MODERN RECREATIONAL SKIING

TECNIQUES FOR TURNING MODERN SHAPED SKIES, FROM MOUNT SNOW LESSONS AND OTHER SOURCES, WITH SEVERAL ADDITIONAL SKI RELATED TOPICS

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WHY YOU WANT TO SKI WITH THE PENINSULA SKI CLUB

First off you might ask, why should I even consider skiing? For starters, it's an invigorating and exhilarating outdoor activity. If you appreciate nature, the scenery can be utterly breathtaking. Because skiing requires your full attention, in other words being fully in the moment, it is a great escape from daily worries and pressures. Another bonus is that to enjoy skiing you don't have to be able to fly down double black diamond steeps or smoothly ski down monster moguls. It is fun whatever your skill level. It is even more fun when done with others with similar ski ability and interest. Club trips normally offer several ski areas to choose from each year and you avoid the hassles of arranging for rooming, transportation and lift tickets. These are a few of the reasons why you should join the Peninsula Ski Club (PSC) and come ski with us.

I can say from first hand experience that all of the PSC trips offer you the opportunity to both enjoy the wonderful pleasures of skiing, with normally someone on the trip beings at your current skill level. In addition, you will get to socially interact with as nice a group of people as you will ever meet. You will no doubt enjoy any PSC trip. However if you are reading this, you are likely interested to learn how or improve your skiing. If that is the case, you might want to consider a weeklong trip that includes five days of ski instruction in its package. Whether at Mt. Snow or elsewhere, five days of professional ski instruction with feedback will help you update and improve your ski technique so much more than taking sporadic one-session lesson with no follow-up, which unfortunately is what many recreational skiers end up doing.

Skiing enthusiast will appreciate that the PSC has a tradition and emphasis on ski technique improvement that was started by the club's past, widely attended annual Mount Snow ski week trip with its five days of lessons. While the PSC has a number of appealing non-ski and off-season activities, skiing has always been and remains the central focus of the club. Another factor that adds to this focus is that we are lucky to have two PSIA (Professional Ski Instructors of America) Level II Certified Instructors in our membership. They are Jim Colbert, who founded our club, and Cathy Margiotta, who now offers ski lessons on many of our trips. Hopefully this article will add to the skiing proficiency focus of the club and be helpful in your quest to improve your skiing.

Although this article is obviously directed toward skiers, any trip with ski lessons also includes equivalent riding lesson for you boarding dudes and dames. If you enjoy the fun, excitement and challenge of running gates in a ski race, then you can participate in an arranged club racing events, as has been done on past trips, or in the recreational NASTAR races available at most ski resorts. The assortment of PSC trips put together by our Ski Trip Chairman and our Trip Captains will enable you to satisfy your "ski" or "boarding thing" whatever that is. Skiing with PSC is where it's at.

THIS SKI ARTICLE'S INTRODUCTION AND BACKGROUND

This article has been a slowly evolving process. It started way back with the Peninsula Ski Club's March 1999 Newsletter. There I published some of my notes and perceptions of carving technique from instructor Bill Rolya's advanced, ski-week class, as part of trip captain Jim Colbert's PSC club trip to Mount Snow that year. Because that

trip was my first skiing after an absence of about 10 years, I started the class with my old, long, narrow skies and using the traditional, narrow stance, parallel Christie technique, which I had learned many years earlier. Thus began my transition to carving turns with modern shaped skies. I have been fortunate to have had Bill as my ski-week instructor for several later club trips. Notes from Bill's on-slope instruction and material from videos he recommended are the foundation for a good deal of my carving technique material in this article. To justify and help explain carving technique, I have added some graphical analysis of the role skiing forces play in carving turns (the engineer in me), as well as my understanding of modern carving, and some ideas I have found helpful from other skiing videos, magazines and books. I have tried to incorporate the "why it works" as well as the more traditional "how to do it" instructions.

Modern American recreational, carved skiing has borrowed heavily from techniques used by pro ski racers, who are considered to be among the world's best skiers. Ski racers use edge-to-edge carving to produce quick and precise turns around the gates on their steep and icy racecourses, while still preserving their speed and control. The ski carving technique discussions in this article all focus on wider-track carving now taught in U.S. ski schools. By carving I mean making turns by edging modern skies instead of by foot steering and skidding. By wider track I mean having feet about hip-width apart.

Bill Rolya's Mount Snow ski lessons very professionally covered the essential features of carving turns. However, he didn't approach it the same way this article does. I begin by graphically representing the forces acting on you when skiing, and then describe how specified lower body movements are timed to interact with these forces in the construction of relaxed, basic-level carving turns. I called this technique "skiing-with-the-force." Sections 1.1, 1.2 and 1.3 describe in some detail the various aspects of this so-called "skiing-with-the-force" technique. If you are new to carving, this is where I recommend you first direct your attention. That technique will introduce you to how specific lower-body movements interact with the skiing forces to edge your skies, and how alternating your edging from side to side will carve successive turns. For those who have the skiing proficiency and interest in working on higher performance, Section 1.4 goes into more advanced carving with quicker edge and direction change.

While carving is the most efficient and exhilarating way to handle the groomed slope conditions that a majority of U. S. skiers, spent their time on, you should be aware that there are recreational ski situations that are best handled by other techniques. This article covers three such recreational situations and their related techniques. The first is Section 3.1, which discusses conditions where some foot steering and skidding are recommended for slower and more cautious skiers, as well as slope situations where this technique must be used even by advanced skiers. The second is Section 3.2 for bump or mogul conditions. The third is Section 3.3 for deeper-unpacked or powder-snow conditions. The more options you have in your skiing tool kit, the better equipped you will be to handle all the different mountain conditions you might encounter.

If you are a "never been" or a "newly started," skier this article's ski technique material will be of limited use to you. While there exist printed instructions for beginners, that is not my objective here. I think getting novices started and skiing under control is best done with on-snow instruction and then putting in adequate slope time to get

comfortable and confidant. The technique lessons are intended for skiers who are going from wedge to carve turns or who now make their turns by foot steering and skidding.

My goal in the technique instruction sections is to give you enough information to start applying these techniques to your skiing. Hopefully this material will arouse in you an interest in improving your skiing skills by careful reading of this and other written material, watching ski-instruction videos or taking on-slope lessons with direct feedback from certified, professional ski instructors. My hope is that the ski technique material in this article's will assist you to eventually become a competent all-mountain skier. At the very least, it has the terminology to help you profit from conversing with more advanced skiers, who are usually very open to listen and give feedback.

To help you get the most out of your skiing experiences, I have expanded the article, into more than the carving ski techniques discussions of Section 1, by adding eight sections on ski related topics. Those additional sections, with their corresponding section numbers, are: (2) a few basics of recreational ski racing; (3) descriptions of alternate techniques to wide-track, pure carving and the corresponding conditions for their use; (4) what to consider when getting your own ski boots; (5) ways to keep your hands and feet from getting chilled; (6) a discussions on how breathing and relaxation can improve your skiing; (7) a simple technique to reduce exposed rock damage to your ski bottoms and edges; (8) some simple, at-home pre-season ski exercises to improve your on-slope strength and endurance; and (9) useful information to cope with potential altitude sickness and dehydration when skiing above 7,000 feet (2,134 meters).

SECTION 1 – CARVING YOUR TURNS ON MODERN SHAPED SKIES

1.1 Basic Body Movements And Pulling Forces To Carve Your Turns

1.1.a Introduction To Basic Lower Body Movements That Take Advantage Of A Shaped Ski's Characteristics To Carve Your Turns

Because of its sidecut, when any moving ski is tilted or put on edge with pressure applied at its center, that ski will bend and carve a circular arc in the snow. This is the technical basic of carving turns. The greater is a moving ski's sidecut, the smaller will be the radius of its circular arc when edged or tilted. Thus, a modern shaped ski is capable of carving a much tighter circular arc turn than the traditional long and narrow ski. This is what makes turning by carving practical for recreational skiers.

The ski technique, to carve successive turns with shaped skies, essentially consists of properly timed lower body movements, which remove then apply pressure to the skies in coordination with alternately edging those skies from side to side. The next Section 1.2 will first describe in some detail a relaxed, fundamental technique for you to start carving your turns. Later Section 1.4 will describe more advanced, higher performance carving techniques to more quickly change your edges and make quicker turns.

The most biomechanically powerful and efficient movement, to tilt or edge your skies, is to rotate or twist your thighs so their femurs (thigh bones) rotate at their hip joint, with your knees and ankles flexed some. Note, this is more than just moving your knees

across laterally, it also includes rotating or twisting your thighs. Tilting your feet by twisting your thighs, will strongly edge both skies into the snow, on their sides that you have twisted and rotated your thighs to. You can easily test this by rotating your thighs, while standing with knees and ankles flexed and with your feet about hip distance apart. Done with street shoes you will feel the pressure increase on the sides of your feet that you have twisted your thighs to. On the slope, increasing the bend of your knees and ankles will increase your feet's and skies' edging when your thighs are rotated. The snug fit and height of today's ski boots and their lateral stiffness will mechanically enhance this feet and ski edging effect. Take note and remember this rotation of your thighs movement to tilt your lower legs and feet. It is your body's strongest mechanism for tilting or edging your skies for carving and plays a major role in this article's techniques for carving turns. Section 1.5 contains more on why you should use thighs tipping and twisting or rotation, to edge your skies, when carving your turns.

While in a ski turn you exert some pressure on both skies, but you put the heaviest pressure (about 80 %) on the center of the outside-of-turn ski. You do this by extending your outside-of-turn leg during a turn to resist and balance yourself against the skiing sideward pulling forces on your body. If you retract that outside leg, you take the pressure off of the outside ski, thus ceasing, with the outside leg, to push back against or resist the forces that are trying to pull your body downhill and toward the outside of the old turn. When you mostly stop resisting those forces, the obvious result is you get pulled in the direction of those downhill and outside-of-old-turn pulling forces. If you properly time and sequence the three lower body movements just discussed (outside-of-old-turn leg retraction, thighs rotation, and then outside-of-new-turn leg extension), you can terminate the current turn you are in and generate a new carved, oppositely-arced turn down the slope. What you just read was an extremely brief sneak preview of the coming attraction, namely the fundamental, "skiing-with-the-force" carving technique that will be much further described in Section 1.2.

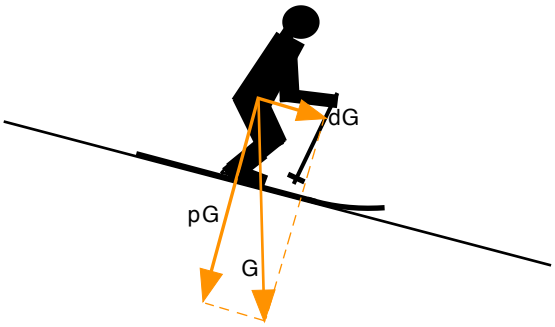
My goal is to have you learning to carve turns be a relatively straightforward and simple process. The approach utilizes the better carve-turning characteristics of modern shaped skies and the three leg movements (just discussed), which, at specific points in a carved turn, are timed to react to the skiing pulling forces (about to be discussed). I call it carving turns by "skiing-with-the-force." We could easily get carried away here with "Star Wars," Jedi analogies, but I leave that up to your vivid imagination. This technique is a fairly straightforward approach to learning how to use the carving capability of modern skies to make your turns.

1.1.b Pulling Forces Acting On You When Skiing

Given what was just said, do you want to know what are the pulling forces acting on you when you ski? The answer is yes if you are someone who not only wants to know what you must do to carve turns, but also wants to understand why you are doing so. Readers, if the underlying physics doesn't interest you, that is if your eyeballs glaze over at the mere mention of any graphical manipulation of force vectors, then skip the following skiing forces discussion and go directly to the how-to instructions of Section 1.2. I don't want to lose you so soon.

When discussing the physics of skiing, we focus on three specific pulling forces that act on you when you ski. One force is perpendicular to the slope and the other two are lateral pulling forces. A lateral force is one pulling outward from your body and parallel to the slope. As we shall shortly see, interacting with the lateral pulling forces plays a major role in making skies turn. Identifying the pulling forces, and understanding how to use them to carve your turns is where we are heading. After defining those skiing pulling forces, we will in Section 1.2 describe how and when you interact with them, when using the 'skiing-with-the-force" carving technique.

When skiing, the physical gravity force constantly pulling on you is displayed graphically in the following figure as a vector **G**, which has a pull direction that is from your body's C.G. (center of gravity) toward the center of the earth, and has a length that is proportional to your body's weight. The more you weigh, the stronger is the pull of the gravity force **G**. For ease of analysis and discussion, we can decompose that physical gravity force vector **G** into two mutually perpendicular component gravity force vectors, which must be equivalent to or sum up to **G** in vector addition. One gravity force component is parallel to the snow's surface, the other is perpendicular to it. These are shown in the following figure. One is the lateral pulling force of gravity component **dG**, which always pulls downhill, parallel to the slope. This is true regardless of where the skier is facing when stopped or when moving directly downhill, moving diagonally across the slope, or moving perpendicular to the fall line. The other gravity force component is **pG**, **which** is perpendicular to the slope.



Pull Of Gravity Force Components

The vector forces **dG** and **pG** are two of the three forces you feel pulling on you when skiing. If you change the pitch angle of the slope, the values and absolute directions of both **dG** and **pG** will change, but in vector mathematics they will still always sum up to the original physical gravity force **G**. Our on slope experience, as well as graphical analysis, tells us that when the slope pitch steepens, the downhill gravity component **dG** increases and the perpendicular-to-slope gravity component **pG** decreases.

The perpendicular-to-slope gravity force component **pG** pulls the ski bottoms directly into the snow to create ski base-to-snow friction, which slows or stops forward speed. Note, that for a fixed slope angle, the directly-against-the-snow gravity force **pG** will remain constant, whether you are moving or not. This means your perpendicular-to-slope leg push required to offset only the pull of **pG** is unchanging in strength and in direction, for a given slope pitch, as long as you are balanced and upright.

Whether you are moving or not, you always feel the lateral downhill pull component of gravity **dG** when on a slope. How about when you are moving, or more specifically when moving in a circular turn? As said earlier, because of its sidecut, when any moving ski is tilted or put on edge with pressure applied at its center, that ski will bend and carve a circular arc in the snow. We are all familiar with the pull to the outside of a curve we feel as a passenger, when in a car traveling around a sharp curve. A skier riding a set of skies, that are carving a turn, experiences the same pull to the outside of the turn.

From physics we know that to get and keep a body in circular motion requires a force acting on the body toward the center of the circle. That force is called a centripetal force. When you whirl around a weight attached to a string, the tension in the string pulling on the weight is the centripetal force. When a satellite is in orbit around the earth, the centripetal force is the earth's gravity force pulling on the satellite. When a skier arcs a turn, the centripetal force is the lateral component of snow pressure along the bottom of the angled ski, which is toward the center of your turn.

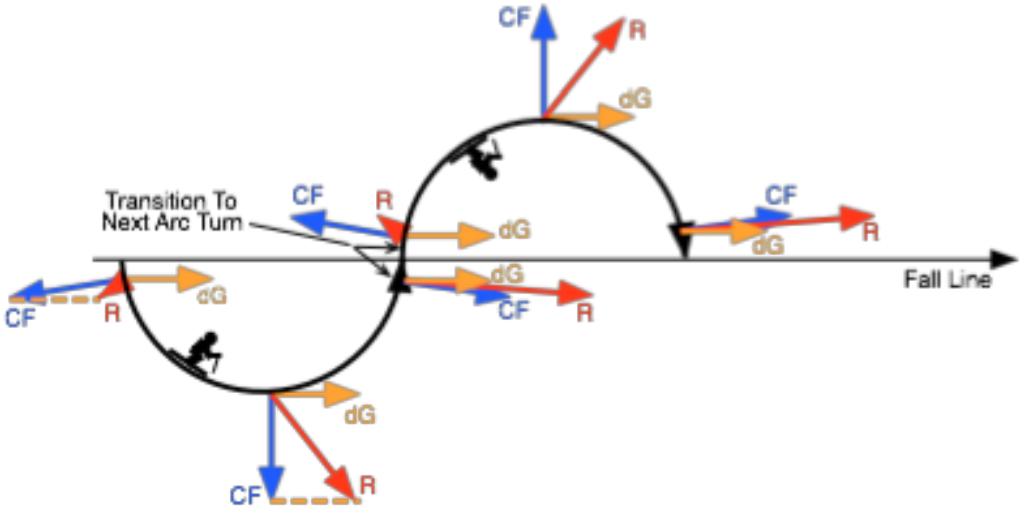
To keep a body in circular motion from being drawn toward the center of the circle by the pull of the centripetal force, it would appear that a direct reactionary force of equal magnitude and in the opposite or outward direction is required to act on the body. This apparent reactionary force is called the centrifugal force (**CF)**. In reality there is no such direct reactionary force. Without going into more detail than desired here, the appearance or pulling feeling of this outward so-called centrifugal force, acting on a body in circular motion, is actually the result of the centripetal force interacting with the body's inertia, which is constantly trying to keep the revolving body in a straight line that is tangent to the body's circular path. It is more straightforward and easier to assume the existence of a reactionary centrifugal force **CF**. This is what we will do in our discussions.

Assuming the centrifugal **CF** is a direct reactionary force to the centripetal force outright tells us the magnitude of the centrifugal force, on a skier in a circular carved turn, is proportional to the square of the skier's speed and inversely proportional to the radius of the turn. In simple-plain language that means the centrifugal force on the skier is stronger when skiing faster or when making a tighter turn. The centrifugal force's constantly changing pull direction is sideward, laterally outward, and perpendicular to the circular arc at that given point in the turn. If the skier in the previous figure were in a left, carved turn, at the time of going directly down the fall line, the centrifugal force (**CF**) pull on him would then be perpendicular to the page, directly toward you.

I would like to note an important graphical property, before we proceed further. Only if an item portrayed in a 2-D (two-dimensional) figure is exactly perpendicular to the figure's look-from perspective, will the magnitude of the item be exactly proportional to the scale of the figure and its orientation will be correctly shown in the figure. Said another way, an item must be exactly parallel to the figure's surface to be accurately scaled and oriented. The next figure is a lookdown, perpendicular-to-the-slope, perspective of two successive, half-circle-arc turns made by a skier going downhill. This parallel-to-slope illustration not only shows the correct shape of the turns, but it also allows us to correctly show the direction and scaled strength of the two lateral pulling forces acting on the skier during the turn, which are the downhill component of gravity

dG and the lateral, outward-to-the-turn so-called centrifugal force **CF**. That is because the curved turns are, and the lateral forces act, parallel to the slope's surface. However, the other skiing pulling force we earlier described, the directly-against-snow gravity force (**pG**), is 90 degrees to the slope. In this figure, it can only be portrayed as a point.

This means that the correct position of **pG** can be located in the following figure, but it cannot be represented as a vector with direction and length. However, remember **pG** has a constant strength and direction for a given slope pitch. That means the direction of the legs push, you need to offset **pG** and keep you upright is always perpendicular to the slope and its strength doesn't change at any time you are on that pitch. Because leg-strength readjustments to offset **pG** are not required at any time during a turn on a given pitch, not being able to accurately display its magnitude in the following figure is not a handicap to our ultimate objective. That objective is to determine what will be the legs' varying strength and direction responses, to offset the combination of the two lateral pulling forces during the turn, which you recall are the downhill component of gravity **dG** and the centrifugal force **CF**. Those varying leg-adjustment responses, as the turn progresses, are what characterize the technique you use to carve successive turns.



Successive Half-Circle Carved Turns With Their Lateral Pulling Forces

In order to determine what the legs' response should be to balance out the lateral pulling forces of skiing, we must first determine how and when those pulling forces are changing during successive turns. The composite, net or total resultant lateral pulling force **R** acting on you during a turn is the vector sum of the two lateral pulling forces **dG** and **CF**. For readers not familiar with the process of vector addition, it might become a little clearer when we discuss an example shown in the previous carving turn figure. Because the resultant or total lateral pulling force **R** is a vector sum, it is a combination of both the values and the directions of the two lateral pulling forces **dG** and **CF**. Earlier we saw that the downhill component of gravity **dG** is fixed both in value and direction during a turn on a constant slope pitch, however the direction of the centrifugal force **CF** is constantly changing during a turn. Because the net or total resultant force **R** is the vector sum of both **dG** and **CF**, and since the vector **CF** is constantly changing during a turn, it follows that the resultant force **R** is also constantly changing during a turn.

With respect to carving turns, the relevant question is how and when should your legs respond to offset this total or resultant lateral pulling force **F**, as it varies during and between turns? Fortunately, in the previous figures' top-down, 2-D, perspective view, we can accurately see how the two lateral pulling forces **dG** and **CF**, and their resultant force **R** pull on you during a turn. That is because, in the previous figure, these forces can all be accurately represented by vectors during a turn. These vectors are the lines and arrows you see, at selected points in the turn. The arrows show the direction of the two lateral pulling forces and that of their resultant or vector sum, as well as their strengths, which are proportional to the line length of the vectors.

In the previous figure's two, opposite, half-circle turns, the lateral pulling forces of both the downhill component of gravity **dG** and the turn's centrifugal force **CF**, acting on a skier, are shown: at the beginning of the turn, at the middle of the turn, and at the end of the turn. At those points in the turn is also shown the resultant total lateral force **R**, which you remember is the total lateral pulling force you actually feel. Since the strength and direction of **R** is obtained by the vector addition of the lateral forces **dG** and **CF**, the easiest way for someone to see how the vector summation process works is by means of a simple graphical method rather than by using trigonometry and vector analysis.

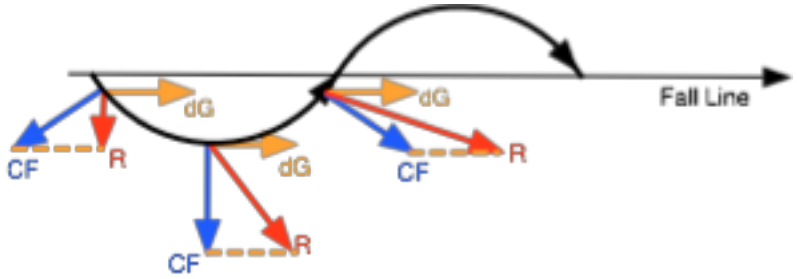
Graphically determining the resultant force **R** is done by taking a virtual image of **dG** and moving its base to the arrow tip of **CF**. The tip of the moved virtual **dG** (the dashed line) now establishes the outward arrow tip location of the resultant force **R** with its length being a line from the point of origin of **CF** and **dG** to the position of the arrow tip of the resultant force **R**. The simplest example of vector summation that I can think of is when two forces pull in the exact same direction. In that case the total resulting pulling force's magnitude is the sum of the magnitude of the two forces and it is in the same direction as the two forces are pulling. This approaches the situation, at the end of a half-circle arc turn, where you begin the transition to the next turn, with **CF** and **dG** are pulling almost in the same direction.

Shortly after starting the left turn in the previous figure, the centrifugal lateral pulling force **CF**, as always, is to the outside of the turn, which at that point is mostly opposite to the downhill component of gravity **dG**. Consequently this makes the resultant total lateral pulling force **R** relatively small at the turn's beginning as compared to its value later in the turn. As the turn progresses toward the fall line, **CF** changes to increasingly align itself with **dG** such that the resultant lateral force **R** increases and reaches a maximum value at the end of that turn. This is the point where the extended outside leg of the turn must be most heavily loaded. The above right section of the previous figure shows the skier continuing from the end of the left turn near the fall line and transiting to a large, half-circle, right turn downhill.

At a point during the brief transition, from the end of the left turn to the beginning off the right turn, the centrifugal pulling force **CF** temporarily goes to zero. This is because all four of your skies' edges briefly go flat to the slope when making the transition from the skies being edged for the old turn to the skies being oppositely edged for the new turn. When the skies are very briefly not being edged, they are temporarily not carving a turn, and thus not generating a centrifugal force **CF** on the skier. This is a key stage in the so-called crossover maneuver, which we will get into in more detail during the

technique descriptions of the next section. When you begin carving the next right turn, the centrifugal force **CF** will reappear and start to pull to the outside of that turn. It will again act on the skier together with the ever present downhill gravity force **dG,** in the phases of this new right turn, in the corresponding manner to what happened in the previous left turn.

The next figure below shows a skier making a left and than a right quarter-circle arc turn, with the same radius of curvature and speed as for the previous full half-circle turns. To avoid excessive clutter, only the lateral pulling forces of the left turn are shown. As you can see, the total lateral pulling force (**R**) at the beginning and at the end of the quarter-circle turn do not have the same values or directions as those of the previous half-circle turns. However, for the same speeds and radii of curvature assumed, **R** at the halfway point of the quarter-circle does have the same value and direction as at the halfway point of the full-circle turn. A notable feature we observe in both figures is that the total lateral forces (**R**), for both a half-circle and a quarter-circle turn, has the same general pattern of its strength being a minimum at the beginning of the arc turn, increasing as the turns progress, and becoming a maximum value at the end of the arc turn.



Successive Quarter-Circle Carved Turns With Lateral Pulling Forces

Even if you aren't geometrically inclined and didn't fully follow the above figures with their force vectors and vector summation discussion, there is an important point I would like for you to takeaway. That point is that the leg's lateral resisting force you must apply, during any carved turn to counterbalance the lateral pulling forces on your body, will change at the different phases of your turn. This needed resisting force, which comes mostly from your outside-of-turn leg (about 80 %), will always be at its lowest value at the beginning of a carved turn, increase during the turn, and be at its strongest value at the end of a carved turn, which occurs as you approach the fall line just as you start the transition to the new turns.

The three lower-body movements, briefly touched on in Section 1.1.a, when properly timed with the lateral pulling forces, just described, will create relaxed, smooth, successive recreational carved turns. Such turns result from an easy-to-learn recreational carving technique, which we will next go into in some detail. This is what I am calling carving turns by interacting with the force. I propose that this more relaxed carving technique be your means of first learning to edge your skies and carving your turns. You should establish control with this technique on moderately pitched ski slopes before testing yourself on steeper pitches.

Only after you have a fair mastery of basic carving should you attempt more advanced techniques. Once there, and if interested in further progress, you should begin working on higher-performance carving as described in Section 1.4. These more dynamic techniques have shorter crossover times and quicker edge changes, to more quickly alter your travel direction.

1.2 Carving Relaxed Turns Using "Skiing-With-The-Force" Technique

1.2.a Basic Technique For Learning To Carve Relaxed Recreational Turns

Turning, while coming down a ski slope, not only changes your travel direction but is also the normal means by which you control your descent speed. Thus in skiing, turning can be considered to act as both a steering wheel and as a brake. This means that becoming a better skier involves becoming a more fluid, efficient and precise turner. Turning with classical long and narrow skies relied on up-unweighting, total ski loading shift from one ski to the other, foot steering (foot pivoting) and sideslipping. Today's recreational carving techniques rely on a different set of leg movements that disengage one set of ski edges and directly engage the other set of edges. This will arc your skies in a new, oppositely carved turn down the slope, without using any foot pivoting or ski sideslipping.

Classical, Parallel-Christie Turn Action Sequence

To make a succeeding turn with the classical parallel-Christie technique use the following procedure: From an old turn with your entire ski loading on the old turn's downhill ski's big-toe edge, you begin a new turn by flexing your knees and planting your pole then up un-weighing (that is pushing upward with leg extension) and shifting your entire ski loading to the big-toe edge of the old-turn's uphill ski. The ski-loading shift together with some foot twisting will create a change in skies' direction and noticeable sideslipping. As a result, the unloaded and passive inside ski tended to slide next to the outside ski in the new turn to create a narrow feet-together stance. You can see this in the middle and bottom figures of the previous Classical, Parallel-Christie Turn Action Sequence from Ski magazine. This was, at least to some, the admittedly elegant look of the skies-together, classical parallel-Christie technique. Making a turn with that technique had the skies initial skidding, with some carving toward the end of the turn. Stein Eriksen, the 1952 gold medal Olympian from Norway, became the poster boy for this narrow stance type of parallel Christie turn with classic narrow skies.

Before shaped skies, the normal recreational parallel turn with traditional narrow skies was the narrow-tracked, parallel-Christie turn. However today with everyone using shaped skies, recreational skiers making skidding turns generally employ a somewhat less stylistic, wider-track, two-footed version of the classical parallel Christie turn. Just imagine the three figures of the Classical, Parallel-Christie Turn Action Sequence above, but with a wider-track stance. By wider track I mean the skies are separated about hip-distance apart. By two-footed action I mean that, after planting pole and up un-weighting, instead of shifting your entire loading to the outside ski of the new turn, only about 80 % of your loading is shifted to the new-turn outside ski, while also doing feet steering (feet twisting). To keep the skies separated, about 20 % of the loading remains on the inside ski of the new turn. When using this turn, the skies are initially skidding in the turn and then carving in the latter part of the turn. Because of the skidding or sideslipping, you initially see considerable snow flying off the skies' outside-of-new turn edges, especially at higher speeds. There is more in Section 3.1 on skidding your turns.

Modern, Carved-Turn Action Sequence

Now instead of skidding your turn with shaped skies, visualize yourself in the latter part of a previous pure-carved, left turn, as shown by the top skiing figure of the above Modern, Carved-Turn Action Sequence, from Ski magazine. Both skies are edged into the hill with skies about hip distance apart. Your outside-of-turn's leg (right leg) is more extended and more heavily loaded to balance yourself against and resist the major portion (about 80 %) of the total lateral pulling forces that the latter part of the left turn is imposing on your body. Remember, a lateral force is one pulling in a direction away from your body and parallel to the slope.

The top skiing figure has his big toe, of the outside-of-old-turn foot, turned into the hill and the little toe, of his inside-of-old-turn foot, also turned into the hill. A simpler way of describing a turn's edging during a turn is that the sides of the skies that are edged into the hill are the same as the direction you are turning toward, i.e. the left sides of both

skies are edged into the snow with the top figure in a left turn. For a wannabe carver, the all-important question to answer is how do you smoothly go from the end of the prior left turn of the top skiing figure, with the left sides of his skies edged into the snow and being braced against the forces of the left turn, to that of the following right carved turn of the bottom two figures, with the right sides of their skies edged and being braced against the forces of the right turn? The bottom two skiing figures show a skier already having made the transition to the right hand turn from the old left turn. The all-important key question is what specifically must you do to end an old turn and start the transition to a new oppositely arced carved turn?

The answer to this key question is surprisingly simple. The downhill or outside leg of the old turn is pulled back, retracted or shortens as you approach the slope's fall line at the end of the old turn. That action unloads the outside-of-old turn ski and results in you temporarily ceasing to resist the combination of both the pull of the downhill, lateral component of gravity and the pull of the lateral outward centrifugal force resulting from the old turn's arc. From the diagrams of the lateral pulling forces during a turn in Section 1.1.b, we saw that the resultant total pull on you, from the combination of both lateral forces, reaches a maximum at the end of a turn.

By you ceasing to resist this maximum total lateral pulling force at the end of your previous turn, you allow this force to start pulling your body's center-of-gravity (C.G.) downhill, then moving it diagonally-forward-and-across your skies. We call this across-your-ski movement of your C.G. a crossover. Ceasing to resist the total lateral pulling force, and allowing it to draw your C.G. diagonal and forward, downhill across your skies, is the foundation of starting a smooth and relaxed new carving turn. As shown by the 2nd skiing figure down in the previous "Modern, Carved-Turn-Action Sequence Figure," the skier's C.G. is just over and crossing the skies, and his C.G. has already crossed the skies in the 3rd skiing figure down.

So the outside-of-old-turn leg retraction is how you end a carved turn and begin the transition to another carved turn. We will next describe the process of transiting to and then beginning to carve the next turn. But before we do so, you must be prepared to discard the old familiar and comfortable leg movements you probably made thousands of times if you were in the habit of making foot-steering and skidding turns. You recall, that involved first upwardly un-weighing (that is pushing upward with leg extension), which momentarily allowed you to pivot your feet and change the skies' direction. To carve your turns you will have to trade in those leg movements for a new and different set of coordinated leg movements. That is the tough part, dropping ingrained, habitual lower-body movements to learn and practice a completely new set of movements.

To begin the transition to a new carved turn, at the end of the old turn as you approach the fall line, **you only need to retract your outside-of-old-turn leg to cease resisting the skiing turn's lateral forces pulling on you**. Together with the ensuing C.G. crossover and the edge change that produces, **you also rotate your thighs**, **to more fully and firmly change your ski edges**. Your thighs are rotated at their hip joint, from initially facing toward inside of the old turn to them facing toward inside of the new turn. It is the new foot-tipping angle created by the combination, of your C.G. crossover and your thighs rotation at their femur's hip joint, which fully sets your skies on new

edges to start arcing a new carved turn. **<u>You then extend the outside leg of the new turn to balance yourself and resist about 80 % of the total lateral pulling forces of the new turn</u>**. As we saw in Section 1.1b, that force is increasing as the new turn continues to develop.

The three leg movements that are underlined and bolded in the previous paragraph are the keys to beginning to carve rather than skid your turns. Repeatedly applying these three leg movements, when properly timed with the lateral pulling forces described in Section 1.b, will create relaxed, rhythmic, flowing-one-into-the-other, successive, symmetrical, arc turns down the fall line. These flowing, symmetrical turns are pleasing to observe and ripping fun to experience. It is what I earlier described as making relaxed turns by interacting with the force.

Using the "skiing-with-the-force" technique, the quickness of your downhill leg retraction and the quickness of the rotation of your thighs determine the quickness of the edge-to-edge change to a new turn. You can do a more gentle shortening of your old-turn's outside leg with a slower thighs twist for a more leisurely crossover and transition to the new turn. On the other hand, at higher skiing speeds you will want to do a quicker retraction of your outside leg along with a correspondingly quicker thighs twist, for a quicker edge-change transition to the new turn.

High Speed Racing Turn

Later in Section 1.4 we will explore higher performance carving techniques to even further reduce the edge-to-edge transition time to a new turn. Regardless of the technique used to transition, to a new turn at higher speed, for a strong racer-type turn, with a higher edge angle on both inside-of-turn ski edges, actively bring your new turn's inside ski up the hill toward your chest. That inside leg should have much more flex then the straightened outside leg of the developing new turn. The feeling should be like you are pinching your outside hip of the new turn. As the racer in the above figure shows, the flex of the inside-of-new-turn leg is so much more pronounced on steeper slopes at higher speeds, with the skier's inside hip almost touching the snow. For those turns, the skies are widely separated along the inclined side of a steeper slope, but relative to the inclined body's axis, they are still about a hip distance apart.

The C.G. crossover transition movement to start the next carving turns is a mostly diagonally across and forward body elongation. Skiers who learned starting a turn with

up un-weighting, which is needed to pivot the feet and change skies direction in a foot steering turn, often unconsciously elongate their body significantly upward instead of just diagonally across and forward when carving their turns. For a relaxed, smooth transition, simply allow your diagonally-downhill body elongation to be a relaxed yielding response to the downhill pull from the lateral skiing forces at the end of the old turn.

You often hear the instruction to start a new turn by leading downhill with the outside-old-turn hip. When skiing relaxed with the force, you shouldn't interpret that to mean some forceful core or leg action to directly push, tip, or drive your outside-of-old-turn hip downhill. Instead I would describe it as that hip's downhill movement resulting from you ceasing to resist the end of old turn's lateral pulling forces and simply letting those forces draw or pull your C.G. and outside-of-old-turn hip diagonally across your skies. This surrender to the lateral forces' pull is what starts the crossover. We will discuss the crossover process in much greater detail in Section 1.2.b. When in an old-right turn, to start the transition to a left turn, retract your left leg and simply let your left hip be drawn downhill. Similarly, when in an old-left turn, to start the transition to a right turn, retract your right leg and simply let your right hip be drawn downhill. This has been described as a relaxed "butt walking" yourself down the slope from turn to turn.

Pause and consider the significance of what has been said; this might well be a novel concept for you. The concept I want you to embrace is that starting a new relaxed, recreational-carved turn, with crossover, involves only ceasing your resistance to the pull of the old carved turn's lateral forces, as opposed to exerting an effort to overcome resistance. Don't get me wrong, it doesn't happen by magic. Again, all you need to do, to start the process to a new turn, is simply to pull back or retract your old-turn's outside leg, relax and let the lateral skiing forces pull your C.G. downhill into a crossover.

The creation of a new turn using the "skiing-with-the-force" technique involves the already described actions of a leg retraction movement along with a twist of your thighs, then an extension of the new-turn's outside leg. I would like to add another element, which is a modicum of restraint or patience. By this patience, what I mean is that after the three earlier leg actions, ***you should allow the edged and pressured skies to arc and naturally change the skies' direction, as opposed to hurriedly trying to forcefully change the skis' direction with a lateral pivoting of your feet***. When using only carving to make your turns, the primary objectives of your legs' and feet's movements are to release your old-turn edges and set and pressure your new-turn ski edges and then let your skies arc and do the actual turning.

The new turn's tightness is determined by a combination of the crossover, the amount of the thighs' rotation, and the amount of forward knee bend and ankle flex you have. Again remember, your thighs' rotation toward the inside of the new turn is not from your hip's rotation; it is from the upper-thigh bones (femurs) twisting or rotating at their pelvis joints. There is more on thighs rotation in Sections 1.5 and 1.10.a.

A focus often used to help students perform their thigh twisting during crossover is analogues to a concept that Coach Harold Harp calls "phantom edging" of the old-turn's outside foot. To strongly set new edges for a new turn during crossover, flex or retract the outside-of-old-turn leg and focus on rotating that thigh, at its femur's hip socket, to the inside of the new turn. Your other thigh (old turn's inside thigh) will naturally follow

suit and also rotate at its femur's hip socket thus creating a crossing rotation of both your thighs into the new turn. Fully tilting your feet and skies by either concentrating on directly rotating both thighs across, which I prefer, or focusing only on the rotation across of the outside-of-old-turn thigh will result in your ski edges smoothly transferring from the old-turn edges to the new-turn edges.

In going from one carved turn to another with crossover, your skis' edges-to-snow progression is: (1.) At the end of the old turn, the outside ski is on a big-toe edge, the inside ski is on a little-toe edge, or the left sides of both skies are edged for a left turn, as shown in the top figure of the Modern, Carved-Turn Action Sequence Figure on page 13. (2) All four edges are momentarily flat on the snow, during crossover, as shown by the second skiing figure down in the Modern, Carved-Turn Action Sequence Figure. This is an important and necessary phase of the crossover transition. (3.) The outside of the new-turn ski is on a big-toe edge, the new-turn inside ski is on a little-toe edge, or the right sides of both skies are edged for a right turn, as shown by the bottom two skiing figures in the Modern, Carved-Turn Action Sequence Figure. As we shall see in Section 1.2.d, this skis' edges-to-snow progression might itself be used as a basics for feedback, in the process of making consecutive curved turns.

The path of a turn made by a pair of edged skies slicing into the snow's surface is more defined and predictable than that made by pivoting and side-slipping skies. Carving rather than skidding your turns with modern shaped skies is not only more precise but also more efficient. The efficiency and energy-saving features of incorporating carving into your skiing are twofold. First, by letting the skies mechanically do the turning you save the muscle strength used for traditional up-un-weighting and swiveling your feet and skies. The energy it takes to push your weight upward and pivot your skies at every turn does add up. Second, in the process of extending and more heavily loading your outside-of-turn leg, with your C.G. inside of the turn, you will be better positioning your body to efficiently balance against or resist the lateral pulling forces. The feeling during carving a turn is more standing against the non-sideslipping, outside's ski edges as they slice through the snow, rather than the skidded-turn's feeling of transferring your weight, and with your leg muscles, balancing yourself against the variable opposition from skidding skis. Thus, in fully carving your turns you use your body's stacked bone structure more to balance yourself and resist the lateral pulling forces on your body.

1.2.b More On Role Of Crossover In Carving Successive Turns

In Section 1.2.a we didn't go into much detail about crossover. In that earlier "skiing-with-the-force": carving technique discussion, crossover was only depicted as your C.G. (center-of-gravity) moving diagonally downhill over and across your skies. You recall this resulted from retracting your outside leg and ceasing to resist the lateral forces pulling on you at the end of the old turn. We will now explore in greater detail the mechanics and effects of crossover.

Your body's C.G., sometimes called C.M. (center-of-mass), is actually within your body, located roughly behind your belly button. The C.G. for any structure is where its total mass is computed to be located, when doing engineering balance and stability calculations. The diagonal, downhill crossover movement of your body's C.G. across

your skies plays an essential role in transitioning to a new caved turn. When your C.G. moves downhill of your feet, the angle of your lower legs changes relative to the snow surface and places your C.G. to what will be the inside of the upcoming new turn. It is the combination, of the feet's tipping from crossover, together with the feet's strong tilting from the thighs' rotation toward the inside of the new turn, which strongly sets your skies on new edges to begin carving a new turn.

When your C.G. goes from inside of old turn to inside of new turn in crossover, your C.G. should cross your skies diagonally instead of perpendicularly to where the skies are pointed. Such a transition goes through all three of the ski and feet edging configurations, described in first paragraph of the previous page, with a short but necessary middle-of-crossover, skies flat-to-snow phase. Going too directly across, rather than diagonally downhill and across the skies, will not result in the desired smooth transition from the old-turn's ski edges to the new-turn's edges.

From crossover, the downhill movement of your downhill-facing upper body to the inside of new turn, in conjunction with a forward wrist flick, is what should touch the pole tip to the snow for your pole plant. This is shown in the third skiing figure down of the Modern, Carved-Turn Action Sequence Figure, in Section 1.2.a (page 13). There is a more extensive discussion of pole planting in Section 1.8.

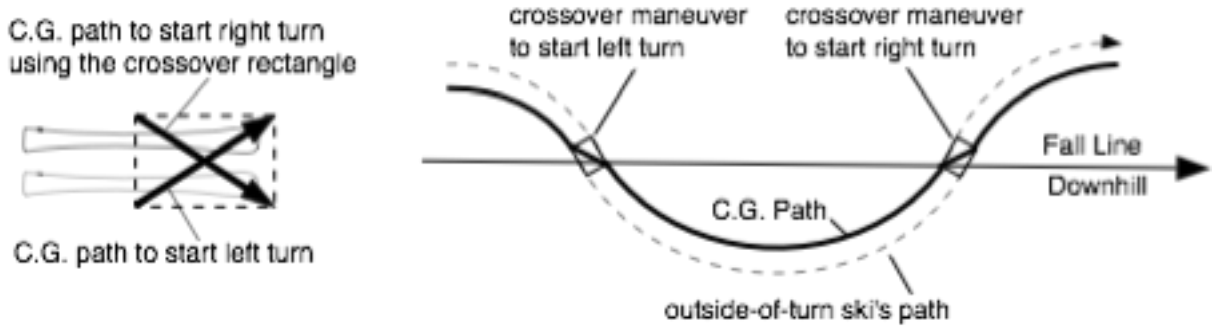
In general you can characterize the crossover as the transition maneuver between two successive carved turns as you approach the fall line, at the end of the old turn. It is the region between where you finish riding one set of ski edges in an arc across and down the hill, with your C.G. still inside of the old turn, and where your G.G. has transitioned to the inside of the new turn, and you begin to ride the other set of edges in an opposite arc across and down the hill. The crossover region is also where you are momentarily unbalanced (more on this shortly). It is the region between where you were in dynamic balance against the old turn's edges, to where you will again be in dynamic balance against the new turn's edges.

When you allow the lateral pulling forces to pull your C.G. and upper body downhill, your feet and skies will temporarily keep going in the direction toward where they were pointed to, when the skies flattened, during crossover. As a result, your C.G. and upper body will have momentarily moved more directly in the downhill direction than what your feet and skies did. This is physically why your C.G. moves across your skies during the crossover transition to a new turn.

During the brief crossover time, just described, when your C.G. is going downhill faster than your feet and skies, you will have a temporary, free-falling feeling. This is because you are in fact in a momentary unbalanced, or in a downhill freefall, state since you are no longer maintaining balance by pushing back against the lateral pulling forces of the old turn. This unbalance or freefall feeling only last until your new-turn edges are set and your outside-of-new-turn leg is extended and more heavily loaded.

The following might be too much graphical analysis for some of you, but don't panic! The next two diagrams are not as complicated as you might at first think. They are only a graphic way to display and help you visualize the results of the biomechanical crossover movements that we have been verbally describing. The following figure's left diagram shows the C.G. crossover movements, for both a left and a right hand turn, with

respect to a simple, conceptual, static, rectangular figure in the snow called, what else, the crossover rectangle. The crossover rectangle's sides are dashed in the figure.



The crossover rectangle's long sides are just outside of each ski, its front side is just ahead of where your ski tips are when you initiate the crossover maneuver to start a new turn, and the back side is at the location of your C.G. when you initiate the crossover at the end of the old turn. Just before you begin the crossover maneuver to transition from the old turn to the new turn, your center of gravity is located at the rear uphill corner of the static crossover rectangle (inside of old turn). With your C.G. at the rear uphill side of the rectangle, your C.G. will then move diagonally downhill across your skies as a result of you retracting the outside-of-old-turn leg. Because your C.G is moving toward the inside of the new turn and toward the front of the crossover rectangle, this makes your C.G. movement across your skies actually a diagonal motion across the static crossover rectangle during crossover. As described earlier, with your C.G. crossing from one side of your skies to the other side and your thighs rotating toward the inside of new turn, new edges are set, and a new arc turn is started.

Transitioning from old-turn edges to the new-turn edges has your C.G. go from well inside the old turn's outside foot and ski (roughly over old turn's inside foot) to that of your C.G. generally being well inside the new turn's outside foot and ski (roughly over new turn's inside foot). You can see these C.G. position changes in the Modern, Carved-Turn Action Sequence figure in Section 1.2.a (page 13). Notice in the above figure's right diagram, while your C.G, crosses both skies to the inside of the new turn during crossover, your C.G., for a brief period, moves down the slope at a noticeably steeper descent (closer to fall line) than the path of your two skies. This steeper descent is a result of temporarily not offering any resistance to the lateral downhill pulling force, which gives you the realistic sensation of momentary freefalling and speeding up in the downhill direction. As this occurs your thighs continue to rotate in the direction of the new turn to complete the setting of new edges and you then extend and more heavily load your outside leg of the new turn. Extending and more heavily loading the new-turn-outside leg balances and resist the pull of the lateral forces of the new turn. Your temporary downhill freefall or unbalanced feeling is thus arrested to save the day and prevent what you might at first worry about - - doing a face plant into the snow.

When first starting to do carving and crossovers, you just have to have faith it will all work out as just described. During the crossover transition to a new turn, that feeling of

going through a brief unbalanced, downhill freefall is normal, expected and in fact embraced by accomplished carvers as being an integral part of their easy, smooth flow down the mountainside. This is what resisting, surrendering to and then resisting again the lateral pulling forces of skiing feels like during a carved turn. However, as might be expected, this does often produce some anxiety for skiers just starting to do crossovers and carved parallel turns. Being able to relax and momentarily surrender to the lateral pulling forces, during crossover, is the crucial learning-to-carve threshold that will open up a whole new, exciting realm of how you feel about and enjoy your skiing via carving.

Dynamic balance against one set of edges, a temporary floating freefall, and then dynamic rebalance against a new set of edges is the recurring, rhythmic sequence you experience when making linked, successive carved turns, with a crossover, that directly flow one into the other. The amount your C.G. moves to the inside of the new turn's outside foot and ski to dynamically rebalance yourself depends on your speed, the radius of the turn and the steepness of the slope, which you will fairly quickly develop a feel for with experience. When starting a turn, at a slower speed on a flatter slope, if your C. G. moves excessively inside your feet and skies with body lean to counterbalance the expected forces, that will of course put you in a dynamically unbalanced position relative to the actual existing, weaker lateral forces of that particular new turn. The subsequent results will have skiers on the chair lift pointing at you with some degree of amusement.

If the temporary imbalance during crossover has you concerned, realize it is analogous to a very ordinary movement you have been doing every day of your life since you were about a year old baby. This, would you believe, is simply walking. Think about it. When you push off with one foot to take a step you are in a temporary state of imbalance until the other foot swings forward to plant and recover your balance. If you took a step forward and I stuck my foot out to prevent you from moving the other foot forward, what would happen? The simple answer to my tripping you is of course either a stumble or a full-fledged fall. Similarly in crossover, when you retract your outside-of-old-turn leg and cease resisting the lateral forces, you are likewise in a temporary state of imbalance. That only exist until your C.G. crosses your skies and you extend and more heavily load your new-turn outside leg to regains your balance. You have long ago gotten use to a temporary imbalance when walking. With repetition you will also get use to the temporary unbalance feeling when doing crossovers to carve turns.

The key to carving turns is to be patient and let the new-turn edges, produced by crossover and thigh rotation, start carving an arc and bring you around in the new turn. Don't jerk or twist your feet to force or hurry the turn. In general, good carved skiing can be characterized as blending each turn smoothly one into the next with a crossovers and thigh rotation to start each turn. It not only looks graceful; it also feels pleasantly rhythmic. In addition to looking smooth, it is also biomechanically efficient to link your turns directly one into the other to produce successive, symmetrical left and right hand turns down the slope. This rhythmic back-and-forth interaction with the lateral skiing forces involves continual combined body and ski side-to-side balancing and rebalancing movements.

Your legs and skis should feel like they are moving like a pendulum, side-to-side below your mostly downhill-facing and relatively quiet hips and upper body. Don't let

yourself get into a static lower-body posture; your legs, ankles and feet should always be in the process of doing something when going from turn to turn. Lack of continual lower-body movement is often seen on the slopes when a skier makes a nice initial turn. However, instead of flowing directly into the next turn, when approaching the fall line, the skier will noticeably stay static over their skis, hanging on to the security of a short traverse before starting the next turn. This breaks the harmony of the continuously turning rhythm and result in a series of "Z" like turns down the slope in contrast to the smooth flow of graceful, symmetrical "S" turns. Lower level skiers often make each turn a clearly distinct event; better skiers link their turns with each turn flowing smoothly into the next.

The previous discussion indicated the important role crossover plays in changing edges to carve successive turns. We also learned that a key factor in getting your C.G. across your skies during crossover is the pull of the downhill component of gravity. However, the flatter the terrain, the weaker is that downhill, lateral component of gravity. So, when transitioning to flatter terrain, with a limited pull from the downhill component of gravity, how are instructors and good skiers still able to produce the quick crossovers needed to maintain the frequency of their carved turns? They do so by using a skating-like leg motion, which create a downhill push that supplements the weak downhill pull component of gravity. Thus they maintain the quick crossover time needed to rapidly go from edge to edge. The ski loading is swiftly transferred uphill, to the inside-of-old-turn ski, from which you then quickly push off to start the new turn. Ski instructors sometimes tell you about this insider technique, sometimes they just let you believe they do it with the normal carving movements taught in their class, but on somewhat steeper terrain.

1.2.c Upper And Lower Body Separation, Stance Width, And Ski Loading When Carving Turns

Looking back at the skier of the Modern, Carved-Turn Action Sequence Figure in Section 1.2.a (page 13), notice his upper body and hips face closer to the downhill direction than where his thighs and skies point to at the end of each turn. The hips and belly button constantly face inside each turn. The legs rotate substantial more than the hips in a turn. This is called separation between the rotation of the lower body, relative to that of the upper body. Good skiers have a quieter upper body and are continually rotating their thighs from side to side, which make for flowing "S" transitions downhill, from turn to turn.

When the hips are facing in a downhill direction, with the thighs rotated across, there is some stretch rotational tension between the thighs and hip, which when released help the thighs to rotate in the opposite direction toward the new turn. This effect is often illustrated by holding the top of a Popsicle stick with one hand and then twisting its bottom with your other hand. When the bottom is released it quickly twist back into alignment with its top. This stretch tension, resulting from the upper and lower body rotation separation, helps start your thighs' counter rotation toward the inside of the new turn. With hips facing downhill, the thighs rotate from facing toward end of old turn, to passing where belly button is pointed down the fall line, to facing toward what will be the end of the new turn. This cycle continues to repeat itself from turn to turn. Section 1.10.c also discusses the lower-upper body rotation separation.

In contrast to the classical technique shown in the Classical, Parallel-Christie Turn Action Sequence, in Section 1.2.a (page 12), today's carving technique, has a wider, hip-distance-apart stance and is a two-footed process. This is shown in the subsequent Modern, Carved-Turn Action Sequence, also in Section 1.2.a (page 13). For carving, a hip-distance-apart stance has an advantage over a narrow feet-together stance because it requires less center of gravity (C.G.) lateral movement to the inside of the turn to set new edges. It often takes a while for some skiers, particularly skiers who were good classical parallel Christie skiers, to feel comfortable keeping their feet apart as much as they should for carving. Patient instruction, conscious practice and the skiing characteristics of modern skies will eventually all work together so they get the light. By that I mean not only the light of understanding and feeling, but also the light coming through their legs from the about hip-distance-apart spacing between their feet. Section 3 discuses some slope and snow conditions that require a different technique from carving, with their own distinctive stance and ski loadings.

The outside-inside ski loading, during a turn, depends on such factors as your speed, the turn's radius, the phase of the turn you are at, and the snow's depth and condition. The little-toe edge of the inside ski, of a turn, must be engaged some to keep your feet apart. When skiing on groomed or packed snow, on-average place about 20 % of your skies' loading on the little-toe edge of the new-turn's inside ski so it tracks a parallel but separated arc in the snow. This will keep the outsides of your feet about a natural hip distance apart (about the same distance as when walking) so you trace two nearly parallel tracks in the snow. Don't make the mistake some skiers do and go overboard to load the inside ski up to 50 % of average loading. This should only be done in deep or powder snow with feet fairly close together (Section 3.3).

Instruction for carving your turns often use words like put 80 % of your weight on the outside-of-turn ski. What you see back in the earlier Modern, Carved-Turn Action Sequence figure of Section 1.2.a (page 13), or from watching skiers on the slopes, seem to contradict that. As you can plainly see in the top and the two bottom skiing figures of the Carved-Turn Action Sequence, both before and after crossover, most of the skier's static body weight is actually closer to being over the inside-of-turn ski. The skier's center of gravity (C.G.) or center of mass (C.M.) is definitely not over his outside ski.

During a turn, the big-toe edge of the outside-of-turn ski is more heavily loaded or pressured to balance against and resist the turn's lateral pulling forces on the skier's body, as described earlier in this article. So as not to confuse you precise-thinking, sharp-eyed observers, we must be careful how we use words like "weight on" "weight over" or "weight above," and instead use words like "pressure on or against the ski" or "load on the ski" when we describe the force applied to skies. Even a phrase such as "more heavily weighing the outside ski," which is intended to mean more heavily loading or pressuring that ski, can be misinterpreted to mean placing more of your body's mass over the outside ski. Again, I want to make it crystal clear that during a turn, it is the greater pressuring or dynamic loading that you apply to your big-toe edge of the outside-of-turn ski.

1.2.d Impact Of Dominant Learning Styles On Mastering A Ski Technique

We don't all use the same approach when learning a new motor skill, such as a new tennis stroke, golf swing or in our case a new ski technique. There are four predominate learning styles that people normally use to acquire a new motor skill. One is the "observer" learning style, which prefers visual images of total motion rather than focusing on component movement elements. Observers transfer and internalize what they see by emulating the total motion of real or visual role models. A second leaning style is the "feeler," which is particularly sensitive to body movements and subsequent reaction. Feelers are more kinesthetically oriented and use sensory feedback for awareness of limb positions and body movements to learn and improve performance. The third is the "thinker" learning style, which wants to understand the process and consciously think through movements. They want to know the how, the why and the when. Thinkers are analytical, logical, meticulous, and ask lots of questions. The fourth learning style is the "doer," which wants to experiment and try things out. Doers tend to be pragmatic and action oriented. They learn through sensible trial and error and refine those efforts into a satisfactory performance.

Although we all use a mixture of observing, feeling, thinking, and doing, generally one style is more dominant in how you acquire and perform your skiing technique movements that you repeat over and over, until you master the skill. The visual learner repeatedly tries to imitate the visual image, in his or her mind's eye, formed by observing proper skiing movements. The feeler, over and over, tries to reproduce the feedback sensations from his body's movements that, he has learned are generated by properly executed skiing movements. The thinker consciously creates the movements, he has mentally understood are correct, repeating them over and over until they become ingrained reflect responses. The doer takes the movements worked out by trial and error and repeats them until they become a polished skill.

Upward of 95 % of people do their motor skill learning using the observer, feeler or thinker styles, with the observer and feeler styles being more common. Learning style is somewhat related to the existing skill level. Visual learning tends to play a larger role when first learning a new skill. However, developing an internal feel and a personal how-to-do understanding tends to play a larger role in the more advanced stages of motor skill mastery.

From what you have earlier read, you probably have guessed it and I admit that like most other engineers, I am a thinker style motor skill leaner. Stop for a moment and consider, what do you believe is your own dominant learning style? That raises a point relating to ski lessons. What is the best type of ski instructor for you? Everyone relates and learns better from written or personal instruction when presented in their dominant learning style. Ski authors and on-slope instructors sometimes fall into the all too human tendency of teaching in their own learning style. If that happens in a ski class and that style is different from your own, speak up and ask questions that will help you better relate to what is being taught. For example, following an instructor nonstop from top-to-bottom of the slope is great for the observer learning style students in the class, but the feelers and thinkers need some pauses to get verbal interaction and feedback. On the other hand an instructor who often stops and gives detailed, technical how-and-why explanations is perfect for the thinker style, but observer and feeler style learners don't

want that type of technical detail. Well-structured on-slope lessons should take into account the needs of whatever dominant leaning styles the students have, both for group and private lessons.

For observers, sequenced pictures of a skier's motion are helpful in printed instruction. However, sometimes that is not quite enough for a strongly dominant observer style learner. For them, videos and live demonstrations are normally more effective teaching approaches. Printed instruction, with its ability to explain and describe, is more suitable for thinker and feeler learning styles. This article's earlier technique discussion boils down to the following: seeing the figure of a skier at the end of a turn and subsequence figures of what starting and executing a new turn looks like; understanding and sensing the effects of the skiing lateral pulling forces during a turn; and an awareness and feeling of what three well-timed leg movements can do when interacting with those pulling forces. This instructional approach I submit is useful to observers, but even more so for helping thinker and feeler types master the body movements, to obtain the skies edge-to-edge progression, necessary for carving turn.

In going from one turn to another, clearly your feet also go through the same edge-to-edge progression as what your skies do as described in the second to last paragraph of Section 1.2.a (page 17). The corresponding feet's edging progression in going from a left turn to a right turn is: (1.) The left sides of both your feet are edged toward the snow during a left turn. (2.) Your feet's bottoms go flat to the snow during the crossover transition to a right turn. (3.) The right sides of your feet are edged toward the snow during the following right turn. After the right turn, for the next left turn you go through a mirror image of the above feet-edging progression, by switching which sides of feet are edged.

Focusing on sensing your feet's tilt gives you direct feedback on the ski bottoms' angle to the snow. If you are a strongly dominant 'feeler' type, you could focus on the tilt of your feet as a means to feel your way through a carved turn. Imagine you are in a turn with your outside-of-old-turn leg extended and more heavily loaded with the sides of your feet edged or tilted to their same sides as you are turning toward. As you approach the fall line at the end of your turn, the feet tilt feedback steps you go through to start a new turn are: 1. Be aware of your feet's tilt position in the old turn; 2. From the feet tilt positions of the old turn, you do the leg movements necessary to tilt your feet and flatten your feet's bottoms to the snow; 3. You continue the above leg movements and further edge or tilt your feet past the flat-to-snow position, toward their being edged on their same sides as the new turn you will be turning toward. With feet tilted in the new turn position, you extend and more heavily load the outside-of-new-turn foot, to balance yourself against the forces of the new turn.

Focusing on the feet-tilt sensory feedback approach, to obtain the skis' edges-to-snow progression described earlier, assumes that your body will automatically react and use the desired thigh twist or rotation, at their femur's hip joint, to efficiently and strongly perform the feet's edge-to-edge, tilt progression. This might indeed happen, however the possible danger is that you could instead start using a simpler, lower-leg, knee-to-foot, linear-straight-across tilt. This will work when first learning on fairly gentle slopes, at slower speeds. However, for steeper slope or higher speed carving, that simple, linear,

lower-leg tilt does not have the leverage strength required. To avoid that possible limitation, let us consider an alternative focus.

Instead of a sensory focus directly on your feet's tilt, you might substitute instead a sensory focus feedback directly on the progression that the twist or rotation of your thighs go through, from turn to turn, to produce the desired feet and skies tilt progression. In an old turn your outside leg of the old turn is extended and your thighs are twisted or rotated toward the inside of old turn. As you approach the fall line at the end of the old turn, the steps to transition to a new turn are: 1. Be aware of your thighs rotation position inside of the old turn; 2. From being rotated toward the inside of the old turn, you first rotate your thighs back toward a neutral position facing straight ahead of your hips down the fall line; 3. You continue from the neutral position and further rotate your thighs so they are twisted or rotated toward the inside of the new turn. To balance yourself against the forces of the new turn, you extend and more heavily load the outside foot of the new turn.

To end an old turn and start a new turn, making the first move be a deliberate, outside-of-old-turn-leg retraction, when combined with the above thighs twist movement focus, will result in a C.G. crossover and a pronounced edge change. Then extending and more heavily loading the outside-of-new-turn leg puts you in dynamic balance in the new turn. Well, what have we made our way around to here? That is right! This combination of outside-of-old-turn leg withdrawal, along with a thigh twist from inside of old turn to inside of new turn, and then outside-of-new leg's extension and heavier loading is precisely the technique that was presented in Sections 1.1 and 1.2. It was what I called carving relaxed turns by skiing with the force. Given the previous discussion, I submit feeler as well as thinker type motor skill learners can learn to carve turns by using the "skiing-with-the-force" technique as it was first presented. In fact, so can dominant observer type learners, but they might sometime need to see the technique demonstrated rather than just explained with verbiage and pictures. If doer style learners experiment with outside-of-old-turn leg withdrawal along with thigh twist to change edges and start a new turn they will, by trail and error, discover the "skiing-with-the-force", carving technique.

Here is something that you strongly "feeler" style, motor skill learners might notice while carving turns. Closely related to the previous discussions of side-to-side leg movements is what your shins are continually doing against the front of your boots when going from turn to turn. Notice your shins are initially against the left front of the boots, with your thighs rotated to the left, to edge your skies in an old left turn. Your shins move around across the front of your boots to the right front as you rotate your thighs to the right and set new edges for the new right turn. In the process of then making a subsequent new left turn, your shins then move back around across the front of your boots to their left fronts. This is yet another way of sensing or feeling what your lower body is doing in going from turn to turn.

1.3 Summary Of The Key Elements Of "Skiing-With-The-Force" Technique

Earlier Sections 1.1 and 1.2 presented the background and a somewhat detailed development of the relaxed, basic carving technique that I called “skiing-with-the-force.” For someone who has understood and absorbed that material, this section is a summary of the key elements of that technique. This section 1.3 is intended as a place where you can quickly refresh yourself on the technique’s major features before hitting the slopes.

- To go from the end of an old carved turn approaching the fall line, into crossover, then on into a new carved turn, perform the following three coordinated leg movements, for the “skiing-with-the-force” carving technique: **1. Flex or retract the outside leg of the old turn** to cease resisting the total lateral pulling forces of the old turn and simply allow these forces to pull your C.G. downhill across your skies**; 2 Rotate or twist both thighs, at their femur’s hip joint, across and to the the inside of the new turn** during the crossover created by # 1, to strongly tip your feet and set new edges and; **3. Extend and more heavily load the outside leg of the new turn,** after the turn starts, to rebalance yourself and resist the increasing total lateral pulling force as the new turn continues to develop. Retraction of old turn’s outside leg is what starts the process of your C.G. crossing your skies. It is the new foot-tipping angle, created by the combination of your C.G. crossover and your thighs twisting at their hip joints, which strongly sets your skies on new edges to carve the new turn. Be patient and allow the edged skies to make the turn, don’t pivot your feet.
- For medium or longer turns, to start the transition to the new turn, think of softening or relaxing your downhill old-turn leg. For quicker turns with quicker crossover and edge transfer, a more active flexing of the old-turn’s leg is achieved by using the hamstring muscle to more quickly pull your buttock closer to the snow, with the downhill ski tail sometimes lifting off the snow a little.
- A focus, to get thighs rotation to inside of the new turn during crossover, is to retract the old-turn’s outside leg *and twist or rotate that thigh across to inside of the new turn, which will get the other thigh to reactively rotate in sync across into the new turn*. Or, you can focus directly on *the rotation of both thighs*, which is what I prefer.
- At the end of a turn, have your upper body and belly button pointed downhill, to the inside of that turn, not where the skies are pointed to. The legs are active and rotate much more across in each turn than does the quieter upper body. This pointer is aimed at helping make smooth, continuous linked turns with upper and lower body rotation separation.
- Ski in balance with your knees and ankles flexed and your C.G. centered, not ahead or behind the arches of your feet. Your C.G. ahead or behind your arches will not put the pressure on your ski centers needed to fully bend or arc your skies when edged. If your C.G. falls behind your arches, pulling your heels back, by bending your ankles forward, is a quicker way to rebalance yourself on skies than moving your upper body forward. On the other hand, if you feel your C.G. is getting ahead of the center of your feet, move your feet forward under you by straightening your ankles.

1.4 Higher Performance Carving Techniques To Quicken Edge Change

If you are new to carving, the leg movements and the feel of carving arcing turns, with your skies on edge, will be noticeably different from those of turning with foot

steering and skidding. I believe a good way shed steering technique leg movements is by learning and using the more fundamental and relaxed carving technique developed in Sections 1.1 and 1.2, which I have called “skiing-with-the-force.” Once you get some comfort and feeling for changing edges, with this basic technique, if interested in higher carving performance, I recommend that you start exploring what is called uphill ski release. Using an uphill ski release will quicken your crossover and edge-to-edge transition to a new carved turn when you seek that higher performance.

What is the widely accepted recreational caving technique, with modern skies, is not a static finished product, but is a constant ever-evolving process. It’s all about balance and more quickly changing the edges of today’s shaped skies. Racers and coaches are constantly looking for any slight advantage. The technique innovation of a hot new racer, if producing wins, can change the currently accepted and recommended technique. There are at times competing visions of what we label as “modern skiing” until the racing and ski teaching community gravitates to a new consensus. This year’s skiing technique being taught could be slightly different from just a few years back, as could be the case in a few years hence. With that in mind let us consider where we appear to be in this ever-continuing evolution of carving technique for recreational skiers.

As has been extensively describing earlier in this article, to start the process of going from one relaxed recreational-carved turn to a new turn, retract the old turn’s outside or downhill leg, which unloads the downhill ski. That enables the lateral downhill component of gravity and the old turn’s centrifugal force to pull your C.G. diagonally across your feet and skies, downhill toward the inside of new turn. Recall from that discussion, you can either do a more gentle shortening of the old-turn’s outside leg for a slower crossover and a more relaxed transition to the new turn, or you can more forcefully retract the outside leg to quicken the crossover and transition to the new turn.

We will now explore even more advanced and higher performance methods for starting a new carved turn. As I understand some of the discussions in the racing community, you get an earlier and more simultaneous edge change to both skies by transferring loading to and then pushing off of the old turn’s uphill ski. That is characterized as preloading and then releasing from the uphill ski.

With shaped skies, the uphill or inside-of-old-turn ski is more engaged and carving in the old turn, so some innovative ski racers discovered a benefit from releasing off of, or pushing off of, the old turn’s uphill ski. This creates an almost instantaneous unloading of the outside-of-old-turn or downhill ski. These racers are also able to reduce their crossover time because, instead of just the downhill lateral component of gravity and the old turn’s centrifugal force being the only forces that pulls their C.G. downhill into a crossover, they have the benefit of an added force from the downhill push from the uphill leg. The combination of the quick unloading of the old turn’s outside ski and the shorter crossover duration quickens the change to the new-turn ski edges. Uphill ski release is where the upper levels of carving now appear to be. Two such uphill ski release techniques will be described in the following Sections 1.4.a and 1.4.b.

1.4.a Hip-To-Tip Technique For Carving Turns

Imagine yourself as the topmost skiing figure in the following Recreational Hip-To-Tip Action Sequence Figure. You are finishing a left turn and about to start a right turn,

with the downhill or right leg more extended and the uphill leg more flexed. To start the new turn using the so-called hip-to-tip technique, quickly advance your uphill hip toward the position that is above the tip of the uphill ski. As the left hip, in the top skiing figure, is moved toward the position that is above the left ski tip, as shown by the red arrow, both thighs are rotated across to the right. This makes the desired uphill hip movement not a pure rotation movement downhill, nor is it a pure upward movement.

Recreational Hip-To-Tip Action Sequence

Because the uphill leg is initially flexed, the uphill or inside-of-old-turn hip movement forward and toward the current position of the tip of the uphill ski makes that hip move forward to catch up to and come over its knee some. The uphill hip catching-up and coming over its knee results in that uphill leg extending, with body elongating on that side. This quickly takes the heaviest pressure off the old turn's downhill ski, thus quickly starting the crossover. The uphill leg's extension not only quickly takes the heaviest pressure off the downhill ski, but its resultant push also adds to the downhill pull of the old turn's normal lateral pulling forces. The consequences are that the crossover both starts earlier and the C.G. crossover, transition time downhill to the inside of the new turn is reduced, which together quickens the change to the new-turn ski edges. In the previous Recreational Hip-To-Tip Action Sequence Figure, the skier starts his hip-leg movements in the top figure and its progression continues in the middle and bottom figures.

Instructors describe the movement and its purpose with the catchy phrase "hip to ski tip for grip." For a little more specificity and clarifying detail, permit me the license of a less catchy and much longer rendition of that phrase. "Move uphill hip toward above where the uphill ski tip is, together with a toward new-turn-direction rotation of thighs for a quicker grip of the new turn edges." For the earlier described, relaxed "skiing-with-the-force" technique, the definitive action, to end the old turn and start the transition to a new turn, is an outside-of-old-turn leg retraction. For the hip-to-tip technique, the comparable definitive starting action is the movement of the uphill hip toward the position above the uphill ski tip.

Using the language of preloading and uphill ski release gives us another way to describe the mechanics of the just described "hip to tip" turn. The uphill's hip-to-tip movement toward a position above the uphill ski tip extends the uphill leg to unload the

downhill ski, thus pre-loads the uphill ski at the beginning of the turn. The uphill hip movement also causes the uphill leg to extent and push, which is an uphill ski release movement.

1.4.b The More Direct And Forceful Uphill-Ski-Release Technique

In Sear Warman's instructional video "Images and Concepts Going South," T. J. Lanning, a U.S. ski team coach, describes a higher performance carving technique being used by the team. This technique significantly speeds up your edges change in a carved turn. This is done by transferring the heavier ski loading to the uphill ski and then quickly and strongly driving down the fall line off of that uphill ski platform. In uphill ski release terminology we can characterize the loading transfer to the uphill ski as preloading and the strong push off from that platform as strongly releasing off the uphill ski. The strong loading transfer to the uphill ski immediately takes the pressure off the downhill ski to quickly start your crossover. Then the uphill leg's strong extension push-off directly adds to the downhill force already provided by the downhill pull of the old turn's natural, lateral pulling forces on your C.G.. This added force further reduces your C.G.'s total crossover time. Not only does the crossover start earlier but the crossover transit time is reduced, which together result is a quicker change of edges between successive turns.

Observe the movements in the following Racing More-Direct Uphill Release Action Sequence Figure, from youcanski.com. You can see the total turn progression, with its beginning at the second-from-the-top figure, where the red arrow, from the uphill boot, shows the preloading and start of the and downhill push off from that ski. The bottom three skiing figures show the further development of the turn. Notice the skier's uphill leg straightening from pushing-off and his thighs rotating toward the inside of the new turn.

Racing More-Direct Uphill Release Action Sequence

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This more direct uphill-ski-release technique has a more deliberate and stronger push-off, from the uphill leg, as compared to the more reactive push-off resulting from the hip-to-tip movement that was described in the previous Section 1.4.a. The more forceful

and direct uphill-ski-release technique uses a stronger uphill leg extension to more quickly create a diagonal C.G. crossover, which in concert with a rapid across-fall-line rotation of both thighs, quickly set new edges to start carving a new turn. This faster edge change is advantageous for the higher speeds of racing and for steeper-sloped recreational carving.

The lower-body movements and their tempo, for the more-direct, higher-performance uphill-ski-release technique, differs some from that of the more relaxed "skiing-with-the-force" technique described earlier in Sections 1.1, 1.2 and 1.3. For the "skiing-with-the-force" technique, the old turn's downhill leg retraction is the leg movement that ends the old turn and begins the transition to the new turn. Whereas, for the direct, uphill-ski-release technique, the loading transfer to the uphill leg and immediate diagonally downhill push off, from that uphill leg, are the leg movements that ends the old turn and begins the transition to the new turn.

The entire leg-movement sequence and rhythm of the earlier described learning-to-carve, relaxed, "skiing-with-the-force" turn is: 1. Retract the downhill leg; 2. Together with ensuing C.G. crossover, rotate both thighs to inside of new turn; 3. Extend and more heavily load the outside leg of the new turn. Whereas, the quicker leg-movements sequence and rhythm of the more direct uphill ski release turn is: 1. Forcefully load and then immediately push-off downhill from the uphill leg; 2. In sync with the quicker ensuing crossover, quickly rotate both thighs to the inside of the new turn; 3. Further extend and accept the heavier loading on the outside-of-new-turn leg.

An association of its leg movement, with that of a ski activity already familiar to you, might give you a better feel for the more-direct-uphill ski release. One such movement I have in mind is the push-off from your alternate insides edges, when skating with your skies to propel yourself forward on flat of moderately inclined terrain. The initial movement of the direct-uphill ski release is much like a loading then downhill-directed, ski-skating push-off from the old-turn's uphill leg. This skating-like push-off is immediately followed by a strong, across the fall line toward inside of new turn, rotation of both thighs at their femur's hip joint.

1.5 Modern Emphasis On Strong Thighs' Rotation To Carve Turns

Because of the influence of Sean Warman's videos, I went back and more strongly emphasized thighs rotation in all my carving technique discussions in this article. Warman's last two videos were done in close cooperation with and featured Michael Rogan, the PSIA (Professional Ski Instructors of America) Alpine Demo Team captain and Ski Magazine's Instruction Director. Thighs rotation plays a major part in setting new edges for the more relaxed, recreational carving technique, first described in Sections 1.1 and 1.2 and also for the more advanced uphill ski release carving techniques that were described in Sections 1.4.a and 1.4.b. Looking back to the time progression of modern wider-track carving instruction, it seem to me the early teaching focus for achieving crossover was more on directly leading with your C.G. or hips across the skies to create crossover and edge skies. You might remember the carve turning analogy to that of tipping or leaning your hip to the inside like starting a bicycle-like turn,

in conjunction with your outside leg doing a push-pedaling like movement to the outside of the new turn.

Using strong thighs rotation (twisting and tipping) to tilt feet and set new ski edges is now strongly emphasized in modern carving. It has itself become an important focus, in carving turn instruction and training. Thigh rotation works together with the crossover to release the old-turn edges and then strongly engages the new-turn edges of both skies. I base this on several sources. As mentioned in the above paragraph, a primary source is from Sean Warman's three instruction videos discussed in Section 1.10. Another source is Ken Chaddock's book "How I Ski, Expert Alpine Skiing Demystified." In addition, Bode Miller is reported to have said "I like to feel I'm changing edges with my knees," which he moves across by thigh rotation. The importance of thighs rotation is also strongly supported by a direct quote from the CSIA (Canadian Ski Instructors' Alliance) book "Canadian Ski Teaching - Science and Skiing." The following is that quote.

> "**Turning the Legs** – The lower body leads the turning effort, acting independently of the upper body. This can be achieved in different ways – the feet can turn below the knees – but turning the femurs in the hip sockets is the primary action in carved skiing. The bigger joints and muscles around the thighs, pelvis and lower back provide strength and leverage."

At some point you might have seen or heard instruction for edging your skies as just simply tipping or tilting your feet. The problem with that approach is that you can tip your feet by using one of two distinct leg movements. One movement is to simply tip your lower legs by only moving your knees linearly sideward right or left. Unfortunately this produces less tipping movement and less leverage strength to the feet tipping. The other leg movement is to rotate your thighs at their femur's hip joint. From the above sources, we know this produces the much more forceful tipping of your feet, which is needed to edge your skies for curving turns at moderate to higher speed. For those of you who are serious tennis players, this thigh rotation is somewhat analogous to how you employ the power from the rotation of the your upper arm to generate the so-called "ATP" forehand stroke with greater speed and topspin. This tennis rotation of the upper arm at its shoulder joint is called inner rotation.

Because of its importance to your edging, I would like to reemphasize some points made earlier. The thighs' movement, from inside of old turn to inside of new turn, is more than simply your knees making a lateral, side-to-side movement to tip your feet. With your ankles flexed and knees bent, the desired knees' side-to-side movement and feet tipping results directly from a twist or rotation of both your thighs at their femur's hip joint, without rotating or twisting your waist. The statement that thighs rotation draws your center of gravity (C.G.) diagonally across is valid because the de-edging of the old turn ski edges, which the thighs rotation to the inside of the new turn helps creates, allows the lateral skiing forces to draw your C.G. downhill and across your skies.

Before incorporating the above paragraphs on thighs rotation, I emailed them to Jim Colbert asking for any comments. Because it is so relevant to this section's material, I have included Jim's reply below. As you might know, Jim lives and teaches at Mount Snow during the ski season. As mentioned earlier, Jim is one of the two PSIA Level II

Certified Skiing Instructors that are members of the Peninsula Ski Club. The following is from Jim's email response.

> "Section 1.5 is dead on. I skied with the PSIA Alpine Demo Team in Dec. 2011, including 4 hrs. with Robin Barnes. The emphasis was on the ball joint of the hips, the strongest joint in the body. With knees flexed, strong stable hips and moving the femur from the ball joint of the hip, you get a natural lead with the uphill hip/ski. The muscles in the waist work to counter the tendency for the upper hip to lag behind."

1.6 On-Slope Exercises To Give You Feel For How Thighs' Rotation Edges Skies

Using hip angulation to put your skis on edges does work, particularly for longer, turns. However, using thighs rotation to set new edges takes less time. In advanced skiing you normally want to develop quicker edge change and better balance than results from the lateral repositioning of your upper body and hips. In earlier carving technique discussions we described how your pelvis' hip sockets let you rotate your femurs or thighbones independently of your hips and upper body. With your ankles and knees flexed, this thighs rotation will quickly tip your ankles and feet to produce a pronounced to-the-snow edging of your skies. As we saw in the previous Section 1.5, there is widespread ski-community endorsement for using thigh rotation to edge your skies when carving. Hopefully by now all this has convinced you of the biomechanical benefits of thigh rotation.

There is a simple on-slope ski exercise that will give you the feeling and idea of how using thigh rotation will produce quick, and simultaneous mirror-image edge change. Facing to the right with skies across the slope about hip distance apart, put your poles next to your boots on little-toe side of left ski and big-toe side of right ski. Without rotating hips, rotate both thighs to the left, as you do for a left turn. Your knees and lower legs will quickly move leftward and simultaneously touch the poles. Likewise facing left across the slope, put poles next to boots on little-toe side of right ski and big-toe side of left ski, and rotate both thighs to your right, as you do when making a right turn. Again your knees and lower legs will quickly and simultaneously touch the poles.

There is another ski exercise that gives you an even better feel for how thigh rotation quickly edges your skies while maintaining balance. Centered over the skis, with skis about hip distance apart, flatten your ski bottoms to the snow and sideslip down a moderate pitch slope. Then, rotate you thighs toward the upslope side, which will make your feet tip to quickly set edges and stop your sideslipping. Release your edges and set them again several times. Turn and face the opposite direction and repeat the exercise. If you use feet tipping from thighs' rotation to halt your sideslipping, you will end up balanced and over your skis. On the other hand, if you use increased lateral hip angulation to set your ski edge angle, your center of gravity will not be over the skies when you stop. You will then need poles or C.G. movement to regain your balance after using hip angulation to edge skies to halt your sideslipping.

Generally longer, very high speed carved turns use thighs rotation and some hip angulation to balance against the strong turning forces. On the other hand, short,

recreational carved turns employ mostly just thighs rotation to change your edges. For example, the higher frequency, short carved turns you see advanced skiers execute down the fall line of smooth slopes make use of rapidly alternating thighs rolls, with ankles and knees flexed, to change edges. There are many who are convinced that ski instructors do these types of rapid-fire turns to make other skiers feel inadequate and inferior, especially their students. Out of the bag for all to see, here is their "I can you can't," one-upmanship secrets. For a series of quick, short turns on shaped skis, rapidly rotate and twist your thighs to move your flexed knees alternately right-and-left to the 2 o'clock and 10 o'clock positions, as you keep your upper body stable and facing the fall line. The thighs and knees move in unison, from side to side.

1.7 Fore-And-Aft Balance Over The Centers Of Your Feet and Skis

If your center of gravity is behind your feet, your leg muscles will be primarily working to maintain your balance, not primarily working to control your edging. Your C.G. centered over the center of your boots, with ankles moderately flexed, is the key to keeping equal ski pressure on both ski tips and tails for maximum ski arcing and efficient carving. **Balance yourself with ankles flexed forward and knees bent so the resultant of all forces is aligned with the center of your feet (equal pressure on balls of feet and heels). Remember, sensitivity to ankle flex is direct feedback to your body being centered and balanced.**

You want your shins to maintain contact with your boot fronts from a balanced ankle flex, not from pressuring the ski tip by excessively leaning your body forward to get your shins against the boot's front. You will be surprised how a balance ankle flex will improve your skiing performance in all kinds of conditions. Not habitually skiing balanced, with ankles flexed, is often what limits skiers from reaching a higher skiing level. A good approach, to develop this ankle flex habit is, just before you start each ski run, to consciously flex your ankles in a balance position, to put some pressure on both your boot tongues.

Stand in the so-called athletic waiting stance like a baseball shortstop or a basketball guard. Your back is relaxed and slanted somewhat forward, with your hands forward (elbows ahead of ribs) and your shoulders forward and loose, not hunched over and tense. If you feel you need more stability, bend your knees to flex ankles more and keep the center of your feet under your C.G.. Don't bend over at the waist and crouch forward. Also, don't lower your rump in the so-called "potty position," off-balanced with your C.G. and hips behind the center of your feet. **A balanced or athletic stance is illustrated by the so-called "Parallelogram Of Power" Figure in Section 1.10.a**.

On a solid, non-slippery surface you generally balance yourself by moving your hips and upper body forward or back. However when on skies over the slippery surface of the snow, fore-and-aft feet movements for maintaining your body's balance are quicker than moving your upper body forward or backward. If you feel your C.G. is getting behind your feet, you need to pull your feet back quickly under you by flexing your ankles forward. On the other hand, if you feel your C.G. is getting ahead of the center of your feet, move your feet forward under you by straightening your ankles. **Adjusting ankle flex is the key to maintaining yourself centered and balance when skiing**.

The shorter length of shaped skis makes it even more important to stay fore-and-aft centered. If you do get back on the skis, to regain your balance you no longer have the leverage of long-tailed traditional skis to work against. *Flex and firm up your ankles to remain centered*. Skiing with your ankles loose will result in considerable more fore and aft upper-body motion about your feet centers with a higher risk of losing your balance.

There is a good training exercise to get yourself skiing centered at the beginning of your ski season or ski vacation. Pick up the inside-of-turn ski entirely off the snow and balance yourself only on the outside-of-turn ski after starting each turn. Doing this for several turns requires you be both centered and laterally balanced on the outside ski with its big-toe side strongly edged.

1.8 Use Of Ski Poles Making Turns

There are two types of pole plants in skiing. The first is a swing-and-touch plant on smoother slopes, which occurs together with your body's crossover movement across the skies. If done properly, the swing-and-touch plant is an integral part of your crossover and turn. The second type is a firmer plant, which is used to better balance or stabilize your upper body in more difficult conditions such as significant moguls or steeper slopes. When your upper body is stabilized, this allows your legs to fully do their turning functions. When moving diagonally to the fall line on groomed slopes, your pole plant should be in the direction of the fall line, not where your ski tips are pointed. In moguls, plant the pole on the crest of the mogul.

When serving a tennis ball, you should grip the racket handle so as to maintain a loose, relaxed hand, arm and shoulder. The same holds true for how you grip your ski pole for a swing-and-touch plant. Your hands, as well as your shoulders and upper-body, will be kept more relaxed by holding the pole with little or no force from your little finger and ring finger. In other words hold the pole mostly with pressure from your thumb and first two fingers. Being relaxed is good for your skiing (see Section 6 for more on relaxation). A tight grip, with all fingers exerting pressure on the grip, will tend to result in more total arm motion. Instead, when crossing over for a swing-and-touch pole plant, what you want is a downward, wrist-flex motion to lower your pole tip to jab the snow. Use a firmer grip only for a stabilizing pole plant in tougher conditions.

Keep your elbows comfortably bent and just ahead of your rib cage so your hands are in front of you at, or just below, chest level. Dropping your hands lower will tend to move your body backward on the skies. This will tend to put pressure your skies' tails instead of where it should be, which is on the skies' center.

Although the term pole plant is normally used, some prefer the term "pole touch" for a swing-and-touch pole plant because it more accurately describes the gentle tap action from the downhill body movement during crossover. When carving, the pole touch begins with a forward and across movement of your C.G during crossover. With a forward arm extension and a downward wrist rotation, flick the pole tip downhill of your body. Your downhill facing upper body, crossing the skies and beginning to lean to the inside of the new turn, together with an downward wrist flick, is what touches your pole to the snow. It is not reaching your arm forward and slamming it down. If you plant your

pole as part of starting each carved turn, then the pace of your pole plants will help establish a rhythm to your linked turns on a groomed slope.

As the pole tip touches the snow, make sure your pole hand drives or continues downhill over and past the lightly planted pole with a further downward rotation of your wrist. Allowing a heavily planted pole to drag your hand back, as you move downhill, will twist your shoulder back uphill. This is an all too common problem that will take you off balance and unprepared for the next turn. You want to remain balanced with your shoulders continuing to face downhill.

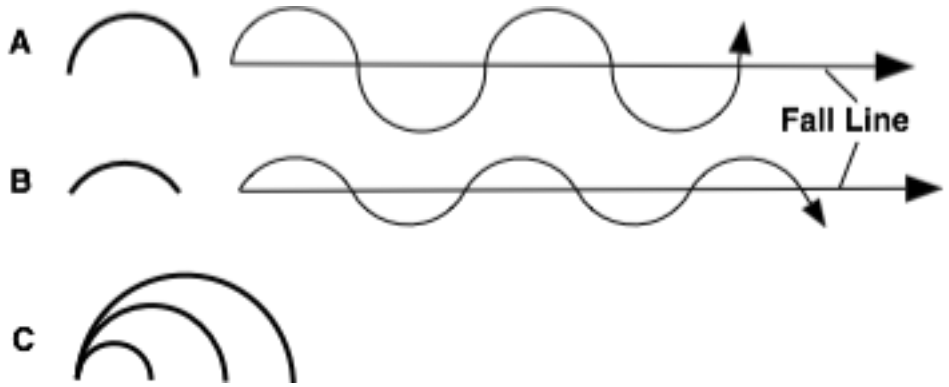
The pole plant for the traditional parallel Christie, or any foot swivel and skid turn, serves as a trigger to lower then raise the body for an up un-weighting, feet swivel and weight shift (see discussion of narrow or wide-track Christie turn action sequence in Section 1.2). On shorter turns, steeper slopes, deep or heavy snow and in moguls, a well defined pole plant is ordinarily used to project your center-of-mass forward and across, to center and stabilize your upper body. Having your upper body thus stabilized allows you to fully use your legs for their turning function, instead of rebalancing.

When carving turns on groomed, moderate-pitched slopes, lower level skiers frequently don't use pole plants. Unfortunately, skiers who have only taken carving lessons on moderate-pitched, groomed slopes, haven't been shown how proper pole planting can improve their turning. If that is your case, I recommend you start using pole plants on your groomed, moderate-slope turns so it becomes a natural part of your skiing. Thus, when you try to upgrade your skiing to handle more demanding conditions, you can apply your full attention to coping with the tougher conditions rather than having to devote some of your attention to a new and unnatural activity, which is proper pole planting. In my humble opinion, U.S. ski schools should do a better job of teaching students the benefits of proper pole planting.

Many old school skiers have the hard-to-break habit of reaching downhill with their arm and then leaning on the pole plant to change edges. Instead when carving, as your upper body tips forward-and-across downhill toward the new turn, you should extend your arm diagonally forward, and with a downward wrist flick, lightly touch the pole tip to the snow. Your C.G. moving diagonally downhill should ring a bell. That's right, it's the by now much-discussed crossover maneuver. This has the effect of beginning the edge change early, before the actual pole plant, resulting in a quicker and smoother turn. On the other hand, reaching down and planting pole too early will delay setting new edges.

1.9 How The Shape Of Your Carved Turns Affects Your Skiing Speed

As you well know by this point, if while in motion you edge you skies and transfer about 80 % of the total loading to the big-toe-edged ski, you will start tracing a section of a circular arc in the snow. With sufficient slope width, this can be extended to an almost complete half-circle, as in the left of Figure A, which is the top of the following three drawings. When linked together as shown in the right of Figure A, you will trace a succession of symmetrical, round, near half-circles down the slope, centered about the fall line.



If you choose to make sequential quarter-circle arc turns of the same radius instead of the half-circle turns, you will trace a comparably straighter path down the fall line like that shown in the right of Figure B above. Down the same slope inclination, this straighter-line, quarter-circle rhythmic pattern will be faster than the half-circular turns of Figure A. Linked quarter-circle arc turns can be used to increase your speed relative to half-circle arc turns, or to maintain your speed when encountering flatter terrain by switching from half-circle to quarter-circle arc turns. You can of course select a turn rhythm that is between half and quarter circle arc turns, or an even straighter line down the slope with less that quarter circle arc turns. The smaller the fraction of a half circle turn you chose, the straighter will be your path and the greater will be your descent speed

Not only is your speed affected by what fraction of a half circle arc you use to make your turns, but it is also affected by the size of the radius of your arc turns. The larger the radius of your arc turn, the more speed you will carry at the end of the turn. The reason is because you are going in the downhill direction comparably longer. Conversely, you can reduce your speed with half-circle arc turns of smaller radius. Thus you can choose to link either less-than-half-circle arc turns of a smaller radius, or complete-half-circle arc turns of a larger radius, as shown in Figure C, to get equal speeds. While in the process of linking larger radius arc turns down the slope, you might have to suddenly execute a smaller or larger radius arc turn to avoid an obstacle, which accordingly will slow or quicken your speed a little.

There are an infinite combination of various radii and fractions of half-circle arcs you can select to make your turns. They are what you choose to adapt to the snow conditions, react to the pitch of the slope or just reflect your natural skiing inclination (speedy and daring, mid speed and relaxed or slower and cautious). Think of these varied carved arcs as the brush strokes you use to paint your own descent picture on the snowy canvas of the mountain's side. They are the various carving patterns that good skiers select to perform their sensual dance in partnership with gravity and the mountain.

If the slope is wide enough, and without skidding, there is an alternate way you can quickly reduce undesirable speed when carving. What you need to do is brace yourself for the increased force buildup and continue turning until you go past the fall line a little, or back up the hill some, before starting a new downhill arc. If your main objective is to

limit your average downhill speed, then the easies way is by using foot steering and some sideslipping to scrub off uncomfortable speed buildup, as discussed in Section 3.1.

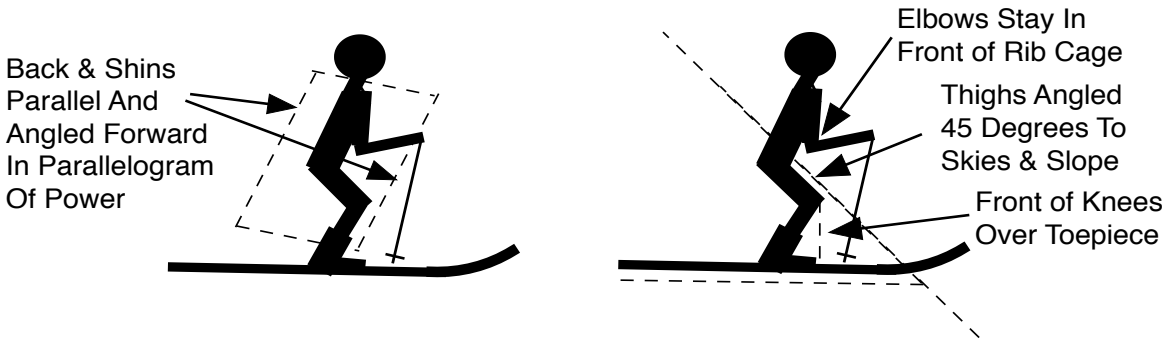
1.10 Carving As Described In Three Sear Warman Instruction Videos

1.10.a Parallelogram Of Power Posture Over Skies

Much of the current U.S. taught, advanced, free-skiing techniques, used on groomed slopes, have been heavily borrowed from ski racers. They and their coachers are constantly looking for more effective and efficient ways to turn around the gates of their racecourses. Together with ski design, professional ski racing technique has evolved considerably since the days of the classical tall and narrow skis. Some of my early Mount Snow carving instruction was based on Steve Cook and Terry Barber's video analysis of the body positions and movements of top ski racers. Their use of a mechanical model, of the lower body on skies, clearly illustrated how thighbones (femurs) pivoting at their hip joints create a strong ski edging. This is shown in the first section of an instruction DVD produced by Sean Warman called "Skiing Movements."

That first video section and skiing footage from subsequent sections were for me, and others students, a revealing aha experience. I liked the insightful way Steve and Terry had reformulated longer and more detailed explanations of modern ski carving technique and boiled them down into a few basic elements that are easy to understand and visualize. As was the case for later Warman videos, this was an organized and simpler way of looking at modern, carved skiing. It's all about the best body stance and movements to get quick, effective crossover and strong, early edge changes. The instructions in Warman's videos, while intended for free skiing, also apply to turning on recreational ski racing courses, which is very briefly discussed in our later Section 2.1.

Good skiing starts with a balanced or so called athletic stance for greater control and edging. This stance is shown in the following illustration. I used two identical skier figures, instead of only one, just to avoid labeling overlap and clutter. The elements of a balanced skiing stance are the following: 1.) Your body's center of gravity (C.G.) is over the center or arches of your feet at the center of your boot, not over the balls or the heels of your feet. The pressure against your boot tongues comes from your forward shin angle, not from your body leaning forward with your weight pressed hard against the fronts of your boots and skies; 2.) Your body is in what is called a "parallelogram of power" posture with your shins angled forward some from ankle flex and knee bend, with your back straight and angled forward parallel to your shins, as illustrated in the left figure below. Note, the skier is not hunched over with back curved in the so-called gorilla stance; 3.) Your ankles and knees are flexed with the upper leg about 45 degrees to your skies and the slope. Good skiing requires you to have your ankles flexed and firmed up; 4.) The front edges of your knees should be over the center of your binding toepieces to position body weight over the center of your boots with your ankles flexed so you stay in contact with the front of your ski boots; 5.) Your hands, holding your poles, are ahead of you at about chest level so your elbows are never behind the front of your rib cage.



The forty-five degree thigh angle in the parallelogram of power position gives you optimum ankle flex and boot tongue-shin contact for good ski-edge control, which is what racers need for their turns down a race course. On the other hand, as a recreational skier you generally will ski most of the day, and although your slope conditions are generally less demanding, you are not likely to be in as good a shape as pro racers. Thus, recreational skiers tend to ski with slightly less knee bend to more relax their thigh muscles. However if you want precise control such as on a race course, down steeper slopes, or just really want to crank a free skiing set of turns to impress your skiing buds or look your best for a video or picture, you will want the full 45 degree knee flex of the ideal parallelogram of power stance.

Modern carving, with shaped skies, favors a stiff lateral boot but with less rigid forward flex. Thus today's forward flex for recreational boots is getting softer. If you feel your boots' stiffness makes it difficult to bend the front edge of your knees forward to over the binding's toepieces, in a parallelogram of power posture, there are things you can do to reduce that problem. The end of Section 4.2 has some approaches to enable you to get your knees' edge over your binding's toepiece with knee and ankle flex.

Good skiing starts with an in-balanced athletic stance for greater control and edging. That stance is the parallelogram of power position, which was just described. You will be amazed at how your skiing will improve by simply being properly balanced in the parallelogram of power posture.

1.10.b Warman's Three Fundamentals Concepts of Skiing

Sean Warman produced a later (2008) instruction DVD called "Images and Concepts of Skiing." This video does not negate anything said in his first video. It merely gives you added perspective on his earlier DVD's concepts by featuring some excellent footage of Michael Rogan and the Austrian Ski Team. Rogan's skiing and the stop-action in his various turn positions, with superimposed graphics, very effectively illustrate what Warman calls the Three Fundamentals Concepts. This, of course, has the skiers in a good balanced stance as described in the previous Section 1.10.a. The three fundamental concepts that Warman emphasizes in this second video are:

1.) <u>The Path Of The Ski Is Round</u>. When carving, the ski traces an arc (section of a circle) in the turn. If the turns flow one into the other, without a noticeable traverse, you will get an "S" like descent as illustrated in Section 1.9.

2.) Balance Against The Outside Ski Of A Turn. Your body's balance shifts from mostly against the outside-of-old-turn big-toe's ski edge (about 80 % of pressure), with that leg extended, to that of mostly against the outside-of-new-turn big-toe's edge, with outside-of-new-turn leg extended. The critical movements that enable you to balance mostly against the new outside ski edge are:

a.) The Hips Move Forward Downhill. Starting a turn, your hips and C.G. move forward inside of the new turn, in a downhill direction. This is what happens in the crossover movement we discussed in Section 1.2.b.

b.) The Legs Change Length. Your right and left legs exchange their respective extended and flexed length in the process of going from an old turn to a new turn. The long outside leg of the old turn is sucked up or flexed so its knee moves toward chest and the flexed inside leg of the old turn is extended or made long, as the new turn's outside leg.

c.) Level Out. Your hips and shoulders should again level out in the new turn because its inside leg is flexed and its outside leg is extended.

3.) Thighs Twist To Make Feet Tip. During crossover, the upper legs tip and twist (rotate at their hip sockets) to edge the skies so they turn, as earlier described by Steve Cook and Terry Barber, in the first section of Warman's first video, "Skiing Movements."

The above three fundamentals are an excellent summary of much of what has already been covered when describing the relaxed "skiing-with-the-force" carving technique.

1.10.c Warman's Two Major Focuses Indicating Proper Carving

Sean Warman produced yet another of his outstanding instruction DVD's called "Images and Concepts Going South." This video features Michael Rogan, Robin Barnes and the U.S. Ski Team at Portillo Chile. It is focused on two major telltale signs of good carving that result from applying the techniques in his first two videos. Warman does a great job of illustrating the two main themes of that DVD with Michael and Robin making turns, with clarifying graphics superimposed on stop action section of the video. Those two focuses are:

1.) Hip-Leg Alignment and Movement.

a.) In skiing, depending on turn size, the hips don't always face directly down the fall line, but they do always face significantly inside the turn. Face down the fall line for shorter turns and little less for longer turns. ***Upper-lower body rotation separation is important for smooth, efficient skiing***. At the end of a turn, your hips and upper body should face more downhill toward where you want to travel to instead of to where your ski tips are pointed to. When you finish your turn, your hips have not rotated to the slope's side of that turn, where your skies are pointed.

b.) From the start of a turn to its finish, your legs turn more than or move past the hips during a turn. At the end of the old turn, your upper legs are turned past your hips in one direction and then turned back past your hips in the opposite direction when generating a new turn. There is separation or independence between the rotation movements of the legs and that of the hips and upper body during a turn. To turn legs independent of the

hips, skiers need to twist or rotate their upper thighs at the thighbone's pelvis joint while using muscular contraction or tension to stabilize pelvis. To keep your pelvis from turning with your thighs, you need to feel like the left side of your pelvis is trying to rotate to the right when your legs are turning to the left and likewise feel like the right side of your pelvis is trying to rotate to the left when your legs are rotating to the right. It feels like the pelvis is counter-rotating in reaction to the legs' rotation.

2.) <u>When Making Alternate Turns, The Feet And Skies Tip From Side to Side.</u>

Your feet are tipped or edged in one direction when engaged in a turn then tipped In the opposite direction when you release from that turn to start a new turn. When carving alternate turns, your feet tip during each release of your old-turn's ski edges to set new-turn's edges. Starting each new turn the feet tipping process results from the combination of both a crossover and a twisting of your femurs at their hip joints, toward the inside of the new turn.

The two focuses of this Section 1.10.c are closely related to the discussion of Warman's earlier two DVD's in Sections 1.10.a and 1.10.b. This video brings home the important effect that thighs twist or rotation plays on upper and lower body separation and tipping feet, particularly in the tutorial section of the DVD. The take away is that the development of a new turn has your knees move together past your hips toward the inside of the new turn from your thighs twisting or rotating at their femur's hip joint. Section 1.5 discusses femur or thigh rotation in more detail.

SECTION 2 - BASICS OF RECREATIONAL SKI RACING

Because individual timed trials, selection of teams and the team races on parallel races courses were such a well-established tradition on past Mount Snow week trips, some basic race technique instructions were often included in the ski classes. This was back when the club was much larger. For many years the Mount Snow trip was so popular, it had skier numbers as high as the mid 70's and took two buses up.

Adding to those past years' race-ambiance ado was the selection of "evenly" matched teams by the always scrupulously impartial trip captain. To fairly match the racing teams, the trip captain used the results of the Tuesday individual time trials and an extremely sophisticated, computer recursive procedure, which is based on a process developed in an obscure branch of advanced optimization mathematics. This procedure has become known as "Colbert's Team Subgroup Equalization Algorithm." This is because of the renown use of the process by the Colberts (Jim and Eddie). They ran the club's Mount Snow trip each year from 1974 to 2013, in addition to other Western and European trips. The Peninsula Ski Club owes many thanks to those two for their service.

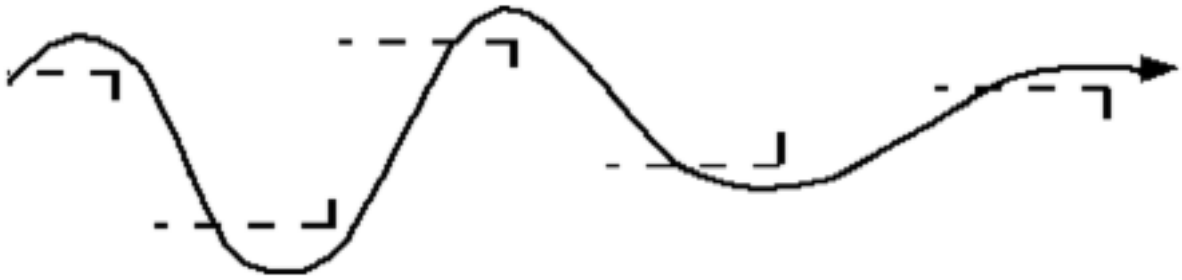
The Thursday races in those past Mount Snow trips were the real deal, with bib racing numbers, starting-tripped timers, racers simultaneously coming down two parallel courses, and even a public address announcer giving numbers, names and skiers' course times, just like they do for televised ski-pro races. We are talking the whole nine yards here, with prizes for all racers and even included official NASTAR medals. The race enabled trip members, who wished to participate, to experience another interesting

facet of skiing, which is the fun and excitement of team competition and the personal challenge of recreational ski racing.

2.1 Fundamentals Of Where to Turn On A Race Course

If you are into recreational ski racing and want to reduce your course times and raise your NASTAR medal level, you should consider investing the effort to learn and practice uphill release, as described in Section 1.4. Think of a ski race as your opportunity to best use your free-skiing carving to minimize your speed loss when turning around gates. The obvious difference between racing and free skiing is that the turn locations on the racecourse are determined by the gate positions, as opposed to being your choice when free skiing.

The fall line is the path of steepest descent or highest gradient down the slope. The rise line is defined as the fall line extended back up the hill from the gate as shown by the dashed line in the previous figure. A turn to the gate should always begin uphill of a gate when the tip of your skies crosses the rise line of that gate, which is shown by the uphill dotted lines from each gate, in the following figure with the ski path for five gates.



If the next gate is significantly offset, your turn should be about completed when passing the downhill side of the first gate. This is the case for the finish of each turn for the first three gates of the previous figure. When the next gate is fairly closely aligned to the current gate, as for the last two gates of the previous figure, your skies should be going down the fall line when passing the current gate. When preparing to skirt the next gate look at its base, not the upper part of the gate, to avoid hooking a ski on the gate.

Don't get fixated on the next gate, which is the most common mistake that beginning racers make. The position and offset of the gate beyond your next gate will determine the kind of turn you will make at your next gate. In order to make the smooth transitions described above, don't wait until you cross the next gate before looking for the subsequent gate. Look ahead at least one gate, better racers look ahead two.

Your speed on the racecourse will of course reflect your skiing level. You want an aggressive attitude suitable for your ability level and racing experience. Ski in balance with your hands forward. However, remember aggressive should never mean reckless, after all we do this for fun.

2.2 Hip-Lift Technique And Its Off-Slope Practice Impression

The hip-lift technique use to be considered a “hot insider movement” employed by top slalom racers to quickly apply big-toe edge pressure to what will be the new turn’s outside ski. The movement was quick and subtle. When used in a turn on the slope, it is not easy to spot. If you stand on level ground and quickly lift one hip straight up, that leg and foot will also rise slightly and your other knee will turn in some. When applied to the downhill hip, this movement will cause a quick pressure release on the downhill ski and a big-toe-side edge set of the uphill ski. While quickly and smoothly transferring pressure from the downhill to the uphill ski, it keeps the downhill ski on the snow and moves the center of gravity toward the inside of the new turn. In addition, the hips are quickly leveled into the new turn with minimum leg movement or adjustment. This is an advanced, subtle but dynamic movement that was used for quick edge chance and turning.

A perception of the edge-set effect of hip lift can be obtained by moving down a gentle slope in a wedge (snowplow) and alternating the lifting of left and right hip. You should feel the right ski edge bite the snow more when you lift the left hip and correspondingly feel the left ski bite more when you lift your right hip. There is another perspective that might help give you a sense for the hip lift movement. Actually lifting the downhill ski off the snow, at the start of a new turn, was an exercise skiers used to practice classical, one-legged, complete-weight transfer to outside-of-new-turn ski. Racers in the Stenmark-Mahre era did the same thing to apply maximum pressure to their longer, narrower, and stiffer, new-turn-outside ski to edge and hold on icy racecourses. If you can relate to the technique of lifting the downhill ski to start a turn, you might think of hip lift as an analogous but quicker and much subtler form of old-turn downhill ski lifting.

When looking at how hip lift works in the first paragraph of this section, we see it has some of the characteristics of the uphill release described in Section 1.4. It decreases pressure on the downhill ski and loads the uphill ski, with a big-toe edge set of that ski. That said we might be tempted to call hip lift a very subtle uphill ski release technique. However, when we watch a modern racer like Mikaela Shiffrin hurtle down a slalom course, it is apparent that when doing aggressive turns, she is making quick and more total edge change in her turns than hip lift is capable of delivering. The trend in racing turns seems to be using a more direct uphill ski release to speed up the edges change, particularly for turns around gates that are significantly offset. However, hip lift can still be used for shallower turns when the next gate is not too significantly offset from the current gate.

I will not name any names, but as you might well have noticed, there is no question that some PSC (Peninsula Ski Club) members appear to be, let’s say, “unique”. They just march to a different drumbeat. However, if you see one of our skiers walking around with an unusual "funky chicken” like gait, you shouldn’t automatically assume they are weird. Only after reading this section would you realize they were only practicing their hip-lift technique off-slope. This only makes them skiing fanatics, which you would no doubt agree is far and away more acceptable than simply being weird.

SECTION 3 – SKI TECHNIQUES OTHER THAN WIDE-TRACK, PURE CARVING AND THE SLOPE CONDITIONS FOR THEIR USE

3.1 Recreational Skiing Situations Where Skidding A Turns Is Preferable

The pure edge-to-edge, wider-tracked curved turn, with limited if any foot steering and skidding, is what racers use when possible to ski down and turn around gates to minimize their speed loss. You want to carve your turns if you choose to ski faster, in precise control, on smoother hard-packed slopes or in NASTAR races. Today's shaped skies make that possible.

However, the slope speed that skiers enjoy and feel comfortable with varies widely. Examples of skiers who would normally prefer to restrict their downhill speed, even on broader, groomed, moderately-pitched slopes are the following: novice skiers still working on their control; more experienced but by-nature cautious skiers, or older skiers with reduced strength and balance. On steeper blue or on black groomed slopes, even intermediate skiers will enjoy the experience more if they can keep from picking up a higher-than-comfortable speed. In addition to limiting speed, as we shall see later in this Section 3, there are other recreational-skiing, slope situations where pure edge-to-edge carving is not the turning technique that is best suited for those conditions.

As compared to pure carving, turning with more speed scrubbing can be obtained by a combination of foot steering with some skidding. You cannot pivot your feet when your skies are pressured and edged into the snow. That is why foot steering and skidding your turns requires a combination of un-weighting and flatting your skies. For a time, in skiing circles, "smearing" was the politically correct new term that portrayed the use of foot steering and skidding to make your turns. However, that term doesn't appear to have stuck and foot steering and skidding is now once again commonly used.

Older skiers might recall that foot steering and skidding was the basics of traditional parallel Christie turning with narrow skies. By keeping your feet a hip distance apart, a wider-track version of the traditional parallel Christie can be made with shaped skies by un-weighing or momentarily floating your skies, together with twisting your feet, and then pushing them to the outside of the new turn, with the outside-of-new-turn leg more extended. The un-weighting can be either up un-weighting (by bending then quick legs extension) or down un-weighting (by quick legs retraction). There is a little more discussion of both traditional-narrow and wider-tracked foot steering and skidding at the beginning of Section 1.2.a.

Instead of using either a pronounced traditional un-weighting to start you foot steering, you can also combine your carving technique together with a little foot steering. This can be achieved by steering or twisting your feet some during the short time when it is easiest to do so. That is during the carving crossover when the skies are momentarily flat to the snow as you are free falling downhill, with your C.G. directly between both skies. Unlike pure carving, which has a mostly diagonally across and forward body

elongation, adding a little upward body elongation to your crossover maneuver makes it easier to pivot your feet some at crossover. However, a pronounced upward body elongation to significantly pivot your feet is really moving from carving your turns to foot steering and skidding your turns with up-unweighting.

On narrow trails, you will need to use strong foot steering and skidding, instead of carving, to get the turning direction change needed in such restricted spaces, particularly if there is any steepest to the trail. There, you can't complete the turn you want to make with pure carving, even with deeply-sidecutted, shaped skies. On extremely steep slopes, turns are started with a pedal hop off the uphill ski to lift and rotate both your ankles and skies in the air so you land on the same ski you hopped off of. If you plan on skiing really steep terrain, then Goggle petal-hop turn to get YouTube visuals and more information on that technique.

As you start skiing a more "all-mountain" range of slope and snow depth conditions, there are times when you will need to vary your stance width, the loading distribution between your two skies, or sometimes both. This is different from what was described earlier for carving turns on smoother hard pack slopes. The following sections on skiing moguls and deeper snow are prime examples of conditions that require you to change stance and ski loading.

3.2 Skiing Moguls

A prerequisite for in-control, recreational mogul skiing is being able to make body-in-balanced, quick-direction and edge changes. Don't kid yourself, unless you have mastered making quick, tight turns on smooth steeper slopes you are not ready for serious moguls. Your feet, legs, and skies must work together in both space and time. Things happen fast, particularly in bigger moguls on a steeper slope, and a narrower-than-normal stance will help your feet, legs and skies all work in harmony. By narrower stance I don't necessarily mean knees and skies glued together, but your ski pants at the knees should or almost touch. A wider stance can place you in the awkward situation of having one ski up on top of the mogul's crest and the other ski quite lower, down its slope.

If you infrequently ski moguls, narrowing your stance is easier said than is sometimes consciously done. After performing thousands of wider-track two-footed turns on smoother slopes, that by nature becomes your normal, ingrained posture. It's very easy to enter a mogul field and without thinking or realizing it, continue trying to use your normal, smoother-slope, wider-track stance. If you don't ski moguls fairly regularly, before entering a mogul field it's a good idea to stop, before proceeding, and think about your stance width, as well as ankle flex and overall balance.

When you enter bumps, you want to be balanced and centered over your skis, definitely not sitting in the back seat. Flex and firm-up your ankles to lower yourself, and put your shins forward against boot fronts. Your back is slanted somewhat forward, but relaxed and you are balanced over the center of your feet. Your hands must remain forward, at about chest level, with your elbows ahead of your rib cage while planting your poles. If your elbows come back past your rib cage or you drop your hands, you will get off balance on the back of your boots and quickly pick up speed, thus making it difficult to

regain control. As discussed in Section 1.7, flexing your ankles forward to bring your heels back is quicker than trying to move your hips and upper body forward, for regaining your body's balance, when your C.G. falls behind skies' center. Flex knees and ankles to lower yourself some on mogul tops (rump to the bump) and quickly extend outside-of-new-turn leg to transfer loading and maintain snow contact with backside of mogul. The key to maintaining snow contact is to move your feet up and down in concert with the changing snow height so your center of gravity (C.G.) barely moves vertically.

Young competitive mogul skies use a fairly straight line down the moguls' troughs, turning against the moguls' sides with extremely quick, rapid-fire pole and knee actions. Keep in mind they are young, fantastic skiers and compete on hills with regular shaped and spaced moguls. However, in a typical recreational mogul field, most skies generally prefer a more leisurely pace with a pronounced foot-steering turn at the crest of a mogul and sideslipping down its downhill side to control their speed. That technique involves pivoting feet at the spine or crest of the mogul and then extending legs down its backside with some angled sideslipping to drift down its downhill slope to the next mogul and repeat the process. When I say angled sideslipping, here I mean the ski bottoms are more angled to the snow on the outside of turn and on downside of the mogul, as opposed to slightly angled, when sideslipping on smooth slopes. This more leisurely descent is what Joe Nevin called skiing the green line in his "Bumps for Boomers" mogul instruction program. Although not as cool and flashy as the young hot shots, it will get you through a mogul field with both gear and dignity intact.

Remember, when mogul skiing you need to revert to closer-tracked skiing. When turning on a mogul top, feet are quickly pivoted and almost all of the skies' loading is quickly switched to the outside-of-new-turn ski, with a leg extension to maintain good edged ski contact with the downhill side of the mogul. Some instructors emphasize strong shortening of the outside-of-old-turn leg as you approach the mogul's crest to get strong outside-of-new-turn leg loading and extension for good snow contact on mogul's downside. Borrowing from the phantom edging focus that Harold Harp describes in his instruction material will set in motion these desired actions. As you approach the mogul's crest, to start a new turn with phantom edging, lift and pivot the old-turn-outside foot and tip its little toe side toward the snow. This will spontaneously extent the new-turn outside leg and prompt the new-turn-outside-foot's big toe to edge toward the snow as you sideslip down the mogul's backside.

In summary, basic-recreational, larger-mogul skiing requires the following elements: a narrower-than-normal stance; good balance with close to all of your loading applied to the outside-of-turn ski; firm and flexed ankles with shins in contact with boot tongues; rapid leg retraction to absorb the rise to the crest of the next mogul for constant snow contact; pivot feet and plant pole when you reach crest of mogul; and a quick outside-of-new-turn leg extension to load and keep your skies in contact with the snow on the downside of the mogul.

3.3 Handling Deeper, Loose Snow

Except for the previous mogul discussion, most of this article's earlier material was about skiing on smooth hard pack with limited loose-snow depth. Today's recreational

skies designed for groomed slopes (hard pack or carving skies) have ski waist widths in the range of 74-85 millimeters (mm). Ski designed for mixed Eastern snow (all-mountain narrow skies) have waist in the range of 86-94 mm. Those designed for mixed Western snow (all-mountain wide skies) have waist in the range of 95-108 mm. Skies designed for deep-power Western snow (fat powder skies) have waist in the range of 109-125 mm. When you plan to spend significant time skiing deep powder, consider renting fat power skies if you don't own any. The wider, waist width of these skies and their rocker tips make them much more buoyant and easier to turn in deep or curd snow. With these skies your sinking in the snow will be limited, so you can turn much as you would do on packed slopes. Regardless of your ski waist width, full-size power baskets on your poles are helpful in deeper snow.

You can still enjoy deeper unpacked-snow with a pair of hard-pack or all-mountain skies. Just realize the skies will sink some and won't react like they do on groomed slopes. When you find yourself in deeper snow, don't panic if you don't have wide power skies or extensive deep-snow experience. You can still have a good time by modifying your groomed-slope posture and loading on your skies. First, bring your feet and knees near each other, which makes the second modification easier. Second, keep each ski equally loaded instead of the normal groomed-slope downhill/uphill 80/20 average ski loading ratio. Third, to maintain lateral balance you will bank your upper-body more to the inside during a turn than you do during a turn on hard pack.

When turning on groomed slopes, your inside-of-turn leg is more flexed and your feet and knees are angled into the hill some to edge your skies. This positions your upper body a little downhill. By comparison in deeper snow, with both legs equally extended, the upper body is positioned somewhat more uphill toward the inside of the turn.

On packed snow your ski edges slice into the firm surface and arc a circular turn, with the leg pressure applied against ski edges. However, in deeper powder your edges have nothing firm to slice into. So, in a deeper snow turn, your legs are both extended and loaded equally to resist the snow pressure across the entire width and length of both your ski bottoms, as opposed to about 80 % pressure on the big-toe edge of outside-of-turn ski. Therefore, with both legs extended, in a turn you will ride your skies similar to what water skiers do while in a turn. In a turn they have their entire body banked to balance against the heavy water pressure on the bottom of their ski. People who normally only ski on groomed slopes have a tendency to fall to the outside of their deeper-snow turns if they don't consciously make an upper-body banking adjustment.

In deep snow the skies' lengths will arc from the combination of the skier's weight pressure on the top, center of the skies and the snow's counter pressure along the entire length and width of the ski bottoms. However, the curvature of the arc that both shaped ski bottoms creates in deep snow will be less than for the outside-of-turn ski when it is strongly edged and slicing an arc into firm snow on a groomed slope. Equally loading both non-powder skies, in deep snow, will prevent one ski from sinking while the other floats closer to the surface in a different turn-arc radius and getting crossed. Closely spaced, equally loaded skies will give you a broader support surface that will plane your skies nearer to the top of the snow to make turning easier. When skiing with hard-pack

or all-mountain skies, balancing yourself with more banking in a turn, with legs equally extended and skies evenly loaded and adjacent to each other are what make your posture and ski loading in deep power, different from groomed-slope, wider-track skiing.

Your C.G. starts out on the inside of the old turn and then transitions to the inside of the new turn when making carved turns on hard pack, as well as when making turns in deeper snow, however the procedures to obtain this transition differ. On hard pack you retract your outside-of-old-turn leg and let the lateral skiing forces pull your C.G. across your skies to the inside of the new turn. This is called crossover, which we earlier discussed in Section 1.2.b. In deep snow however, you retract both legs, pivot you feet and then extend them to the outside of the new turn, which crosses your skies under your C.G.. This is called crossunder. These deep-snow leg actions both change the skis' length direction and ski bottoms orientation to the snow, which starts a new turn and you begin resisting the lateral pulling forces of the new turn.

When you quickly retract both legs and un-weigh, the skies float up closer to the snow surface from the brief, un-resisted snow pressure against the ski bottoms. This temporary flotation makes it possible to quickly pivot feet. Then you extend both legs to the outside of the new turn, to start that new turn. For you older skiers who have experimented with different types of classical turn techniques, you might be able to relate to this deep power turn as being a closed-tracked, evenly-leg-loaded version of the traditional Parallel Christie turn using down un-weighing instead an up un-weighing.

While talking about un-weighting, I should mention that you can also use a two-legged, up un-weighting version of the classic, parallel Christie to temporarily float the skies and change their direction. This involves lowering your upper body by bending knees and then pushing up, off both legs, which unloads the skies and allows you to pivot your feet and change your skies direction. Skiers using this technique have a more noticeable up-and-down or porpoise-like motion to their deep-snow turns.

Considering those two deep snow un-weighting options, I prefer the down un-weighing model because of its more immediate action. Powder turns generally have larger radii and are slower to develop than carved turns on groomed slopes. You must be patient and allow time for deep snow turns to progress.

Being nervous in unfamiliar conditions, novice deep-powder skiers have a tendency to try turning too often and too sharply across the fall line to keep their speed from building up. In deeper snow you can make your turns shallower because the snow resistance to forward motion is considerably more than for groomed slopes. In deep snow, skiing with some speed are your allies to make your skies plane better. You certainly don't want to hurtle down the slope on the precarious edge of high anxiety, but you will need more speed than a novice skier learning to turn on groomed slopes. If you are a competent groomed slope skier, try and relax and allow yourself to approach the higher speed that you ski on groomed slopes. Like a water skier, you must have some speed to enable the skies to plane.

Welcome home all you old-school classical skiers. Tired of being beat up in ski school classes for having your feet too close together. The worm has turned. Your narrow stance is now the desired model for deeper snow. While keeping your boots and skies close together, remember your weight must stay evenly balance instead of being

totally shifted to the outside-of-turn ski, as was done for the classical, one-legged, parallel Christie turn.

You should be balanced perpendicular to your skies longitudinally, neither forward against your ski tips nor backward against your tails. Whether you are flexing or extending, keep the center of your feet underneath your body's center of gravity. Keep your ankles firmed-up and flexed to maintain contact between shins and boot tongues and balance yourself over the center of your skies (Section 1.7). Fight the all-too-common tendency, as well as don't listen to the all-too-common faulty advice, to sit back with weight against the back of your boots and ski tails, trying to float your ski tips. This is a sure-fire way to tire out your legs. If you quickly feel your thighs burn, you are sitting too far back. Regardless of what you might hear, leaning on the back of your boots is just an outright bad powder technique. If you are tending to lean back, pull both your heels back into a lower but balanced athletic stance with ankles, knees and hips flexed.

SECTION 4 – WHAT YOU NEED TO KNOW ABOUT SKI BOOTS

4.1 First Major-Gear Priority Should Be Properly Fitted Boots

If you too get hooked after trying skiing with rental equipment, you will likely start thinking about getting your own gear. The first major ski equipment that I recommend you purchase is a pair of correctly fitted ski boots. Boots that fit right will affect your skiing more than anything else. You will ski much better in a correctly fitted pair of boots with mediocre skis than with incorrectly fitted boots and higher performance skis. By having your own properly fitted boots you can easily find higher performance skies to rent at most ski areas. However, you will not be able to rent quality, custom-fitted boots if you have your own skies.

When and if you do decide to buy skies, you should try several pairs in the performance range of interest before purchasing. Most ski-area shops allow you to try their demo skies and take the rental cost off the price if you purchase skies. With your own correctly fitted boots as a constant in the trial process; you can compare the relative performance of a number of demo skies at different shops and even at different ski areas over a season before making your personal ski selection.

Another approach to consider is whether to just buy boots and forgo buying skies altogether. An important factor to consider is the ever-increasing cost of taking personal skis along when you fly to a ski area. For check-in, airlines normally treat a ski and boot bag as a single bag. If you can pack your boots and your clothes into one check-in bag and one carry-on, you will save yourself the second checked bag charge on both the flight to and from the ski area. The one-way, second bag charge, currently about $40, will likely go even higher as fuel prices increase. The saved round-trip, second-bag surcharges will help pay for ski rental at your destination resort.

If you only ski out West, you should weight the financial advantage of renting skies at your destination versus the combination of added luggage charge and the purchase price

of personal skies and bindings. You must also add to the weighting the cost of edge sharpening and waxing personal skies, if you don't do your own maintenance. Other important factors are how much skiing you do per season and how long do you keep your skies before updating. If you only ski a week or two out West per year, the financial trade-offs definitely favor renting skies. Two added bonus for renting are the opportunity to try the latest performance skies and of getting skies that better fit the local conditions, for example fat power skies after a big snow dump. Since I ski both East and West and do my own ski maintenance, my approach was to get a single pair of skies called "all-mountain" skies that have a waist width between those of hard-pack and deep-powder skies.

4.2 Basics Of Fitting Boots And Choosing Their Stiffness

Let's be clear, what I mean about boots that are a proper fit for you, I don't mean in any fashion sense boots that match the color of your skies or ski outfit. It is all about, and only about, sizing properly for your feet and ankles. Regardless of whether you are a first time boot buyer or looking for replacements, you should put some time and effort into getting correctly fitted boots.

Boots that are too large will not properly transmit the leverage of lower leg movement to the skies. You will need extra thigh and ankle movement to put your skies on edge to carve, or to swivel your feet for foot steering. So, even if you do what your ski instructor tells you to, your skis will not respond like those of your classmates who have snug-fitting boots. True, there are adjustment buckles to snuggle up the fit. However, if the boots are too big to start off with, when you try to tighten the buckles for a snug fit, you will excessively distort the hard plastic shell and create painful pressure points. On the other extreme, boots that are too small will have excessive tightness or pressure points that might only feel uncomfortable in the shop, but will become increasingly more painful from the forces and flexing of normal skiing. Also, boots that are too tight will cut circulation and create cold feet. Nothing can ruin an otherwise gorgeous ski day like cold and hurting feet. I hope I have got your attention about the importance of proper fit. Remember the three most important factors in selecting ski boots are fit, fit, and of course fit.

A Brannock is the device used in a shoe store to measure your shoe size. Those used for ski boot fitting are calibrated to give you a half-size smaller foot-size reading than your shoe size. Beware of someone trying to sell you boots the same size as your shoe size or that fit too comfortable when you first put them on. After skiing some, the liner will get compacted a little and the boots will then be too loose for you. One of the most common problems that skiers have with their boots is that they purchased boots that they either believed or were led to believe fitted, but were actually too large for them. I can name you a number of our Peninsula Ski Club members who have experienced this very problem.

Be aware, good boot fitting is considerably more involved than just correct foot size. Men and women's boots are shaped differently, with each tailored to their sex's general lower leg and feet anatomy. However, even within a particular sex there are significant differences. Individuals' lower legs and feet come not only in different sizes but also in

an endless variety of shapes. High insteps, low insteps, wide heels, medium heels, narrow heels, wide forefoot, medium forefoot, narrow forefoot, thick calves, medium calves, thin calves, some feet are stable when they are weighted, others pronate when weighted, etc. People with pronating feet will get fitted with boots that are too large, unless the fitter stabilizes the feet so they don't elongate in the boot when weighted. Skiers that are bowlegged or knock-kneed will need either cuff alignment or canting.

The impact of all these factors indicates you should select a boot fitter who has a good reputation in the community where you purchase and works in a shop that has the proper equipment to make needed adjustments. A good fitter will have orthotics footbeds, equipment to check for canting, and carries a number of boot brands, which improves your chance of good fit. To handle a hard-shell, pressure point problems, a professional fitter will of course be able to properly heat and expand the boot's shell at those points.

The odds of finding a professional, well-qualified fitter are much better near a larger ski resort. You should ask around to find a highly regarded boot fitter. There is a big difference between a general ski-shop clerk selling everything in the store, including boots, and that of a trained, experienced, full-time boot fitter. Be open to the fitter's suggestion, because the boots that your buddy swears by might be the best for his or her feet and ankles, but not necessarily be the best for yours. Some brands fit narrow feet or thin calves better, while others are roomer for wider feet or thicker calves. A good boot fitter will evaluate your feet-calve characteristics and steer you toward a brand and model that better match your feet and ankles rather than push the same brand on everyone.

Always bring the socks you ski in when trying out boots. When your foot is not measured in a shop, for example when checking out a person's second-hand boots, try on the prospective boots without the liner, with your ski socks on. After taking out the boot liners, there is an old boot fitting rule of thumb for correct length you can use. When the big toe just touches the front of the shell, there should only be enough room to reach down with your hand and be able to slide one finger down between the heel and the back of the boot shell, as shown in the following figure (Ski, Dec. 2007). Replace the liners and buckle the boots to a medium setting to test their flex and feel.

Avoid a quickie 20-minute selection or a rushed lunchtime pick at a mountain shop. Allow about an hour and half, if not more, to fit and purchase new boots. Potential boots, after being buckled to medium setting, should fit real snug at the instep, ankle and balls of your feet. Remember, you don't want the roomy, comfortable fit of a bedroom slipper here. If you can lift your heels any, up and down inside the boot, then the boots are too loose. If after repeatedly flexing forward against the tongue, for a few minutes, your toes still press hard against the boot tip, with no wiggle room, then the boots are too short.

If new boots fit correctly, they should initially feel really snug, bordering on or actually feeling too tight. After several hours of skiing the liners will compress some and conform to your feet such that you will go on to enjoy a happy relationship with your boots. The fairly thin margin between feeling real snug and being too tight is why you want to learn a few basics of ski boot fitting, as well as deal with a good boot fitter who listens. With the boots on, walk and hang around the shop for 30 or so minutes to check for places where the contour of the plastic boot and that of your feet or ankles have a significant mismatch, which are called pressure points. This is not the time to be stoic and silent. If there are any noticeable pressure points, work with your boot fitter because, unless alleviated, they will become increasingly painful when you ski. Another advantage of buying at a resort is that before the end of your stay, after skiing some, you can come back to the boot shop to get any fine-tuning you might need, at no charge.

In addition to fit, you should also pay attention to boot stiffness or flex. A stiff boot requires more force to flex it when you bend your ankles and push your knee forward. Properly used a stiff boot will turn the ski quicker but will also transmit more of the ski's vibrations to your shin. On the other hand, a softer flex boot will not allow you to turn the ski as quickly but will dampen out or isolate more of the ski's high frequency movements from your shin. If you are a beginner to intermediate skier, you want decent quality, medium-stiffness, recreational boots. Many boots now have some direct flex adjustment.

A low-end beginner's boot is generally too soft and flexible; you want a boot that will support your skill improvement. On the other hand the top model, very stiff, racing boot is not made for general open-sloped, recreational skiing and most definitely is not for lower to mid-level skiers. Avoid a mistake beginners something make, which is because they are more expensive, racing boots will be better for their skiing. Unless you are an upper level skier who knows exactly what he wants, definitely stay away from racing boots.

A boot's flex index or rating is often marked on the boot, but if not ask the salesclerk for its rating. Flex indexes are usually associated with skiing ability. Flexibility ratings are 55 to 75 for beginners, 75 to 95 for lower-level intermediate skiers, 95 to 120 for upper-level intermediate to advanced skiers, over 120 for expert skiers and 140 to 150 for experienced, advanced racers. In addition to skiing ability, take into account your personal situation. If you are a heavier skier or a fast and aggressive skier, consider adding 10 points of flex index. On the other hand if you are light and slight, have weak knees, tender shins or advancing in age, you should consider adjusting down 10 points.

When buying a pair of ski boots, check to make sure they allow you to move the front of your knees over the center of your binding's front toepieces, by flexing ankles forward, in the parallelogram of power posture (described in Section 1.10.a). The new

boots should allow you to do this as they are, or with easy adjustment. If your current boots don't allow you to do this, there are several possible fixes other than buying new boots. Some boots allow you to increase forward flex by removing one or both allen or hex wrench screws on the back of their shell cuffs. According to their web site, Lange boots, with two allen screws in the back of their lower shell, will increase their flexibility as follows: 6 % with removal of only the top screw, 12 % with removal of only the bottom screw, and 20 % with removal of both screws. If you do remove an allen screw, to soften the boot' flex, be sure to also remove the rivet on the inside of the shell, which has a shaft through the boot-shell hole that the screw threads into. Not doing so will prevent the boot from flexing as expected.

Some model Lange boots have a screw on their cuff to directly adjust boot flex, with a flex range of about 10. For other boot brands, check their specs or confer with a reputable boot man about adjusting their flex. Grinding the tongues or plastic shells of boots can reduce stiffness, but only a qualified, professional boot technician should do that. Another approach to reduce a boot's forward stiffness some is to position your boot's power straps so when you tighten the straps, they will be directly against the liners of your boots, not over and against the boots' front, outer, hard-plastic shell.

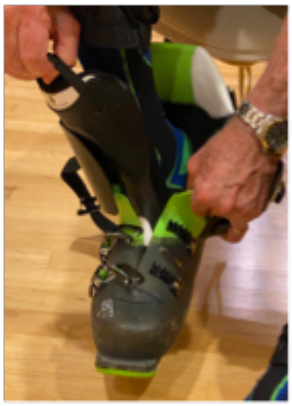
When a skier's own boots don't allow their knee to move forward over their binding's toepiece, with ankle flex, a stopgap measure sometimes taken uses rubber wedges that compel a more forward angle to the shins. This moves the knees a little more forward than what the boots will permit from only normal ankle-flex pressure on the boot tongues. These curved wedges are placed behind your calves, between the boot's liner and its outer, hard-plastic shell, and are held in place by glued-on Velcro strips. They can be obtained from online ski and boot supply merchants or purchased and installed at the boot departments of a well-stocked ski shop. However, realize that although advancing your knees in a more forward position, these wedges do not actually alter the boot's forward stiffness. By far the best solution, when you purchase your boots, is to get a pair that will let you dynamically move the front of your knees forward, to over the center of your binding's toepieces, by flexing your ankles and knees forward.

4.3 Putting On Your Ski Boots In The Morning

For some skiers, putting on their boots in the morning can be somewhat of a problem. The first thing you want is for your boots to be dry and at room temperature. If you drive to a ski area in the morning, don't put your boots in a cold car trunk. This will make your boots very stiff, which means they will be hard to pry open and very difficult to put on.

There is a widely recommended, specific way to open the front of your boot for the best chance of sliding your foot in. This is shown in the following left picture. Put the boot on the floor, and of course unfasten the power strap and unbuckle all buckles. Then with one hand grasp the handle loop, at the top of the tongue, and pull it diagonally forward to open one of the lower, inner-plastic flaps of the boot that fit over the tongue. Make sure the tongue is well underneath the boot's inner flap. It's important that you pull the tongue diagonally forward at about a 45 degrees angle, not directly to the side nor straight-ahead. Jointly with the tongue loop pull, slide your other hand down and grab

the boot's other side lower inner plastic flap, which normally fits over the lower tongue, and pull it open, also diagonally forward. With the front of the boot thus opened, move the front of your foot down into the opened boot and push your heel down against the back of your boot liner. Ordinarily this procedure will enable you to slip your entire foot fully down inside the boot. After your foot is fully inserted, check to make sure that the tongue is properly inside the booth liner before starting to buckle your boot.



If you still can't get your heel to slide down into the boot with the above procedure, there is a simple implement that will help the process. You can purchase or borrow what is called a "Ski Boot Horn." It is shown in the right picture above. This is a slippery and flexible contoured piece of plastic about the length of the back of your boot liner's height. With the Boot Horn slid down the inside back of the liner, behind your heel, open the front of the boot with the procedure just previously described, insert the front of your foot in the boot and push your heel down. Because of its low friction, your heel will more easily slide down against the Boot Horn's surface than directly against the material at the back of the boot liner. Once your foot is down into the boot, simply pull the Boot Horn out by its rope handle.

I got a Ski Boot Horn from one of several sites offering it by Goggling "ski boot horn." I know how you guys think; some of you are already considering another possibility. Admit it, rather than purchase the commercially produced Ski Boot Horn, you are right this instant thinking of how you might make a cheaper, homemade version for yourself. Chances are that too will probably work if it is made with a low friction material.

4.4 Simple Steps For Long Term Ski Boot Preservation

After each trip, you should remove the liners to let them completely air dry or use a room-temperature boot dryer for six to eight hours before putting them away. Crucial is where you store your boots during the off-season. Store them in an insulated and temperature-controlled part of your house, not in your attic storage space or any other spot that gets extremely hot in summer. Significant exposure to high temperatures will appreciably speed up the deterioration of both your boot's liners and their plastic outer shells.

SECTION 5 – APPROACHES TO AVERT COLD HANDS AND FEET

5.1 Ways To Simultaneously Keep Hands And Feet From Getting Cold

Cold hands and feet will put a serious damper on your enjoyment of any ski day. Before we discuss actions that are aimed at keeping the hands and feet specifically from getting cold, let us consider general measures that have a significant affect on the temperature of both your hands and feet. When your body's core starts feeling chilled, your body begins restricting blood flow to its extremities to increase its internal blood flow and protect its vital internal organs. At that point your own body's survival mode, as well as the external low temperature and wind, will be working to lower your hands' and feet's temperatures. I can't overemphasize how important it is for your body's core to be properly insulated from the slope's cold and wind. That alone will go a long way toward keeping both your hands and feet from getting cold. If you are in doubt, err on the side of overdressing. If you wear a core layer too much for the weather, opening underarm zip pits or partially unzipping your ski jacket's front can easily prevent overheating. On the other hand, under dressing by a core layer will likely lead to your hands and feet feeling much colder than if your core is sufficiently insulated.

Speaking of keeping your body core from getting cold, there are other factors, besides the kind of insulation in your ski pants and jacket, which can affect your core temperature. Ski pants with bibs that cover your chest area are coming back into fashion. This type of ski pants is naturally warmer than waist level ski pants. Most good quality ski jackets have what is called a snow skirt that can be deployed, when skiing deep powder, to restrict snow from coming up through the bottom of your jacket. Many of you have probably not skied in deep enough powder to use this feature. However, in really cold weather, deploying and zipping up the power skirt around your middle will help prevent the escape of body heat while also limiting cold air seepage from the underside of your jacket. In really cold weather, closing up your snow skirt will make a noticeable difference in helping to keep you core from getting chilled. Actually, the best outfit to keep you core warm is the one-piece snowsuit. After being out of fashion and unavailable for some time, they are once again starting to become available.

Damp gloves or mittens lose a lot of their normal insulation capacity, therefore will offer reduced protection from the cold. Also, damp boot liners will moisten your socks and more quickly chill your feet. A small portable boot-dryer, which simultaneously blows room-temperature air into both your boots and your gloves or mittens, and is compact enough to fit in your boots when packing, is well worth the investment. When you return to your room or condo after skiing, use this dryer for several hours and your boot liners and gloves will be nice and dry to start your skiing the next day. Blowing room temperature air into your boot is preferable because blowing hot air, from a hair dryer, will speed up the deterioration of your boot liners.

5.2 Added Steps You Can Take To Avoid Cold Hands

In addition to keeping your body's core warm and your gloves or mittens dry, what else can you do to keep your hands from getting cold? If your gloves don't keep your hands warm enough, consider better-insulated gloves. If that doesn't do the job, try well-insulated mittens. A mitten, with all the fingers in one insulated pocket, has the combined body heat of all four fingers to heat that pocket. In a glove each finger is in an individual, insulated pocket and has only the body heat of that one finger to heat its pocket. That is why mittens are inherently warmer than gloves, given equal insulating and exterior material. However, you do lose some flexibility to adjust equipment or grab or hold anything with mittens.

Whether you decide on gloves or mittens do a little research to find a product that will keep your hands both warm and dry. You want the product to have gore-tex or equivalent material to prevent exterior moisture from getting in but allow sweat moisture to escape. Try on several brands; you will be able to quickly feel which is warmer. It is well worth paying a little extra to prevent the agony of cold hands. This is one item of your ski attire that you definitely don't want to skimp on.

If you have a serious problem with hands getting cold, get gloves or mittens that have zip pockets to insert chemical hand warmers. Those warmers will normally generate enough heat to prevent the dreaded cold hands. Gloves or mittens with longer cuffs, that extend well over you jacket sleeve, do a better job of protecting your wrist and hands from the wind and cold. When buying ski gloves, get them one size larger than your hand size. That prevents any possible tightness around your fingers to restrict blood circulation. This will also allow you to put on glove liners without cramping your fingers. Speaking of glove liners, you should carry a pair in your jacket pocket when you ski. They can be worn in either gloves or mitten and will give you an extra insulation layer when you feel your hands are starting to get cold.

If you have a serious cold-hands problem but don't want to mess with chemical hand warmers, there is now another option for you. Several companies now make gloves that are heated by rechargeable batteries that you can charge up overnight. They have a no heat setting for moderate conditions and three heat setting to handle increasingly colder temperatures. They are more expensive than regular ski gloves but are well worth it if you blood circulation is such that you have a serious cold hands problem.

5.3 Added Steps You Can Take To Avoid Cold Feet

Assuming your boots are properly fitted and don't cramp your feet, in addition to insulation your body's core and drying your boot liners, what else can you do to prevent uncomfortably cold feet? A common mistake many skiers make is to over-tightening their boot buckles. The top two buckles should be tightened enough to give you a snug boot-ankle fit to transfer your ankle movements to you ski. However, tightening any more will not improve you skiing, but will seriously reduce blood flow to the lower legs and feet. The bottom two buckles should only be tightened enough to anchor your feet so they don't move up and down in the boots. Barely tightening them with enough tension so they stay buckled is sufficient, anything much more will excessively press down and cause foot pain as well as cut your feet's blood circulation.

You need to wear proper ski socks. Modern ski boots are much warmer than earlier models and designed to be worn with medium-to-thin wicking ski socks. Wearing extra thick or two pair of socks is not recommended for either skiing performance or warmth.

Don't give up if your blood circulation is such that you tend to get cold feet even with the above precautions. There are some other remedies available. One simple, cheap option is wearing a pair of low-quarter nylon sheer stockings as a thin, additional insulation layer under your ski socks. They are so thin that it won't affect your boot fit. This also works well for skiers with normal circulation on those extra-bitter cold days.

Another simple option, available in most ski shops is a pair of so-called boot gloves. They strap to the top of your lower boots to give you an extra-insulated layer above your feet. Yet something else to try is a pair of commercial thermofeet heat insole. They are thin reflective aluminum insoles placed inside your bootliners underneath your existing footbeds, which act like a mirror to reflect thermal wavelength energy back to your feet. You can easily make yourself homemade thermal reflectors by using the outline of your footbeds to cut out a layer of food-wrapping aluminum foil to put beneath your footbeds.

If you are especially cold natured, a more expensive but effective option is to purchase rechargeable battery-powered heaters for your boots. Another more recent option is heated socks with rechargeable batteries. Either can be a Godsend if nothing simpler does the job for you.

SECTION 6 – BREATHING AND RELAXING WHILE YOU SKI

You must of course continue regular breathing, while skiing, to provide your muscles with their necessary oxygen supply. This is rather self-evident, you might think, so why even bring it up? If joggers don't need to be reminded to continue regular breathing, why should skiers? Well unlike joggers, skiers, particularly those with skiing ability in the lower ranges, often unconsciously slow or even temporarily halt their breathing when skiing in conditions that significantly raise their anxiety level. You can understand how it might be difficult to breathe normally when you are in a high-anxiety state, with an unconscious death grip on your poles and your toes curled up inside your boots. Actually, anxiety levels much less extreme than such a tight pucker-factor situation can unconsciously slow breathing. Typical situations that can raise anxiety level include: terrain steepness that is near or past what one feels comfortable with; pressure of keeping up with faster skiing buddies; facing unfamiliar snow conditions like moguls or deeper power; or the pressure of performing in a ski race, particularly in a team format with teammates and others watching. You need to be aware of your breathing so you don't unconsciously slow down or stop regular breathing when tenseness sneaks up on you on the slope.

The better solution of course is to ski more relaxed, which naturally avoids breath-slowing tension. The advantages to being relaxed while you ski are: you will stay warmer; you will ski more balanced, fluent and efficient; you will not tire out as quickly; and of course you will enjoy the experience much more. As will be described below,

occasionally utilizing a simple deep breathing exercise will help relax you to prevent over-tenseness in your skiing.

At opportune times during the day, employing a special type of calming breathing is an easy and effective technique to reduce anxiety and muscle tension on the slope. Such deep breathing is a basic technique of Yoga and the Eastern martial arts to calm the mind and body, as well as being a normal part of minefullness and meditation rituals. Take a really deep breath through your nose to expand your abdomen (not your chest) for a slow count of four, hold for a count of two, exhale slowly and completely through your nose for a slow count of four. Some recommend exhaling through the mouth instead. This type of deep breathing is called diaphragmatic or abdominal breathing which small babies naturally use, as opposed to thoracic or chest breathing which adults normally use. When your diaphragm contracts downward and your abdominal muscles relax, oxygen is drawn into the more calming and blood rich lower lobes of the lungs. As you inhale, raise your shoulders up and back, then let your shoulders loosely fall while exhaling. Opportunities to relax yourself, with four or five abdominal breaths, can be taken before you start your run, when stopping to rest your leg muscles, or waiting to re-gather your ski group.

Another useful and easy way to help you relax is simply to smile while you ski. That might sound somewhat Pollyannaish, but it does have a sound biological basis. The so-called fight-or-flight response is the body's natural response to a perceived threat to one's safety or security. Whenever you feel threatened, anxiety and muscle tension naturally occurs. In the first paragraph of this section we mentioned possible ski situations that could raise you anxiety level. The body's fight-or-flight response raises the body's adrenalin, which ups your strength and reflexes that originally helped our early ancestors survive life-threatening situations in the wildness. Putting on a smile sends a signal to your body's parasympathetic nervous system that the perceived threat causing the body's stress-producing fight-or-flight response is over, which results in a reduced stress level. This is why if you smile while coming down the mountain, your body's natural response will be to loosen you up so you get the benefits of relaxed skiing that were listed earlier in this section. If you see skiers smiling, it might be because they are really enjoying the experience, or it might be their way of keeping themselves relaxed.

SECTION 7 – REDUCING EXPOSED ROCK DAMAGE TO SKI BOTTOMS AND EDGES

As you have no doubt noticed, there are often exposed rocks on the slopes, particularly early in the ski season, even out West. Obviously if you see rocks well down the slope you will steer your way around them. However, what about those times when you don't see the rocks until it is too late to turn around them? In such cases there is a simple technique you can quickly employ to avoid or at least reduce rock damage to your skies' smooth P-tex bases and sharpely filed steel edges.

When suddenly confronted with a rock you usually don't have time to lower yourself and then push up to jump over the rock, which is the more commonly used up-

unweighting in recreational skiing. A technique that will work quicker is called down-unweighting. This is simply done by quickly retracting your legs to pull your feet up underneath you and then extending them again downhill of the rock. You will momentarily not feel gravity's pull against your ski bottoms as they are pulled upward. Your feet and skies will trace the trajectory of an artificial bump that is created by the retraction of your legs.

With luck your skies will pass across, but higher than the exposed rock's surface, with no contact damage. If you don't completely avoid contact, you will at least reduce the encounter force and thus reduce the damage to your ski-bottoms and edges. You should practice this a few times on imaginary rocks to make it part of your skiing repertoire. This will quicken your reaction time, when you do need it, and thus be more effective in reducing rock damage.

SECTION 8 – SIMPLE PRE-SEASON EXERCISES TO PREPARE YOU FOR SKIING

There are some cynics out there who will say I have concocted the following only to make my point about pre-season exercising. Not so! There actually is an underground, secret, small group of hard-core PSC (Peninsula Ski Club) members who work out and practice all year around, on their own personal ski-training machine. They are the skiing equivalent to the addicted, totally committed, gung-ho tennis or golfing nuts you hear about. Being a recognized and self-admitted tennis nut myself, I recognize the type. I suspect you probably want to know who these way-serious skiers are so their exclusive, some might even say unfair, advantage is exposed for all to see. I regrettably can't give out the names of the members of this covert, hush-hush, in-group because they are a secretive and fiercely, self-protective clique who know where I live.

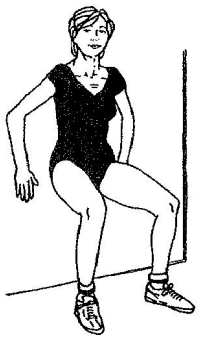
The point of the above, limited exposé is that whatever else you might say about those ski nuts, that before they hit the slopes, they do prepare themselves for the very real physical rigors of skiing. However, the all-important question is, do you? For those of us who are less dedicated and driven, particularly if you are not physically active, doing some form of physical preparation before the ski season is strongly recommended. Pre season exercise will avoid the following situations: breathlessness after even a fairly short-run; mid-afternoon or earlier fatigue; that uncomfortable second or third day soreness; or even worst, the dreaded ski-week-vacation, mid-week burnout. Preparing yourself physically will enable you to keep up with your skiing buddies and significant other. That itself makes it well worth the effort, don't you think? Another important benefit is that reducing fatigue significantly reduces the risk of a tired-muscle fall. An addition benefit is that skiers with stronger leg and knee muscles will have less chance of knee injuries when they do fall, which as you well know occasionally happens even to higher level skiers.

Don't despair; you can avoid being a ski-slope wimp or wimpette without having to spend huge hunks of your hard-earned bucks on fancy exercise equipment or giving up a major part of your limited free time slaving away in some sweatshop gym. If you regularly work out with machines or weights, concentrate on your quadriceps and body

core a little more, at least 6 to 8 weeks before your skiing starts. For those who normally get very little active exercise, some pre season regular walking, swimming, bicycling or playing an active game like tennis will help in preparing you for the slopes. I recommend supplementing that with one or two of the more ski-oriented exercises described below. These simple exercises will increase your core and leg strength and improve your cardiovascular system to extracts the oxygen you need from the thinner air at ski slope altitudes.

Skier's Throne

One of the oldest, still commonly used and simplest ski oriented exercises is the skier's throne. This exercise is shown in the following illustration. You stand an appropriate distance from the wall so that when you bend your legs and lower your rump, your upper back will lightly touch the wall and your thighs will be inclined a little above being parallel to the floor. Your hips are a little higher than your knees. Let your arms hang down and use only your thighs to hold yourself up. Think of this as sitting upright in an imaginary chair with the wall as your chair's back.



Do the exercise every-other day or evening because it takes about two days for the rebuilding of muscles tissue after the breakdown that occurs in a strenuous exercise session. Start out in the skiers throne and time yourself until your thighs start to burn, then add 5 seconds to your next session two day later. Don't wait until just a few days before you start skiing. You want to begin doing the skier's throne early enough before your first skiing so that by adding 5 second on alternate days or evenings you will reach somewhere between 5 to 7 minutes depending on your dedication and motivation. When not skiing, continue doing the throne through the ski season to maintain your muscle tone. This exercise does not take much time and can be done in street clothes against any convenient wall or closed door.

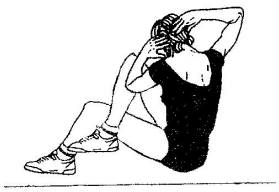
My being an active tennis player, and doing the skier's throne and some simple half sit-ups and crunches are really the only physical activities I do to prepare for skiing. If you do nothing else, I strongly recommend that you at least spent some pre season time building-up your quadriceps strength with the skier's throne. If you haven't done any quad exercises in past seasons, once you experience the benefits of the skier's throne on the ski slope, I doubt that you will ever go skiing again without preparing by doing it or some other suitable quad exercise.

Skier's Lateral Hop

Another good dynamic and taxing exercise is the skier's lateral leg hop from side to side over a short object or line on the floor. This is shown in the previous figure. This can be done by hopping off both your feet, hopping only with your outside foot on each side, or doing short periods of each. Lateral leg hops not only improve your strength and endurance but also improve cardiovascular conditioning and balance. Time yourself the first time and stop when you get somewhat winded. Like for the throne, add five seconds on each alternate night you do the hopping until you reach 3 to 5 minutes. After reaching your desired level, continue for the rest of ski season. People who are more serious about their preparation do the skier's throne one day and the skier's hop the next day.

Half Sit-Up And Crunch

The next body area to consider in preparing yourself for the ski season is your core or torso area. I recommend you do some form of core exercise. The separation between the rotations of the lower body, relative to the upper body is made via the core-connection link. Your core is vital to maintaining body stability and balance. With the idea that we want to keep the exercise straightforward but not as strenuous as a full sit-up, and also not require special equipment, this simple half sit-up and crunch exercise fits the bill.



Lay on your back and slide your left foot toward your rump so your thigh is about 45 degrees to the floor and then cross your right leg over your left (as shown in the previous figure). With your hands behind your head, lift your shoulders and upper body and touch your left elbow to your right knee (as the women in the previous figure is in the process of doing). Lower your shoulders and upper body and keep repeating until you feel some side and stomach tightness. Again repeat the process by reversing the leg positions and

the elbow that you touch your knee with. Gradually increase the repetitions until you can do twenty-five to forty on each side.

Many trainers now recommend a less strenuous version of this exercise, by eliminating the full touching-the-knee crunch. This is almost as effective for core strengthening and is something older skiers, with reduced flexibility and strength, can still do. With your hands behind your head, you only raise the back of your shoulders off the floor toward the ceiling enough to strongly tighten your core while you twist your torso so your opposite elbow moves about halfway toward the crossed knee. Lower your shoulders and repeat.

Jump Rope

Another tried-and-true, effective exercise, not requiring elaborate equipment, is one-person rope jumping. Rope jumping is one of the major exercises that boxers have traditional used to help reach their extreme level of cardiovascular fitness. You can hop repetitively using a particular leg between rope turns (as the rope jumper in the following figure is doing), you can simultaneously hop on both legs, or you can sequentially hop on one leg then the other. My suggestion is to start with one leg until fatigued, then the other leg, and then switch to either alternate legs or two legs. Working yourself up to two to four minutes will do wonders for your conditioning.

Recapping Why You Want To Do Some Physical Training

A little time and effort physically preparing for the ski season will allow you to ski longer distances and more vertical on a given run before needing to take either a catch-your-breath or a thigh-burn break. In addition you will be able to ski longer each day. You also will feel stronger and more confident. In addition, as mentioned at the beginning of this section, you will significantly reduce your chances of a ski injury. For all these reason, I believe you will find some physical conditioning well worth the effort before your next ski vacation. So PSC, what do you say? Let's all hit the slopes in better shape to more fully enjoy what we all agree is the rocking good fun of skiing.

SECTION 9 – ALLEVIATING HIGH ALTITUDE SICKNESS AND DEHYDRATION

9.1 Altitude Sickness

Altitude sickness is not a concern for Eastern U.S. skiing. However, it has occasionally been a problem for some of our Peninsula Ski Club members, particularly the older skiers, at the higher altitude of some Western U.S. and Canadian resorts. Altitudes that can start causing problem are upwards of 7,000 feet (2,134 meters). Altitude sickness is the body's reaction to having less oxygen molecules available in a breath of air, when doing physical exercise at higher altitudes. Higher altitude also significantly increases dehydration, which can further aggravate altitude sickness. If the dehydration is severe enough, it can trigger other serious health problems. As we shall see in the next section, managing your hydration is very important at high altitude.

The symptoms of mild to moderate altitude sickness include one or more of the following: headache, fatigue, stomach distress, dizziness, sleep difficulties, above normal heart rate, and shortness of breath from limited exertion. About 20 % of people that go from sea level to between 6,300 and 9,700 feet experience at least one or more of the symptoms of mild altitude sickness. Shortness of breath, even from limited exertion, you will notice immediately, but the other normal symptoms usually manifest themselves 6 to 10 hours after going to higher altitude. If in good health, all symptoms generally subside in one or two days.

Sleeping the first night at an intermediate altitude is a regularly used technique by mountain climbers to acclimate themselves to significantly higher altitudes. Unfortunately this is not usually available to skiers. It is generally not an option for a typical ski trip, particularly group trips or prepackaged ski destination vacations.

When arriving at high altitude, the body will start to produce additional red blood cells to help absorb more of the oxygen available. This acclimation to the higher altitude's reduced oxygen level generally takes 1 to 2 days. To reduce the likelihood of altitude sickness symptoms, it is best to avoid very strenuous activities within the first 24 hours at high altitude. Go easy on your first day and postpone your high-speed descent down the double diamond chutes or moguls until your second or third day. The prescription drug Acetazolamide has been found to speed the body's acclimation to high altitude and help reduce the symptoms of altitude sickness if taken 2 days before going to high altitude and continued 1 to 2 days while there. A common dosage is 125 mg. tablets taken morning and evening. Some studies have indicated that gingko bilabial started 5 days before your trip, and taken twice a day in 100 mg dose appears beneficial. If you are on aspirins or other blood thinners, you should definitely avoid gingko bilabial.

Any skier, who has experienced significant altitude sickness symptoms in the past, should take some sensible precautions when going to an area with a base altitude above 7,000 feet. Start by getting a prescription for Acetazolamide from your doctor. Skiers with a 5-day lift ticket, often take off the third or fourth day of a 6 ski-days week to shop, do some other winter activity, or rest. If you know you are highly susceptible to altitude sickness, I suggest you take the first ski day off instead of in the middle of the week. Assuming you arrive late afternoon or evening before the first ski day, taking the first day off allows about 36 hours for your body to acclimate to the altitude before subjecting it to the rigors of skiing. If you are taking the first day off, proper hydration, and some light walking during that first day is better than daytime sleeping because respiration decreases during sleep, thus increasing the likelihood of possible altitude sickness.

If you are highly susceptible to altitude sickness, it is a good idea to even avoid tobacco and alcohol and other depressant drugs including, barbiturates, tranquilizers, and sleeping pills, especially during the first 2 or 3 days. These depressants further decrease the body's normal reduced respiration during sleep, which could worsen the symptoms of altitude sickness. Even if you have a high susceptibility to altitude sickness, the measures discussed above should enable you to enjoy the pleasures of higher-altitude skiing, especially its dryer and normally deeper snow.

9.2 Adequate Hydration At High Altitude

We saw in the previous section that altitude sickness is the result of reduced oxygen levels at high altitudes. However, high altitudes can also create unique hydration-depletion complications. Even healthy, athletic skiers can experience problems, if they ski hard for a couple of days without the added hydration needed at higher altitudes. Severe dehydration will create serious blood electrolyte depletion that can trigger some heart irregularities, even atrial fibrillation for those who are susceptible.

Increased dehydration at high altitude is caused by two interrelated factors. The first is an increased rate of breathing due to reduced oxygen. This is significant during the first couple of day before your body has produced enough additional red blood cells to cope with the reduced oxygen level. The second factor contributing to increases dehydration at high altitude, is the higher water-vapor evaporation rate from your lungs due to the reduced atmospheric pressure. If you tend to be someone who skies hard for a half-day or more without off-slope breaks to get liquids, ***when at high altitude, it is important that you carry water to consume on the slopes.***

There are several means of carrying water while skiing at altitude. The Camelback Backpak seems to be popular with experienced high altitude skiers and hikers. The Camelback can carry more than enough water for a half-day of skiing. Its only drawback I know of is that the drinking tube can freeze at lower-end skiing temperatures. A water-filled, traditional wine pouch works fine, but wine pouches not considered chic nowadays. Another solution is a collapsible water bottle that you can hang around your neck with a lanyard inside your jacket. If your jacket pocket is big enough, just put a bottle of water there, or if not, then another option is carrying it in a fanny pack.

To recap, if you are susceptible to more-serious altitude sickness, you can still enjoy skiing at higher altitude areas by adopting the measures presented in Section 9.1. These measures, together with keeping properly hydrated, should allow you to experience problem-free, higher-altitude skiing. This keeps you ripping, even up high.