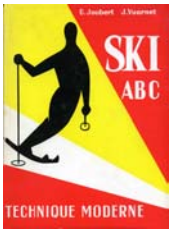
The Man Who Taught Us Modern Skiing

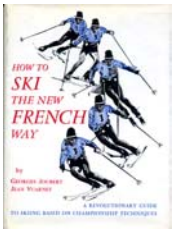
Georges Joubert Remembered

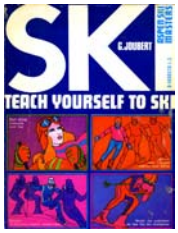
Ron LeMaster

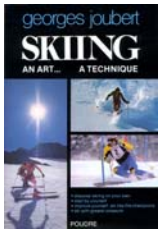
1923 - 2010

- No single person has had a greater impact on our understanding of how modern skiing works and how to teach it to others
  - Brought an academic, systematic approach to ski analysis and teaching
- Trained several Olympic and world champions



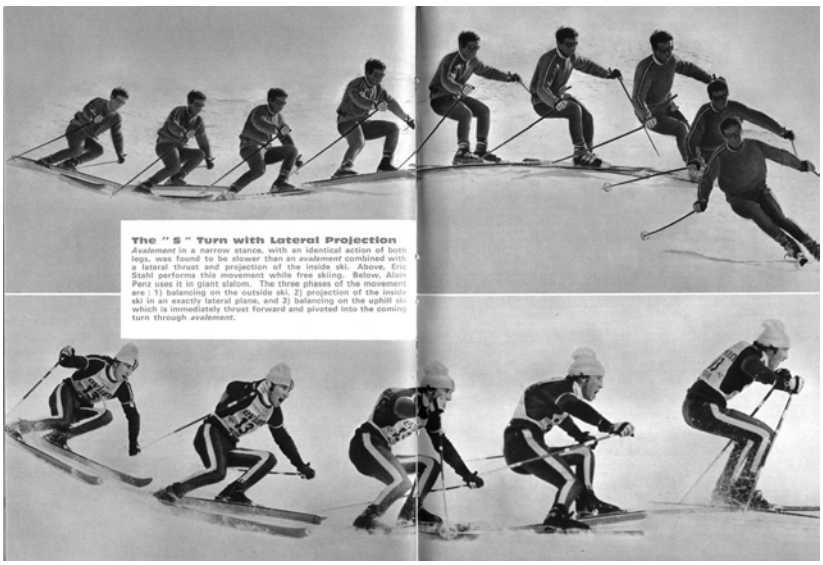


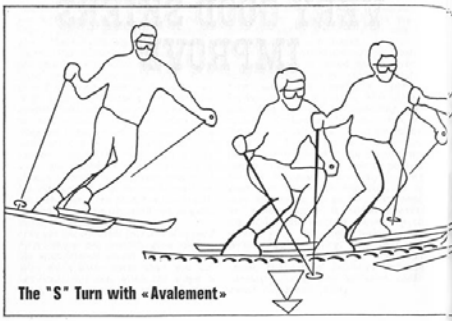




Books

- Books had two sections
  - Tutorial
  - Technical
- Illustrated with the best photographs, photomontages and illustrations of their time





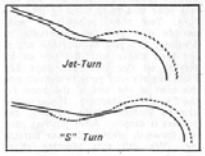
The "S" Turn with «Avalement»

The technical element which has revolutionized high level skiing in the last few years is *avalement*. I observed the first movements of this element in Jean-Claude Killy while he was only a "hopeful" on the French National Team. I thought then that *avalement* would open the way to considerable technical progress, and I took the risk of training several young racers with a technique mainly involving this movement. Since the experiment proved conclusive in 1966, we included many pages about *avalement* in the chapter on competition in *How to Ski the New French Way*. Many of the illustrations were photomontages of Patrick Russel, then a young, unknown, high school racer from the city. Today, *avalement* is known world-wide and the name I gave to it has been universally accepted because of the publication of our last book in nine languages. However, all over the world even mediocre skiers have wanted to use *avalement*. Some of them saw only the seated position of the movement, and they now ski while constantly sitting back, leaning continuously against the back of their boot tops! Others were struck by some of the very low, flexed positions of the champions. They did not notice that these positions lasted only fractions of seconds, and now they ski in a constant crouch appearing as if they had no legs. Yet others remembered only the forward thrust of the feet. These skiers now hold their legs glued together and initiate their turns only by thrusting their feet downhill. They only avoid falling on their rear because

of their slow speed and the solid support of their pole plant.
The observation of these inevitable excesses brought me to propose a common turn, classic in its sobriety and appealing due to its elegance, a turn which would include *avalement* without the risk of causing excesses to develop. It is a sort of "instructor's final form" turn incorporating this last born element of competitive skiing, *avalement*.

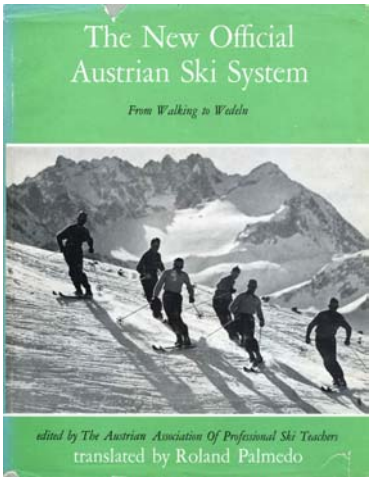
How to make an « S » turn

You know how to make jet turns, or in simpler terms, a turn with a dynamic counter-turn. I use the word "dynamic" in order to stress the fact that this counter-turn is incisive enough to result in a springboard effect which launches the skier into the turn. The track left in the snow by such a turn is characteristic : the sideslip of the counter-turn leaves a crescent, concave side uphill, and as soon as the turn is



Skiing Culture in the Late 1950s

1958



The New Official Austrian Ski Technique

- Position oriented
- Narrow, tall stance
- Lots of ankle bend
- Erect from waist
- Form over function

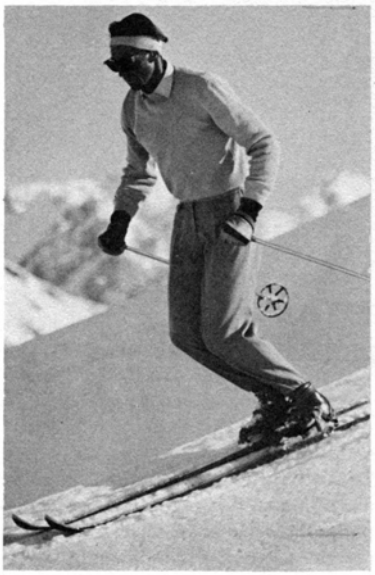
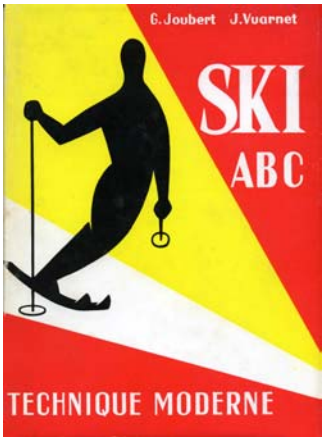


Plate 6: Downhill position

Plate 67: Wedel turn

(action sequence continued on following page)

1957



Georges Joubert

- Professor of physical education at University of Grenoble

Grenoble University Club "The GUC"

- Large sports club with many programs (skiing, cycling, etc.)
  - Thousands of members
- Provided instruction for recreational participants
- Provided coaching for competitors
- Joubert was its president

Joubert's Approach

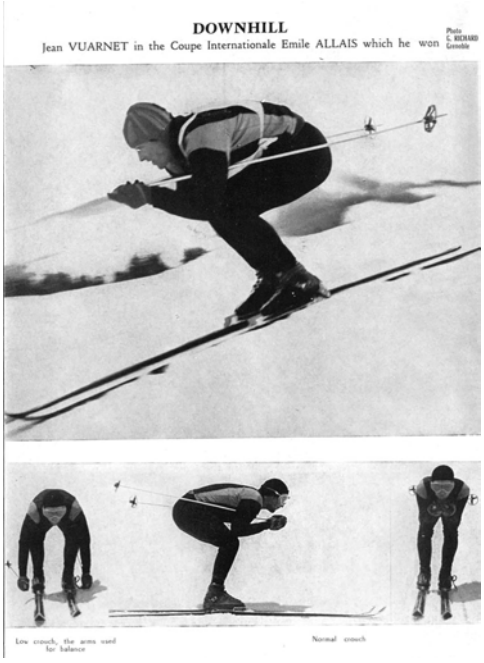
- Sport science-based
  - Came to ski education not as a skier, but as a sports educator
- Saw the best technique was international

Analysis

- Observe the best skiers in the world
  - Racers
- Distill the common elements of their skiing
- Determine how and why it works

Pedagogy

- Figure out how to teach it to others
  - The GUC was his teaching laboratory
- Teach by what it feels like, not how it looks
- Use exercises that do the teaching



“The Modern Technique”

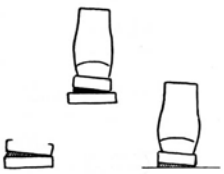
- Function over form
- Movement oriented
- Athletic stance
- Independent legs
- Less ankle bend
- More bend forward at the waist

- Based on observation of the best international racers
- Referenced in the PSIA “White Book”

Plate 6: Downhill position

CORRECTING POOR BINDING ADJUSTMENT

I. The skier who has trouble flexing his knees without having them bend inward will have difficulty in using his inside edges.



First measure to take :

Lift the inside edge of the boot with respect to the ski by having a cobbler put a wedge under it, or by putting a wedge on the ski (under the binding).

Second measure :

Displace the axis of the boot towards the outside of the ski (not more than a half inch from the axis of the ski).

II. For the skier who has trouble standing on the outside edge of the ski.

Measure to take :

Displace the axis of the boot to the interior (not more than a half inch from the axis of the ski).

III. For the skier who has difficulty in squatting on his skis without falling to the rear.

Measure to take :

Have a cobbler place a small wedge on the heel of the boot or fix one on the ski.

The 1960s - Modern Skiing Emerges

- Metal skis
  - Vuarnet wins 1960 Squaw Valley Olympic downhill on Rossignol Allais 60
- Fiberglass skis
  - Dynamic VR 7
  - Rossignol Strato
  - Kneissl White Star
- Ski could bend, hold, and not break

Recreational Skiing

- Wedeln is king
- Everyone wants to look like Stein
- Metal and fiberglass skis
- Buckle boots

Portillo 1966

- FIS World Championships
- All events won on aluminum and fiberglass skis
- The competition was dominated by the French
  - Jean-Claude Killy in particular
  - Austrians are humiliated (1 medal)

Jean-Claude Killy

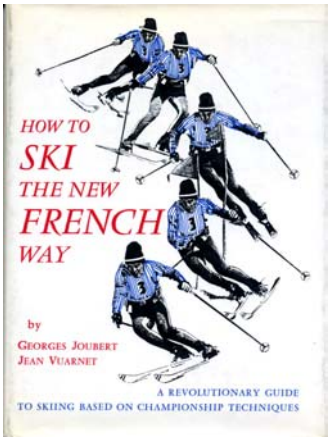
- The first modern skier
- First World Cup Champion
  - Won 12 of 17 races
  - He also won the season titles in each of the three disciplines; he won all five of the downhill races and four of the five giant slalom races.
- Won every event at Grenoble Olympics
  - Combined was a World Championship event, not Olympic. He won that, too

Key Elements

- Wide stance
- Independent leg action
  - Turning with the legs
  - Stepping
- New approach to transition
  - Less edge set
  - Little or no rebound
- More fore-aft movement

- Killy instinctively developed techniques that took advantage of the new skis
- Joubert saw what Killy was doing
  - Analyzed it
  - Systematized it
  - Developed teaching methods through the GUC
  - Wrote his most important books about it

1966



How to Ski the New French Way

- John Fry's title, not Joubert's
- Joubert's title: "How to Perfect Your Skiing"
- The book that changed my life in 1971

1. Typical form of today's best skiers. *Photo by G. Joubert.*

The "Rebound" of Rebound Turns and Check Wedeln

Rebound is a more dynamic down-up motion performed from a low body position. The relaxation movement which results in the compression of the skier's body is checked by the contractation of the extensors. The rebound results from this action which resembles the action of a compressed tennis ball. Using rebound effectively depends on the body position assumed during the down motion and especially on the pivoted position of the trunk in the direction of the fall-line (*vissage* or anticipation). This position results in the rapid pivoting of the skis once they are unweighted.

American or Austrian System

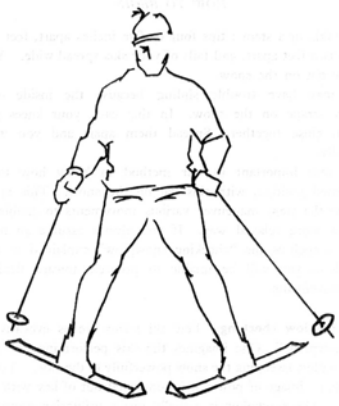
- “We advise you ... to push your knees forward less and to bend you upper body more.”

1. Typical form of today's best skiers. *Photo by G. Joubert.*

- “There is a highly effective type of parallel skiing in which the skis are held fairly wide apart.”

Sliding Stem

- What we now call a *gliding wedge*
- Cautioned against the braking snowplow



A SLIDING STEM.

It is very important in our method to know how to ski in the stemmed position, with skis flat on the snow. This is because we add to the stem maneuver various movements to enable you to turn in a more relaxed way. If you always assume an unrelaxed position — such as the "checking snowplow" explained in the next paragraph — you will be unable to progress toward flexible and elegant movements.

Braquage

- What we now call leg rotation
- Literally, *turning*
- Joubert was the first person to describe it

IF YOU ARE A GIFTED OR BOLD SKIER

STEERING BY JEAN-CLAUDE KILLY.
Prior to entering a tricky combination of slalom gates, Killy pivots his skis rapidly under his body crosswise to his momentum. The same movement can be used by the gifted or athletic beginner to make a Natural Turn or Stop, usually after just a few hours of skiing.

Anticipation

- What we now call *windup-release*

New Approaches to the Transition

- Reduction of rebound
- Improved gliding and snow contact
- Increased inclination

Techniques

- Serpent
- Jet turn
- Reploiement (literally *folding*)
- Avalement (literally *swallowing*)

- Killy performed developed the techniques intuitively
- Joubert trained Patrick Russel in them in the GUC
  - World Cup champion in SL and GS

Serpent

- A movement to get the body to move across the skis when the edges are set
- Like a snake striking

SERPENT TURN FROM THE TOP OF A BUMP.
Between the bumps, you should be in a balanced, upright position. At the top of the oncoming bump, plant your pole downhill and face your upper body downhill in anticipation. Now, relax and let your upper body tip forward and down between your pole and skis. A split second later, bend your knees. Your skis will slide naturally into the turn.

The Purchase of the Skis on a Steep, Icy Slope

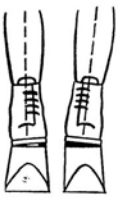
Jean-Pierre Augert's position in the upper photo illustrates perfectly what a skier should do in order to make his skis hold on a steep, icy slope. He pushes his knee inward as much as possible and balances on his outside leg by leaning his upper body downhill (angulation). This photo is the third in the photo-montage and corresponds with the precise instant when the edges bite the most (the edgeset).

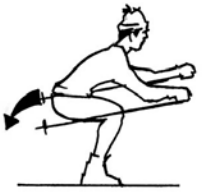
Jet Turn

- The rebound produced by the edge set is partially absorbed by flexion at the hips and knees
- “In Jet Turns, the skis are unweighted by down-up motion”

Avalement

- Folding with forward movement of the feet
  - Can be passive or active
  - Replace edgeset & rebound
- Forward thrust of feet
  - Improve gliding and release
  - Establish inclination





HOW TO WEDGE YOUR BOOTS.
Place a 1/8-inch strip of wood (a leather thong can also serve), or a piece beveled to 1/8 inch, along the full length of the inside edge of each boot sole. Experiment, on hard snow if possible, for at least two hours. You can slightly decrease or increase the thickness, but do not exceed 3/16 inch. It's also a good idea to slip a wedge between your toe pieces and the tops of your skis; in this way, wedging your soles will not impair the releasability of your toe bindings.

WEDGING YOUR SKI BOOT HEELS.
To ski well, you should be able both to bend your knees and lower your seat easily. With skis on, test to see whether you can remain in a squatting position, arms held forward, without a tendency to fall backwards. If you find you can't, try nailing a 1/4-inch, 1/2-inch, or even a 3/4-inch wedge under each of your ski boot heels. (Check your binding first. There is a difference under the heel between a turntable and a cable binding of 3/8 inch to 5/8 inch.) If your boots are a little large, you can insert a 3/16-inch to 3/8-inch wedge inside.

Wedging the heels is becoming increasingly necessary as ski boots become more rigid, and more greatly hamper forward ankle bend.

Technical Section

Side camber, however, is not the only reason skis turn. The resistance of the shovel section to flexing and to torsional twisting also plays an important role.

SKI, IN CARVED AND STEM TURN

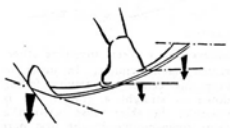


Figure 13 — The directional effect of the edge in stemming; how this effect is increased by shifting body weight.

A ski opened into a stem is 100 percent directional when, without side-slipping, it makes the skier follow the direction of its own movement. If the ski side-slips a great deal and does not control the direction of the skier, we no longer speak of it as having any directional effect.

At low speeds, a stem — even a wide one — can be 100 percent directional. As speed increases, there is less need for openness of the skis.

At extremely high speeds, a very small stem, imperceptible to the eye, can have a directional effect.

In parallel skiing, increasing the edge-set angle produces a directional effect because of the side camber of the ski. A forward weight transfer onto the edged, stemmed ski will increase the turning effect. If the ski side-slips, heel pressure produced by sitting back will facilitate the turn. This kind of turn no longer represents a directional effect of the edges, however; rather it is a modification of the distribution of the checking forces.

Figure 14 — A powerful turning action with both feet (steering) can be effected with the feet apart.

Using the rotator muscles to create a turning action on the femur of one leg might be thought to cause the pelvis to pivot in the opposite direction. However, the pelvis offers a resistance because it is also the fulcrum for the movement of the femur of the other leg. These two turning actions are thus limited only by the force of the skier's rotator muscles and the strength of the joint. The turning action is performed with

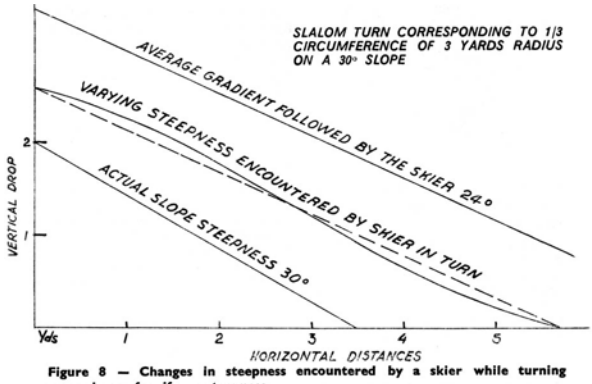


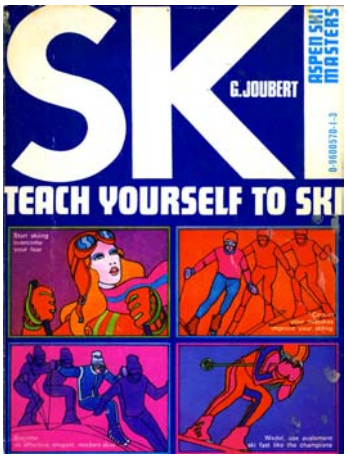
Figure 8 — Changes in steepness encountered by a skier while turning on a slope of uniform steepness.

In the traverse separating two turns, the skier experiences his minimum steepness. Going into the turn, the steepness gradually increases until the skier reaches the fall line where his angle of descent corresponds to the real steepness of the slope. Finally it decreases through the return to the traverse.

The average steepness experienced by a turning skier is not as great as the actual steepness of the slope. Rather, it is equal to the true distance his body moves in dropping down the slope (dotted line).

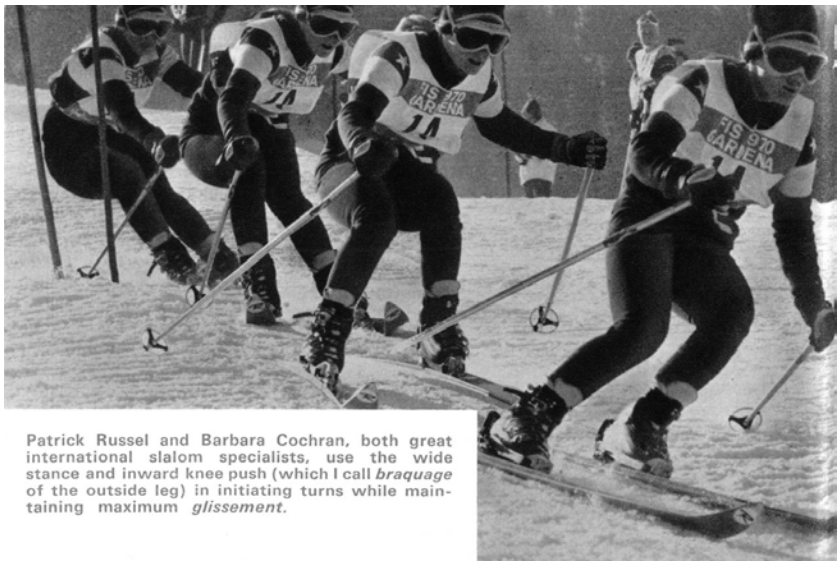
If a skier could make his center of gravity follow this average slope by employing down-motion and straightening movements during turns, he would completely erase any pressures on his body due to variations in steepness. On a 30-degree slope and skiing with linked turns, each of which covers a third of the circumference of a circle having a radius of 10 feet, the maximum distance covered by the center of gravity in going from down-motions to the necessary straightening movements is 8 3/4 inches. The average steepness of the slope followed by the skier is 24 degrees.

1970

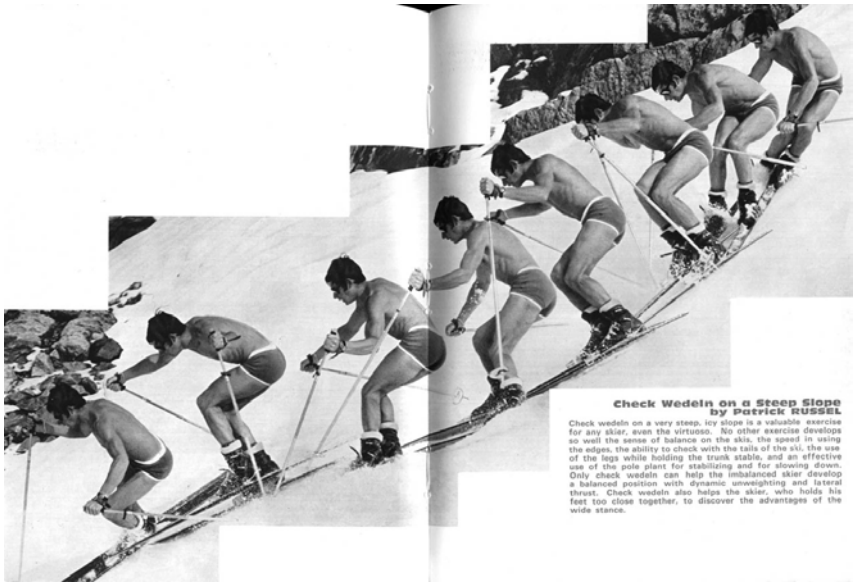


Teach Yourself to Ski

- Most complete, and best, tutorial of Joubert's books
- Curt Chase and Roby Albouy brought it to the US
- Became the Aspen Ski School system
- Had wide influence across the US



Patrick Russel and Barbara Cochran, both great international slalom specialists, use the wide stance and inward knee push (which I call *braquage* of the outside leg) in initiating turns while maintaining maximum *glissement*.



Check Wedeln on a Steep Slope
by Patrick RUSSEL

Check wedeln on a very steep, icy slope is a valuable exercise for any skier, even the virtuoso. No other exercise develops so well the sense of balance on the skis, the speed in using the edges, the ability to check with the tails of the ski, the use of the legs while holding the trunk stable, and an effective use of the pole plant for stabilizing and for slowing down. Only check wedeln can help the imbalanced skier develop a balanced position with dynamic unweighting and lateral thrust. Check wedeln also helps the skier, who holds his feet too close together, to discover the advantages of the wide stance.

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they may also be completely new to you.
When you ski with other good skiers of about your same level, do you feel that you cannot do some of the things they do because your balance is poor ? You would feel this way particularly in uneven or unpacked snow and on difficult terrain. Perhaps it is true that your balance is not as good. Just as some people can high jump six feet while others barely make three, some people have better balance than others. However, my experience indicates that limited balance results more often than not from certain technical mistakes which can be corrected.

Balance depends on sensitive feet

I emphasized very strongly the fundamental role of the feet (in the chapter "Intermediate Skiers, Correct Your Bad Habits", page 70) first in perceiving the pressures exerted underneath them, and more precisely, under any single part of the sole of your ski boot. Next, there are the pressures which vary in strength, and which you exert with your feet on different parts of the soles of your boots, or with your ankles against the tops of your boots. Many good skiers have never thought about this sensitivity even though they attach a great deal of importance to their trunk, arm, and hip movements. For a few years now much more has been said about the action of the legs in skiing, but not enough has been said about the role of the feet. Try to develop a conscious sensitivity in them and you will immediately enrich the thousands of balancing reflexes which are transmitted to and from your feet.

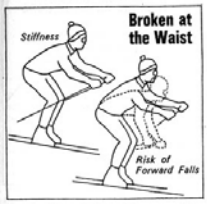
A very serious mistake, watching your skis while skiing

This mistake is very common and almost never corrected. It is, by the way, very difficult to correct. To do so takes a long time. However, you should make the effort. Not only will you be able to ski better, but you will better enjoy your beautiful snow covered surroundings by observing the terrain around you. Only under these conditions will your sense of sight be able to play its important role in helping you to stay in balance. If your field of vision is restricted to a pair of zigzagging tips and a couple of square yards of snow, you will miss certain points of reference, certain landmarks, which are indispensable in maintaining your balance. To correct the mistake, fix your eyes on a single point about one or two hundred yards down the slope and make short turns or wedel without losing sight of that point. At first your gaze will flicker back and forth constantly from the point to your skis, but persevere and you will soon succeed. Another remedy

which could act as an intermediary exercise consists in following about ten yards behind a friend and watching him constantly. Try it. You will feel much more freedom and you will be much more at ease. Your skis will no longer be instruments attached to your feet which you must force around. They will become simple extensions of your feet. Only then will you be able to discover the effective balance of a truly good skier.

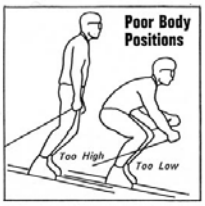
Is your body position correct ?

It is very possible that like thirty per cent of all intermediates and good skiers you have adopted a poor body position. All of your movements, grafted onto this position, take on a questionable form and become much less effective. The two most serious of the common body position problems are sitting back or leaning forward constantly. We will discuss these further along. Let's take a look at the more benign errors which might still disturb your balance.



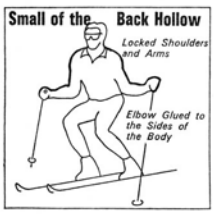
Too straight a body position, especially if it is used by a tall, thin skier, is very poor at higher speeds. First, because the position is unstable and second because the play of unflexed joints is very unfavorable for recovering one's balance. This position impedes the incisive, rapid reactions characteristic of good skiers and prevents good balance.

Too low and too stiff a position is just as bad. In order to remain in a low, flexed position, a skier must contract his muscles. If he is an athlete in perfect condition, there will be no problem. Otherwise, his muscles will stiffen because of their excessive contraction, and they will prevent the small readjustments in muscle tension which form the basis of good balance.



"Breaking at the waist" will not allow good balance. Most often, breaking at the waist occurs simultaneously with an insufficiently flexed leg position, or with stiff legs. On smooth slopes this presents no problems, but in bumps or in short turns, if the skier's trunk starts to swing forward, it will tend to unbalance him. It could cause dangerous forward falls. If this is your problem, you will be able to overcome it in only an indirect manner. Try to flex your legs a little

more, and try to keep them more flexible. Absorb bumps and the compression phase of turns by simply bending your legs. Also, check to see if your pelvis is properly "placed" (see following pages). Another very effective method of remedying the problem is to hold your hands chest high without ever letting them fall. Holding them this way will stabilize your trunk.



A hollow or stiff lower back can also cause trouble. This is difficult to see in others, let alone in oneself. Too upright a position and a certain rigidity in the trunk, shoulders thrown back too far, elbows and hands held too close to the plane of the upper body, chest thrown out too far, all point to this position error. The problem could be morphological, but even if this is the case, it should be corrected. Otherwise, during turns your trunk will move as a solid unit accompanied systematically by your shoulders, both arms, and sometimes even your head. More often than not, you will be unable to plant your pole correctly. Not only is your balance disturbed, but your technique is falsified. The correction of this error is difficult, and it takes a long time. Ski with your hands as far forward as possible and pull in your chest, thus curving your spinal column. This is the only way you will be able to relax your back and disengage your shoulders and arms from your body.

Do you control your arm movements ? Do you plant your poles ?

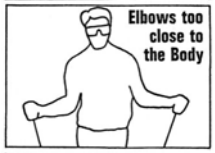
Have you acquired the habit of letting your arms go any which way, or have you exaggerated movements which, performed with more moderation, might be correct ? If so, you will have a lot of trouble correcting the problem because nothing is more difficult than eliminating a useless movement which has become a conditioned reflex. As human organisms have a very poor ability to "erase" habits, you will have to substitute certain somewhat artificial positions or certain effective movements, for your poor positions and unnecessary movements.

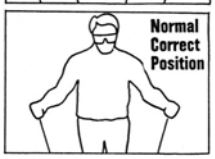
Bad arm positions and useless arm gesticulations are most often associated with incorrect trunk movements or

Annie FAMOSE, A Good Model to watch

World champion in Portillo, several time collegiate world champion, Annie Famose started summer training with the Grenoble University Club when only thirteen years old. Today, she is a champion and also a professor of physical education. Her charming anatomy and solid technique make her an excellent model.

DO YOU LACK EASE AND GOOD BALANCE ?





positions. Arm locked too far back, elbows glued to the body or placed behind the back, as well as crossed arms, occur most often in skiers whose backs are hollow, or flat and stiffened. High elbows and rounded arms, which stiffen the shoulders and the nape of the neck, are found most often in the skier who rolls his seat forward and who uses rotation in order to initiate and control the arcs of his turns. An arm thrown high and then lowered in time to make a poleplant is characteristic of the skiers who sit back too far. An arm which plunges downward is characteristic of the skier who leans to the inside of his turns excessively. Rounded arms held wide are usually associated with the excessive hip movements of some skiers.

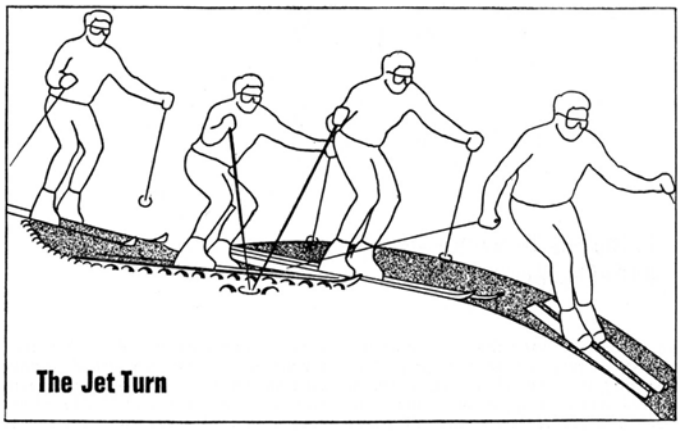
We have noticed at the University of Grenoble Ski School that the chances of a pupil exaggerating any arm movement taught him are so great that we have not taught any arm movements at all for several years. Experience has proven that a correct positioning of the arms from the very first session on skis is the sole effective means of obtaining the sobriety in shoulders and arms which is absolutely indispensable to good poleplants and good balance. The poleplant at the beginning of the turn is often dispensed with altogether or performed incorrectly, either too late or too early, by skiers who use too much arm movement or too many poleplants per turn. If this is your case, you must realize that you cannot correct the problem without making an effort to plant your pole systematically at the right time and in the right place during your

Continued Emphasis on Transition

- Jet Turn
- Reploiement
- “S” Turn
- Avalement

This is **not** a Jet Turn

GOOD SKIERS, IMPROVE



The Jet Turn

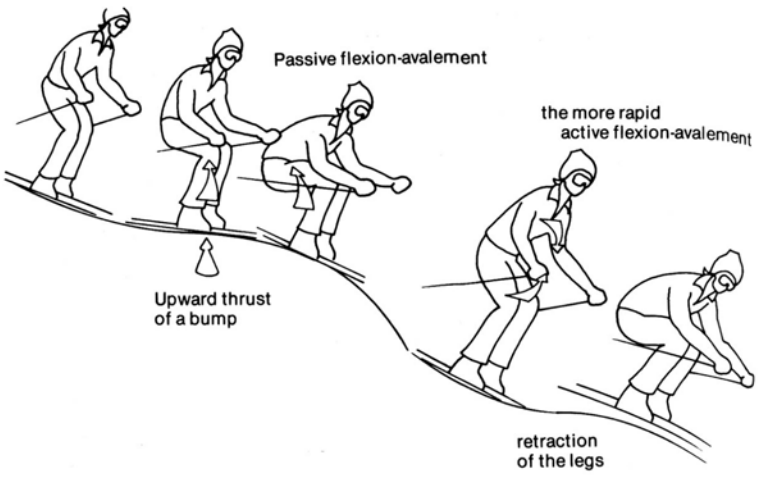
Down-Up Initiation of a Slalom Turn

The two classic modes of initiating a slalom turn are demonstrated by Patrick Russel, photographed during the last World Championships. This proves the necessity for a slalom specialist to use a great variety of technical tools in order to adapt to the snow conditions, the terrain, the radius of the turn, the speed, his own physical strength, etc. It should be noticed, however, that Patrick performs a down-up motion slightly different from that used ten years ago. He sits back a little more not because of a backward movement of his trunk, but because of a slight forward thrust of his feet. This thrust is in itself a form of *avalement*. (See the gliding jet-turn presented in the following pages).

Initiation through Avalement

Reploiement and Avalement

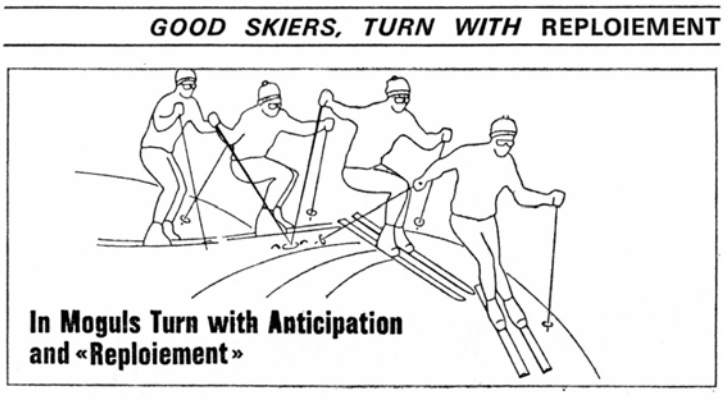
- The difference isn't clear
- Common thinking
  - Reploiement is passive flexion
  - Avalement is active flexion
- More careful reading
  - Avalement involves forward thrust of the feet



Absorb the bumps with your "feet forward" while schussing.

Reploiement

- "...replace rebound or any up motion at the beginning of a turn with an inverse, folding movement called *reploiement*."



Avalement

- Deeper flexion than reploiement
- Includes forward movement of the feet
  - Required by higher, stiffer boots
  - Helps establish greater inclination in turn
- Learned through the *"S" turn*

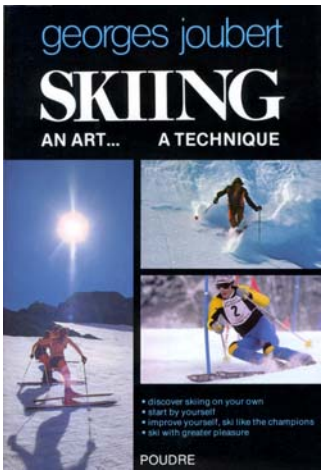
" S " wedeln with Avalement

This type of wedeln is performed on a steep slope and resembles check wedeln. As this series of photos illustrates, this technique allows the skier to make very tight turns. Its advantages are threefold : 1) It allows the skier to shorten the time normally spent braking in such a series of turns. The skis are pulled forward and cut the snow, thus carving instead of sideslipping. 2) Because of the preceding fact, turns can be made much more complete. 3) Rebound is reduced and the skis can remain in contact with the snow. « S » wedeln is the best exercise for very short complete slalom turns.

1973 – French National Team

- Joubert was men's coach
- Part of committee that fired the entire men's World Cup squad
  - Joubert voted against firing them
- Left lasting negative feeling about Joubert in France

1978



Skiing – An Art, a Technique

- True modern plastic boots
- Surf technique
- Lateral projection
- Chapter on becoming a ski instructor
- Strongest technical section
  - 70 pages

USE "FEET FORWARD EXTENSION" TO ENTER A TURN MORE SMOOTHLY

This is one of the latest technical evolutions of giant slalom racing as demonstrated perfectly here by **INGEMAR STENMARK**. Ingemar moves his feet forward, relative to his upper body, at the peak of his extension, allowing him to return to the snow with very progressive tail pressure. The turn can then be initiated with flat skis and a slight pivoting effort of the feet or, as Stenmark demonstrates in the photos, by returning to the snow on the inside edge of the outside ski in order to smoothly carve the trajectory from the beginning of the turn. In both cases, the return to the snow is made in a slightly angulated position and with knee angulation on hard snow. The skier then has a great deal of flexibility available to control the turn and smoothly absorb the compression that will occur after crossing the fall line.

CULTIVATE "GLIDING"

Would you like to try to pilot your skis better?

To do this, you need to concentrate your attention on your feet, and particularly on the outside foot of the turn. This foot must draw the curve of your turns on the snow much as your hand draws letters on a sheet of paper.

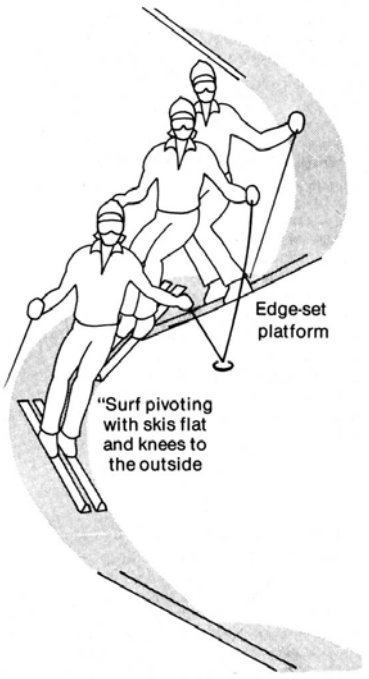
First you must feel that your foot is properly "positioned" on the skis; simultaneously adjust the two pressure points under the heel and ball of your foot (page 22) and the pressure of the inside of the ankle bone against the shank of your boot while skiing on hard snow (page 66). The outside knee should remain "alert", ready to help the movements of the foot. Feel that your thigh is well positioned under your hip and, finally, that your upper body is leaned slightly forward with your arms spread wide for balance and position yourself in a supple, angulated position over your hip (pages 62 and 67).

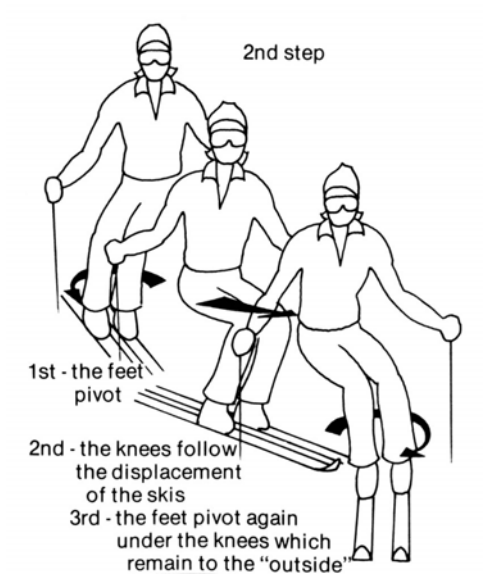
You have enough time as you control long turns over easy terrain to check point by point the position of your foot, your knee, your hips, your torso and your arms. You can even feel this position by practicing it at home in front of a mirror by holding yourself in balance on the inside of one foot and slightly pivoting this foot under your body to the right and to the left. Eventually you should feel, on snow, that piloting your ski consists of very fine pivoting or counter-pivoting efforts much like the fine adjustments you make with the steering wheel of your car while driving on icy roads. This fine and precise control will seduce you just as it has seduced the greatest international racers once they understood that there is less risk in nibbling away a few hundredths of a second in this way than in assuming extreme risks through the most difficult sections of the course.

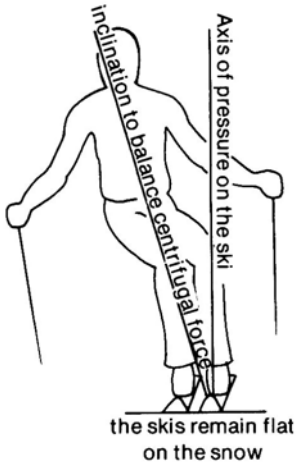
You will become even more infatuated once you discover that this piloting is the best way to improve your balance while turning. Because within a margin of a few centimeters, you are able to place your skis precisely where they need to be relative to your body mass and, therefore, can ski with even greater smoothness and acquire the profound relaxation that characterizes the skiing of the virtuoso champions.

Surf Technique

- For controlling the engagement and free sliding of the skis
  - Particularly in the transition and top half of turn
- De-angulation with the knees
- More visible today than ever before
  - Stivot







Part 3
DO YOU WANT TO BE AN INSTRUCTOR ?

Part 4
TECHNICAL DOCUMENTS FOR SPECIALISTS

muscles as in (438-e).
h) The generally greater acceleration imparted to the upper body during take-off explains why the body has a tendency to extend passively during the flight.

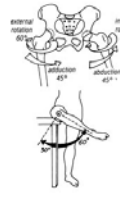
500. Muscle mechanisms which pivot the skis.

These mechanisms are in addition to the passive pivoting of the skis produced by the friction between the skis and the snow (134, 135, 155 and 156).

First we will examine the anatomical and physiological possibilities for pivoting and then the various families of pivoting mechanisms which are used in skiing.

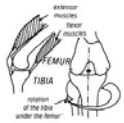
510. Centers of pivoting and muscle rotator groups.

511. The hips
a) The spherical head of the femur and its socket in the pelvis acts like a ball and socket joint. Its range of pivoting, however, is limited by the ligaments and muscles.
b) Amplitude of pivoting: 30° to the inside, 60° to the outside. This variation in degree of rotation sometimes explains the "divergence" of the inside ski at the end of very round turns made in positions with very pronounced vissage-angulation.
c) For the same reason, angulation, which is an abduction of the outside hip, limits the range of pivoting of the hip to the inside.
This also explains why very "tight-jointed" racers with bowlegs have such a difficult time slowing down using a downhill stem or wedge.
Note: Skiers who are very bowlegged should always ski with an internal rotation of the hips to correctly position their knees so that they can flex in the fore-aft plane.
d) In the "surf" position, with the thighs virtually parallel to the ground, a pivoting of the femur around its axis no longer produces a pivoting of the feet. Instead, it causes the lower leg to bank laterally under the knee, displaces the foot laterally, and tilts the ski onto edge.
e) The rotator muscles of the hip are extremely powerful. They also act as lateral fixators of the hip and in skiing are used for both of these functions (pivoting and holding the ski on edge in angulation).



512. Articulations of the lower back.
a) A pivoting of the 5th lumbar vertebra over the sacrum (which forms the dorsal side of the pelvic girdle) is usually associated with a pivoting of the 5th lumbar vertebra under the 4th, of the 4th under the 3rd, etc....
b) The amount of pivoting used varies greatly among individuals. In some skiers, pivoting of the lower back totally replaces pivoting of the hips, in which case the pelvis remains "square to the skis".... Among very good skiers, pivoting of the lower back is always associated with pivoting of the hips and increases when the hips have been pivoted to their limits.
c) The muscles that perform this rotation are very powerful.

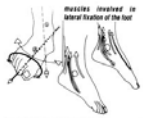
513. The knee
a) The tibia can pivot passively approximately 30° under the femur to the inside and 40° to the outside when the knee is flexed 90°. This rotation is negligible when the knee is straight and the amplitude of pivoting, with the knee flexed, is less when controlled by muscle action.
b) In the flexed knee skiing stance, this pivoting is obtained by the action of the quadriceps, which fix the angle of flexion of the knee, and the hamstrings and internal and external rotators (The top ski champions have extraordinary development of these muscle groups).
c) The rotator muscles also act as lateral fixators to transmit the pivoting of the hip or to hold the skis on edge.



Note: Insufficient muscle strength can make the "seated" stance and "surf" leg action potentially damaging for the knee joint.

514. The foot
a) Articulation of the tibial-tarsal (ankle) joint doesn't allow pivoting movements. However, there are two possibilities for pivoting within the bony assemblage of the foot. First, around the axis of the tibia (adduction and abduction of the foot) and also rotation of the foot around its axis (pronation and supination). Pronation of the outside foot, for example, corresponds to a banking of the ski onto edge and supination results in a flattening of the ski.
These two types of pivoting are associated in such a way that a pivoting of the outside foot in a turn will keep the skis flat despite a slight lateral inclination of the tibia. Likewise, pivoting of the inside foot through the turn results in a flattening of the inside ski because of both mechanisms acting in the opposite direction.
b) A pivoting of the foot in skiing is generally associated with a pivoting of the knee (513).
c) The muscles which provoke this pivoting have limited power. They are fairly effective if the skis are flat and inefficient if the skis are held on edge because they then act as lateral fixators.
d) When these muscle groups act as lateral fixators, they produce a slight pivoting of the feet to the outside. If the skis are in contact with the snow, the feet don't pivot. Instead, the knees "angulate" to the inside of the turn or up the hill in a traverse.
e) These pivoting movements of the feet create slight fore and aft displacements of the ankle in the boots, consequently the necessity of fitting boots so that they won't block the foot (194).

515. Vertebral articulations
a) The back can be pivoted in the same direction as the feet, hips and lower back; for example in a global rotation. The back can also rotate in the opposite direction to enhance the counter-rotation of vissage.
b) Tall skiers, in particular, can split the rotation of the back, with part of the back pivoted as in (a) to enhance the counter-rotation of vissage, yet with the shoulders and head twisted in the opposite direction to face the skis (ie. vissage without displacement of the shoulders).
c) Pivoting the shoulders in the horizontal plane can enhance the pivoting inertia of the spinal column. During vissage, for example, this can increase the counter-rotation of the upper body. On the other hand, it can compensate for pivoting of the lower back; for example to keep the shoulders square to the skis despite vissage or even hip rotation.



(1) and (2) represent the two axes of pivoting mentioned in (514-a). (3) the lateral fixation of the ankle through muscle action.

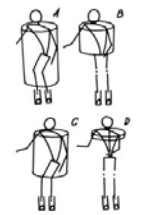
516. Pivoting of the hip and lower back and hip angulation.
a) A skier who uses leg action in a slightly flexed stance to pivot his skis

520. Initiating turns by rotation.

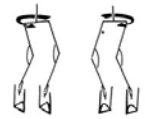
521. The wind-up then transmission of the recoil to the skis.
a) 1st phase: Part of the body is rotated, thereby generating a force in the opposite direction which is applied against the ground and requires that the skis be held firmly in place. The energy expended by the rotator muscles in producing this movement is stored in their antagonists and is a function of the body mass that has been rotated, the speed of rotation and the distance between the rotated body masses and the center of pivoting (the effect of rotating an outstretched arm can be considerable despite its relatively small mass). In the old French Allais-Gigneux Ski Technique (1937), only the upper body was rotated. In the Christiania Leger Technique (1957), virtually the entire body was rotated.
2nd phase, pivoting of the skis: The part of the body that has been rotated is attached to the lower limbs (and eventually the skis) by muscles that are antagonists to those which started the rotation. These muscles progressively decelerate the rotation and can then smoothly reverse the rotation to vissage. Many technicians have mistakenly dissociated vissage techniques and rotation techniques when, in reality, they are perfectly compatible

522. Forms of rotation used today.
a) *Minimal form:* A simple rotation by a symmetrical relaxing of the extensor muscles associated with an inclination forward and to the inside of the turn can add a mild motor effect to the passive pivoting of the skis (''Christiania leger'' or ''circular projection'' of the French National Ski School).
b) *Maximal form:* A rapid rotation of all limbs down the fall line preceded by a preparatory rotation up the hill to make a hopped turn.
c) *Thrown anticipation:* A global pivoting of the body down the fall line from a slightly flexed position followed by a platform with pole plant and a slightly prolonged, global pivoting down the fall line during the unweighting.
d) *''Hip projection'' in deep snow.*

A, wind-up of rotation. B, transfer to the skis.



The body mass thrown into rotation can be maximal (in A, the entire body less the feet) or minimal (in D, only the arms are rotated) or involve only the torso (B). A rotation of the torso and pelvis (C) is often referred to as ''hip projection''.


Rotation facilitates the change of edges as the ankles are increasingly flexed.

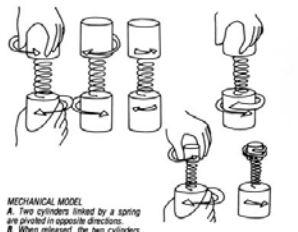
Similar to (c) but with an accentuated displacement of the hip to the outside of the turn (519-b) which allows the skis to be kept flat despite the obligatory global inclination of the body to the inside.

523. Thrown rotation, edge change and unweighting.
a) The edge change that is produced at the start of a turn where the entire body is thrown into rotation is facilitated by a flexing of the ankles in a stance that is as upright as possible in the other joints (the lower leg is inclined laterally following the pivoting).
b) The edge change is linked to a passive inclination of the body to the inside of the turn.
c) It's easiest to set the platform during the first phase with a vertical thrust of the legs.
The relatively slow rhythm of this maneuver dictates that the associated vertical thrust will be slow, thereby giving the flexion and extension of Christiania Leger its characteristically slow rhythm.
d) The relationship between the counter-turn and thrown rotation is more a function of the vertical support of the platform than the pivoting mechanism.

524. Thrown rotation and wedeln.
a) On hard or well packed snow, the inertia of the rotation movement and the difficulty in quickly regaining pressure on the edges makes the linking of short turns into a wedeln rhythm difficult.
Note: Since the rotation is generally associated with forward weighting, the inertia of these two movements is added and a rapid wedeln is made even more difficult.
b) On the contrary, hip projection in deep snow (522-d) is very effective. It allows the skis to be kept flat and uses the inertia of the rotation movement to push the skis laterally through the snow. Deangulation is immediately linked to this rotation followed by another anticipation. The relatively slow starting rhythm of a thrown rotation is also beneficial for turns in deep snow.

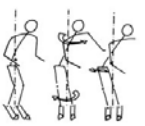
530. Initiating turns by ''vissage''.

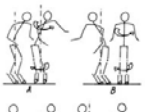
531. The ''action-reaction'' mechanism.
a) *Principle:* The skis and lower body are pivoted by rotator muscles which attach to the upper body. The upper body is pivoted in the opposite direction resulting in counter-rotation.
b) *Amplitude of rotation and counter-rotation:*
—The amplitude of these two movements is inversely proportional to the inertia of the two displaced body segments or, more precisely, the inertia of momentum (the product of the mass and its distance to the axis of pivoting).
—The inertia of the lower body mass includes the skis and, by way of simplification, can include the ski-snow friction.
—The inertia of the upper body mass includes the torso, arms and, for simplification, any force eventually exerted on a planted ski pole.
—The inertia of any previous pivoting movement of the upper body down the fall line (thrown anticipation or a passive pivoting of the chest supported by a pole plant) is added that mentioned above.
c) *positions of the body at the start and finish of the movement:*
—Vissage can start with the body square to the skis.
—Or start from an anticipated position and return to a normal position. This is a ''*vissage recoil*''.
—Or start in an anticipated position and return to a position with the body twisted in the opposite direction.
—If the anticipation and vissage recoil are made dynamically, it is referred to as a ''*Vissage wind-up*''.
—If the upper body is stabilized by a pole plant during vissage, the movement can be made around a more or less fixed point which becomes the primary support. This is true for both the vissage recoil and the wind-up.
—An anticipation that is sufficiently prolonged to become a rotation of the upper body into the turn is referred to as a thrown anticipation or thrown rotation with vissage recoil.
—If the skis are prevented from pivoting by being held on their uphill edges, vissage can be very pronounced in the upper body and have no effect on the lower body (eg. falls in slalom with exaggerated vissage).
d) *Speed and force of movement:*
Since vissage is activated by muscular effort, it can be instantaneous (2 to 3 tenths of a second for the wind-up, 1 to 2 tenths for the recoil) or prolonged. The degree of pivoting produced is limited by:
—The inertia of the upper body.
—The amount of support available from the pole plant.
e) *Wind-up vissage over a platform with pole plant.*
—Vissage with a pivoting of the skis up the hill (counter-turn) and a twisting of the chest down the fall line (anticipation) leading to an edge-set with a pole plant permits (because of the support available from the pole plant) a tensing of the rotator muscles which slow this movement followed by a recoil of the lower body pivoting in the opposite direction during the unweighted phase. There is a platform followed by a recoil of the skis.
The pole plant serves: 1) to accelerate the anticipation of the torso; 2) to delay or prevent an unwinding of the upper body in the opposite direction. For these two reasons, a more significant pivoting of the lower body is created. The support lasts 1 to 3 tenths of a second.
The recoil of the skis is particularly noticable and effective if it is made while the skis are unweighted. An unweighting by rebound is necessary because even the compression of a simple initiation by extension can neutralize the vissage recoil.
f) *Wind-up vissage and counter-turns:*
The vissage wind-up causes the skis to pivot up the hill and this effect can be in addition to any passive pivoting.
—A counter-turn with a platform can conclude this pivoting and initiate a pivoting down the fall line.
—Even if a platform isn't used, the recoil of the vissage will halt the uphill pivoting and start the skis pivoting down the fall line.
—When the counter-turn uses the directional effect of the skis more than the braking produced by their pivoting, refer to (g).


MECHANICAL MODEL
A. Two cylinders linked by a spring are pivoted in opposite directions.
B. When released, the two cylinders pivot back until eventually stopped by the spring.
C. The spring, wound up during B, starts a recoil.
D. If only one cylinder is released, it will pivot twice as fast as in B.
E & F. If one of the cylinders is twice as heavy as the other, it will pivot only half as far.

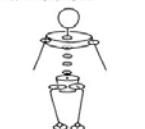
g) *Slow motion wind-up vissage.*
The slow motion wind-up vissage is made either without a platform or during a prolonged platform (particularly true for an 'S' counter-turn or a turn with passive avalement or a turn with ''windshield wiper'' pivoting).
—The wind-up phase is a pivoting of the upper body down the fall line provoked by a forward thrust of the skis and the support of a solid pole plant. The rotator muscles are stretched.
—The return is not so much a recoil as it is a muscular response to the stretching produced during the wind-up phase. The contraction generally has 2 objectives: 1) to slow or reverse the movement which tends to increase the distance between the mass of the body and the support of the skis on the snow for balance; 2) to pivot the skis, which will then permit them to aid in the rebalancing.
Note: The pole plant is indispensable to the backweighting of the upper body and is also used to assure balance during the pivoting.

532. Vissage angulation of the hips.
a) The center of pivoting resides essentially in the hips. Pivoting of the lower back is only of secondary importance. The pelvis doesn't pivot with the thighs.
b) We have seen that vissage of the hips can appear to be angulation (516-a).
c) Angulation can accompany vissage at the beginning of turns down the fall line. It adds an outward lateral thrust to the pivoting exerted on the skis. This lateral thrust facilitates a flat ski edge change of a lateral displacement of the skis in the air at the beginning of the turn (lateral banking (273-c)).
d) Vissage uses powerful muscle groups in the hips. In all sports, movements that require a great deal of power start in the pelvis and are then diffused upward or downward.
e) Vissage hip angulation typically provokes a global pivoting of the lower body, with lateral blocking of the knees and ankles.
f) The change in inclination of the lower legs eventually combined with (b) promotes the change of edges, especially in a position with very pronounced ankle flexion.
g) A lateral relaxing of the ankles permits a flat ski displacement which can be combined with the vissage of the hips but requires a voluntary effort. It is most easily obtained in a position with the ankles slightly flexed (the ''modern'' position).


Because the upper body is flexed over the lower body, vissage looks like angulation. An actual angulation can be combined with vissage.



A: Vissage wind-up. B: Vissage recoil. C: Complete vissage. D: Complete vissage with the upper body supported by a pole plant.


THE DIFFERENT LEVELS WHERE VISSAGE CAN BE EFFECTED.

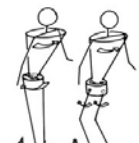
533. Different forms of vissage angulation of the hips.
Progressive vissage at the beginning of ''controlled'' turns.
a) A wind-up vissage with change of support foot is used if the turn that follows is to be carved. This can be accomplished with an extension and spreading of the uphill ski if a very progressive weight change is desired. Or, a flexion in a wide or semi-wide stance can be used if immediate holding of the outside ski is needed.
b) Vissage recoil with both skis weighted can be used if the turn is to be controlled with flat skis. This generally implies anticipation then extension and a progressive vissage recoil during the following unweighting and in a narrow stance.
c) The same mechanism can be used in deep snow following a ''thrown'' anticipation (or ''thrown rotation'' or ''hip projection''). The rotation is generally combined with an extension in a backweighted position in a narrow stance.

Rapid forms
d) Using vissage without pole plant for short, round and quick turns (for example in slalom on easy or moderate slopes). The pole plant acts as a balancing aid. Generally the turns are started with flexion and controlled by the edges of the skis. The chest is bent forward and the arms are outstretched to prevent any significant counter-rotation of the chest.
e) Wind-up vissage with edge-sets and pole plants is used to prevent the chest from pivoting (for braked turns such as check wedeln or slalom on steep slopes) or to prevent sideslipping and allow the next turn to be started earlier. Vissage angulation is the technique that best uses the wind-up mechanism and is necessary for good wedeln.
In a narrow or wide stance.
f) Many skiers can more easily execute vissage angulation of the hips in a narrow stance. This explains why many skiers abandon wide stances and foot steering mechanisms.
—The pivoting mechanism in a narrow stance tends to be situated both in the hips and the spinal column and the hips pivot with the skis more often than in a wide stance.

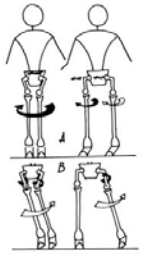
—Having both feet weighted equally and positioned close to the center of pivoting on the snow seems to give the pelvis and legs a certain unity.
The counter rotation of the upper body then tends to be more significant.
—This ''unity'' of the pelvis and legs seems to lend a certain elegance and efficiency to skiing in deep snow but is inconsistent with the lateral balance adjustment capability and rapid pivoting that are necessary to handle all terrain and competition situations.
g) Vissage-angulation in a wide stance seems as if it should be made more in the legs, but appears to be made more in the hips.
—The lateral distance between the pivoting axes of each of the legs and the vertical axis of pivoting of the torso seems to account for the lesser counter rotation reaction of the upper body and the scissoring of the feet.
—Vissage in a wide stance permits better edging by knee angulation following the pivoting of the outside leg into the turn (517). This is often used in competition.
—Vissage in a wide stance is often combined with a change of support foot (See ''steering of the outside foot'' (556)).
h) *Delayed vissage-recoil.*
A delayed vissage-recoil is used in 'S' counter-turns, turns with passive avalement, and turns with ''windshield wiper pivoting'' (531-g).

534. vissage-angulation of the knee and foot: ''flat ski surfing''.
a) The two centers of pivoting are the knee and foot. The skier must assume a very low position with the knees flexed (428). The upper body mass, in this instance, is taken to include both the torso and the thighs. Thus, the mass that is displaced is smaller which results in faster displacements of the feet and skis and a lesser reaction of the upper body.
b) For anatomical reasons (514-a), the pivoting that is produced is made with flat skis, even if the lower legs and the axis of the body are inclined slightly to the inside of the turn to balance centrifugal force.
c) Like vissage-angulation of the hips, surf vissage-angulation is very easily made with wind-up movements (eg. counter-turns, wedeln).

535. Different forms of flat ski surf pivoting.
a) Turns in a wide stance with flat skis, and particularly flat ski surf wedeln or easy slalom turns on soft snow with linked wind-up movements. Because both feet are spread laterally away from the pivoting axis of the upper body, counter-rotation of the upper body is substantially reduced and can even be eliminated entirely, even though this phenomenon is difficult to explain in mechanical terms. This kind of pivoting can accompany a change of support foot.
b) In a narrow stance with flat ski turns, but particularly in wedeln by linked wind-up movements. The counter-pivoting of the upper body is somewhat more pronounced but remains minimal even without a pole plant provided the chest is banked forward and the arms are extended.
c) In deep snow: a narrow stance and forward thrust of the feet during turns or wedeln. The pivoting produces a braking. Therefore, the feet are pushed forward just before the pivoting. This is followed by a combination of braking and a slight vertical platform from a backweighted position then an anticipation into the next turn.
d) Flat skis and carved tail-pressure in counter-turns or wedeln. A slight forward thrust of the feet during flat ski surf pivoting results in tail-pressure. A carved directional effect then allows the skier to reestablish his balance and start into the next turn.



A. In a narrow stance, with the feet blocked against each other, the center of pivoting is located almost exclusively in the lower back.
B. In a wide stance, vissage in each of the two hip joints is independent.



SURF POSITION:
A. Pivoting of the tibia under the femur in a wide stance, just as in a narrow stance, results in only a slight lateral displacement of the pelvis.
B. Pivoting of the femur around its axis doesn't result in a pivoting of the tibia, but a lateral displacement of the foot as the tibia ''swings'' underneath the femur.

Amplification of surf pivoting by passive lateral displacement of the knees.
—When seen from along the axis of the skis, a simple pivoting of the feet makes the knees appear to move to the outside of the turn.
—This outward displacement of the knees can be far more pronounced if the skier lets his knees follow the movement of the skis along their axis after they have been pivoted as described above during a wedeln. The thighs are displaced laterally in front of the body in a passive manner until the pivoting in the opposite direction is begun. This is the case in certain very round surf wedeln or counter-turns.
e) *Amplification of surf pivoting by active lateral displacement of the knees.*
The lateral displacement of the knees can also be active which corresponds to a voluntary acceleration of the sliding of the skis.

Joubert's Legacy

- Function precedes form
- Technique is developed intuitively by talented skiers
- Instructors and coaches don't invent it

Joubert's Legacy

- Sport-science approach to technical analysis
- Systematic development of teaching methods
- Teaching how it feels rather than what it looks like
- Application of graphical tools to convey concepts

1923 - 2010