

# High Performance Skiing



In the realm of music, once you know the scales, you can play, compose, improvise, innovate and embellish, but, first, you must master the scales.

This manual, commissioned by The Sport Loft, Holladay UT, describes the fundamentals — the scales, if you will — of high performance skiing; that is to say, skills and how to build them.

*- Peter Keelty, January 2016*


## 1: An Eye for Greatness

A suggestion from World Cup coaches and athletes and other elite level skiers that may sound strange at first blush can have a powerful effect and can play a role in getting ready for your first days on snow.

Watch video.

Observe some of the world's best skiers, studying how they make turns. You can find a wealth of such video on YouTube and Vimeo.

Here Ted Ligety discusses and demonstrates the GS turn, which forms the basis for high performance skiing. Any top level skier will tell you that the GS turn is the "standard turn," the reference turn, the foundation for high level recreational skiing.

Ted Ligety on his GS Turn 

Note how the inside knee rises progressively up toward the torso as the weight-bearing outside leg remains extended. Watch for the migration of pressure from the outside carving ski to the new inside (now uphill) ski before the transition into the next turn. See how the arms control the timing. Observe how he *rolls*, rather than steps, from one turn to another.

Watch the video until you are completely familiar with Ligety's moves (including not only feet, legs and skis, but torso, arms, hands and head as well) and then relax, close your eyes and visualize yourself making the same moves.

Seek out other top-level skiers on video channels like YouTube and Vimeo and study them in the same way. We suspect you will be pleased when you first step on snow .

## 2: Ski Like a Human, Not a Pigeon



This skier's weight is 100% on the downhill ski (A) as he prepares to transfer to what will become the new downhill ski (B). Notice the skier's vulnerability (C) to going "over the handlebars" as loose snow accumulates in front of the downhill ski sidewall.

Many skiers struggle, through no fault of their own, with what we call "two-edge" skiing. These skiers make turns with weight concentrated on the big-toe edge of the downhill ski and then, at transition from one turn to the next, step directly onto the big-toe edge of the new downhill ski, often abruptly.

This, we suspect, is because well-meaning "experts" (including not a few instructors) have told them that the holy grail of technique is to keep total pressure on the big-toe edge of the downhill ski at all times.

This is not how the best skiers ski.

Such awkward technique is at odds with how the human body functions bio-mechanically and is at odds with how humans are designed to walk; in fact, it is more like the way that pigeons waddle on the ground. And on the hill, it results in wedge turn entry, whether gross or subtle, 100 times out of 100.

Have you ever experienced difficulty maintaining control on hard or icy surfaces?

This could be why.

Ever cross a tip in deep snow “for no reason?”

This could be why.

Ever get snagged by “snow snakes” in moderately deep snow?

This could be why.

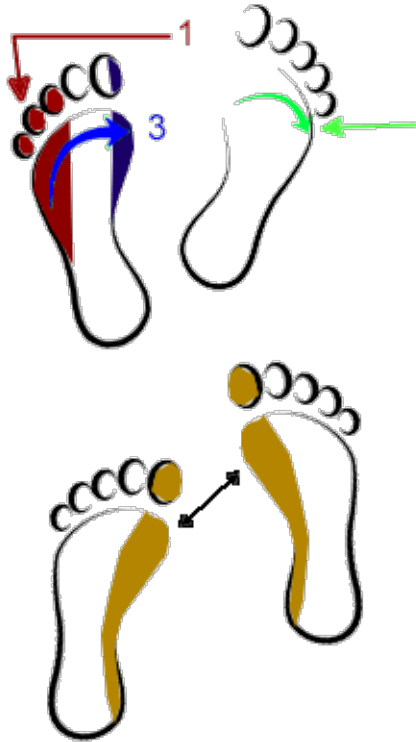
Ever wondered why true carving prowess is so elusive?

This could be why.

Moreover, this “technique” places more stress on knees and hips than is necessary, stress that can lead to injury.

There is a more efficient way, the way that top skiers execute what we call “four-edge” skiing.

The diagram on the next page illustrates the fundamentals.



- 1. finish the turn with all of your weight on little toe edge of uphill ski
- 2. flip (or roll) the now weightless downhill ski down into new turn
- 3. the uphill ski will roll over and start carving on its big toe edge

this is "4-edge" skiing, which facilitates carving & control

skier steps abruptly from one big toe edge to the other big toe edge, with no involvement of the uphill ski

this is "2-edge" skiing, which creates wedge turn-entry (100% of the time) and a host of bio-mechanical problems

Compare this image of US Ski Team member Tommy Ford at the moment of transition to that of our wedging skier at the start of this section 2.



Tommy has crossed the fall line and begun transition to the next turn. Weight and pressure migrate progressively to the inside ski that will become the new outside ski. Notice how more snow spray emanates from the inside ski (B).

The old outside ski (A), still bent under maximum extension, will flatten as transition progresses and Tommy retracts the extended leg. It will become relatively weightless just prior to the final moment of transition.

Ford will roll the unweighted ski down into the new turn. The new outside ski will follow, rolling onto its carving edge to begin the new carve. Pressure will build and bend the ski into a carving arc as he retracts the old outside leg and extends the new one. All this happens seamlessly in progressive fashion. (We again recommend study of Ted Ligety in motion, here)

Most of us are never going to ski as well as Ted or Tommy, but by practicing Four-edge skiing, we can come closer, maintain bullet-proof control and reduce stress on our legs and hips.

For more on this, I recommend:

Harald Harb's Anyone Can Be an Expert Skier 

&

John Clendenin's The Clendenin Method 


This technical paradigm-shift can revolutionize your skiing and take you rapidly to previously unattainable levels.

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### 3: A Most Important Day

I don't know of any official studies, but after a lengthy on-hill career in capacities ranging from patroller to instructor to trainer, I am fairly certain that the first day of any season is one of the most high-risk days for virtually all skiers.

The following suggestions are designed not only to help you enter the new season seamlessly, but may even help reduce the risk of mishap or even injury.

- Go easy the night before the big day. Try not to overeat or drink excessively. Get a good night's sleep.
- Rise early the morning of the big day. Eat a solid breakfast. Head to the slopes early, if possible. One of the best ways to guarantee a good day is to get a great parking space and early birds get the best spots. Many savvy skiers leave very early and eat breakfast at the area.
- Stretch. There is little that affords better anti-injury protection than getting out on the hill already warm and limber. Here's a link to 6 pre-skiing exercises 

Certainly the river of enthusiasm runs at flood level the first day of the season, but exercising a bit of restraint and approaching the first morning with a cogent plan can pay huge dividends.

On that first run, for example, don't just roar down the hill on the most challenging slope you dare (or even ski fast on something more mellow).

Instead, I recommend you use your first run to tweak rusty technique. Two exercises we have featured on our site are ideal for this technical dial-in.

John Clendenin's *Tip and Tuck* exercise, used in his camps, and shown below, has raised hundreds of skiers' ability levels in a short time, usually about one morning. Here it is in static form:

*Practice this exercise on extremely gentle terrain at very low speed.*

Cross the hill with skis about 2 fist-widths apart, weight on the uphill ski.



Touch pole about midway between tip and binding of downhill ski.



Tip the downhill ski and move your center of mass into the turn.





As the skis come to the fall line, progressively draw in the old downhill ski (new inside ski toward stance ski, beneath your center...



...thus re-centering progressively on the new inside, uphill ski.




Practice in both directions and in series of linked turns.



There is more on this in The Clendenin Method, available here [👉](#).

If you want to completely transform your skiing in two days, with emphasis on off-piste skiing, we recommend that you attend a Clendenin Method Camp.

Harald Harb's *Wedge Blocker* exercise on our site , can transform your skiing in a day. Both drills are great ways to begin a day, or season.

On drills: Mikaela Shiffrin adds a thought  that may well be the very heart of her technical domination on the World Cup: Don't just do the drill, *master* the drill.

Finally, some pockets of "conventional wisdom" suggest taking a lesson on the first day. Let's turn that around. Why not *give* someone of approximately your own ability a lesson? The Harb and Clendenin exercises provide great subject material, as does Tip 2, above. If I've learned one thing in decades of helping skiers ski easier and better, it's that the best way to improve your own skiing is to coach someone else

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## 4: Carving Sensations

The unfortunate truth is that many skiers imagine they are carving, but, in fact, are not.



What follows is not a "lesson" per se, but rather a drill through which to experience the true feel of carving.

*If you are not completely confident of your ability to perform these drills safely in accordance with the Skiers' Responsibility Code 🚧, please do not attempt them. \* If your equipment is not correctly set up and adjusted, please do not proceed until certified binding technicians and boot fit experts have checked everything. Skis that are out of tune, or that are tuned to other than factory specifications, will render this exercise difficult and dangerous. Boots that are ill fit or misaligned will render the exercise pointless; it won't work.*

## Park and Ride

Terrain is critical. This exercise should be performed only on smooth, gentle terrain with little – or, better – no traffic.

Green terrain is best. Be aware that speed builds rapidly in this exercise and safety is a primary concern.

I call this Park and Ride because it is not dynamic skiing. The goal is to do as little as possible while letting the skis do the work.

During the exercise, what you *don't* do is as important – actually more important – as what you *do* do. Here are some don'ts and, as you'll likely discover, this is hard part:

- ✎ Don't proactively extend and retract.
- ✎ Don't make a conscious weight transfer from one ski to the other.
- ✎ Don't fight these things should they naturally occur, but don't force anything, either. Just let things happen.
- ✎ Above all, resist the urge to steer the ski. Be patient and wait for the ski to come around on its own; it will!

Forget about pole touches; just hold your poles comfortably with hands above and in front of the waist and slightly more than shoulder-width apart.

Start with what we call *Knee Rolling*.

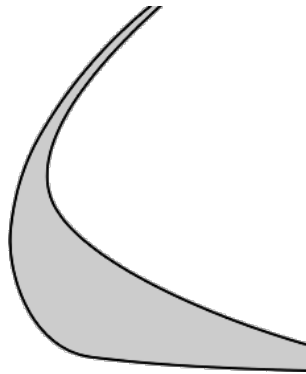
Head straight down the fall line. As speed builds, simply roll both knees in the direction you wish to go. Roll to the right to go right; roll to the left to turn left.

At first, roll knees in one direction and keep rolling them until you come to a complete stop. Above all, do not steer the ski. Just let the knee-rolling build the turn all the way around until you stop.

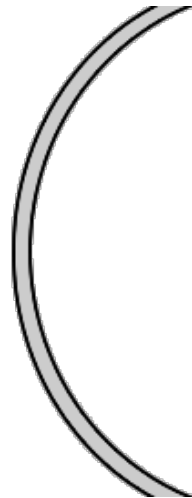
Repeat in the other direction. Do this exercise until you can etch a clean set of tracks, with no signs of skidding, in both directions. This may require a few attempts and it may demand real concentration on not steering, but it is important to remove all steering at this stage. Let the skis do ALL of the work and stick to it until you can leave clean tracks every time.

How can you tell a clean track? Look at the tracks on the snow behind you. Compare them to these shapes.

A skidded track has this shape



A carved track has this shape



Now we'll repeat, making linked turns. (Remember, you are not pro-actively forcing weight transfers, nor are you resisting transfer that may be happening automatically and you are still not worried about pole plants or anything except rolling into the new turn.)

The difference this time is that you are going to roll only the knee that is on the side to which you wish to turn. In other words, roll the right knee to create a right turn, roll the left knee to turn left. Don't roll both knees; use only the one on the side to which you wish to turn.

Don't worry about the other knee; it will follow along on its own. You won't split!

## Tip and Bend

Let's polish the skill.

Repeat the single-knee rolling phase, but concentrate this time on rolling the ankle – roll left ankle to go left and when you want to turn to the right, roll the right ankle. No up-unweighting. No down-unweighting. No Steering. No forced weight transfer. Just ski tipping controlled by the inside foot.

This may sound odd, but by controlling with the ankle, rather than the knee, you will discover that the exercise becomes almost completely effortless.

That's it; you should be feeling what high-edge-angle carving turns feel like and will increasingly notice how easy it is to change direction simply by tipping the skis and letting the bent ski create the arc. This is a key to how the best skiers in the world ski 🌟.

We call it *tip and bend* (see the image on the next page). As a bonus, the Park and Ride drill is ideal for livening up otherwise boring runouts, catwalks and roads.



If you are in the Wasatch, contact the store (801.272.3701) and arrange for an *Anton Adventure* session. You likely will advance further in a few hours than would you by any other method.

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## 5: Short Leg, Long Leg

Among the most challenging tasks in high-level skiing is getting — and holding — a powerful carving edge on hard snow and ice. The most extreme environment in which this skill is required is competition, whether Beer League, Masters, NorAm, Europa or the World Cup itself.



Observe the extreme edge angle of the outside, carving ski in this photo of Ted Ligety at Alta Badia 2015. Notice the bend. This is what athletes and coaches refer to as “getting angles” and Ligety is among the best in the world at it. It is the ultimate expression of Tip and Bend (see Section 4).

World Cup GS tracks typically are “injected,” which means they have had water literally injected into the surface and then the course has been allowed to freeze overnight, weather permitting. The resulting surface is more akin to a skating rink than to any condition recreational skiers are likely to encounter, at least anywhere west of the



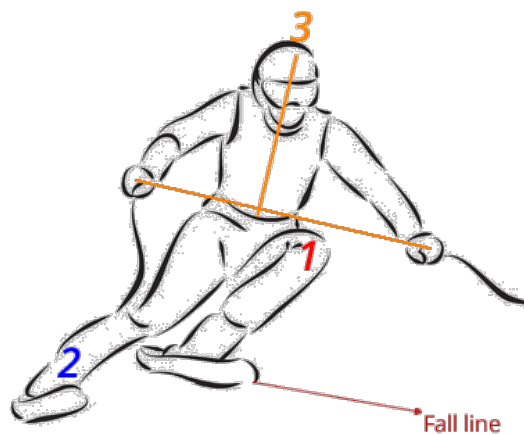
Mississippi. It is all but impossible even to walk on an injected course; skiing such a surface in typical recreational posture is out of the question.

It requires high edge angles and powerful input to the carving ski to navigate a FIS course, but recreational skiers likewise can profit from having angle-skills in the arsenal for those times when the groomed surface is less than groomed, for example after a warm day when the surface is frozen in early morning.

I find the first couple of hours of the day often provide some of the best skiing; slopes and lifts are typically less crowded as others wait for the “ice” to soften. In my opinion, confident carving on hard and frozen snow creates one of the sublime sensations available to skiers, or at least those for whom slick surfaces are not intimidating.

“Getting angles” is actually as easy as 1-2-3 with understanding and, as always, quality mileage practice. Most of us who are not world class racers will never achieve the extreme angles of a Ligety-level athlete, but more modest yet still effective angles, as in the illustration below, are accessible on the less demanding non-fis surfaces often present in major resorts.

Think boilerplate.



Use this image for illustration of the comments on the next 2 pages.

## Short Leg (1)

Instructors communicate the process of putting pressure on the outside ski in various ways. You may hear, “Stand on the outside ski,” “Drop your hip,” “Pressure the downhill ski,” variations of these, or something else entirely.

Sometimes people struggle to put such advice into practice; some skiers will simply lean the hip toward the snow, or stand upright up on a flat downhill ski, or actually lean out over the downhill ski.

These moves can result in falling inside to the snow in a “slide for life,” catching the downhill edge and going over the handlebars or, at least, not getting the correct result.

I’ve found that the simple suggestion: “Raise the inside knee progressively toward your chest as you approach the fall line” (#1 in the image on the preceding page) is a simple and all-but-impossible to misinterpret way to explain this.

## Long Leg (2)

When timed correctly, and performed progressively, this will result in pressure building on the big-toe carving edge at the top of the turn, above the fall line—through to the middle of the turn, as the outside leg simultaneously extends (#2 in image). I call this Long Leg and it is this action that bends the ski into an arc and creates the holding edge on hard snow.

Once you pass the fall line, the process of relaxing the carving ski leg to begin letting forces migrate to the little toe edge of the inside ski in preparation for the next turn takes over. (see Section 2: Ski Technique for Humans)

Just prior to the moment of transition, both legs will be retracted beneath the body approximately the same more amount, with knees at more or less 90° angles, as shown in the image below.



### The Secret Sauce (3)

How the skier manages the upper body has a profound effect on successful performance of this skill.

Imagine a line running up the spine, with another intersecting it, like the orange lines in the sketch (#3 in image). Although it is not possible to do this perfectly, try to keep the vertical line as perpendicular to the slope as possible, while the lateral line defines where the hands are: in front, above the waist and approximately level. Once again, look at Ted's hands and upper body; his position, despite his extreme angle, is pure textbook.

### The Principle of Adequacy

As with any powerful tool, the ability to “get angles” should be used with a bit of judgment. Extreme angles do not work well in powder or at all bumps and can be problematic on velvet Utah grooming. Too much power can get the skier “jacked up” and thrown violently forward or laterally on snow that is too easy to groove.

Consider this skier.



Skier has carved the top of the turn, passed the fall line and begun to migrate pressure to the inside ski in preparation for the next turn.

With a more modest application of edge angle, this skier can handle virtually any surface available in the Wasatch (or even in renowned ice paradises such as Stowe and Whiteface).

Moreover, he is using less energy — and hence becoming less fatigued — than skiers who consistently attempt to achieve angles similar to those used in high-end racing. I suggest generally leaving extremes to athletes in actual courses, although extremely high-angle carving can be fun under the right circumstances. It's just that, in our opinion, such circumstances don't include slopes packed with less proficient skiers.

## 6: Little Big Things

Daron Rahlves famously once said, "Hundies count!"

Remember that he had won the '03 Hahnenkamm, besting Didier Cuche by 5/100 of a second, which provoked, so the story goes, some trash talk from 6th place finisher Herrman Meier.

Well, details count, too.

Let's consider a few seemingly little things that make the difference between a good skier and a great one. These are not grand fundamentals such as we have examined above, but subtleties that make a huge difference in performance – and that can slip away all too easily when focus wanders, even among the world's top athletes.

*The Standard*



On the preceding page is a photo of Ted Ligety performing a nearly perfect carved turn (nothing is ever truly perfect, but this is about as close as it gets in skiing!)

Ted's turn certainly is more exaggerated than turns that civilian skiers generally make — he is at race speed on a World Cup GS course — but the image illustrates all the basics of the seminal ski turn. As we go through these "Little Big Things," you will notice that all are present in this Ligety moment.

### *The Struggle*



Compare this timid skier to Ligety on the previous page ; we don't mean to pick on her, but the stark differences highlight several crucial issues, starting with her defensive inward lean and stare-at-the-tips posture vs. Ligety's textbook outside-ski "stack" and down the hill focus.

We chose the exaggerated illustration for clarity, but some of this inefficiency can creep into even the best skier's execution, including that of one who is on the cusp of officially becoming the best skier in history. Lindsey Vonn herself has been known to lose focus and lean in, losing pressure on the carving ski and skiing out. Not often, to be sure, but it can happen even at her level.

### *Roll vs. Flip*

It is useful to differentiate progressive technical elements from elements that are ballistic in nature. As a general rule, progressive execution is preferable to ballistic execution. For illustration, a classic hockey stop is a ballistic – sudden, forceful, often jerky – movement and less likely to be as smooth as a nicely rounded short-radius turn to a stop.

Other examples of ballistic movements include the practice of stepping from one big toe edge onto a new big toe edge to create a new turn, a practice we highly discourage (see Section 2).

So also is the old school method of lifting the downhill-soon-to-be-inside ski at turn initiation. That movement was popular among high-end skiers in the pre-shaped-ski era, but is one which upon modern ski equipment is no longer necessary, or even especially helpful. (There are exceptions, such as the bicycle turn on steeps, but they are tactical applications; here we deal with skills.)

It is true that both Harb and Clendenin use such a tail-lifting move in early stages of helping skiers understand four-edge skiing (see Tip 3), but those are exercises. In high performance skiing, one key goal is to maintain contact with the snow as much as possible. Even in World Cup downhill, athletes attempt to limit airtime. Obviously this is not always possible, but the more time the skis are in contact with the surface, the faster the run, the more stable the skier and the less the chance of inadvertent disaster.

And so, too, is it with recreational skiers.

Notice how, in the montage of Harald Harb below, both skis remain on the snow as he rolls into the turn. He has initiated from a stance on the little toe edge of the uphill ski, but is not lifting the downhill ski; rather he is rolling onto the new edges.



### *Hands and Eyes*

Notice in our reference image at the beginning of this section that Ted's torso stays relatively square to skis, but his eyes are focused laser-like down the fall line; you go where you look.

Hands, on the other, er, hand, are both tricky to master and often the most fertile realm for improvement. Relatively few skiers, even at the stratospheric level of World Cup



competition, have perfect hands. Ligety and Harald in the images above demonstrate flawless hands, and other top-tier technical skiers like Mikaela Shiffrin and Hendrick Kristofferson likewise have superb hand control, but among recreational skiers, it is probably safe to say that many skiers can use some improvement.

One pernicious issue is the post-pole-plant drooping inside hand.



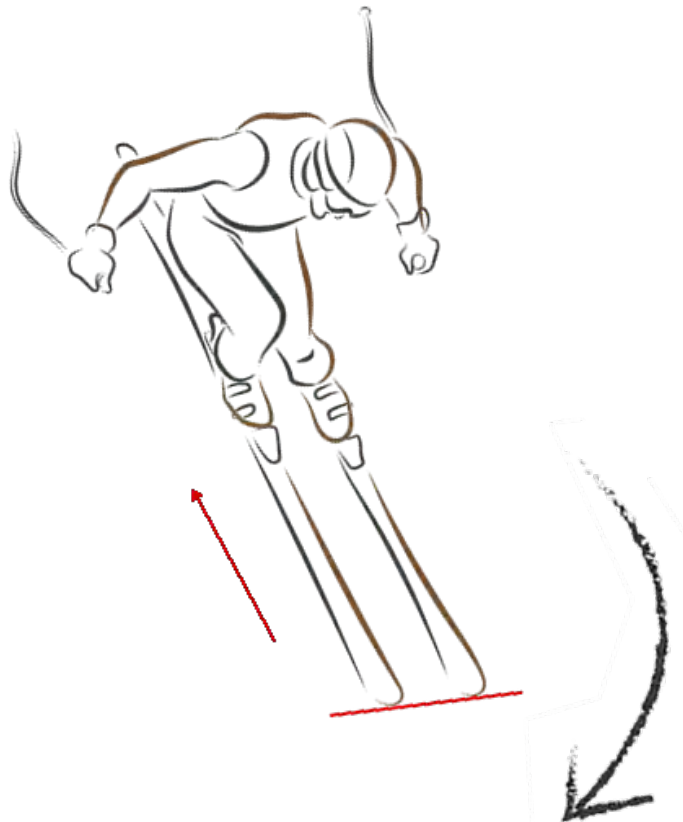
This can afflict even very good skiers occasionally, but if it becomes habit, balance, timing, accuracy and arc are all affected in a negative cascading sequence, resulting in loss of power on the carving ski, a pronounced banking lean and, usually, some degree of skidding. The ideal is to maintain a powerful, high inside hand.

One of the best exercises for exorcising this issue is the double pole-plant drill. Instead of triggering the turn with just the downhill pole, try making a few turns touching both poles simultaneously to initiate the turn; minimize arm movement using the wrists.



The exercise likely will feel awkward at first, but with practice should become ever more comfortable. Once discomfort fades, try taking a run using a double pole touch every third or fourth turn. The double pole exercise has been a favorite of racers for decades and can work wonders if an arm has become habitually lazy.

### *Ski Tips Together*



"Tips together" means tips in the same plane (reference the red line in the picture on previous page); we are not talking about knees with a penny between them.

This exercise helps develop a sense of the range of power available in a turn, even in the most demanding conditions that early mornings in spring can produce. It will impart a quickness and smoothness that are hallmarks of the best skiers.

Begin, on gentle terrain, by making one turn out of the fall line keeping both tips in the same plane throughout the entire half turn. This, too, may feel awkward at first. Stick with it until you consistently can execute half-turns in each direction.

Then begin from a shallow traverse and complete a whole turn with tips together. Make a series of linked turns in this manner. You should feel a supercharged sense of power and quickness in your skiing, even at low practice speeds.

The trick to incorporating this into basic technique is to "pull" the inside/light/downhill ski back immediately upon beginning transition to a new turn. The degree to which this happens will control the radius of the new turn. Of course, since you are travelling forward, the ski won't literally move back, but you should feel the skis all but turn themselves.

### *Speed Management*

There are more efficient ways to manage speed than simply by skidding or slamming into a hockey stop or even "throwing them sideways."

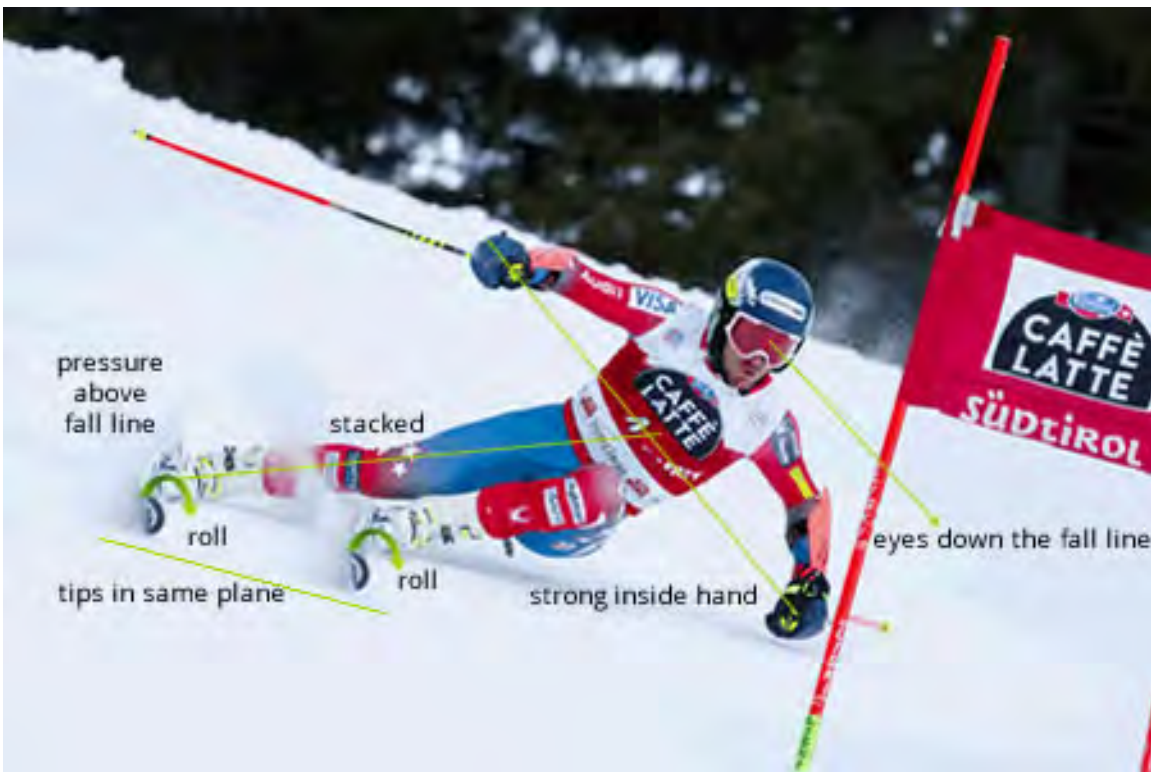
Pressure the carving ski above the fall line, at the top of the turn, to go faster. Conversely, if pressure is applied from the fall line on, in the second half or bottom of the turn, speed will decrease. The more pressure is applied at the bottom of the turn, the more speed will diminish. This works whether the ski is carving, or "skarving" with softer edges.



Faster: Spray goes up hill

Slower: spray goes downhill

Here's our reference image of Ligety again, annotated with the elements discussed in this section.



*The Biggest Little Thing*

Fear and hesitancy are among the worst performance thieves in skiing and actually can lead to injury. Dive into the gravity well. Attack! Though it may seem counter intuitive, approach even low-energy skiing with definite purpose. Commitment makes all the difference; lack of it can ruin a run, a day, a season or a career.

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– Peter Keelty for The Sport Loft