

**NOTE TO THE READER:** Most images in this article have an associated video. You can watch the videos and find related information on the OPTIMAL theory of learning theory by clicking on the box or visiting [ronlemaster.com/32Degrees-MA](http://ronlemaster.com/32Degrees-MA).

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# Rethinking Movement Analysis

By Ron LeMaster

**M**ovement analysis has long been a core component of ski instruction, to the point where it now occupies a central place – some would say an oversized one – in instructor training. The *PSIA Alpine Technical Manual* defines it as, “The

process of observing a movement, evaluating the relevance and effect of that movement on other movements and the action of the skis, and prescribing changes for enhanced efficiency, effectiveness, and performance.”

There’s a lot to unpack in that definition, and, in practice, people commonly focus on cause-and-effect relationships between body movements and ski performance – what this article loosely refers to as “technique.” That narrow focus often leads instructors down

academic, stress-inducing rabbit holes that don’t necessarily serve the larger purpose of teaching skiing: helping others enjoy skiing more, usually by skiing better. Rather than focus solely on technique, we should consider other, equally important facets of a person’s skiing when formulating the best prescriptions for change. Furthermore, we should deliver those prescriptions to our students using guidance from the best sport-science research in motor learning,

## IN THE ARTICLE

- ▶ When performing movement analysis, focus on the skier’s tactics and intentions, not just their technique.
- ▶ Avoid basing your analysis strictly on your ideas of what constitutes good skiing.
- ▶ Communicate with students using practices based on sports science.

some of which will seem counterintuitive to many instructors.

## IDENTIFYING CHANGE: EVALUATING ANOTHER SKIER'S SKIING

We all have our own ideas of what “good skiing” is, but do they really encompass what good skiing is for our students? Are those ideas based on how we would like to ski? What we regard as “correct” technique?

When evaluating someone else's skiing (or snowboarding, for that matter), you might subconsciously assume higher performance is better. More sophisticated and difficult

techniques are better. Carved turns are better. The list goes on.

Most students, however, measure their performance by other, more fundamental yardsticks. Do I feel in command of my speed, my line, and my stability? Can I control my movement down the hill at a level of risk that I enjoy? These metrics coordinate more directly with that person's basic intentions than does the proper execution of specific turns and techniques.

### There Is No One, Best Type of Turn – There Are Many

Watch the video of PSIA Alpine Team member Jonathan Ballou and ask yourself which turns are better: the ones on the left half of the screen or the ones on the right. In informal tests, instructors generally label the higher-performance turns on the right as “better.” This judgment is likely based on the instructors' sense that they would be judged as better skiers if someone saw them making the higher-performance, more difficult turns.

If a student skis like Jonathan does on the left, would you assume that he or she would prefer to ski like Jonathan does on the right? Such judgments expose instructors' biases regarding what they *think* students should want to learn when, in fact, students' interests are often much different from those of their instructors. For instance, rather than etch perfect high-speed carves, your student might prefer less aggressive yet graceful turns that allow them to ski longer with less fatigue.



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### There Is No One, Best Ski Type of Ski Performance – There Are Many

In this video of PSIA-AASI National Alpine Team member Stephen Helfenbein skiing across a steep sidehill, he makes much different turns to the left than to the right to stay high on the counter slope. His turns to the left are shorter, sharper, and begin with a pivot. The turns to the right are more carved and their shape is more drawn out. Because of that, his body movements also differ.

Put another way, his intention to ski a line that goes across the fall line determines the turns he makes and the techniques he uses to execute them.



### **There Is No One, Best Combination of Body Movements – There Are Many**

You may have heard that it's always best to steer a ski with leg rotation, that you should always come to a neutral stance in the transition between turns, and that every turn should begin with a pole swing. But when you watch a group of great skiers ski the same type of turns – whether in a clinic, a World Cup race, or just free skiing, you'll see there's no single, "right way" to nail the same turns.

The image – and related video – below shows Helfenbein and Robin Barnes, another PSIA Alpine Team member, synchro-skiing some short-radius turns. Their task is to make turns of precisely the same shape and speed. Stephen and Robin accomplish this with noticeable differences in technique. Each skier's movement patterns, and stance, from how they move up and down to how they angulate, are suited to his or her personal body structure.



Synchro-skiing with Stephen Helfenbein and Robin Barnes.

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### **Intention and Invention Are at the Heart of Good Skiing**

To improve on-hill performance, skiers often execute certain prescribed, programmatic combinations of body movements to get them grooved. Think "medium-performance parallel turns in a 20-foot corridor." This is similar to what jazz musicians call "woodshedding," that is, playing scales, phrases, and exercises to develop more flawless ability with their instrument. They might get some enjoyment and satisfaction from it, but their real goal is to express themselves by improvising: assembling their own melodies, harmonies, and rhythms on top of the musical structure presented to them.

Real skiing (and riding), likewise, happens when you conceive and create turns in real time: assessing the snow and terrain ahead of you, imagining the turn you want to make, and then assembling the movements to produce that turn. How well you ski or ride is a matter of how well you conceive what you want to do and how well you pull it off.

This next video shows PSIA Alpine Team member Josh Fogg finding a line through changing terrain. He first skis across a shelf to a short drop, then into a gully, where he expects to find some cold, dry powder in the shade against the bank on his right. First, he sizes up the lower gully from the shelf by standing tall and directly looking far ahead. Next, because he can't see the snow or terrain on the drop until he gets right up to its edge, he makes his last turn on the shelf a short one, with a sharp finish just on the edge of the drop to scrub some speed and get a good look at what's below.

He makes the first turn on the pitch a short one, too, then plans two longer turns to get over to the shady side of the gully.

To accomplish these intentions and tactics, Josh uses a variety of techniques, coordinated in real time to produce the desired line shape and speed given the snow and terrain. He keeps turn shapes small and his speed in check by employing leg rotation, windup-release, and a couple of blocking pole plants. He applies extension in some transitions, flexion in others. And depending on the turn shape and placement in relation to the fall line, coordinates knee and hip angulation in varying ratios.

In the real world, you're often presented with situations that aren't amenable to any turn you might be asked to make in a cert exam, calling on you to put together something unique on the fly.



Josh Fogg's line in changing terrain.

Now watch PSIA Alpine Team member Mike Hafer ski through a steep section of large moguls. He has to adjust his line for some rocks in his intended path, so he sideslips the end of the preceding turn, then starts the one above the rock with a quick pivot and scrub – assisted by a blocking pole plant – to reduce his speed and move his line inside of the rocks.

He picks up more speed in the middle of the turn and is left with his skis pointing straighter down the hill at the bottom of the trough than his originally-intended line would have taken him. He adjusts by flaring his ski tails as he skis into the next bump and, again, plants his pole solidly for increased stability. “Textbook” turns? Hardly. Great skiing? Absolutely.



Mike Hafer in steep moguls

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doctors talk with a patient, they focus on what the patient can do to improve: taking medication or doing physical therapy, for example. Any medical explanation is delivered in the patient’s language, *not* the language doctors use among themselves.

Unfortunately, instructors often talk with students as if they are talking with other instructors. Technical lingo like “dorsiflexion,” “center of mass,” and “ground reaction force” is counterproductive and puts distance between you and your student. Alternatives like “ankle bend,” “your core,” and “the snow pushing on your skis” will connect you with your student. Few students are interested in sport science, physiology, and biomechanics, and not many benefit from understanding it.

But changing your vocabulary isn’t enough. Some explanation can be useful when you first introduce new movements to students. It’s not, however, what you want them to be thinking about when they’re skiing down the hill. Widely accepted research in motor learning over the past 20 years tells us that the most effective coaching cues – the things you want an athlete to think about when he or she is performing – involve *actions* the athlete can direct at concrete things outside the person’s body. Cues that focus attention on the athlete’s body – things like bending an ankle, moving an arm, or feeling pressure under a foot – fall far short of producing the results of ones that focus attention on something external; that is, the effect or desired outcome achieved by making the movement. The remarkable effectiveness of externally focused cues is explored within the OPTIMAL model of motor skill learning pioneered by Dr. Gabrielle Wulf. In *The Language of Coaching*, which draws heavily on Wulf’s work, author Nick Winkelman promotes a “coaching loop”

### Intentions Drive Tactics, and Tactics Drive Technique

Why do your students ski better when they ski behind you? It has as much to do with you showing them good tactics as good technique. The technique becomes easier once the tactics are right. Often, the skier’s body can figure out the technique on its own, without the conscious brain getting involved.

Our technique serves the purposes of our tactics, which serve our intentions. Putting technique – body movements and ski performance – first is like putting the cart in front of the horse. So, if the student wants to tackle more challenging terrain, stemming and skidding might be good techniques, even for a Level 7 or 8 skier. If a skier’s tactics aren’t in line with their intentions, that’s where to look for changes to prescribe. If the tactics are sound, consider technique.

### PRODUCING CHANGE: COMMUNICATING WITH THE SKIER

It’s appealing to think that once you use movement analysis to figure out things skiers can do to improve their skiing in ways that fits their interests, you just need to *tell* them what those things are and have them *do it*. But while movement analysis might tell you what a good change might be, it doesn’t tell you how to get the skier to *produce* that change.

You need to flip a switch both in *what* you talk about with students and *how* you talk about it. Put in academic terms, you need to move from the realm of *kinesiology* to that of *motor learning*.

Instructors doing movement analysis are like doctors analyzing a patient’s condition. Doctors talk with each other using concrete, objective, medical language. When good



Jenn Metz visualizes her line in the bumps, which is one type of external cueing.

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of describing, demonstrating, cueing, doing (performing) and debriefing. Winkelman emphasizes using verbal cues that focus the athlete's attention on actions involving external objects.

Fortunately, skiing provides us with plenty of external things to focus on. You can reach with your pole toward the *center of the next turn*. You can start your turn by pushing the *tip of your ski into the snow*. You can keep your *gloves* in front of you, where you can see them all the time. When you're about to start a turn, you can look at *the place you want it to end*, then draw an *arc with your skis* that takes you there. This might sound counterintuitive and even a bit silly, but it's borne out by the experience of high-level coaches around the world.

You can still talk about the why and wherefore of your prescriptions for change, but those discussions will bear more fruit if they address tactical outcomes more than body movements, and aren't on the students' minds when they're skiing down the hill. That's the time when those simple, external cues can exert their power.

### INTEGRATE TACTICS, TECHNIQUE, AND TEACHING WITH MOVEMENT ANALYSIS

Ready to reimagine movement analysis, put aside your personal biases about good skiing, and help students make good on their intentions? Broaden your view of movement analysis to see its place within, and connections to, the bigger picture of skiing and teaching (fig. 1). In essence:

- ▶ **Our intentions drive our tactics, which determine the techniques we use.**
  - ▶ Analyzing and evaluating tactics, particularly in light of the skier's intentions, is an essential part of movement analysis.
  - ▶ Ski performance and body movements – technique – must be evaluated by how well they achieve the skier's tactics and intentions.
  - ▶ Prescriptions for change in tactics are often more helpful than changes in technique.
- ▶ **Talking with the student – describing, cueing, and debriefing – is not part of movement analysis.**
  - ▶ Movement analysis provides a basis for cues and explanations, but the words must be in the student's language, not the instructor's.

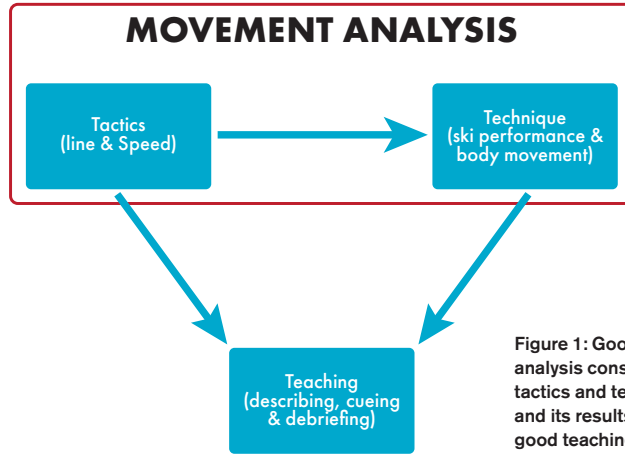


Figure 1: Good movement analysis considers both tactics and technique, and its results help drive good teaching.

- ▶ Performance cues should be succinct and externally focused.
- ▶ Tactics, because they inherently involve external elements, are often the best subjects of cues.

Understanding and integrating tactics, technique, and teaching are essential skills of a master instructor. You might notice that this article makes no mention of being a master skier. I consider that secondary, having known many great instructors who couldn't ski as well as

some of their students, and many great skiers who were mediocre instructors. The skills that are truly essential are within everyone's reach. **32**

A ski coach, instructor, and trainer for more than 50 years, **Ron LeMaster** is the author of several books on skiing, including *Ultimate Skiing*, and numerous magazine articles. He is a staff trainer in the Vail and Loveland ski schools, and contributes to educational materials for PSIA, USSA, and many other organizations. He thanks Carol Levine for her invaluable advice while writing this article.

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