Compendium to the Nordic Skiing Practical
(Nipissing University PHED 2224: Nordic skiing)

Written by Dave Minden

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A. Introduction

This is a supplement to the Nipissing University 2nd year Phys. Ed. course PHED 2224 Nordic Skiing practical at the North Bay Nordic Ski Club. (Unfortunately, due to COVID19, the course was cancelled for the 2021 season.) In no way should this outline be seen as a replacement or substitute for active and engaged participation in the practical sessions. It may also be of interest to NBN club skiers who want to "ski better".

B. North Bay Nordic

The North Bay Nordic Ski Club is a not-for-profit business (incorporated 1975) and is administered by a volunteer elected Board of Directors. The Club's mandates are to provide cross-country skiing to its members and the general public and to provide programs related to the growth of cross-country skiing in association with Cross-Country Ontario and Cross-Country Canada. See:
http://www.northbaynordic.ca/;
http://www.xco.org/ ;
http://www.cccski.com/Home.aspx?aspxerrorpath=/main.asp

C. A Very Brief History and Overview of Skiing

Today, there is a very sharp division between Nordic (cross-country) and Alpine (downhill) skiing. This wasn't always the case. Before the advent of ski lifts in the 1930s, everyone who skied used equipment that allowed both techniques. Skiers climbed the hills that they then skied down. As mechanized rope tows, T-bars, and chair lifts gained popularity, many skiers gravitated to the "downhill" scene, but a strong component of skiers stayed with "cross-country". Cross-country skiers tend to be those who enjoy the solitude of skiing on remote winter trails and at the same time engage in an activity requiring a fair degree of fitness and skill. Competitive cross-country ski racing is one of the most demanding of all sports competitions. In the early 1980s, an American skier named Bill Koch won a World Cup race using a "skating technique" and this changed the world of cross-country skiing.

At North Bay Nordic you will see skiers using either of two techniques. In traditional or "classic" technique, skis move straight ahead along "tracks", which are molded grooves in the snow; the tracks keep the skis from slipping sideways. The tracks are compressed into the snow surface by a specially designed "track-setter" that is pulled by a snowmobile or by hydraulic pressure by our Pisten Bulley 100 snow grooming machine. The tracks are set to one side of the trail leaving a wide flat portion of the trail. This is the "skate zone" where you will see diagonal marks in the snow from those who are skating. The skate zone is also used by classic skiers for passing slower skiers, or sometimes when climbing or descending hills. North Bay Nordic has a good selection of rentals for classic technique and a limited selection for skate technique. In the Nipissing University programme we teach classic technique. Students are encouraged to come out at other times to try skating or to gain more practice and experience in classic technique.

D. Equipment

Classic Skis
When your arm and hand are extended above your head, ski length should be up to your wrist. Another method is to add 10 cm to your height. Cross-country skis have a curvature called `camber` which allows the skis to bend depending on how you apply your weight. To see the camber, hold two skis together, base against base. Note the wide space between the skis which results from the curvature or camber of the ski. While the height of the skier is a related factor, it's the weight of the skier that determines the correct sizing of the ski to that person. Hand strength is also somewhat co-related to weight; try squeezing your pair of skis together. An approximate guideline is that if you can squeeze the skis together too easily, they are too soft for you, and if you cannot compress them together at all, they are too stiff.

The mid-portion of the ski base is called the `kick zone` or ``grip zone``. When you stand on your skis and equally weight both skis, there should be a very small space between that mid-portion (grip zone) of the skis and the

surface of a hard floor or the packed snow surface. A piece of paper should be movable back and forth from the heel of your foot to about 20 cm in front of the ski binding. When gliding down a hill and equally weighting both skis, this grip zone should not be touching the snow. When you put all your weight onto one ski, the complete grip zone of the ski should then contact the snow surface and provide grip, just as the tread on your shoe should do when walking or running. The “paper test”, if done properly on a hard surface, is an effective way to determine the correct sizing and stiffness of the ski. Most specialty ski shops will have a mechanical device to accomplish this purpose, and the technician will also mark your skis to show the exact limits of the kick zone. If it’s a no-wax ski, the device will determine if the fish scale grip zone is the proper length for the skier. With improvements to ski technology, ski manufacturers now produce skis labeled with the optimum skier weight range for that particular ski, or the ski shop technician will consult weight/ski length charts.

So why is this important? If your skis are too soft, the grip zone will always be contacting the snow. You’ll have great grip but very poor glide. If your skis are too stiff, you will never able to compress the grip zone to contact the snow when you need traction or grip. Great glide, yes – but no grip. Both scenarios (no glide; no grip) are very frustrating. To enjoy cross-country skiing, it’s vital to have skis of the correct stiffness.

Grip is achieved in one of two ways as there are two types of classic skis: “waxable” and “no-wax”. With waxable classic skis, specially designed grip wax is applied to the grip zone. At a microscopic level, snow crystals stick into the wax when weight is applied to the ski, but the ski can still glide quite well. Grip waxes are harder for colder temperatures and softer for when it is warmer. (This relates to the differences in snow crystal structure at different temperatures.) Second, specially manufactured skis called `no-wax skis` have been developed to eliminate the need to apply wax for grip. One type has a fish scale texture molded into the base, providing the needed traction. More recently, “skin skis” have been introduced to the market; skin skis have a specially designed fabric in the grip zone. There are many pros and cons about fish-scale and skin skis, and we will not pursue that discussion here.

No-wax skis are generally slower-gliding than properly grip-waxed skis. But consider that it takes about 5 minutes to properly grip wax a pair skis, that the grip wax wears off and needs to be re-applied regularly, that skis have to be cleaned with solvent if the temperature has changed since you last went skiing and need a different grip wax, and that it would take more than an hour to wax skis for large groups of skiers such as these. Grip waxed skis will also have more variability in gliding speed, and skiers in the groups will separate quickly. No-wax classic skis provide a fairly uniform amount of grip and glide for most weather conditions and help keep the groups together. Thus we use no-wax classic skis (with the ‘fish scale’ base) in our ski rental shop, and they are more suitable for group instruction.

That being said, note that there is still variability within the no-wax skis in the rental shop. Over time, stiffness is lost and the fish scales wear down. Also, a lighter person may not be able to compress a ski matched to his or her height, and conversely, a heavier person might compress the ski too much. If you feel you don’t have “grip” to get going, or your skis are dragging and not gliding, a switch to a different pair is probably required.

Lastly, even though they’re called “no-wax skis”, all classic skis are glide-waxed on the parts of the ski base not within the grip zone: the tip (the portion in front of the grip zone) and the tail (behind the binding heel plate).

Poles

Poles for classic skiing have evolved from bamboo sticks with 5” wide baskets to fiberglass and carbon fibre with tiny baskets suitable only for hard-packed trails. For classic skiing, the pole should fit very snugly under the armpit. The strap is adjustable and should be adjusted to allow you to push back and release your grip on the pole but still allow you to control the pole in the recovery phase. (See below in Poling with Diagonal Stride - page 9.)

Boots

Ski boots for classic skiing should feel like a good pair of running shoes. Only one pair of socks should be needed. (Don’t walk around the clubhouse with just socks on your feet; they’ll probably get wet.) Boots that are too tight will restrict blood flow to your feet and you’ll suffer from very cold or frozen toes. Boots that are too loose will result in rubbing and blisters. Take the time to get the proper fitting boot.

As mentioned above, you will see skiers using both classic and skate technique on the Nordic trails. Avoid being tempted to imitate skate skiing on no-wax classic skis. In most snow conditions, the fish-scale surface on no-wax skis doesn't glide very well on the skate portion of the trails, and your shorter classic poles don't allow you to get the proper arm motion. The result is some pretty clumsy looking skiing – and you may fall and embarrass yourself. If you look carefully, you'll notice several key differences between classic and skate ski equipment.

The following chart outlines the main differences.

	Skate Skis	**Classic Skis**
Camber	Very slight	Curvature produces grip zone from heel to about 20 cm in front of binding
Glide wax	Entire surface	Tip and tail outside grip zone
Grip wax / fish scale surface	None	In grip zone only
Length	About 10 cm shorter than classic skis	To wrist when arm extended overhead; or height plus 10 cm
	Skate Poles	**Classic Poles**
Length	About chin to nose height; 10 cm longer than classic poles	Tight under armpit; or .85 of your height
	Skate Boots	**Classic Boots**
General appearance	Higher, more rigid like an ice skate	Lower, less rigid, to allow lifting of heel and toe flex
Binding and Boot work together.	**Skate Binding**	**Classic Binding**
	Quite firm to keep heel of boot close to binding	More flexible to allow heel of boot to lift

E. Some Essentials

1. Clothing - It`s not necessary to spend hundreds of dollars on the fanciest ski wear. But keep in mind that lightweight, breathable under- and outer-wear lasts a very long time and is well worth the investment. Good quality winter running wear is very similar to cross-country ski clothing. Avoid heavy parkas, bulky winter coats, and downhill ski suits (you're not riding up ski lifts), but wear clothing that keeps you warm and dry and permits flexibility and motion. Wear `layered` clothing: long underwear, heavier long-sleeved shirt and pants, and a light to medium weight jacket that will block the wind on the downhills. Use polypropylene "wick-away" layers that move moisture away from your skin. Avoid cottons (like cotton turtlenecks) as cotton absorbs water and stays damp for a long time. Avoid jeans and cords. Mitts or gloves are mandatory. Even on warm days, ice crystals can cut your skin if you fall, and your hands need protection from the ski pole straps. It's pretty difficult and uncomfortable to use your poles correctly without gloves so just wear the lightest that you can get away with for the temperature on that day. Toques are generally worn except on warm spring days.
2. Hypothermia and frostbite are possible with any outdoor winter activity. Reduce the risk. Wear proper clothing. Don't venture out on longer trails in extremely cold weather, but instead, do repeats of shorter trails and stay closer to the clubhouse. At North Bay Nordic, most of the long downhill stretches on the longer, outer trails are in the last few kilometres. They can be extremely uncomfortable after you've worked up a sweat. Ski with a buddy and check each other for white, waxy looking patches of exposed skin.
3. Like runners, many experienced skiers carry a water bottle when skiing longer distances.
4. Novice skiers should take the time to work their way up to skiing longer and more difficult trails. The goal of this programme is *to have the students ski with confidence and competence the inner trails (Sprint, Yellow, Gold, and Purple*.) On your own, if you're feeling confident and competent on the 3 km Purple trail, try the Brown (4 km – with steeper climbs and downhills, but the downhills are quite straight with no turns). The

Red (5 km), Blue and Blue Ex (8 km and 9 km) and Green (18 km) are all more difficult due to their increased length and the terrain, as the trails climb and descend the North Bay escarpment.

5. Definitely have fun and enjoy the ever-changing winter scenery (See Part K.)

Cross-country skiing has three main components: skiing down hills, skiing on flat terrain, and skiing up hills; Skiing down hills is the fun part! But you have to first know the basics of slowing down, stopping, and turning.

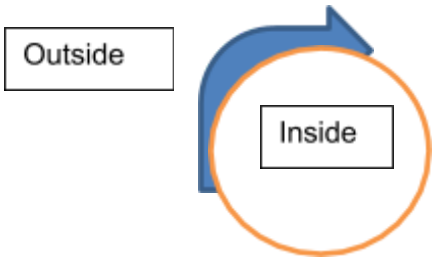
F. Downhill Skiing, Stops, and Turns – The Basics to avoid crashing into trees and other skiers

BASIC WEIGHT SHIFT AND THE STAR TURN

With both skis on and while standing on a flat snow surface, imagine your skis are the hands of a clock and are pointing to 12:00. Lift the tip of your right ski and shift the ski to point to 12:05; then lift the tip of your left ski and bring your left ski parallel to the right ski. Move your right ski to 12:10 followed by your left ski, and then your right ski to 12:15 followed by your left ski. You've turned 90 degrees. Continue for the whole 360 degrees. Note that every step requires 100% weight shift from ski to ski. Making small step adjustments to get your skis pointed in a new direction is done frequently.

SOME IMPORTANT SKIING TERMINOLGY – The "INS" and the "OUTS"

Skiing terminology uses the terms "inside" and "outside" to refer to the sides of the trail, the skis themselves, and the side or edge of each ski. The path of a turn is an arc of a circle, so there's an "inside" and "outside" of both the circle and the arc of the turn. In auto racing or horse racing, one may pass another on the inside, closer to the wall or rail, and much strategy is involved with passing on a turn: the inside is the shorter route while the outside is the longer route. In skiing, the ski on the inside of the turn is called the "inside ski" while the ski on the outside of the turn is called the "outside ski". Skis are put "on edge" to prevent side-slipping in several actions: turning, using the snowplow to stop, or the herringbone to climb hills. The terms "inside edge" and "outside edge" refer to the sides of the skis closer or further from the mid-point between the skis.



The "downhill position" for safe and enjoyable skiing

As you're gliding down a hill, always make sure you're in a relaxed athletic downhill stance. Your knees and ankles are slightly bent to cushion any shocks from bumps in the trail, and your hands are held ahead of you with the poles angled back but not allowing the baskets to drag on the snow. Position your elbows slightly ahead of your hips. Imagine carrying a tray in the cafeteria. It is critical to keep your weight forward (knees bent slightly; hands extended forward). If your weight is too far back, your skis will slide out in front of you and you will fall backwards.

STOPS

You learn where the brakes are when learning to drive a car for the first time, even before testing out the gas pedal. So where are the ski brakes?

1. Slow down with one ski out of the tracks – half snowplow

When in the classic tracks, a simple method to slow down is to put one ski out of the track and angle it like half of a snowplow "^" / with the tip of the ski angled in at the tip but not crossing the track. Note that to shift one ski out of the track requires complete weight shift to one ski before you can move the un-weighted ski. Put all your weight onto the right ski. Then raise your left foot and ski, and place the ski outside and parallel to the left track, about 20 cm to the left of the track, and then equally weight your skis. Then angle the left ski (tip in, tail out), flex your knee

and ankle to roll the ski onto its inside edge, and put more weight down on it. The amount of edging and weight shift will produce resistance and will determine how much you slow down. On flat terrain, it will probably bring you to a stop. This is a good first step in slowing down to avoid crashing into a skier in front of you or to avoid some obstacle in the tracks like a stick or exposed rock

2. Snowplow stop

If just one ski outside the track isn't going to work, do the following for the full snowplow stop. First, shift both of your skis into the skate portion of the trail in the following sequence: put one foot and ski (e.g. left ski) out into the skate portion of the trail; put all your weight onto that ski; then lift the right ski and position it beside your left ski; and equally weight both skis. You are now gliding straight ahead on the skate portion of the trail. As you're gliding down the hill, make sure you're in a relaxed downhill stance. Using successive weight shifts as needed, take small corrective steps and angle changes to control where your skis are pointing. Rotate the skis very, very slightly onto their inside edges by flexing and slightly pronating your ankles and knees. You can now slide your skis outward at the tails and point your ski tips together forming a ^ with your skis. Use fine motor muscles in your feet to keep the tips of the skis a few centimetres apart so the tips don't cross. "Edge" both skis more on the inside to form a distinct snowplow wedge shape. To do this, you have to flex and bend your knees and ankles more severely. This will produce lots of "edge", the skis will act like brakes, and you should come to a stop. (As a last resort and to prevent serious injury, sit down on the snow and roll over to one side.

TURNS

1. Snowplow turns

The snowplow turn is a simple extension of the snowplow. As you're gliding down a hill in the skate portion of the trail, make sure you're in that relaxed downhill stance. With your skis running straight, move your skis into the snowplow ^. Now for a turn! Put more of your weight on your right ski. That ski will continue to move in the direction it's pointing: which is to the left. The right ski is now the "outside ski" of the turn. Now shift your weight back to the left ski to equally weight both skis and you will stop turning (and you are now heading for the edge of the trail and the bush); then shift more of your weight to the left ski and it will then turn you to its direction. The left ski is now the outside ski – and you turn to the right. That's a fundamental rule for turning on skis: always get your weight onto the outside ski. There's one more important detail for a successful turn. If your skis are flat on the snow, they will slip sideways and you'll drift off to the side of the trail. To counteract sideslip, you need to angle your outside ski onto its inside edge. To do this, flex your knee and ankle, and press down on your big toe side of the ski; this will roll the ski onto its inside edge. You can modify the extent of the turning motion by changing the direction that the outside ski is pointing and/or the edge angle. Also, be careful: if trying to turn on a ski that is still flat on the snow, you might angle the ski on its outside edge. "Catching an outside edge" is one of the most common causes of a fall in downhill skiing.

While used infrequently, linked or alternating snowplow turns are used to steer around obstacles on the trail or to ski at a very controlled speed on downhills. One of our trails (the Red) has an S-turn descent and most skiers use successive snowplow turns to navigate the three turns. Note: Don't do snowplow stops or turns when in the classic tracks. Always step out into the skate portion of the trail to do these manoeuvres. This is done for two reasons. First, it is important to preserve the track for other skiers who wish to use it on downhills; and second, you can easily catch your ski on the walls of the tracks and that will cause a quick fall. On steep descents, some skiers elect to free-ski the hill out of the tracks in the skate portion of the trail. To keep your skis pointed in the correct direction, you'll need to do frequent minor weight shifts to change your direction in small increments while using either small snowplow turns or "step turns".

2. Step turns

Use snowplow turns when you want to slow down and turn at the same time. But if you want to ski down an incline and maintain your speed as you're turning, "step turns" are the preferred option. Let's say you're skiing down an incline and you're in the skate portion of the trail. You've either stepped out of the tracks or maybe it's a section of the trail where no tracks are set (or they have been obliterated due to heavy traffic). Suppose the trail turns to the right on the downhill. First let your skis run straight. Make sure you're in a relaxed downhill stance. Then lift your right ski and shift it and angle it to point about 5 degrees to the right. Very quickly, shift your left ski the same 5

degrees to the right so it is now parallel to the other ski. Repeat: Shift the right ski to a new direction and bring the other ski parallel. This is exactly the same as the “Star Turn” except you’re moving. After two or three successive shifts or steps, you’re now skiing in the desired direction. But there a few critical components needed to avoid a spill:

a. Bend your knees; keep your hands forward with the poles angled backwards but not touching the snow. In other words, assume a relaxed downhill stance like in the snowplow turn.
b. Take small steps and keep the angle change small at first until you get comfortable with this more advanced technique. Each step requires a distinct 100% weight shift. (Note that when skiers use skate technique, they use step turns on downhills except when in the tracks.)
c. Edge the skis very, very slightly on the side to which you’re turning to prevent side-slipping. If you’re turning right, angle or tilt both skis slightly on the right-side edges. That will be the inside edge of the outside ski and the outside edge of the inside ski (be cautious as you don’t want to “catch an edge” and fall). If you’re turning left, edge on the left side of both skis. The amount you need to edge the ski will vary directly with speed, the steepness and contour of the trail, and the severity of the turn.
d. Lean slightly to the inside of the turn to counteract centrifugal force that wants to throw you to the outside (left as you turn to the right). A tip is to extend your hand and arm off to the side – point to the side you’re turning; that will keep you leaning to the inside.

3. Downhill skiing in the tracks

With good technique and equipment (e.g. skis of the right stiffness for the skier, or correct grip wax, etc.), it’s quite possible to ski the inner trails at North Bay Nordic and stay in the tracks entirely. Skiing downhill in the tracks can be a bit unnerving at first (you may feel locked in and out of control) but if you know that you can bail out with one ski out as a brake, or step out of the tracks entirely and use a snowplow to check your speed, then you should be able to try staying in the tracks on the downhill sections. If the incline is fairly gentle and there are no turns, it’s pretty simple – just bend your knees a bit and keep your hands out in front in a relaxed downhill stance. Do some double poling (see below in “Poling Technique”) to get going even faster. Or you might just want to catch your breath and enjoy the scenery.

If you’re going quite fast, you might want to tuck your poles under your arms and assume a “high tuck” position for even more speed in a lower, more aerodynamic position. This also gives more stability with a lower centre of gravity. Bend 90 degrees at the hips so your back is parallel to the snow surface. Maintain your head position in line with your back but keep watching about 5 to 10 m ahead for any unusual objects in the tracks that could cause a problem. Always be ready to step out of the track to avoid something that could cause you to fall. Keep your knees slightly bent. Extend your hands far out in front to create an aerodynamic position. (A “low tuck” with your thighs parallel to the ground is used by downhill racers though infrequently in cross-country skiing. But it’s an option.)

4. Downhill skiing in the tracks with a turn.

a. Assume a relaxed downhill position with knees bent and hands held forward.
b. Imagine you’re riding a bike down a hill and the road or trail turns to the right. You’ll lean to the inside (the right side in this case) to prevent centrifugal force from throwing you to the left and out of the tracks. Do the same thing on skis: Lean to the inside of the turn. Your speed will determine how much you need to lean. It may not be very much, but with a lot of speed and a sharp turn, you’ll probably need to lean a lot. A trick used by veteran skiers is to drag the ski pole on that side. Drag the basket of the pole and lean on the pole like using an outrigger. (It can get a bit scary out there at times, and using the inside pole for support can hold you up.)
c. Similar to a snowplow turn, if you are turning to the right, put pressure on the outside ski (here, the left ski). If your ski does come out of the track, you will be ready to steer with one ski already out of the track and your weight already on it.
d. To summarize the last two points: For turning on steeper hills while in the tracks: Lean to the inside; put pressure on the outside ski.
e. The tracks are a uniform distance apart. Some skiers prefer a wider stance when skiing steep downhill sections. To do this (where the tracks are on the right side of the trail), lift your left ski and place it about 15

cm to the left of the tracks so your skis are about shoulder width apart. You now have the right ski in a track but the left ski is in the skate zone. (If the tracks are on the left side, you would shift the right ski outside the track.) This wider stance provides better stability and allows you to check your speed when required with a half-snowplow. If the trail turns on a downhill, move the outside ski out of the tracks, if there's enough room, and do a half snowplow if necessary to slow down.

The first time you were at North Bay Nordic, you had not yet learned how to stop and turn. That's why we walked down to the field for the first instruction session. Normally skiers ski straight past the large trail map out to the trails without skiing down to the field area.

G. Falling and Getting Up Again

Everyone falls from time to time. Most falls occur on hills but they can also happen on flat terrain where even a slight incline can pose problems. If it's absolutely flat, getting up is uncomplicated. If your skis are not already parallel, move your skis so they are parallel and fairly close together. Make sure your poles are free and not under your skis as your skis could slip on them. Move and centre your body near the middle of the skis, roll onto your knees and onto your toes, and stand up. You should not need your poles to pull yourself up.

If there's an incline or hill where you have fallen, another factor has to be considered. As you stand up on your skis, if they are pointed in any way up or down the incline, they're going to slide away as you get your weight on them. So first, inspect the terrain carefully. Where is the "fall line" - the route a ball would roll down the hill? Then, while sitting or lying on the snow, quickly scrunch your skis around so they are perfectly perpendicular to the fall line and also make sure you are on the up-side of the hill with your skis on the down-side. Then, as above, roll onto your knees and stand up. You will also have to edge your skis into the uphill to prevent them sliding sideways down the hill.

Most falls occur on sloped portions of the trails. If you were skiing up the hill, position your poles as braces on the downward side, and carefully step around (star turn) so you are facing up the hill and then proceed skiing. (See below: Skiing Uphill) If you were skiing downhill, also use your poles as braces below you to keep your skis from sliding downhill too soon. Edge your skis carefully and step around (star turn) until you have your skis parallel and you're facing downhill. Get ready to very quickly assume the downhill stance, release your poles, and you're on your way again. On hills, it's most often easier to get going in the skate zone, and when the trail levels out, shift your skis into the classic tracks.

H. Skiing on Flat Terrain

1. Kick and Glide – Diagonal Stride

The fundamental action in cross-country skiing is the kick and glide sequence called the diagonal stride. As lead-up to this you went through a progression of scooting on one ski and then skiing with no poles. The diagonal stride technique is based on a complete weight shift. Start by bending your left knee and ankle and putting all your weight onto the left ski. Exert force down and back (and hope for grip), and instantly thrust the right ski forward and shift your weight onto the right ski and glide out on it. It's just like walking and running but with one critical difference: the gliding ski is moving forward and you have to get your weight on top of a moving target. Key elements are bending the knee slightly and getting your hips fully on top of the gliding ski. A mantra used is: nose over knees over toes. Do not project your foot forward to straighten the in-step on the top of your foot. Do keep both your ankle and knee bent, so that if you glance down, you will see your knee over the toe of your boot, but not the instep. Next, as your gliding right ski slows down, exert force down and back on that ski and glide off on the left ski.

Complete weight shift onto the gliding ski is the most important skill to achieve. And it is also important not to shift back to the other ski too soon. If you hear your ski slapping down on the snow surface, this is the sign of shifting your weight too soon and well back of where it should be. As you thrust your gliding ski forward, your weight should

shift onto your gliding foot just as it passes the other foot. This is quite easy to master when skiing up gentle hills (see tight diagonal stride below) but sometimes needs a lot of practice on the flats.

Another critical component is your body position. Stand completely erect and it's not possible to move. You have to lean a bit forward to start walking or running and skiing is the same. Lean forward – a lot – and you'll power off with each stride. Another component is arm swing and this will come into play when using the poles. Your arms swing in the same cadence as when you walk. So when your left arm moves forward to start the next poling motion, your right ski is gliding forward. Then your right arm moves forward as the left ski glides forward. Because of this left-right alternating sequence, it's called the "diagonal" stride. If you lose the concept or want to make sure you have it right, just stop and go through the walking motion with arms swinging naturally.

Practise skiing without poles. This helps improve weight shift as well. The arm swing components are:

- Imagine you're shaking hands with someone. Your hand is extended forward and your arm stays slightly bent at the elbow. This is called "the skier's handshake". When poling, keep your hand and pole grip low and straight ahead, not up and over shoulder height.
- As you pull your arm back, follow through by extending your hand past your hip and straightening your arm. With poles in hand you'll be first pulling and then pushing back. Finish the action with a strong push and then recover for the next poling sequence. A common error is omitting the push-back past the hips.
- Don't cross your hands in front of you like when swimming freestyle. Keep each hand in the same vertical plane as it moves forward and back. Imagine an invisible wall right beside you and keep your hand moving in line with it. Your hand should follow an arc under your shoulder like a pendulum. Observe people as they walk or run and it's an interesting study as people make all sorts of interesting motions, while some do not move their arms at all. Cross-country skiing is different and requires a very precise, active, and vigorous arm motion in a straight-ahead and back motion. Poling contributes greatly your forward propulsion.

Kick and glide key components:

- Kick phase: "pre-load" by flexing at knee and ankle; exert force down and back on one foot and ski
- Weight shift from kick ski to glide ski with nose over knees over toes
- Lean forward
- Dynamic arm swing
- Keep your head in line with your back and extended rear leg after the kick. Look about 5 m down the trail.

When learning to ski, introducing poles too soon usually confuses the situation. So we often go back to concentrate on fundamentals by skiing without the poles getting in the way. It's a gradual process. Skiing without poles is often a training routine used by elite skiers in both skate and classic technique.

2. Poling with Diagonal Stride

For proper diagonal stride (the kick and glide), poles need to be properly worn. This involves the process of putting your hand up and through the grip strap and pulling down with the strap over the back of the hand. Correct poling involves pulling down firmly on the strap, not gripping the pole tightly. The grip strap should be adjusted so that it is neither too loose nor too tight. (And this can change if the skier changes from gloves to thicker mitts, or reverse.)

The key concept in strap length adjustment is to find the length that allows for the push-back phase after the hand passes behind the hip and for a gradual partial release of the pole. If the skier grips the pole tightly and does not release the pole, the sharp end of the pole (the pick) will flip out of the snow. Proper poling involves holding the pole grip very lightly, with thumb and fingers simply guiding the pole to its correct location, preventing it from flipping forward, and planting it right beside the opposite foot. Then, as the hand passes the hip and begins the push-back phase, the thumb and fingers release – but the pole strap continues to hold the pole in place and the pole tip will stay in the snow for a longer period of time. If the strap is too loose it will flop around and control will be lost. If it's too tight, the follow through and push-back phase cannot be executed.

It takes some trial and error to find just the right strap length. Most pole straps are fairly easy to adjust but some may be defective and need to go back to the rental shop for adjustment and possible repair. It's best to fiddle

around with this inside the clubhouse or at home if you have your own equipment; you don't want to do this outside when it's well below zero.

The timing of the use of poles follows exactly the cadence used when skiing without poles. As the gliding ski slows down, the pole is planted on the opposite side across from the other foot and 10 to 15 cm beside the track. This is followed by an immediate "pull back" motion. Then, three things occur almost simultaneously: the "push-back" phase of poling – pressing down on the kick ski – transferring weight to the other ski and gliding ahead on the new gliding ski.

The pole should always be slanted backwards – in other words, your hand on the grip should always lead the way. Avoid flipping the business end (the pick) of the pole forward as you ski, for if it catches on something you could injure yourself. If you're just standing around talking to someone and you feel your skis start to slide and need to use your poles to stop further motion, that's OK. But when moving, don't jam your poles in the snow ahead of you to slow down. Instead, use the half-snowplow or full snowplow and to slow down or stop.

Key Poling Components:

- Proper length of pole
- Correct grip strap length and adjustment to allow follow-through and release of pole grip
- Poling starts with "pulling", ends with dynamic and forceful "push back"
- Pole always angled backward; control with thumb and fingers, but do not grip tightly
- Pole is planted about 10-15 cm beside ski and opposite the foot on the gliding ski

3. Double Poling

When skiing along using the kick and glide (diagonal stride) technique, you may at times start to feel your skis are moving faster than you can keep up with them. It's like biking in too low a gear; you're just spinning the pedals and you need a higher gear. This may be due to faster snow in some areas or a slight downhill grade. Thus you may want to shift to double poling, which is a higher gear. At this point you stop doing the kick and glide with your skis and just concentrate on strong and dynamic poling with both poles simultaneously. Some components stay the same. The "skiers' handshake" is still there but done with both hands at the same time. Poles are still angled back, with your hands and pole grips in front, though at the instant the poles are planted, they may be perpendicular to the snow surface (but don't flick them forward). Depending on your speed and arm length and length of your poles, the poles will be planted well forward of your feet. There is still a "pull" and a strong "push back", but the action can be even more forceful as it is done on both sides at the same time. One component that changes quite a bit is your lean forward. The double poling action will start with a more aggressive and angled lean forward and as the poles are pulled back, bend at the hips and contract your abdominal muscles (do a "crunch"). Then as you recover for the next poling action, raise your hips and upper body to the forward lean that you started with. It's not necessary to bend your knees in an up and down motion – it's an energy waster; just keep your knees slightly and comfortably bent.

Be ready to change gears between diagonal stride and double poling as terrain and snow conditions change. Don't forget to stop and enjoy the winter scenery.

3. One-step double pole (aka kick-double pole)

This more advanced technique is an extra gear. It is a transition between diagonal striding and double poling. When increasing speed and when you feel diagonal striding is a bit rushed but you're not quite ready to double pole, this technique will provide a burst of speed to get you up to double poling speed. Conversely, when slowing down after a downhill and double poling seems to be losing effectiveness (i.e. it's too hard!), this technique can be thrown in before you settle back into diagonal striding. At its essence, the technique involves two components being done at precisely the same time. To coordinate the two takes a bit of learning and practice. When double poling, your weight should be equally distributed on both skis. One-step double pole starts just before you bring your hands forward in the pole recovery phase: Shift your weight to one ski (e.g. right ski). Then, simultaneously, kick down and back on that foot/ski at the same time as your hands are brought forward to begin the next double pole action. Then get your weight back onto both skis for the double pole action. As your hands follow through past

your hips, shift your weight to the other ski (left ski). Then kick down on the left ski as you bring your hands forward for the next double pole action. Alternate back and forth, kicking on the left ski and right ski, as you continue double poling, or just do it once or twice in transition.

I. Skiing Uphill

Skiing up hills is like portaging on a canoe trip. It's not always fun. But using proper technique gets it over with quickly and leads you to the next downhill!

1. Uphill or Tight Diagonal
   Very slight modifications to the diagonal stride will enable you to stride up gentle to moderate hills.
   a. Assume a slightly more erect position. Generally, the angle of your body to the snow surface should stay the same.
   b. Quicken your weight shift tempo and shorten your stride length to avoid back-slip.
   c. In poling, shorten the arm swing. You won't have time for a long follow-through push phase. As your hand passes your hip, start the recovery to the next poling stroke. Apply lots of power.
   d. As the uphill portion levels off to flatter terrain, lean over more, lengthen your stride, slow the tempo, and push back with the poles completely.
   e. Watch the terrain and adjust your body angle and tempo accordingly.

2. Herringbone Climb

The herringbone climb is the ultra-first gear in cross-country skiing. It`s used when your tight uphill diagonal just doesn't work and you don`t have the arm strength to power your way up the hill. (Or you have the wrong grip wax!) As you sense the uphill diagonal is losing effectiveness (you may feel you're just about to back-slip), step out onto the skate portion of the trail. You may find that you can now get some grip in the looser snow and you may be able to diagonal stride without the benefit of the tracks. If that doesn`t work, it`s time to herringbone up the hill.

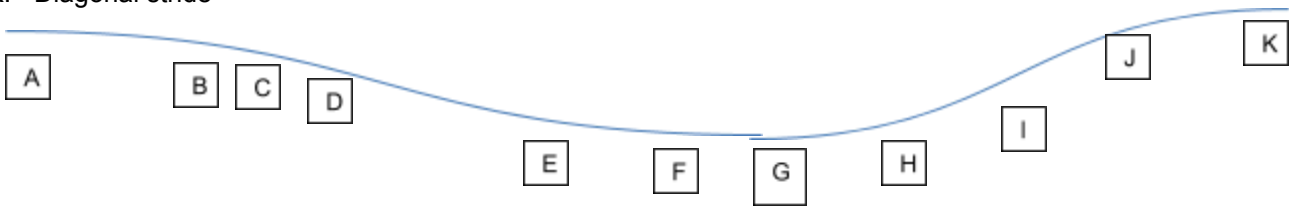
a. Form your skis in a V position opposite to the snowplow, i.e. with tips apart and tails together.
b. Edge your skis on the inside by rotating your knees and ankles inwards. In contrast to the snowplow, this will prevent your skis from slipping backward down the hill.
c. It is essential to keep your weight centred over your skis. Bring your body (centre of gravity) to a more erect position. Avoid leaning forward, which will result in your skis slipping back from under you.
d. With each stride, plant the pole baskets firmly in the snow behind but close to your feet. Push vigorously on the pole with each stride.
e. The sequence of walking up the hill using the herringbone always has at least one pole firmly planted in the snow at all times.
f. Initially, the sequence is done slowly as follows: Move your left ski forward and up the hill about 15 cm and keep it angled out at the tip and edged on the inside. Bring your left pole up and plant it firmly in the snow behind your left foot. Now advance your right ski about 30 cm up the hill (passing by your left ski, and not stepping on it) and place it while angled and edged ahead of the left ski. Bring your right pole up and plant it behind your right ski. (Note that when you move the right pole, it`s your left pole that s supporting you, and vice versa. Always keep at least one pole planted in the snow.) Repeat the sequence. With practice, the sequence is condensed and is done in exactly the same sequence as the diagonal stride. Once mastered, try "running" up a hill using a "running herringbone".
g. As you approach the crest of the hill, it will start to level off. Bring the tips of the skis closer together, reduce the amount of edge, and gradually resume the diagonal stride with your skis moving straight ahead. As soon as possible, shift into the tracks where the grip and glide will be better. Stop for a second and look back down the hill. The fish skeleton pattern in the snow gave the name to this technique: the herringbone.

J. Watch the terrain – changing gears

Successful and enjoyable skiing involves efficiently changing gears and technique as the terrain and/or snow conditions change. For example, assume you are skiing along a flat trail that has a steep descent that levels off before the next uphill climb to another level section. The sequence of ski techniques you might go through is:

A. Diagonal stride

B. (Optional transition - one-step double pole)
C. Double poling (at the beginning of the downhill)
D. Tuck and glide
E. Double pole (as you come out of the tuck and decelerate)
F. Optional transition - one-step double poling
G. Diagonal stride
H. Tight diagonal (where the uphill grade is gradual enough to keep going in the tracks)
I. Herringbone climb
J. Tight diagonal
K. Diagonal stride



K. Have fun!

Cross-country skiing in and of itself is a fun and satisfying activity on many levels. To add to the enjoyment of skiing, and in no particular order, try any of these:

a. Nature appreciation – watch for winter birds and mammals or their tracks and evidence of "kills" such as a spot of blood on the trail and the wing marks of a large owl. Try tree identification (especially the leaves and cones that fall onto the trails in late winter)
b. Observe changing snow types and conditions from day to day.
c. When it's snowing, observe the variations of snow crystals on your jacket sleeve.
d. Take a camera to record winter scenery.
e. Count the kilometres. Set goals for total distance skied over the season. At Nordic we have the Green Trail, Blue Trail, and All Trails Clubs where skiers record dates when trails were skied.
f. Listen for the phantom skier that you hear skiing behind you – but isn't there
g. Ski with a friend of similar skiing speed. Otherwise you are stopping and waiting or not able to keep up
h. Get involved in participation racing like loppets. Similar to road or cross-country running racing, skiers are placed in age categories.
i. Take clinics for technique improvement or to learn new techniques (like skating if you only ski classic or classic if you only skate.)
j. Test new skis on ski demo days.
k. Try snowshoeing on the snowshoe trails. Snowshoeing is great fun and gets you closer to nature; it also increases your appreciation for gliding on skis!
l. Try skiing at night - under moonlight, or with a headlamp, or on the lit inner trails.
m. Ski on Reverse Trails Day. The trails at NBN are skied in one direction for common sense safety reasons. Occasionally we have Reverse Trails Day where all trails are signed for skiing in the opposite directions. It's a whole new experience and a totally new set of trails.
n. Come out for club social events. Or on Sunday afternoons to watch the Jackrabbit programme in action.
o. Get involved as a volunteer. If you brush a section of trail in the fall, that's "your section" (you have pride of ownership for that section of trail).

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Rees, David. *Cross-Country Skiing – Touring and Competition*. Copp Clark: Toronto, 1975