

## Basic Turn Dynamics

### The Anatomy of the “Modern” ROUND Turn

#### What is “Good” Skiing?

What is a good, modern, round turn? Just what is good basic skiing? What is good advanced skiing? What are the basic defining characteristics? Both when we ski and when we watch others ski, what do we see when we say, “That’s good skiing?”



At the most basic level, we should at least look for or feel the following:

1. **Continuous total motion** - Flexion/extension, bending/unbending in continuous movements while in motion. Flexion/extension matches the turn shape, size and speed. This encompasses stance, balance, alignment in **continuous total motion**.
2. **Guide and direct upper body as actively as lower body** - Aim your upper body towards the apex of turn as you guide and steer an edged ski throughout the turn, remaining stacked and balanced against the outside ski. (For lesser dynamic turns, the ski may be partially or totally skidded.)
3. **Blue angel effect** - Tipping and turning of the skis occur simultaneously, they are synergetic; they work together to create their own energy or dynamic.
4. **Accurate/disciplined pole use** - Pole use is one of the components that work dynamically with flexion and extension. It facilitates the timing and coordination of the upper body with the lower body for accurately guiding the skis throughout the turn.

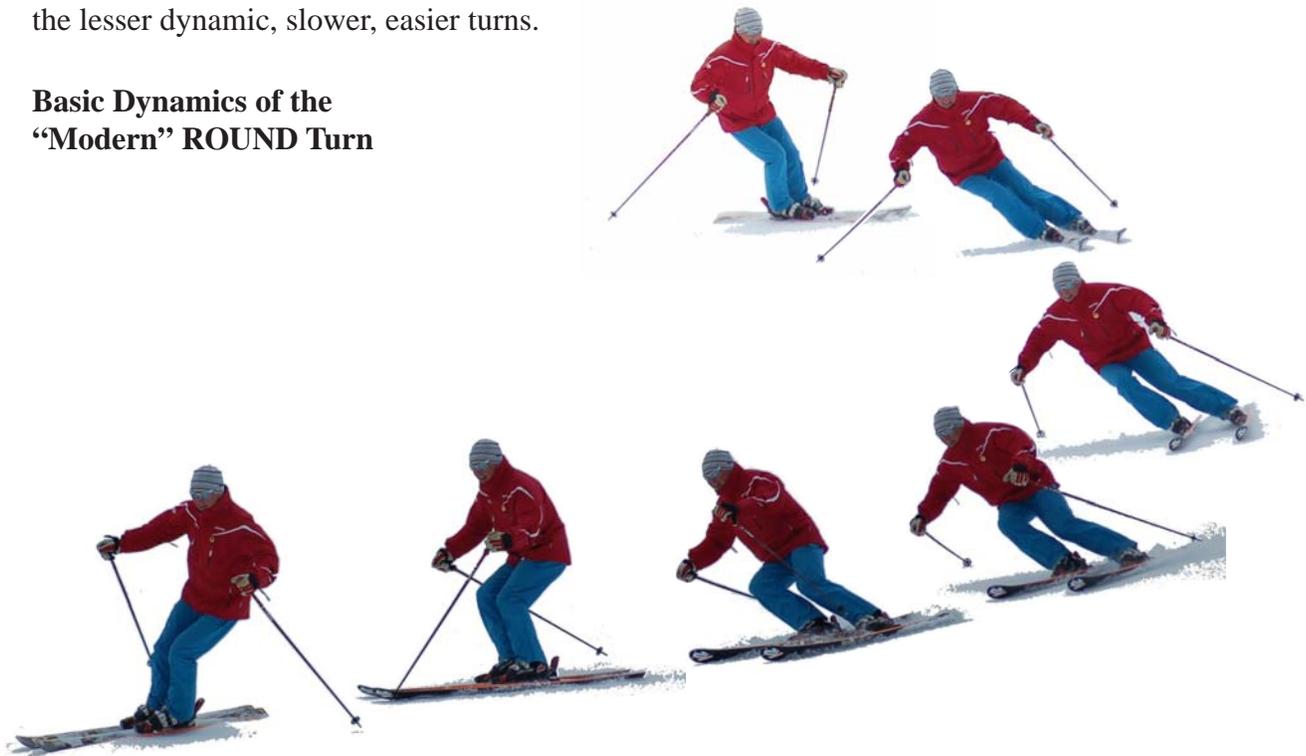
That may sound nice, but what exactly do we mean? How do the above concepts apply to the basic dynamics of a turn?

In science and math, before there can be any profitable discussion, we must first make certain that we are speaking the same language and have assigned the same meanings to our words. We

must first define our terms. Therefore, before we describe a basic turn in skiing, let's first define and discuss some characteristics and concepts that we will use to describe turn dynamics. We will then describe these characteristics as they progress throughout a turn. The intent is that by the end of this discussion, you will have a more clear understanding of how a modern round turn is made. So, please bear with us as we will be about as detailed as can be, in an attempt to be as clear as possible.

Please do not be intimidated by the more advanced photos that are used in the illustrations. It is easier to see the movements when they are more dynamic, however, the same concepts apply to the lesser dynamic, slower, easier turns.

### **Basic Dynamics of the “Modern” ROUND Turn**

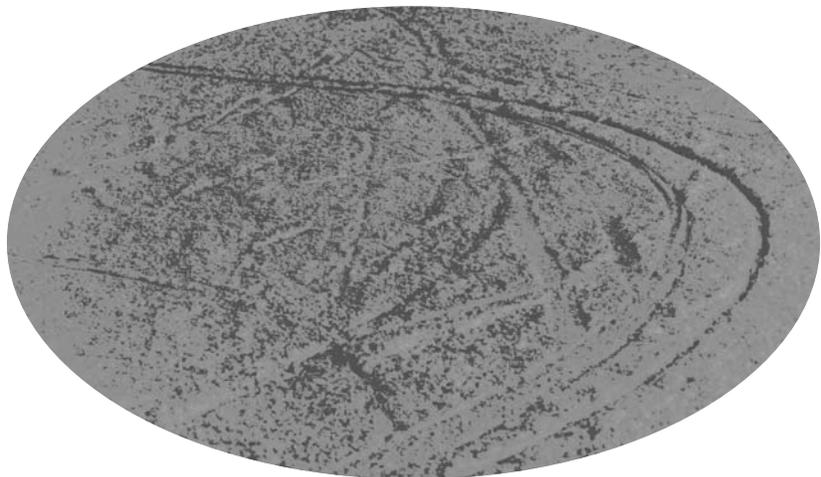


A turn is created by a progression of movements of the body which effect the skis which then interact with the snow.

A turn obviously is dynamic and not static.

All the movement patterns are continually moving and changing. We should not assume a position, hold it, pause and then move to the next position. Instead, think of continually flowing and moving and dancing; i.e.

**Continual Total Motion**



Following is a summary of the terms and concepts that we will describe in simplified detail. These are the important concepts we must understand first, in order to understand the dynamics of a basic skiing turn.

Skiing is all about physics and managing the real world around us - and oh, is it ever fun.

In 1975, the National Demonstration Team, Professional Ski Instructors of America (PSIA), introduced the Skills Concept. The skills concept describes skiing dynamics as various blends of four basic skills; balance skills, edge control skills, rotary skills, and pressure management skills. These are skills in how you use your skis, your tools or rather toys, that make skiing so much fun. You tip your skis, you turn your skis, you weight or unweight your skis while you stay in dynamic balance and sail down the mountain having fun.

We will elaborate on these skills and show how they are blended and used during a basic turn. Following is a summary of skill blends that will next walk you through in detail.

- ✿ 1. Stacked and balanced against the outside ski - Balance is all about the timing and the managing of “turn” pressure using the forces of gravity and your muscles and bones. Anticipation is critical to balance; i.e. moving proactively. It is imperative to understand your body, how it inclines relative to the turn forces. It is imperative to understand your feet, where the pressure comes down through your shin bones into your feet. It involves not only steering and guiding your legs, but also steering and guiding your upper body; all to stay stacked and balanced against the outside ski in continuous total motion.
- ✿ 2. Steering/rotary movements of your skis are always in harmony with edging movements; i.e. the “blue angel” effect.
- ✿ 3. Bend/unbend, flexion/extension *continually* help immensely with dynamic balance. The direction of bending/unbending, “fore/agonally” is important.
- ✿ 4. “Thigh over” then “shin drive” is a very functional and helpful concept when directing your body how and when to move.
- ✿ 5. Edging of our skis should always be continual and progressive.
- ✿ 6. Pole swing should be continual and not static. It is a timing tool used to coordinate our motion helping to keep us in dynamic balance.

It is our hope, that better understanding of the dynamics of skiing will help you improve your own skiing and lead to even more enjoyment of the sensations. Skiing is such an incredibly great feeling.

## Basic Concepts and Terms

1. **Stacked and balanced against the outside ski** - this is the basic body to ski relationship. The only time our body is not balanced against the outside ski is at or near edge change where we are balanced over both skis equally.



When discussing balance in regards to the skis, it is important to understand the forces that effect **pressure** during a turn and how we distribute that pressure between our two skis. Dynamic physics explains how, using gravity to move your body weight through time and space and then trying to redirect it, will create “**turn**” **pressure**. We need to manage this pressure and still stay in balance over the skis. We have no choice but to distribute this pressure of our turns over our two skis.

Most of the time in a turn, we will choose to balance with more pressure against the outside ski. We can change that pressure distribution very much in the same way as we walk. For example, if while standing on two feet, we start to move as if we were going to pick up one foot, more pressure is placed on the other foot. Same with skiing. Relaxing the muscles in one leg will cause us to have to balance more over the other leg and there will be more pressure on that foot. A good skiing exercise is to make long, round turns and play with this lateral pressure management. Soften one leg and then the other. Push down harder on one leg and then the other. Soften or push down harder on both legs. Vary where in the turns you try these.

A key to balance is **timing**; i.e. when should we begin transferring more pressure or weight from the outside ski to the inside ski. Some people refer to this as lateral pressure management, but that is a confusing term that has different meanings for different people. Simply put, I prefer to use foot-

to-foot or “up one leg and down the other” or simply “weight transfer”. A popular descriptive term now is “**early**” **weight transfer**. This timing is critical to be able to set up for the new turn. This timing is also critical in skiing certain terrain and conditions successfully. Many skiers do not actively transfer their weight or soften one leg to begin moving onto the other. Many skiers



simply wait until after the fall line for the pressure of the turn forces to transfer the pressure to the outside ski. This is too “late”. The skill of pressure management is normally one of the most difficult skiing skills to master. **Pressure management needs to be active and accurately timed.**

The total pressure of the turn forces will, of course, relate to speed, size and shape of the turn, however, you can also play a bit with choosing when and where to distribute those forces by using techniques such as rebound and retraction. For rebound, you load up the bottom part of the turn so you have some rebound to “pop” when you release your edges. For retraction, you flex by pulling your feet towards your body at the bottom part of the turn. This decreases the pressure at that part of the turn, in other words, it makes it “lighter”. On ice, this is really helpful.

The other part of being stacked and balanced is that **the more you can stack your bones** to deal with the turn forces, **the less muscle energy** you will need to use to stay balanced. This is especially useful to remember if you are either tired or old or injured. Through the years, there have been various “techniques” or “positions” that were popular, even though often times ineffective. Some were useful with the old straight skis. However, for the new skis, think of staying stacked to stay balanced. One older “position” that has been making a come back recently is to tip your upper body outwards over your outside ski. This is not a position of strength. You are not stacking your bones to the turn forces. You will have to use your muscles more to stay in balance. Another “position” is to rotate your hips into the hill. Again, you will not be in balance.

Also, if you are sitting back, you will have to use a lot of thigh muscles to hold yourself up. Instead, simply think about **stacking your bones** over your feet and being inclined in relation to the turn forces. You can do this both while extended and flexed. Depending on where you are in the turn, you will need to be inclined more or less to stay stacked and balanced. Think of the amount of edge angle your skis need to have to hold you up, then line yourself up with the attitude that your boots are and stay stacked and inclined to balance against the skis. Often you hear people talk about staying level, keeping their shoulders level. **Level to what?**



Some then say level to the horizon, others say level to the slope. When you examine photos and

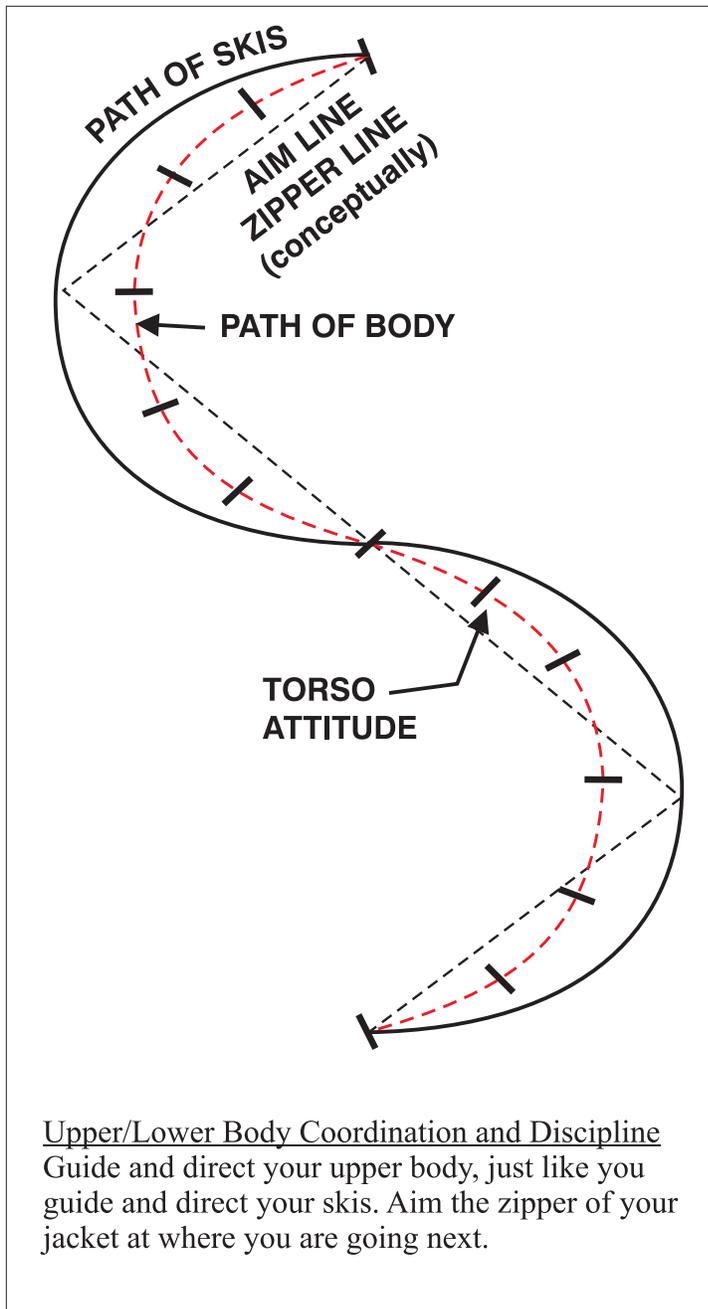


videos of the really good skiers, you see that their shoulders are seldom level to either the horizon or the slope, or any other static reference plane. They are always dynamically moving, tipping, inclining as related to the “outside” world. However, if you consider their “inside”, dynamic world, they are always balanced, stacked, inclined relative to the forces of the turn. You might say that they are always “level” relative to the turn forces; i.e. as their skis are appropriately edges to sustain the arc of their turn, they are “level” to their skis.



In considering stance and balance, it is also important to understand how your feet are in your boots. Do you stand in your boots with more weight on the balls of your feet or your heels or your arches? Let’s see what happens when you try to stand on the balls of your feet. Stand on the balls of your feet. Now try to flex your ankles. It’s hard. Your feet and shins do not work so well with your weight on the balls of your feet. Similarly, you do not want to put your weight on your heels.

If you examine a skeleton, you will notice how your heel is actually quite long and sticks out pretty far behind your shin bone. Since your body weight is being transferred down through the shin bone, you will be better balanced when you take that weight primarily where it comes into your foot. You can then distribute it over your foot as you move. In skiing, it seems to work best to imagine where your shin bone is connected to your foot. So think of **the arch near the forward part of your heel as being the center for your stance**. You can tip the shin bone forward as needed, you can roll your foot side to side and tip the shin bone sideways. When you are skiing and stacking your bones, stack them over your feet at that main point. You will learn



to recognize that as a sweet spot, especially through the arc of a carved turn.

One last discussion we need to have when considering stance and being stacked and balanced is the old friend, counter. **Counter** is what we used to all be hung up on when we would discuss skiing posture as if it were a static subject. We would assume the position and face downhill, to varying degrees. Facing downhill is another old sacred cow that we need to put out to pasture. With the new shaped skis, why would you want to twist yourself up and face downhill? We now ski much more squarely to our skis and face where we are going next. I like to think in terms of **aiming the zipper of my jacket where I am going**. In large turns, that will mean that we are very square to our skis; in short radius turns, we will indeed be facing more down the hill. So, in “modern” skiing, counter is not some position or attitude that you need to pay much attention to and try to achieve. If you think of staying stacked and balanced against your outside side and moving fore/agonally with your skis as

you turn, with the appropriately timed pole swing and extending, you will be fine in the “counter” department, so don’t lose sleep worrying about it.

Another old and popular phrase is also the “quiet upper body”. In fact, when you observe a good skier, who is very smooth and whose upper body appears quiet, it is the result of “**upper body discipline**”. He is not holding his upper body “quiet”, rather he is very actively guiding and directing his upper body,



just as he is guiding and directing his feet. This is keeping him balanced and moving with his skis.

Nevertheless, the number one overriding factor to consider when making turns is to stay **stacked and balanced against the skis** and to manage the pressure of the turn forces to maintain that balance dynamically.



**2. Steering/turning skis/rotary movements** - For a typical, modern turn, all steering needs to be smooth and progressive. Of course, the rate and degree or extent of the rotary movements will be determined by the desired turn shape and size as well as the speed, terrain and conditions.

It is important that the **steering movements always are in harmony with the edging movements**. Edging and steering work together. With modern skis and turns, we steer edged skis. With the older equipment, many average skiers would first flatten the skis, then turn or steer their

skis, and then edge again. A few of the more athletic better skiers actually carved on those long straight skis. With our new skis, many people are learning to steer their edged skis and “carve” turns. It’s an exhilarating and fun sensation to steer the skis while they are on edge. P.J. Jones refers to as the **“blue angel” effect**; it is exactly what the jet pilots do to turn their planes - tip them and turn them at the same time.

One of the most important steering movements to master is to learn to continue steering the skis in an arc across the hill and **“finish” or “round out”** the turn. It is quite common to see people steer only their skis immediately after the fall line and then simply stop steering, never really completing the turn. This is fine if you want to continually increase your speed with every turn, however, when you are using turn shape for speed control, you need to keep steering your skis across the fall line to control your speed. There is an older technique called virage avale which is a pre-turn up the hill before turning down the hill. This helps even more when you want to use turn shape for speed control; you complete your turn so much that you turn up the hill before you roll to your new edges and begin your new arc.

Smooth, progressive steering is what you want to strive for, in most turns. A good practice drill for this is to go to a gentle slope and make various size turns paying attention to your edges and steering them in the roundest arcs you can.

**3. Bend/unbend or flexion/extension** - While turning, we are always bending or unbending. We should never be static. **Always bending or unbending will help immensely with dynamic**



**balance.** It will also keep your muscles from getting tired by tensing them to hold a position or posture. We used to refer to this as going up and down. We still go up and down when we are making slow turns, however, the more we speed up, the more we need to move in the direction of the turn to stay in balance. We now describe this as extending forward and diagonally into the new turn or “**fore/agonally**”. The direction of this extension is how we stay stacked and balanced during the turn. When we move fore/agonally, we are stacked, balanced and inclined. We flex or bend in the same alignment, staying balanced against the outside ski.



4. “**Thigh over**”/”**shin drive**” - This description is actually part of the bend/unbend or flexion/extension movement pattern. However, we will make special note of it in describing a turn because it is a very effective descriptor to have in your head that will help you improve your turning movements. In describing movement patterns during a turn, we will describe moving the thigh over or driving the shins. This is an effective way to describe what body part to move in which direction and when to move it, to make a turn. As you begin to direct your skis down the hill and toward the fall line, we will discuss moving the thigh over in the direction of the turn. As you are moving fore/agonally into the turn, think about moving your thigh over as you extend. Moving your thigh over at the top of the turn, helps in your extension and makes your thighs move into a more vertical position.

After the fall line, to help manage pressure and increase the edge angle of the skis, we will discuss driving the shins. Driving your shins both into the hill and forward to help edge more, is at the same time in the turn where we flex or bend. Thinking of “shin drive” works well with thinking of flexing. Both “thigh over” and “shin drive” all work with thinking of stacking the bones and balancing against the outside ski. (I hope you are starting to understand and see how we are choosing characteristics and patterns of turns that are intertwined and build on each other.)

So, start a turn thinking “thigh over”, and then, as the pressure builds in the bottom of the turn, think “shin drive” - and start moving to the next turn already.

5. **Edge angle** - We will be describing the edge angle of the skis. Since the boots are connected to the skis, and since our feet and ankles are in the boots, edging the skis means how we move our feet inside our boots and how we move our shin bones. Stand in your ski boots and feel your feet. Earlier we described the center, or where your shin bone is attached to your foot at the back



part of the arch just in front of the heel. Stand there. Now that you are standing centered in your boot, consider how you move your foot to edge the boot and the ski. We start with a much stronger position if we first begin to edge by moving our foot inside our boot. You can start to roll or articulate your foot inside your boot. Depending on how tight your boots fit, you will have either a little or more movement. As you roll one foot inwardly and the other foot outwardly, eventually the ankle bones and shin bones hit the shell of the boot and then the whole boot will begin to roll. Then, as we drive our shins further, we achieve a higher edge angle. That is how we should be moving to edge our skis. Of course, we are also still keeping our bones stacked and balanced.

**Edging of our skis should also always be continual and progressive.** We do not want to simply jamb the skis from one extreme edge angle to the other. We want to smoothly and continually either edge them more or less. This edging also needs to be balanced with rotary or steering as we previously discussed. Think of steering your skis onto an edge and then continuing to steer an edged ski. This progressive steering/edging begins with the feet and then progresses to the rest of your legs and body as they are connected.

**6. Pole swing and touch** - Pole swing should be continual and not static or stop and start. In “old-fashion” skiing, we used to have a pole plant on edge set at the bottom fo the down. Now we perform a pole touch on edge release, on the extension. The movements and timing of the movements of pole usage are coordinated with all the rest. It helps to mainly connect the pole usage movements to flexion and extension or bending and unbending and moving fore/agonally into the turns. Again, use of the pole is a timing issue that aids in balance and continuous total motion. It is coordinated with all the blended skills, rotary, edging, pressure, balance.

## Description of The Basic Turn

Now we are ready to describe what is happening at the various parts of the turn. Basically, you are **steering-edging-unbending-thigh over-fore/agonally, then steering-edging-bending-shin driving-riding your skis and back to steering-edging-unbending-thigh over-fore/agonally**. We will describe a more carved turn as opposed to a skidded turn. However, the movement patterns are the same for a skidded turn, only a little less edge angle when it is balanced with the steering or rotary movements.



**Point 1:** At about 2 o'clock (or 10 o'clock) in the turn, just before the "apex" or outer most part of the arc - you are at the point of full extension. I often think of this as the relaxing part of the turn. If my thighs are tired, I try to make this part last a little longer so they can breathe. I also inhale at this part of the turn. Your edges are engaged and slicing. You are steering an edged ski. There is some pressure, but not a lot, however, you are stacked and balanced against the outside ski. You have already moved your thighs over in the direction of the turn and now you **standing tall and moving with your skis**. You are already steering an edged ski in a round arc at the top part of the turn. Your steering is not abrupt, but rather balanced with the edging movements - nice, and round. As you approach the apex of the turn, the turn pressure begins to increase and your inclination will also increase in order to stay stacked and balanced against the outside ski.



**Point 2:** Apex of the turn - The forces of the turn are increasing the pressure that needs to be managed. Edge angles are now higher, you are stacked and inclined more, balanced against the outside ski with the pressure on that ski increasing, you have a longer outside leg and more bent inside leg. Around this apex point is where you are beginning to flex and drive the shins more forward and into the hill to maintain the round carved arc of the turn.



**Point 3:** 4 o'clock (8 o'clock) or after the apex of the turn - You have even a higher edge angle and are driving the shins; you are still stacked and inclined, only shorter, balanced against the outside ski; here is where you have the maximum turn pressure, however, you are already beginning to move to the new outside ski, **beginning to redistribute the turn pressure from your outside foot to your new outside foot for the next turn**; here is where you are already beginning to swing the pole for the next turn;

you are also possibly retracting or pulling your feet more towards your body for pressure control. This is a very intense and active part of a turn. It is the **beginning of transition/finishiation**.



**Point 4:** Well into transition or finishiation - You are continuing to set up for the new turn by beginning to move fore/agonally; you are stacked, but less inclined, you are decreasing the edge angle of the skis while still moving more to the new outside ski, however, there is still more pressure on the current outside ski and you are balanced against it, **your pole is swinging out fore/agonally towards next turn**.



**Point 5:** End of transition or finishiation - This is the fleeting moment that you pass through, leaving one set of edges and going to the next; if you indeed did finish your turn, your skis should be heading just about across the hill or possibly pointed even a little up the hill; you are stacked and fairly level, not inclined, **balanced about 50-50 over both feet**; inside your boots, you feel your feet beginning to roll across to engage the new edges with your ankle bones about to press against the sides of the boot more as you begin to move your thighs over toward the new turn; your pole touches the snow on the way back from its maximum point it was swung out. This a very active part of the turn, but does not feel as intense.

Note: One currently popular fad is to advise people to “pause” or ski on a flat ski at transition. This is not advisable. You do have flat ski for a millisecond, but you do not want to think about it or linger there. Instead, think about your skis moving across the fall line, and still aimed across the hill as you begin to edge them with your feet as your thigh is moving over. You need to make sure that you begin steering your skis only as you begin to edge them and that the steering and edging are balanced. You are steering an edged ski and both edging and steering are very progressive.

**Point 1:** Full extension/starting point again. Smile and repeat.

The above description is all derived from the world wide accepted model of skiing skills, the “Skills Concept”, introduced by the PSIA National Demonstration Team in 1975: Balance, rotary, edge, and pressure control.



**Point 1**

Tall, stacked, moving with skis



**Point 2** Apex - turn pressure, edge angles increasing.



**Point 3** Shin drive, higher edge angles, begin to gradually pressure a bit more "new" outside foot.



**Point 4**

**Point 5** 50/50, edge change, pole touch. (Flat ski for 1 millisecond.)

**FINISHIATION/TRANSITION**

Begin to swing pole and begin to move thigh over fore/agonally.

**Point 1**

**Point 2**



**Point 3**

**Point 4**

**Point 5**



**FINISHIATION/TRANSITION**

