is shown in the following diagrams.

The first diagram shows why modern skis make for a faster line than traditional skis. The dotted circles on the left represent the tightest arcs that could be made on a pair of skis ten years ago, and the ones on the right by skis today. The solid lines show the lines a skier, using those skis, might take through some gates. The two big advantages of the tighter arcs possible on modern skis are clear: the transition between turns is steeper, so the skier will travel faster between turns, and the total distance the skier travels is shorter.



The next diagram shows two ways of approaching the gate on today's skis, and the advantage of passing the pole closer in the fall line rather than in the final third of the arc: The transition is shorter, so the total distance traveled is less. Note that in both cases the

radius of the turns is the same, and the traverse isn't steeper: The whole line has just been moved down the hill in relation to the gates.



The benefits of these tactics come at a price, however. Errors in technique and timing are magnified greatly, and you can count on finishing in the money (or finishing at all) with less regularity. Go too straight or turn too soon and you end up making a J-shaped turn, trying to tighten the arc below the pole. Start to carve too early and you either have to make a double turn or you hook the gate. In contrast, the classic line gives you a chance to adjust your approach to the pole after you've started carving. The direct line doesn't. And you must commit to making a portion of the turn below the pole, where the snow may be more difficult to carve on.

[I think we can cut this paragraph. It doesn't add much] In the past, two factors prevented skiers from taking this line. First, they ran into more difficult snow below the pole, Second, and probably more important, they could not get their skis carving as early in the turn. The entire turn was usually made after the skis had gone through the fall line.

Jesse Hunt, Alpine Director for the U.S. Ski Team, says that developing a faster, more aggressive line, involves two stages, which need to be developed in sequence. The first is to develop the ability to make tight turns with as much of the turn as possible being made with the skis in or near the fall line. The key factor in accomplishing this is for the athlete's hips and upper body (and hence the center of mass) to take a steeper line across the skis in the transition from one turn to the next. This sets the skier up for more inclination, higher edge angles, and sufficient tip pressure when the skis enter the fall line.

Jesse suggests the following drill for this: Set a series of open gates with brush gates directly up the fall line from each of the turning poles. From the beginning of the transition between turns, the skier does what Lore Pequenot does in the sequence below: She targets her upper body at the next turning pole, then "reaches out" into the fall line with her feet. If she were running one of Jesse's drill courses, this is where the brush gate would be. You can see how the steep line taken by her torso helps get the skis well up on edge early and puts pressure on the forebody of the skis, so they are carving by the time they are in the fall line.





The second stage is to learn just how direct a line you can take at the gate. Trevor Wagner, coach of the U.S. women's World Cup technical squad, has developed a great exercise for this: Two small brush gates are placed between each pair of gates, as shown in the photo below. It's important to time all runs. Racers start by skiing the course along the high line above both brushes between each pair of gates. After a couple of runs on this line, racers ski the middle line between the brushes. Finally, they push themselves to ski the lower, direct line. A number of runs on each line, all of them timed, will help skiers learn how much they can push their line.

Trevor points to the second run of the St. Moritz GS this year as "a perfect example of when you can ski that line." According to him, "Julia Mancuso ... used those tactics to win the run by 0.70 sec., a huge margin." Mancuso said herself that she decided to use her aggressive GS tactics in the World Championship Super-G at Bormio, where they netted her a bronze medal.





This approach is becoming more and more common. But, as with all things in skiing, not everyone in the top echelons of the World Cup applies this tactic. Mike Morin, head coach of the U.S. men's World Cup gate squad, points to Bode Miller, Ted Ligety and Rainer Schoenfelder as regular practitioners, while Manfred Pranger skis one of the rounder lines. Benni Raich is somewhere in the middle. These are not the best tactics for all turns in all courses, but every athlete should run the training drills to find his or her optimal line.