Ski Orienteering Training Handbook

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What is Ski Orienteering?

Ski Orienteering (SkiO) combines orienteering with cross country ski racing, adding a thinking component to a pure horse-power event. The athlete gets his map at the start of the race, and the controls to be visited are marked on the map. The order to be visited is shown on the map, but the athlete has to find his own best route to each one. The course is designed so that the athlete can always ski on trails, but it is also possible to take short-cuts through the woods. Read more about the sport at: http://orienteering.org/ski-orienteering/

Ski Orienteering is in rapid development and every year new nations are established as Ski Orienteering nations. Today more than 30 countries participate in IOF Ski Orienteering events. Ski Orienteering has for a long time tried to become an Olympic sport, but has not yet succeeded. With the technological development it is now easier to make a good TV production out of Ski Orienteering, which gives hope that Ski Orienteering soon can get into the Olympic programme.

See some movies of Ski Orienteering and how fun it can be by following the links in the last chapter of this handbook.

This Handbook is made as a guide for new athletes and coaches in Ski Orienteering, but can also be used as inspiration and tips for technical training for both young and established athletes.

Two world class Ski Orienteers

Equipment

In modern Ski Orienteering all the top athletes are using regular cross-country skate skiing equipment and a map holder. While earlier it was more common to use classic technique skis or shorter skating skis, modern Ski Orienteers use regular skate equipment with a few additional considerations:

Skis

Since the athletes in Ski Orienteering mostly ski on narrow soft tracks, it is worth giving some consideration to ski choice for Ski Orienteers. In the 90s there were special skate skis made for Ski Orienteering that were shorter (140-150 cm) yet still stiff enough for adults. This was done so that it could be easier to skate in the narrow tracks, but often they did not have as good glide as longer 'normal' skating skis. Today the athletes use almost the same ski length as they use in cross-country skiing or some centimetres shorter. Normally a longer ski will glide better because of a larger glide surface and thereby less friction. But if the skis catch in extra snow because of the extra length, you will lose the advantage very fast and probably much more. As a guideline, you use skis as long as yourself in Ski Orienteering.

Poles

Since you have reduced possibilities of forward power with your skis in the narrow tracks in Ski Orienteering, the upper body has a bigger workload than in cross-country skiing, especially on the uphills. That's why it is very important to have poles that are the right length for your upper body power, size and personal technique. This makes the optimal pole length for Ski Orienteering very personal, and it varies a lot from athlete to athlete. For most people it will be too difficult to do the hardest uphills with normal length skating poles.

Since the upper body has a bigger workload in Ski Orienteering, this also makes bigger demands on the pole properties. With a bigger force the pole will bend more and you will lose power to the ground. That's why it is of great importance to have stiff poles that will bend as little as possible when you are on the steepest hills. In Ski Orienteering you are also skiing much closer to the trees on winding tracks, making it easy to hit the trees with your poles. This can damage the carbon that most of today's top poles are made of, and reduce how much power they can take before they will break. This makes it important to have poles that endure a few hits to some trees, and also that you take good care of them. Many athletes have competition poles they only use for competitions. Athletes may also use poles of different lengths for different types of terrain.

As a guideline, you use poles 20-25 cm shorter than your own body length - or even shorter - in Ski Orienteering, but this has to be tested on a real Ski Orienteering track by the athletes themselves.

Baskets

The biggest and most important difference between the equipment in Ski Orienteering and regular cross-country skiing is the size of the baskets. Ski Orienteering tracks are often soft, and this makes it very important to have big enough baskets so that you can use your power to move forward, and not just for digging holes in the snow. Rex and Swix have had some big baskets that suit Ski Orienteering very well, but now marathon cross-country ski racers have also seen the use of bigger baskets, so there are more brands coming on to the market. The problem with bigger baskets is that they are heavier than normal baskets and therefore change the pole swing. This will make it slower to get the pole forward again, but this is a small price to pay compared to being able to use your power to go forward.

In Ski Orienteering it is common to use extra big baskets

Map holders

For Ski Orienteers to be able to read the map while they use their arms most effectively, they use a map holder strapped to their upper body to carry and read the map. The leading maker of map holders for Ski Orienteering over the last decade has been the Swedish company Nordenmark Adventure, which has specialized in making ski and mountain bike orienteering map holders. But there are also other companies producing map holders, for example Miry from the Czech Republic. The map holders are made with a lot of adjustable parts so that the athletes can adjust them to fit properly. You can for example choose how tight it should be strapped around your upper body and how far from your face you want the map. What each athlete prefers differs a lot, but the most important thing is that all straps and screws are fastened tight enough so that the wind will not blow it out of position. To make it easier for the athletes to read the map, it is better to have the map as close to the face as is possible while the athlete can still read it clearly. Some athletes find it hard to read the route choices on the longer legs if it's too close, but reading in a tight network of tracks is often easiest with the map close to the face.

As a guideline, some athletes have the distance of a fist between their nose and the map board.

Ski Orienteer with a map holder

Punching

To verify that the athletes pass all the control points, each athlete has to register a punch at each control. Today there are many different punching systems in use for Ski Orienteering. The most common are Emit and SPORTident. Both have two kinds of punching systems: one where the athlete has to physically make a punch, and another that is a touch-free system. It is important for the athlete that their punching card is fastened so they can easily punch quickly and that the punching card doesn't disturb the athlete's skiing or orienteering.

Punching in Ski Orienteering. To the left EMIT punching and to the right SPORTident punching. The EMIT punching card is fastened to the glove and the SPORTident chip is fastened to the finger

The punching card for a physical punching system is typically fastened to one of the athlete's gloves. Some also fasten it to the top of one of their poles. The SPORTident card is fastened to one finger and normally secured by safety pins and tape. The Emit brick is fastened to the back of the hand, and the Nordenmark Adventure map holder company also makes holders to secure the EMIT card to the hand.

The new touch-free systems allow the athletes to pass the control at higher speed without having to stop to punch. This gives the athletes more orienteering technical challenges and makes the sport more spectator-friendly. This system works by having the athletes carry a chip on a band fastened to their wrist. To punch the athlete brings the chip close the control, which sends a radio signal that is registered with the chip. After the chip has received the punch it will blink quickly for five seconds and then slower for an additional ten seconds.

Punching with EMIT touch-free system to the left and checking the registration blinking to the right

Compass

In Ski Orienteering it is not necessary to take a compass. When you know which track you are skiing on, you can orientate the map using only the direction of the track. But a lot of Ski Orienteers still like to have a compass as a back-up if they should become lost - because if you're not sure on which track you are skiing, it is an easy check to take a look at the compass and check if the track you're skiing is going in the right direction. Also, when you have lost your way the compass can make it much easier to relocate. Many athletes also like to have a compass at the start so that they can orientate the map faster when they put it in the map holder. This also helps them to locate where the start triangle is on the map and get started orienteering quicker.

Since you can't ski with the compass in your hand because of the poles, the athletes either fasten the compass to the map holder arm or with a strap around their wrist.

Glasses

Ski Orienteering is an outdoor sport and can be done in many weather conditions, from strong sunshine to snow storms. For the athletes it is important to be able to read the map and the tracks as well as possible. The athletes can also meet changing conditions during a race, for example when they are going from an open sunny area or alpine track to a dense dark forest. It will take time for the athlete to adjust to these new conditions so they again can read the map properly, and some dark glasses will make this even harder. Since the athletes' sight is so important, athletes can get problems with drops of sweat or

dew on their glasses. This is why so many athletes choose not to use sunglasses in Ski Orienteering. Since this makes it hard to see the contours in the snow, and also the reflections of the sun can blind athletes when they are trying to read the map, many athletes draw black lines under their eyes like the players in American football. Normally they simply take soot from the exhaust pipe of a car to draw this black line.

An athlete with soot under his eyes

When there is heavy snow falling, most athletes use either clear sunglasses or some kind of snow shield to make the map reading as easy as possible. With no protection, snow can also cause discomfort when it hits the eyes, especially at high speed.

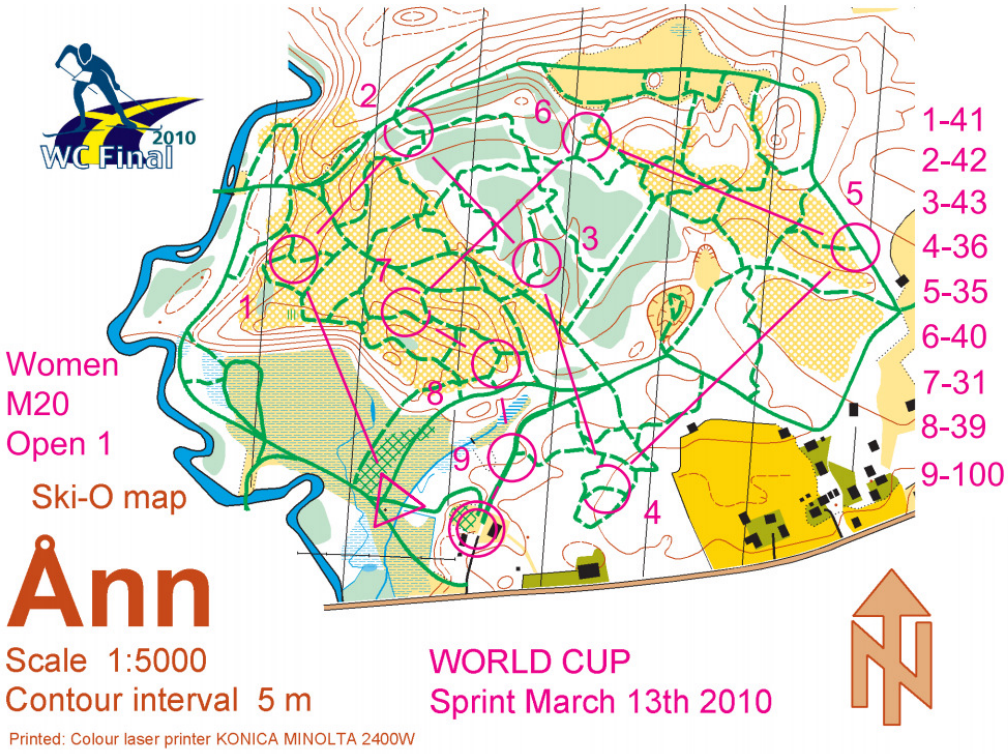
The Ski Orienteering map

The Ski Orienteering map is made to give racers the most important information they need to orienteer as easily as possible. The most important symbols on the map are the tracks. They are marked as various green lines that show the width of the track. Solid lines indicate tracks made by a grooming machine and are more than 2 metres wide. Dashed lines are made by snow mobiles and are between 0.8 – 1.2 metres wide, and dotted lines are either poor snow mobile tracks or prepared only by skiers.

The map is normally based on a normal foot orienteering map with contour lines to show the height differences and different colours to show the vegetation, water, and man-made features. Read more about the orienteering map standards at: **http://orienteering.org/resources/mapping/**

To make the Ski Orienteering map more readable at high speed, it only includes the items that will be of importance for the racer. That is why a Ski Orienteering map doesn't have intermediate contour lines (form lines), only uses one shade of green colour for dense forest, only marks the most visible stones on the map, and so on.

The Ski Orienteering course is marked on the map with purple lines. The start is marked as a triangle and the controls are marked as circles. The controls are connected with a straight line in order, and the finish is marked as a double circle. Close to the control circle there is the control number and punch code for the control. These same punch codes are marked on the control in the forest so the athletes can be sure they are at the right control.



Map example 1: The Ski Orienteering map

For more information about the Ski Orienteering map take a closer look at the International Specifications for Ski Orienteering maps 2009 (ISSOM2009), which you can find on: http://orienteering.org/resources/mapping/

How to do Ski Orienteering

Orienteering is fun, especially when you find the controls. But Ski Orienteering is different to Foot Orienteering since you are skiing. The skiing makes the speed much higher and because you normally follow the tracks, the mistakes become even more crucial. It is when you reach the combination of skiing at maximal speed and orienteering with 100% control that you enter the flow zone, and you will get the kick of Ski Orienteering.

But to reach this level where you can do Ski Orienteering with flow requires a lot of practice. The rest of this handbook will take a closer look at how athletes can improve their abilities in Ski Orienteering.

Navigation

Map reading in Ski Orienteering is done in three steps. Step number 1 is to find all the possible route choices on the leg. For the first leg this step is done at the start, while for later legs the athlete should try to find these routes while they are skiing on easier parts of the leg before. In this step it is important that the athlete finds not only the shortest routes, but also routes that are a bit longer but can be skied faster. For example these routes can have less climb, go on wider tracks, or just have fewer crossings or go straighter, so the orienteering will not cut down the speed as much as in a denser track network with a lot of crossings and turns. In this step the athletes should also try to figure out where it is possible to short-cut.

Step number 2 is to decide which of the routes you found in step 1 you think will be the fastest. To do this the athlete should consider length, climb, track quality, the difficulty of the orienteering, if it is possible to maintain speed or if you will have to slow down because of turns, and how likely short-cuts are.

In Ski Orienteering there are big pace differences between uphill skiing and skiing on the flat, and ever bigger differences when the athlete is skiing downhill. Uphill skiing on narrow tracks is much slower than on wide tracks, but downhill there are no big differences as long as the downhill track is not too technical. In flat areas the narrow tracks are only a bit slower than the wide tracks. This is what makes route choice so hard in Ski Orienteering. On the uphills, and especially steep uphills, it can be much faster to ski a long way around on a wide track than to use a steep narrow track. On downhills the shortest and least technical, both in orienteering and skiing, will be the fastest since the narrow tracks are not much slower than the wide tracks, but can often demand more technical skiing. On flat areas it is the shortest route choice that normally is the fastest. But in flat terrain the wide track demands less map reading, and you can ski a bit faster and save some upper body power for the coming uphills if it is not much longer than the narrow track route.

From all the information the athletes can find about the different legs, they should try to decide the one route they think will be the fastest. If the athlete decides on a route with short-cuts, the athlete should

always have a plan B if no-one has made the short-cut before and it is too difficult to be the first. Sometimes it will be fastest to make the short-cut first, but it can also be faster to ski around on the tracks if no-one else has made it. To select the right route choices can be very hard and needs a lot of practice in different terrain types and track networks. It is something that gives experienced athletes a big advantage and why Ski Orienteers should try to compete as much as possible to gain experience. Step number 2 should also be done before the athlete starts the next leg, so that the athlete doesn't have to stop at the control and make the route choice. Often the variations between the different possibilities are small, so the first acceptable route an athlete finds on the map is often a good route that he won't lose much time on. The athlete will often lose more time by stopping or skiing slowly for a while longer to find a 'perfect' route.

Step number 3 is to ski the route choice that was made in step 2. To be able to navigate quickly and safely, Ski Orienteers should use many of the features on the map. That means they should be able to orienteer using track crossings, contours, and other terrain details. It is of big importance for the athletes to always read the track system closely so as to not to miss any crossings. But other terrain details like marshes, open areas and buildings can help the athletes simplify their navigation and make sure they are on the right track. The athlete should also know if he should be skiing uphill, downhill, or flat to be sure that he is skiing on the right track. An example of an athlete's thoughts during a leg could be: "I'll take a right turn in the first crossing and pass a small stream, then a quick left up a steep hill to the wide track and ski left on the wide track. Then I'll pass a house on the right and enter an open field. Then I'll take a right turn and in the middle of the slight downhill I'll take a left and then the control is 50 metres ahead."

To be able to ski fast in Ski Orienteering the athlete needs to read the map in advance. If an athlete reads the map only where he is, he will have to stop at the next crossing to know which track he should take. That means the athlete needs to know where he is going to ski in the next crossing before he gets there so as not to lose time. In a tight track network the crossings can be so close that the athlete will need to know where he is going to turn for the next 2-4 crossings. To take a short cut the athlete will also have to read the map in advance. If he sees a short cut in front of him and just takes it because it might goes in the right direction, he will probably make many big mistakes in a race. Before an athlete takes a short-cut he needs to check on the map that it is smart to take it and that the short-cut is going in the right direction.

Earlier, and even today, some athletes use a technique where they memorise where they are going to ski for the entire leg, and then just ski the leg from memory as fast as possible. This is a very risky business, since if you turn wrong at just one crossing you will not notice it before you've skied for a long time. Then the athlete will have lost a lot of time and will have problems recognising where he is on the map.

This is even more risky today when the track systems are getting more demanding. Modern Ski Orienteers try to read the map for a very short time as often as possible to check that they are skiing on the right track, where they are going to turn at the next crossing, and also the route choice for the next leg if they have time for it. To do this in a tight track network the athlete should read the map every 5-10

seconds for 1-2 seconds. Since they are reading the map this often, they know where on the map they are going to look and don't have to try to recognise the right spot. This can be hard for foot orienteers who normally use their thumb to show where they are on the map.

The biggest difference between top Ski Orienteers and Ski Orienteers on a lower level is that the less good orienteers have to slow down and stop more during a race, even if they ski faster than the best athletes at some points of the race. The better athletes can keep a more even speed, and during the race this gains them a lot of time. That is why all athletes should try to ski at a pace where they can ski safely to orienteer. In the long run they will be faster with the safer speed than by making mistakes.

How to ski

Ski Orienteering has different technical skiing demands than cross-country skiing. On the wide tracks the skating technique is the same as in cross-country skiing and will not be given any further description here.

But since Ski Orienteering is often practised on mostly narrow tracks, to know how to ski on these tracks is essential. The narrow tracks are only 0.8 – 1.2 metres wide, though they can get wider if many earlier skiers have skied with their ski tips in the loose snow outside the track. This means it is not possible to use a normal skating technique in these tracks. The athletes can therefore only use double poling or one leg skating in these tracks. Some athletes also manage to do a narrow two leg skating technique in the narrow tracks, especially where the tracks are a bit wider. In the steepest uphills when the speed is really slow the athletes can also use herringbone to get up by putting their ski tips in the loose snow. If the uphills are extremely steep the athletes can also take off their skis and run up the hill. It is also possible to run downhill if the track or short-cut is too steep and technical.

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Ski Orienteering has much bigger technical skiing demands than Cross-country Skiing

What technique an athlete should use on a narrow track depends on how wide and hard the track is, if it is uphill, flat, or downhill, and the athlete's strength, technique, and ski agility. Normally the more speed you can achieve with your legs, the more power you can save from your arms. In flat areas it is possible to get a lot of speed with the legs in one leg skating, while on steep uphills most of the power has to come from the upper body. Also when the speed is high it is hard to make more speed with the legs, since the skis can very easily catch in the loose snow.

Distances in Ski Orienteering

In Ski Orienteering there are four distances: sprint, middle distance, long distance and ultra-long distance. Middle, long and ultra-long can be done as mass starts. In addition there are also relays and sprint relays. Read more about the distances in the IOF competition rules 2011 – Appendix 5.

Mass start in Ski Orienteering

The sprint and sprint relay distances have enormous demands on the athlete's map reading skills at high speed and how fast they can make the right decisions. Often there are also hard route choices in a sprint. Not that the routes differ very much in time, but since every second in a sprint is important there is much to lose with 15-30 seconds on a route choice.

The demands of long and ultra-long distances are to take the right route choices on long legs – the alternatives can differ a lot in time – and to be able to ski fast over a long time. But these distances often pass through tighter track networks too, and the athlete must be able to adjust the skiing speed and read the map more carefully there. On the longer distances the athletes often make mistakes because they think it is 'too easy' and then forget to read the map and focus on their tasks.

The middle distance is often a mix of the sprint and long distance and the athlete will get hard route choices at the same time as they ski in a tight track network. The legs are not as long as in the longer distances, but since the track network is tighter there are often more routes to choose between. The relay is often similar to the middle distance, but can have fewer controls.

Training for Ski Orienteering

Orienteering is an endurance sport and therefore has many demands common with other endurance sports. The physical demands in Ski Orienteering are especially similar to cross-country skiing, and the orienteering technical demands are similar to Mountain Bike Orienteering and also partly Foot Orienteering. This handbook will only take a briefly look at the endurance demands in Ski Orienteering, explain the biggest technical ski training differences from cross-country skiing, and focus more on exercises to improve the athletes technical Orienteering abilities.

Physical factors in Ski Orienteering

The common limiting factor for all endurance sports is the maximal aerobic power, called VO2 max. Even though the orienteering part is very important in Ski Orienteering you will need to have a high maximal aerobic power to be able to compete at the top international level. For cross-country skiing it is said that to win a FIS World Cup you will need a minimum of VO2 max at 80ml/kg/min. For Ski Orienteering this minimal limit can be set to a VO2 max around 70 ml/kg/min, but the athlete will always have a better chance for a top result with an even higher VO2 max, and many of the best athletes have a VO2 max around 80 ml/kg/min or higher.

Another factor that seems to be important for all endurance sports is the anaerobic threshold. That is the speed or the amount of VO2 usage the athletes can ski at and keep the production and elimination of lactate stable. There are many ways to calculate the anaerobic threshold, but the important thing is to be able to ski at the highest possible speed without accumulating more lactate than you can eliminate.

The narrow tracks in Ski Orienteering also put bigger demands on upper body power than in cross-country skiing. This is why it is very important for Ski Orienteers to both be strong enough to keep their speed up on the steepest hills and have enough endurance in the upper body to ski the whole course (up to 90-150 min) with a bigger contribution of the upper body muscles than in cross-country. That is why Ski Orienteers do much specific endurance strength training on their upper body, like double poling distance training in hilly terrain and short maximal double poling sprints on steep uphills.

All the physical factors above are very important for performing in Ski Orienteering, but it is also important to handle the changes between the different techniques in wide and narrow tracks and the changes in speed and intensity you will meet on a Ski Orienteering course. That is why it is important for a Ski Orienteer to practice these factors over the whole year in order to perform at a high level during winter competitions.

Below there are examples of some special exercises for Ski Orienteers. These are just examples for inspiration in making other specialised exercises for SkiO. When starting with new exercises, one should always use progression to get used to the new exercise. In the first few weeks one should always do

them with lower intensity until you have the right technique, and then increase the intensity until you reach the level you're supposed to train with.

Example of short interval training for Ski Orienteers

Trains the aerobic endurance system and the ability to resist lactate production with speed changes. A way to simulate the way you ski in Ski Orienteering. Can be done both skating, double poling and as narrow track technique.

- Warm up: Slow skiing 20-30 minutes with some faster sprints
- Interval: 30-60 times 20 seconds skiing (first 5 seconds maximal sprint, the next 15 seconds maintaining the speed), 20 seconds rest
- Cool down: 15-20 minutes slow skiing

Example of long interval training for Ski Orienteers

Trains the aerobic endurance system, work economy, technique changes and map reading. Can be done on rollerskis or skis on a rollerski track, ski course or on long uphills.

- Warm up: 20-30 minutes of slow skiing using the different techniques skating, narrow track skating and double poling. Some faster sprints.
- Interval:
    - 6 times 10 minutes (2 minutes skate + 2 minutes double poling + 2 minutes skate + 2 minutes narrow track skate + 2 minutes skate)
    - 82.5%-87.5% of maximal heart rate
    - Reading map from a Ski Orienteering event during the interval. Selecting routes and trying to ski the routes mentally. Also possible to draw the routes as a map memory exercise on blank paper during the rests.
    - 2-3 minutes rest between intervals
- Cool down: 15-20 minutes slow skiing

Example of maximal strength training for Ski Orienteers

Main muscle groups trained: M. latissimus dorsi, M. triceps brachi, M. rectus abdominus, M. iliopsoas

- Warm up: 15-30 minutes slow running/skiing + some strength exercises with low intensity.
- Strength training: 2-2.5 minute rest between sets.
    - 3 times 4-6 repetitions pull down with narrow grip, 80-90% of 1RM (one-repetition-maximum)
    - 3 times 4-6 repetitions standing double poling, 80-90% of 1RM
    - 3-4 times 10 repetitions dips, 70-80% of 1RM
    - 3-4 times 10 repetitions vertical sit-ups with weight, 70-80% 1RM

Example of strength training for Ski Orienteers on skis and rollerskis

Main muscle groups trained: M. latissimus dorsi, M. triceps brachi, M. rectus abdominus, M. iliopsoas

- Warm-up:
    - 15 minutes slow skiing, skating and double poling
    - 5 skate sprints from slow speed and increasing speed until maximum.
    - 5 double poling sprints from slow speed and increasing speed until maximum.
- Strength training, start every 2nd minute
    - 4 times 20 strokes V3 skate with as long strokes as possible on steep uphill
    - 3 times 20 strokes V2 skate without poles on steep uphill
    - 3 times 20 strokes triceps double poling on slightly steep uphill
    - 3 times 30 strokes diagonal poling with a straight upper body on slightly steep uphill
    - 3 times 20 strokes double poling with straight upper body on slightly steep uphill
    - 3 times 30 strokes diagonal poling with only use of the upper body on steep uphill
    - 3 times 20 double poles as long as possible on a steep uphill
    - 5 times 25 double poles as fast as possible on a steep uphill (3 minutes rest)
- Cool down: 15-20 min slow skating

Ski Technical training for Ski Orienteering

To become good on narrow tracks you will need a lot of practice on narrow tracks. You need to be able to use the bumps in the terrain to create speed without catching your skis in the snow. To improve leg work on narrow tracks, the athlete should ski narrow tracks with a reduced ability to get power from the upper body. Since it is hard to ski narrow tracks without poles, one way of doing this is to ski narrow tracks with only one pole. This will also be an exercise where the athlete will need to stabilise the upper body to be able to get any power.

Other ways of improving technical skiing ability are to go out and have fun on the skis. They can be obstacle courses, jumps, slalom, playing football, soccer or bandy on skis etc. It is also possible to do obstacle courses as head-to-head sprints or relays. All kinds of skiing that push the athlete's limits will improve their technical skiing abilities and help them go faster on narrow, winding, and bumpy tracks and have fewer falls during a race.

It is also possible to try to follow someone who has better skiing abilities than yourself when he is skiing downhill on narrow tracks. Then you should try to copy what the better skier is doing and try to follow him down the hill.

Other things that can be worth training for Ski Orienteers are for punching: how and when to brake, how to do the punch, and then a fast acceleration after the punch. This can be done on an open groomed area like a ski stadium, with many controls in a row, or as an obstacle course where the athletes should try to do the course as fast as possible. It is also possible to make a short loop in a track system where the athlete should try to ski the course as fast as possible and punch the controls. In a race with up to 40 controls there can be a lot of time to gain from having a good punching technique.

Orienteering technical training for Ski Orienteering

The obvious most important factor in all orienteering sports is of course the orienteering part. If you make a 30-second route choice mistake, or lose one minute because you turned at the wrong crossing and have to turn around, you have wasted a lot of energy and the time loss is impossible to catch up later. That is why the best Ski Orienteers also make the fewest mistakes.

The absolutely best way to improve one's Ski Orienteering technique is by skiing Ski Orienteering competitions. Here you will get both competition experience and routine, and you will have to orienteer under pressure. But it can be hard to do enough Ski Orienteering competitions, because of long and expensive travel and the shortage of such competitions. This reduces the Ski Orienteer's opportunities for doing the most relevant technical training for Ski Orienteering. Nevertheless it is possible to do a lot of good orienteering technical training for Ski Orienteers, both with and without a track system, both in summer and winter. Further down there are some example exercises, but it is only one's imagination that limits the number of exercises you can create.

Orienteering technical training in the summer

It is important for Ski Orienteers to do technical orienteering training over the whole year and not only during the last few weeks before the competition season. That is why they are including both Mountain Bike Orienteering and Foot Orienteering in their training, and many Ski Orienteers even compete at a high level in these sports. But it is also possible to do even more relevant training for Ski Orienteering, like Rollerski Orienteering and running Path Orienteering with map holder and poles. Rollerski Orienteering is done as normal Ski Orienteering with roller skis and a map holder, in a residential area or other area with a technical paved road network during quiet traffic times of the day. In Path Orienteering the athletes run with a map holder and short ski poles in their hands. Then they also can work with their upper body at the same time, and they cannot hold the map holder while they are running, as in Ski Orienteering. Path Orienteering is done on very dense path networks that are often located close to cities. For Path Orienteering you often use a large map scale to make it readable when you are running, and it is therefore very important that the path system on the map is correct. Almost all the exercises in this handbook can be done as Ski Orienteering in winter and by Rollerski Orienteering, Mountain Bike Orienteering and Path Orienteering in summer.

Focus in orienteering technical exercises

The most important thing when you're doing technical orienteering exercises, to get the most out of them, is to be 100% focused on your tasks and try to do the exercises as similar as possible to competitions. The exercises should also be done close to or even above the athlete's competition speed to develop the athlete's skills, but it is also possible to do some of the exercises at lower speed in order to find the flow in the orienteering. But if the exercise is supposed to be done below competition speed, it is very important that the athlete manages to maintain top focus throughout the whole exercise.

Something that is important to have in mind when you are doing technical orienteering training is that for each time you train in the track, path or road network you will learn more and more of the area. That means you will get less technical orienteering outcome when you have used the same area a couple of times. At the end you will know the area so well that you will be navigating more on your memory than the map, and then you're not getting much technical orienteering training. This can even be destructive for your orienteering skills because you can develop bad orienteering habits. That is why it is important not to 'wear out' the technical networks, but instead save them for later exercises.

Analysis

After each technical orienteering training or competition, the athlete should analyse their race and find all the time losses he/she made. This should preferably be done in pairs or a group with other athletes that have done the same exercise or course. Then discussions will start, and the athletes will get to know what other athletes are thinking and maybe find routes they didn't find themselves. When the athletes are trying to analyse their race, they should use their split times to really see where they lost time compared to others. The athletes should also analyse the reason behind their time losses and document both how much time loss they had on the exercise or competition, the reason, what kind of terrain the time losses appeared on, and other important factors for the time loss. After some exercises and competitions it might well be possible to see some common areas where the athlete loses the most time, and then start training to improve these aspects.

In recent years it has become more and more common with GPS tracking at competitions, and a lot of ski orienteers also track their routes using GPS watches. GPS tracks can be very informative when you are going to analyse your race or an athlete's race. This will give you a lot more information about why and how you lost time than just the split times. Programs such as GPS Seuranta, MapandCoach, 3DRerun and QuickRoute are specially constructed for making orienteering analysis. Here you can make a mass start of all the runners or just a portion of the runners. You can also mass start them at points along the course and thereby analyse the different route choices, and you can see the athletes flow and how much they are stopping. Some of the programs even give you a lot of graphs that help you detect the athlete's flow and skiing speed. In the 3DRerun program you can also upload a headcam movie that you can synchronize with the GPS track and then get even more information about the athlete's orienteering habits and see the reasons for their mistakes. These are great tools for analysing your own race, but also to get more experience by looking at others' races and see how the best ski orienteers ski. The web-based programs also save the old tracks. This gives less experienced athletes the possibility to pick up some of the knowledge the more experienced athletes have, and thereby decrease the experience gap between them. One of these programs is GPS Seuranta; see a link to this program in the GPS analysing programs links at the end of this document.

Ski the same course more times

For new athletes to the sport it can be hard to understand how fast it is possible to ski in the narrow tracks, especially when you also have to orienteer. That's why new athletes should try to do the same course several times. The first time they will have to focus a lot on the orienteering and their skiing will be pretty slow. If they ski the same course one more time they will have less challenges with the

navigation. This will give them the opportunity to feel how fast the best ski orienteers, that ski just as fast with or without the navigation challenge, are skiing in competitions. This will also give the new athletes the possibility to get good practice at high speed in narrow tracks, which is important for them to develop as ski orienteers.

Below there are some Ski Orienteering technical exercises for both with and without track system and even some mental exercises. All the physical exercises can be done as summer training like Mountain Bike Orienteering, Rollerski Orienteering or Path Orienteering or as Ski Orienteering exercises in winter. Also listed are what orienteering ability the exercise is training, how it is done and some map examples that show how the exercise can be done.

Physical orienteering technical exercises with track system:

Ski Orienteering course

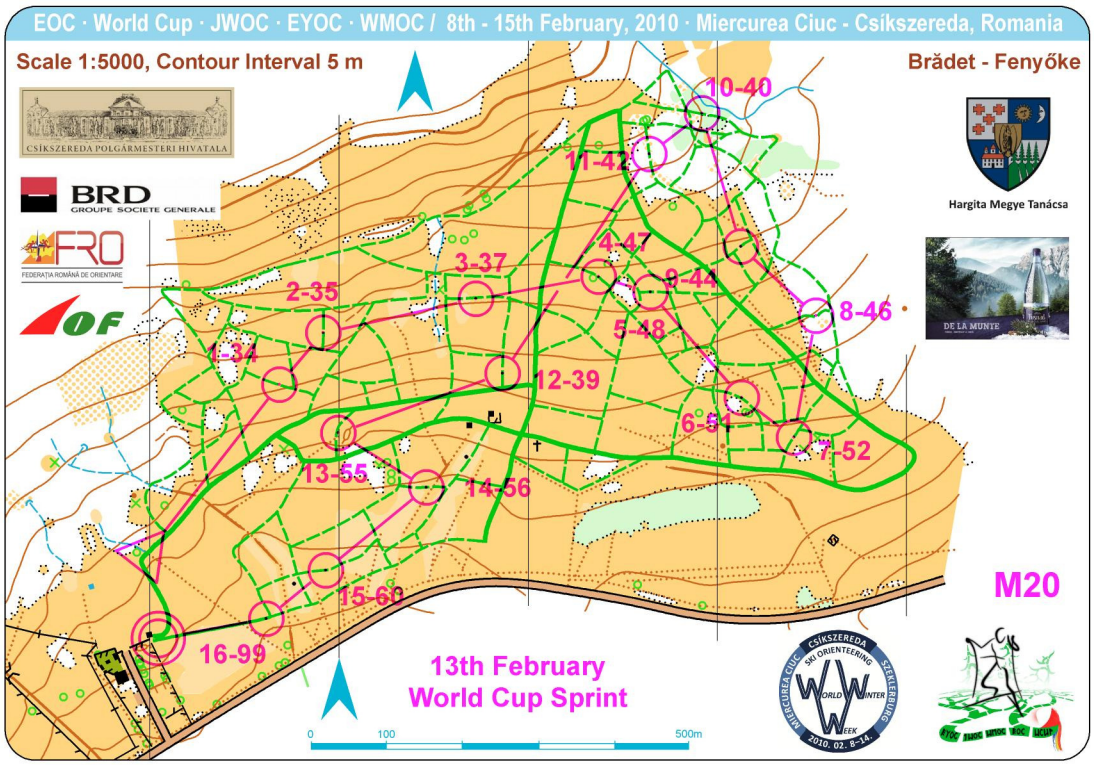
Difficulty	Easy to hard
Technical factors	• Map reading • Route choices
On – Off snow	On snow (alt. off snow)
Track system	All kinds – harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
In this exercise the athletes will just ski a normal Ski Orienteering course. The athletes can have some personal tasks they are going to focus on. Examples of tasks:

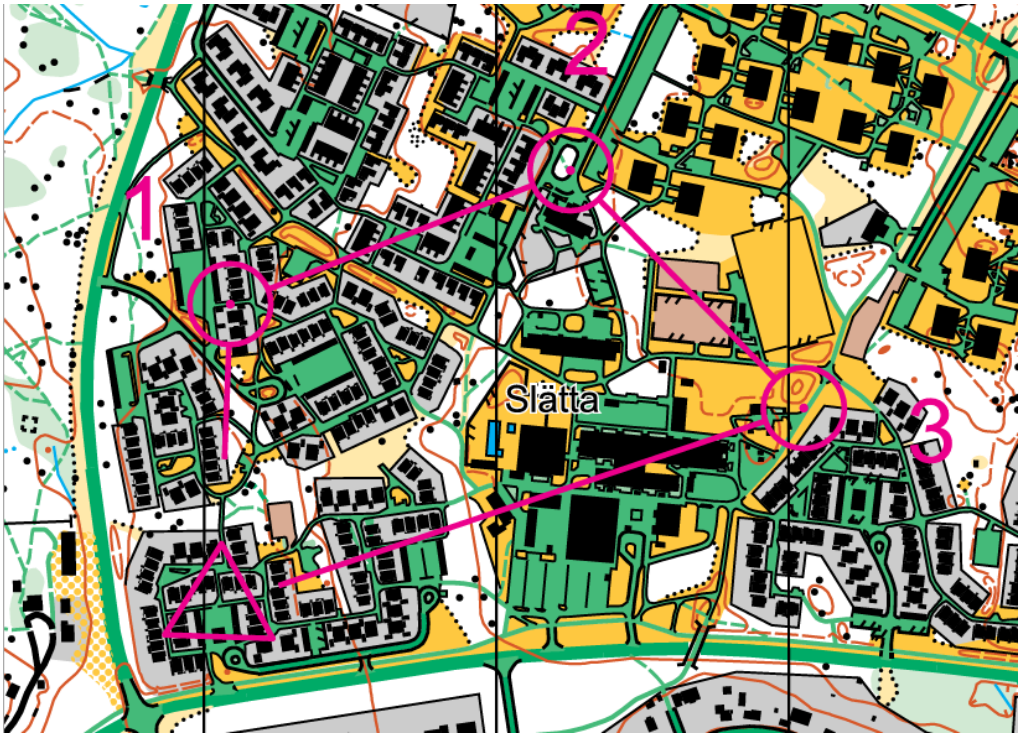
- Always take the best route choice – take some extra time to choose routes
- Always be reading ahead on the map. Where am I going at the next 2-3 crossings. If you don't know this you have to stop and find out
- Regulate the speed between the easy and hard orienteering technical areas
- Try to find the best short-cuts
- Find easy routes where you can keep the pace high

The exercise can also be used as competition preparation where the athlete prepares and does the course as it should have been in a competition. It is also possible to do this as a test race and let the athlete feel the pressure when they know the time is running.

The course can have a sprint, middle distance or a long distance character. It is also possible to increase the challenge by having sprint distance character for a one-hour training session, or by switching between the characters within the exercise: first there are some controls with a sprint character before a long route choice leg and then more sprint controls.



Map example 2: Ski Orienteering course



Map example 3: Rollerski Orienteering

Map example 4: Path Orienteering

Ski Orienteering intervals

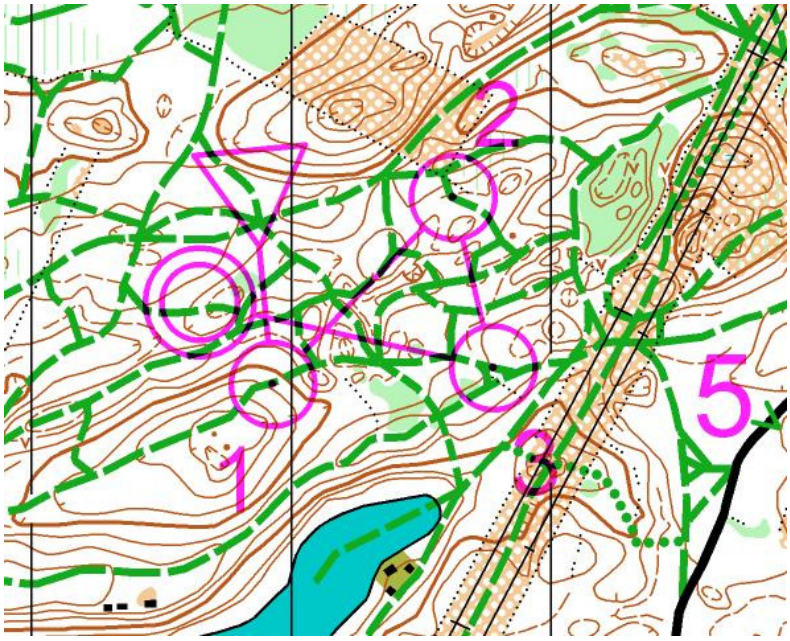
Difficulty	Medium to hard
Technical factors	• Start procedures • Getting into focus • Over-speed training • Handling stress from other skiers* • Map reading • Route choice
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	High speed
Training method	Intervals
Number of athletes	Alone, or two or more together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
Ski Orienteering intervals are intervals in short ski orienteering courses from 3-15 minutes, often of sprint or middle distance character. The athletes should try to do the courses as fast as possible without any mistakes.

This challenges the athlete to work through their routines of focusing before the start, putting the map in the map holder and attacking the first controls. To do Ski Orienteering as intervals the athletes will also ski at more than normal speed, and this will develop their orienteering skills and skiing skills on narrow tracks.

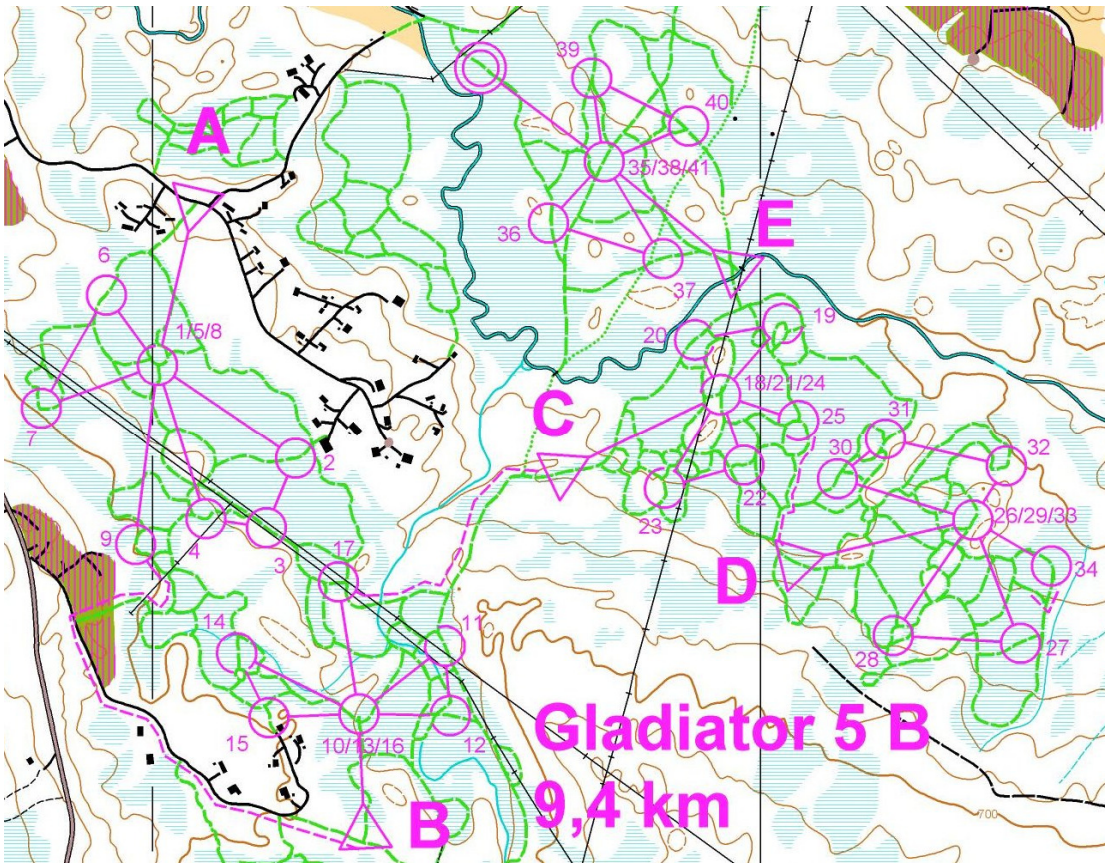
The interval can be done in many ways. It can be just a normal course, or it can be done with more people starting together, or even as a chasing start. If there are more people skiing the same course at the same time, it is possible to create different kinds of gaffling to force them to orienteer by themselves, but it is also possible that they ski the same course and stress each other. If they are going to ski the same course, it is important to have good route choices they can choose between. As a gaffling method, butterflies are a good option. See one example called Gladiator in map example 6.

At an interval session it can be possible to mix the interval type. For example the first interval can be an individual start with 30 seconds between each skier. The next interval can be ungaffled, the third a gladiator butterfly and the last interval an ungaffled chasing start.



Map example 5: Ski Orienteering interval

Map example 6: Gladiator intervals. In pairs with different gafflings



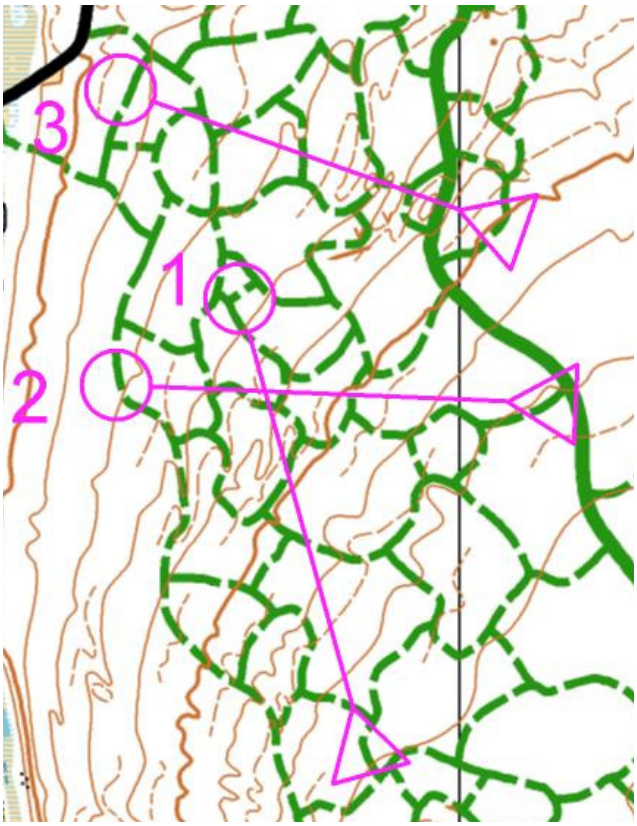
Downhill intervals

Difficulty	Hard
Technical factors	• Over-speed training • Ski handling • Getting into focus • Start procedures • Map reading • Route choice • Short-cutting • Handling stress from other skiers*
On – Off snow	On snow (alt. off snow)
Track system	Tight network in a downhill
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Intervals
Number of athletes	Alone, or two and two together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
Downhill intervals are as the name says: orienteering on a downhill. Since a downhill always ends, downhill orienteering is done as intervals. But as you get high speed downhill, you can get difficult orienteering demands without the same physical effort. When they have finished their course down, they ski on another track back up again at a slow speed before they again prepare for the next start at the top.

The biggest challenge in downhill Ski Orienteering is the high speed. The athlete will ski at over-speed with limited opportunities to read the map. This requires them to read the map precisely as often as possible, since they don't have the opportunity to read the map again. In downhills there are also more possibilities to do short-cuts, which again makes the orienteering challenges even harder.

It is also possible to do this exercise with stress from other skiers by starting two and two together on the same course or with gaffling.



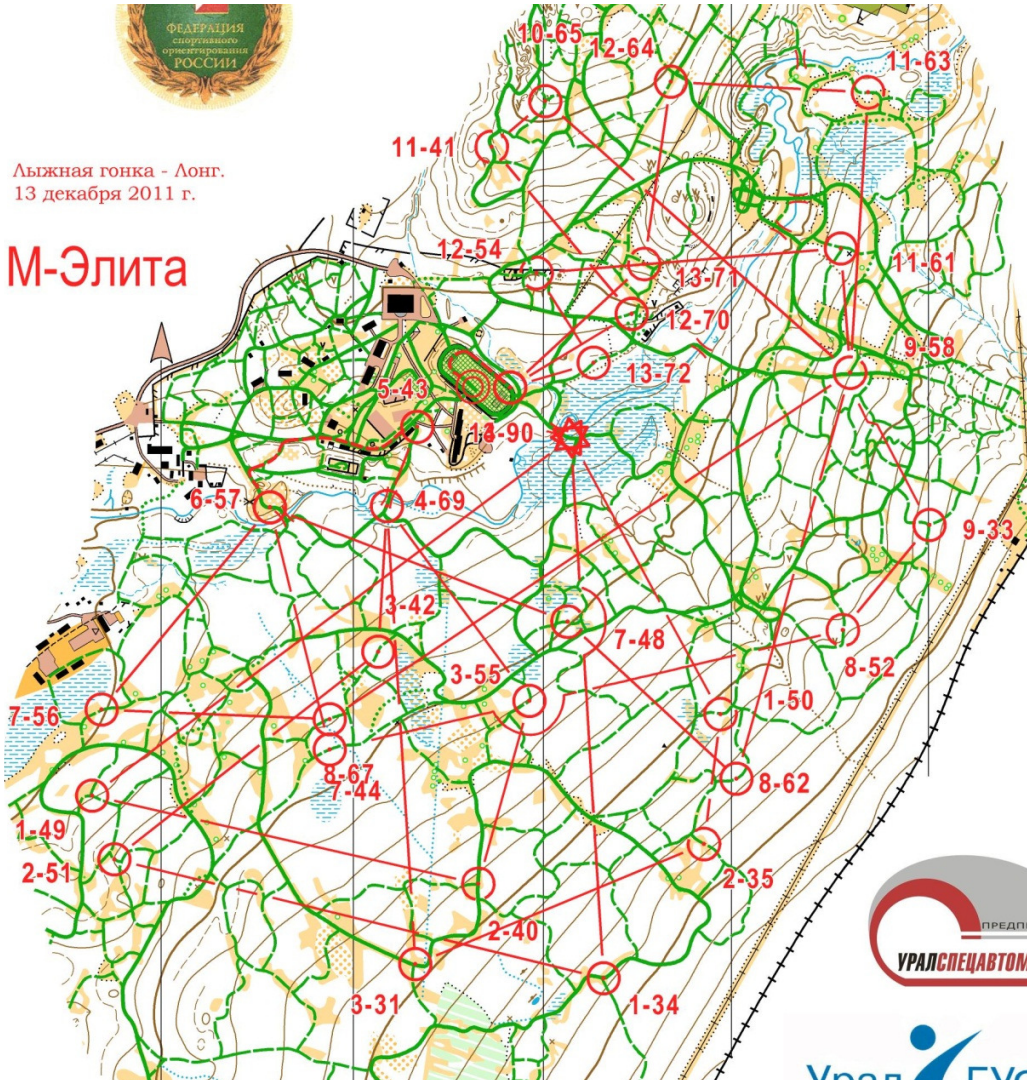
Map example 7: Downhill

One man relay

Difficulty	Medium to hard
Technical factors	• Mass start and relay training • Handling stress from other skiers • Map changes • Map reading • Route choice
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	High speed
Training method	Continuous
Number of athletes	No limit, but two or more skiers
Preparations:	Much – Track network, maps, courses with gaffling, map changing and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls • Map change equipment

Description:

One man relay is like a mass start or a relay where one skier skis all the legs. The course can for example have 3 loops that are gaffled and the skiers will ski the course as a mass start. Because of the gaffling, the skiers will not have the same course for the whole race, and they will have to orienteer independently and still use the other skiers. This is a great exercise which will make the athletes give everything to beat each other.



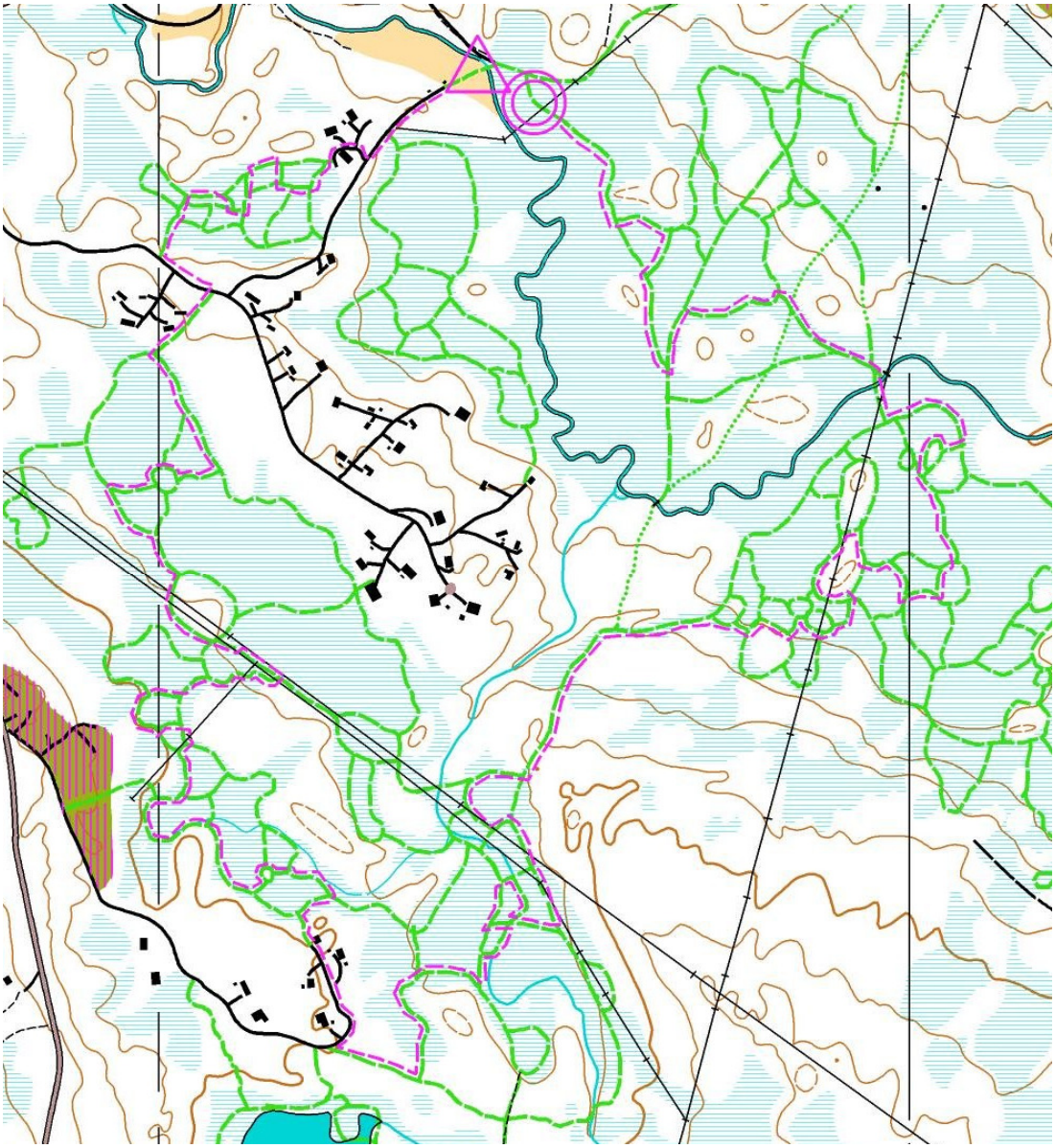
Map example 8: One man relay

Follow the line

Difficulty	Easy to middle
Technical factors	• Flow in map reading • Practice reading rhythm
On – Off snow	On snow (alt. off snow)
Track system	Middle to high crossing density
Physical intensity	Low (also possible to do at higher speed)
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – track network, maps and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and line • Controls

Description:
In this exercise the athletes are going to try to navigate on a chosen route. They are going to try to follow the line marked on the map. Along the line there will be controls that are not marked on the map and the athletes should punch at these controls. When they have finished the course they will read out their punches and see if they have punched all the controls and thereby stayed on the chosen route.

This exercise will be harder the faster you ski, but if you have a very tight network of tracks this exercise is also possible to do at lower speeds. It is also possible to do this exercise without controls in the forest to make the organising of the training easier.



Map example 9: Follow the line

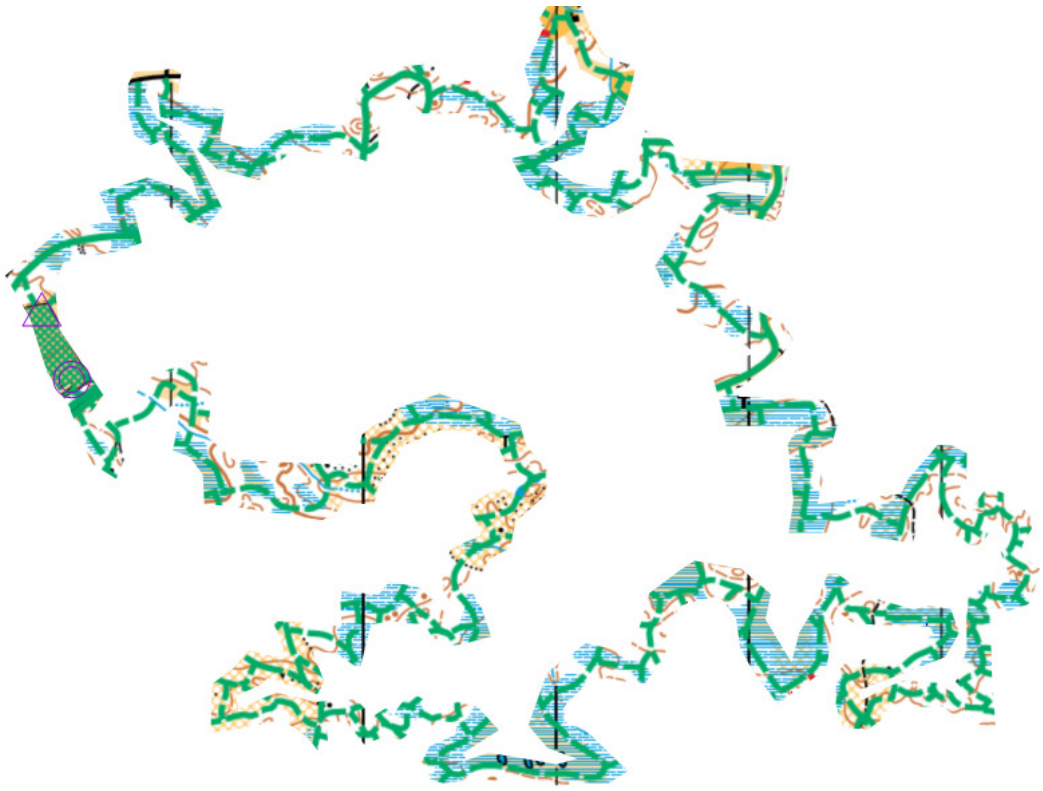
Corridor

Difficulty	Easy to middle
Technical factors	• Flow in map reading • Practice reading rhythm
On – Off snow	On snow (alt. off snow)
Track system	Middle to high crossing density
Physical intensity	Low (also possible to do at higher speed)
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – track network, maps and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and corridor • Controls

Description:
In this exercise the athletes are going to try to navigate on a chosen route. They are going to try to ski within a corridor marked on the map. Inside the corridor the map will be shown normally, but outside the corridor the map will be blank. Only what the athletes need to know for navigating should be inside the corridor. That will be the track they are skiing, crossings and maybe some terrain items.

Along the corridor there will be controls that are not marked on the map and the athletes should punch at these controls. When they have finished the course they will read out their punches and see if they have punched all the controls and thereby stayed on the chosen route.

This exercise will be harder the faster you ski, but if you have a very tight network of tracks this exercise is also possible to do at lower speeds. It is also possible to do this exercise without controls in the forest to make the organising of the training easier.



Map example10: Corridor

Route Choice

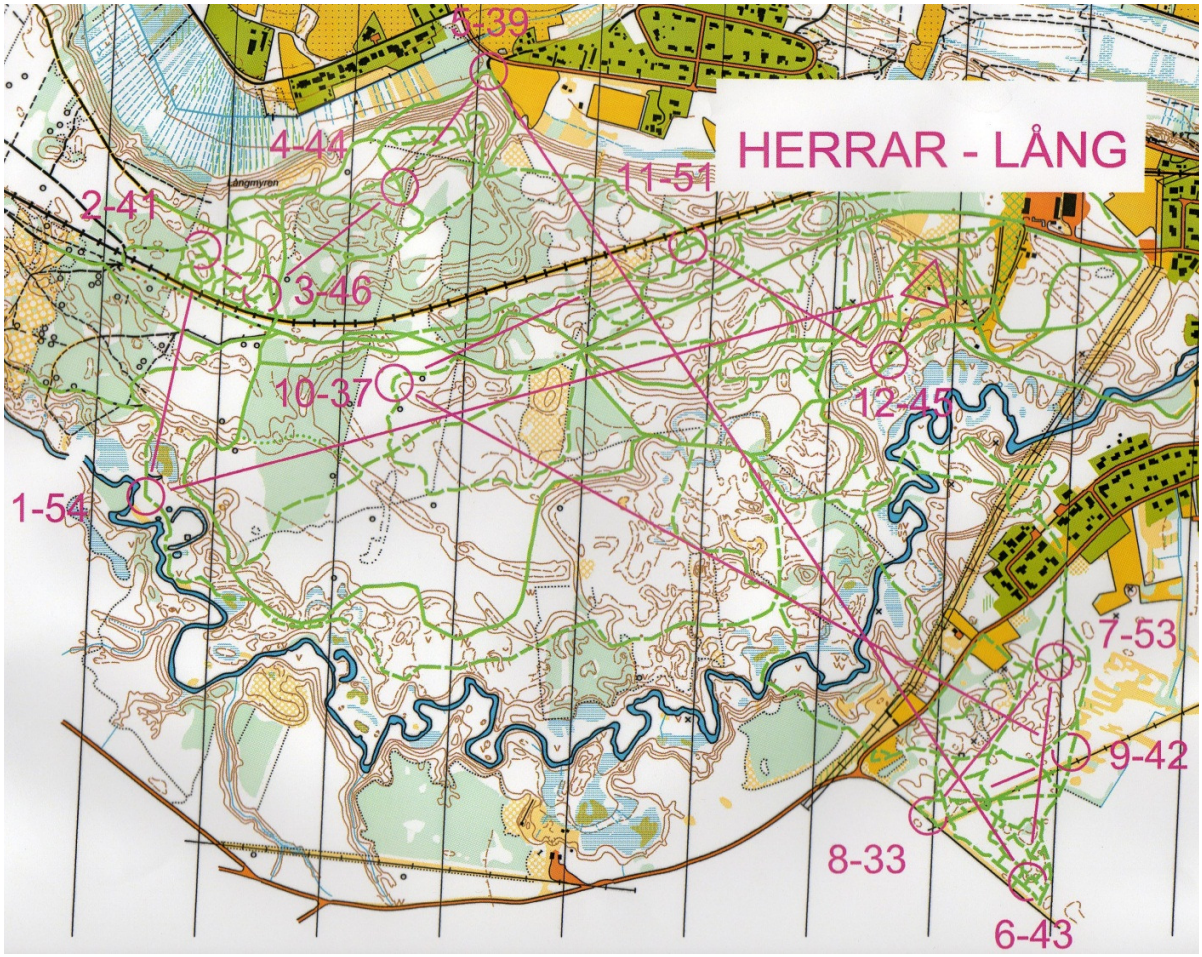
Difficulty	Easy to hard
Technical factors	• To find the most effective route choices • Stress by skiing against each other
On – Off snow	On snow (alt. off snow)
Track system	All kinds - most important that the track network gives challenging route choices
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous or intervals
Number of athletes	Two and two together (alt. ski the course alone twice)
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and courses • Controls

Description:
In this exercise the athletes are going to ski a course with good route choices on each leg. The legs can both be longer and shorter as long as the route choices are demanding and interesting.

Two and two athletes start this exercise together. The first athlete decides the route choice he wants and the athlete behind has to take another route choice. If they are not going to ski at maximal speed, they should decide which speed they are going to ski at before the start. Then the first to get to the control has taken the better route choice.

It is also possible to do this exercise with pre-decided route choices. Then the map is drawn with two different lines as route choices between each control. The two athletes choose their own line and the first to the control took the better route choice.

This exercise can also be done alone. The athlete first skis the course once and prints the split times from the first run. Then they ski the course one more time, but this time choosing another route to each control. When they have finished the second run they print their splits and then they can compare the first and the second run and from the split times decide the best route choice to each control. Thereafter they can ski the course yet one more time, trying to take all the best route choices, to see how much faster it is possible to ski the course when they know the route choices and have skied them before.



Map example 11: Route choice

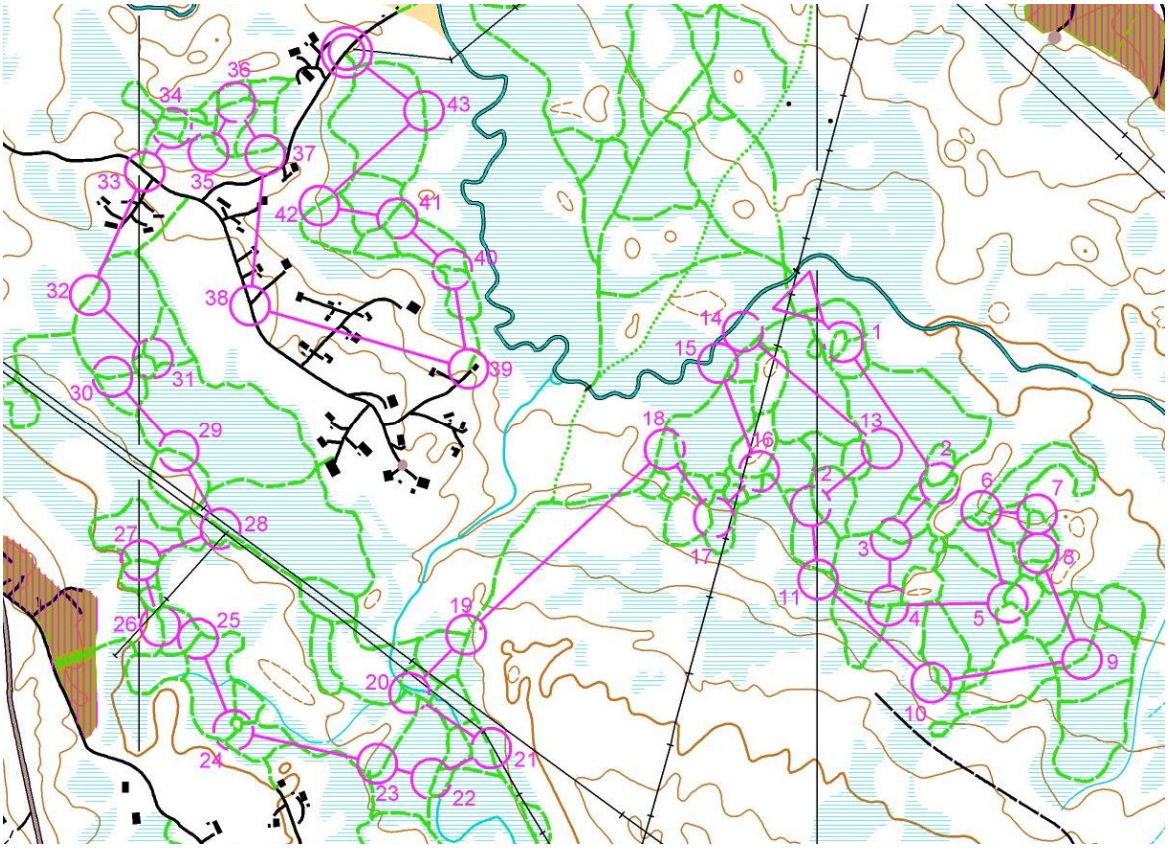
Control picking

Difficulty	Easy to hard
Technical factors	• Practice flow and smoothness in map reading and navigation • Make fast route choice decisions • Control punching and turning
On – Off snow	On snow (alt. off snow)
Track system	Tight track network
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
In this exercise the athlete skis a course with a lot of controls and short legs in a tight track network as fast as possible. They should try to do this exercise without stopping or going wrong at any crossings, and always taking the best route choices.

This will challenge the athlete's navigation skills and their ability to make fast route choices in a difficult track system. To be able to ski the course at a fast speed, the athletes need to read the map in advance and know where they are going at the next 2-3 crossings all the time, or they will have to stop or will make mistakes. This will also challenge them to try to read the map as often as possible, forcing them to read whenever it is possible (it is hard to read the map when they are skiing through crossings, turns and on a steep downhill etc.). If they only read the map for where they are and not in advance, they will have to stop after the difficult parts in order to read their map. Each time they stop to read the map they will lose time, and on skis one stop takes as long as skiing 50-100 metres.

It is also possible to do this exercise at a slower speed where the athlete feels they have control, and thereby train on skiing with flow. After a while at slower speed, they can raise the speed a bit and try to keep their flow. The best athletes can ski even the most difficult areas with flow at almost maximum speed.



Map example 12: Control picking

Pace variation

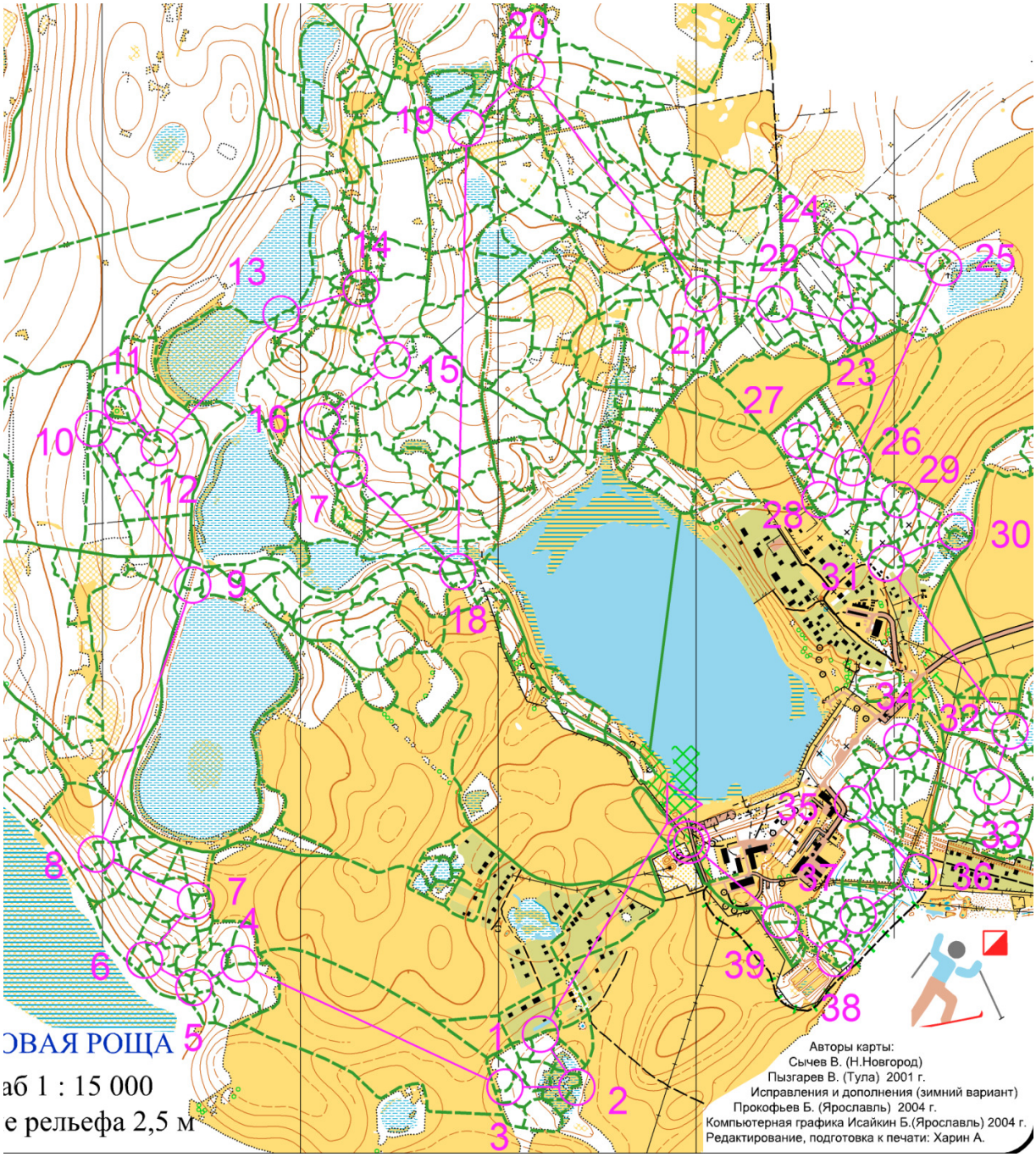
Difficulty	Medium to hard
Technical factors	• To change pace when entering different orienteering technical characteristics • Route choice (on the longer legs) • Flow in the map reading (on the difficult legs)
On – Off snow	On snow (alt. off snow)
Track system	A track system with different characters. Some tight areas with easier areas between
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous (alt. intervals)
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
Very often the course setter varies the pace on a ski orienteering course, forcing the athletes to push their physical limits on a long leg demanding full-speed skiing and then combining with short, demanding navigational legs. The aim of this exercise is to push the limits in skiing on a long leg, so that physical tiredness will force mistakes and weakness in mental concentration and navigation on a more challenging part of the course.

In this exercise the athletes should do a course where they should focus on never skiing above their orienteering level. The course should be made with big differences in the characteristics where they mix long, hard physical legs and go directly over to more technical legs in a difficult track network. Then the athlete has to turn down the speed since they are tired after the physical leg, and need lower speed to manage the orienteering in the difficult part. After the difficult part there can again be some longer physical legs where they have to speed up again before entering a new difficult area.

If the athletes have big problems slowing down, then the coach can mark on the map beforehand where they should lower the speed and focus on the orienteering, and where they can ski at full speed. After a few exercises the athlete should understand where to change focus, and can do it without any marking from the coach.

This training can also be done as an interval where the athlete first has a longer leg to the difficult area, then some short legs inside the difficult area before a longer leg to the finish.



Map example 13: Pace variation

Lead John

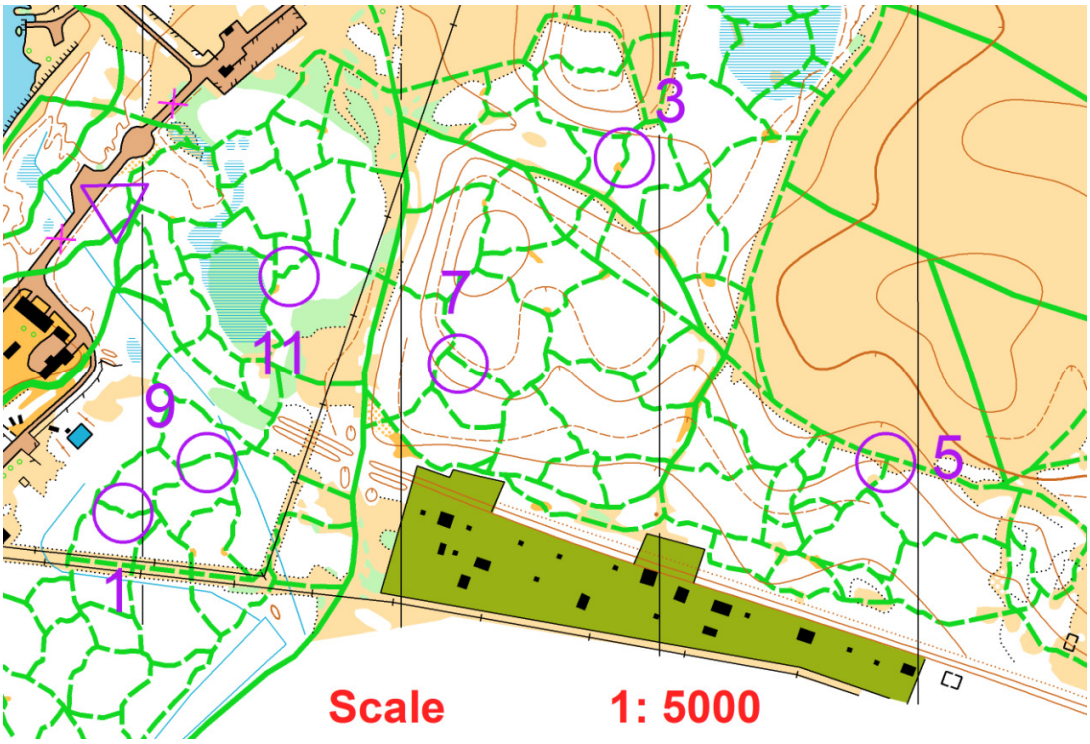
Difficulty	Medium
Technical factors	• Practice map reading in advance • Memorising*
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	Two and two together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • One map with control 1, 3, 5 … etc. • One map with control 2, 4, 6 … etc. • Controls

Description:
In Lead John the athletes are skiing in pairs. One of the athletes is going to tell the other athlete where he is going to ski. The athlete who is told where to ski is called 'John' and is skiing first, while the skier who is telling him where to ski is skiing behind. At each control they change who is 'John'.

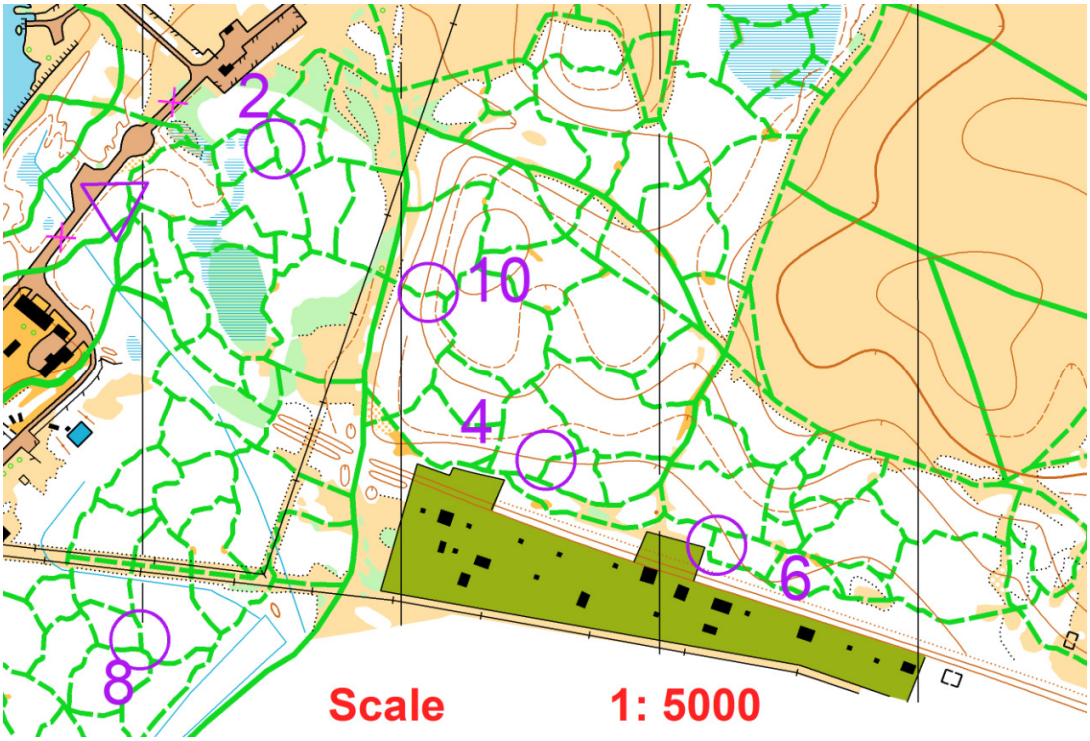
This exercise forces the athlete who is telling 'John' where to ski to read the map in advance. If not, the skier in front won't know where to ski at the crossings. The exercise can be done at all speeds, but it will be more difficult if they ski faster.

This exercise can be done in two ways. One way is for both skiers to have a map, but the maps shows only every other control. That means the first leader has controls 1, 3, 5 (and so on) on their map but the other runner has controls 2, 4, 6 etc. on their map. The runner being told where to ski then also has to read the map to know where they are, because when they reach the control he is going to show the next leg without asking the other runner where they are.

Another way of doing this exercise is that the 'John' has to turn his map over so that he is not able to look at the map while he is in the lead to the next control. At the control he will turn his map over, and by memory and looking at the terrain and tracks try to locate where they are, before he leads the new 'John' to the next control.



Map example 14: Lead John, skier 1



Map example 15: Lead John, skier 2

Follow John

Difficulty	Medium to hard
Technical factors	• Mass-start training • Memorising*
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	Two and two together
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • One map with control 1, 3, 5 … etc. • One map with control 2, 4, 6 … etc. • Controls

Description:
Follow John is pretty similar to Lead John, but in Follow John the 'John without the next control on the map is skiing behind the athlete with the next control on the map. At the control they change, and the skier with the next control on the map is going to ski to the next control without asking the other where they are.

This is a good exercise for mass-start training. The skier behind has to follow the other without knowing where he is going, but still needs to orienteer to be able to take the next control.

This exercise is also possible to do by memory, if the runner behind hides the map so he can't read it while they are skiing. At the control this runner then, by memory and looking at the terrain and the tracks, has to try to locate where they are and ski to the next control without asking the other runner.

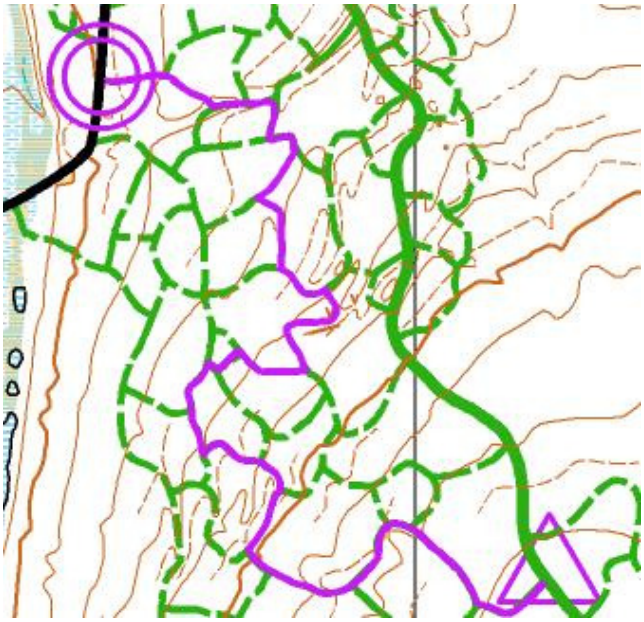
See map example at Lead John

Hunt John

Difficulty	Medium to hard
Technical factors	• Map reading • Understanding the map and the speed of different route choices • Using the map another way than normal – think 'outside the box' ○ May lead to a better understanding of the sport
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Intervals
Number of athletes	2-5 (has to be more than one)
Preparations:	Some – Track network, maps and well planned lines
Equipment	• A Ski Orienteering track network • Maps with lines

Description:

This is a complex exercise where the athlete has to think 'outside the box'. The athletes will get a map where a route line is drawn taking 3-10 minutes to ski. One of the athletes is going to follow this line from the start, while the rest are waiting. The first athlete is called 'John' and the rest of the athletes are going to try to catch him. At a determined time depending on the track network and line characteristics (for example 30 seconds) the rest of the athletes can start hunting 'John' by using all the tracks in the terrain. The one that catches him first wins, or if John finishes the line without anyone catching him he will win. To make it possible to catch John the line has to be winding, and the line should give the athletes that are hunting 'John' tactical challenges in their hunting of 'John'.



Map example 16: Hunt John

John the Starter

Difficulty	Hard
Technical factors	• Memory • Map and terrain understanding • Problem solving • The ability to understand where you are when you are lost
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Intervals
Number of athletes	1-6
Preparations:	Much – Track network, maps and controls in the forest
Equipment	• A Ski Orienteering track network • Maps with tracks and a control • Controls

Description:
This is a complex exercise that challenges many technical orienteering abilities. In this exercise the athletes are following a leader into the track system with their maps hidden. The starter is driving on a snow mobile or skiing. When they are at the start the starter gives a signal, like raising a hand in the air or stopping, and the athletes are allowed to turn over their maps. On the map there is no start triangle telling them where they are, only a control circle. The athletes should now try to find the control by identifying where they are on the map by memory from where they have skied and by looking at the terrain and the tracks. They are allowed to ski to try do find out where they are and they should find the control and get back to the 'start' as fast as possible. It is possible to do this with many athletes at the same time, and it can be even more challenging if not all the athletes have the same control on their map.

This can be a really challenging exercise, so it can be hard to do the orienteering part as hard training since the athletes often have to ski slowly for a while to be able to identify where they are. If you want to make this exercise into hard training, then in the time when they are following the leader they should be skiing fast. It is possible to do this as an interval, where the time behind the leader is the hard period and the time they are trying to find the control and get back is the rest. Skiing fast after the leader also makes it harder for the athletes to memorise what they are passing, and thereby harder to identify where they are when they turn over the map. It is possible to make this exercise even harder if the athletes are skiing without compasses.

Incorrect map

Difficult	Hard
Technical factors	• Read more features on the map than just the tracks
On – Off snow	On snow (alt. off snow)
Track system	All kinds, but it should be possible to go pretty straight on the legs
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, maps customizing, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with custom track network and a course • Controls

Description:

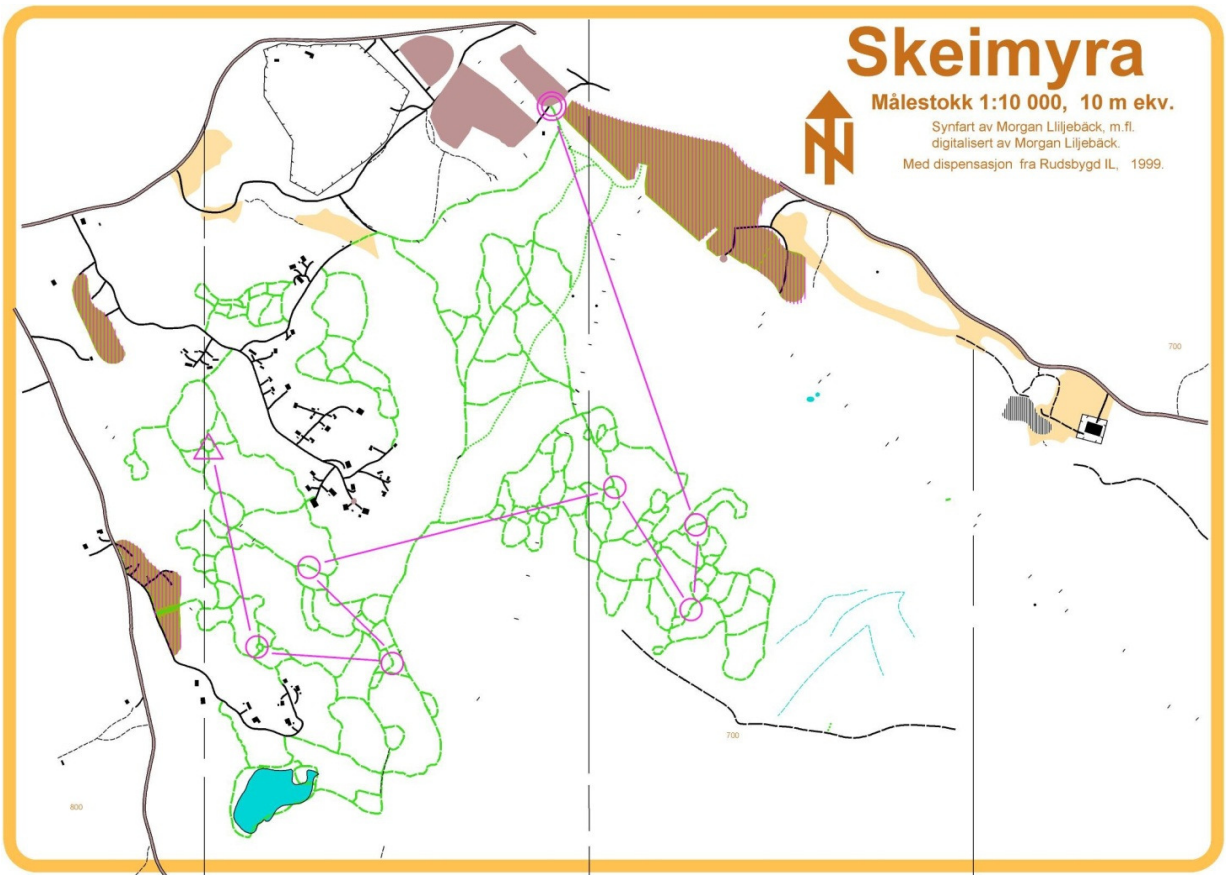
Ski Orienteers often read only the tracks and not so many of the other features. That is why it can be challenging for them if they have to ski on a map where there are extra tracks on the map or some tracks are missing. The athletes are allowed to ski on both the tracks that are on the map and those that are only in the forest. This will force the athletes to read other features and not only the mapped tracks.

Only track system and contours

Difficulty	Hard
Technical factors	• Read more carefully the tracks and the contours on the map • Contour understanding
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, map customizing , courses and control placing
Equipment	• A Ski Orienteering track network • Custom maps with only tracks and contours and a course • Controls

Description:

Another way of mixing up the map or making the track network look different, if the athletes are getting to know the area, is to make a map with only tracks and contours. This will especially make areas with distinct vegetation look different. Then the athlete will not be able to navigate using felled areas, open areas, or marshes and they have to pay more attention to the track system. This exercise will also help them in understanding the contours, since that is the only thing they can read on the map beyond the tracks. It is also possible to have a map with only the tracks. That will make the athlete have to focus more on the tracks and not on other features. This can be a good exercise in open land or big marshes.



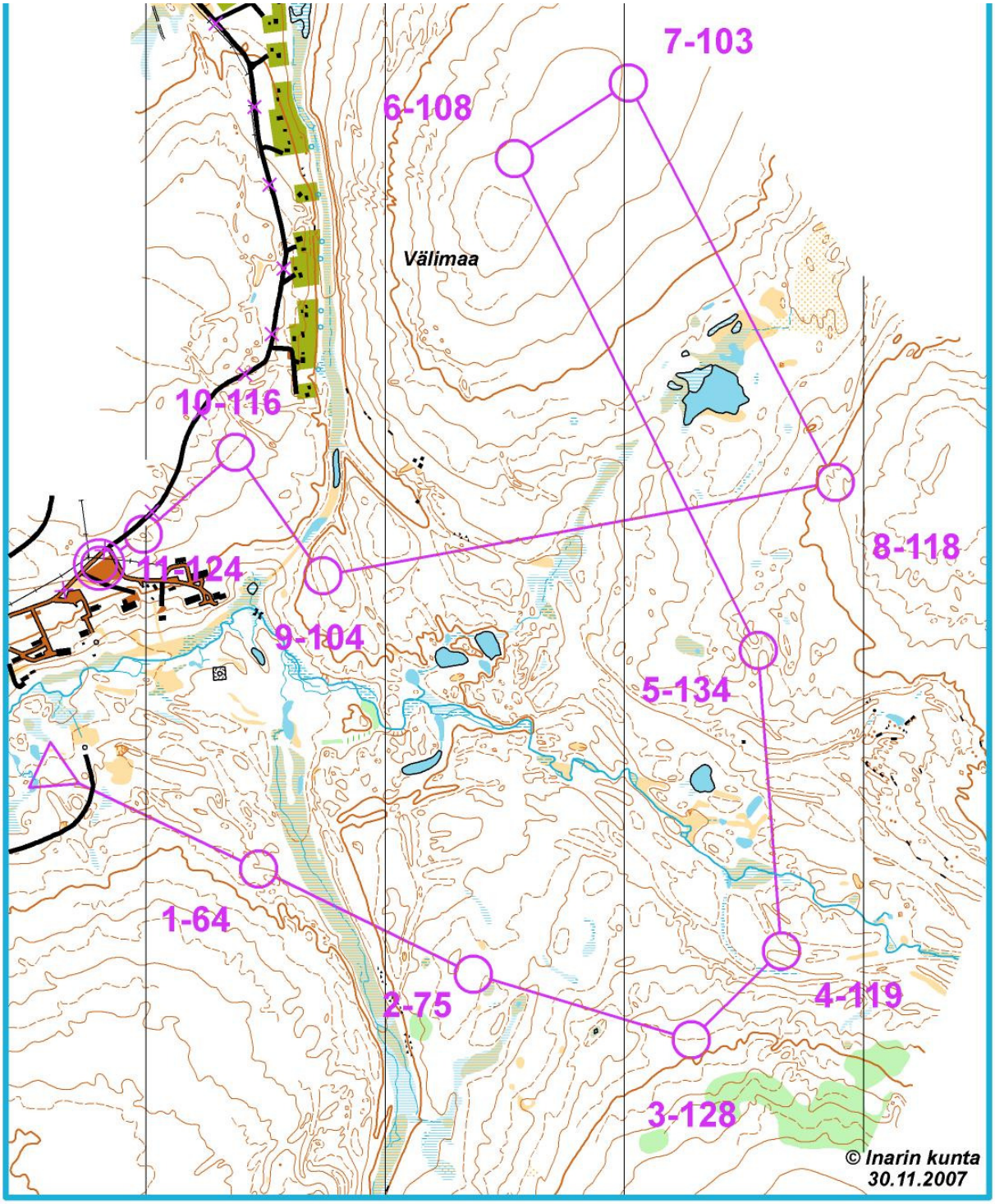
Map example 17: Map without vegetation and contours

Maps without tracks

Difficulty	Hard
Technical factors	• Read other features than the tracks
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Much – Track network, map customizing, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:

To do Ski Orienteering without the tracks on the map can be really demanding. This forces the athlete to navigate using other features. Since in Ski Orienteering you are very dependent on the track system to select the best route choices and not make any mistakes, this will be impossible to do perfectly without the tracks on the map. But still as a variation and for teaching the athletes to read more details than just the tracks, it can be a good exercise to do a Ski Orienteering course on a map without any tracks occasionally.



Map example 18: Map without tracks

Map memory

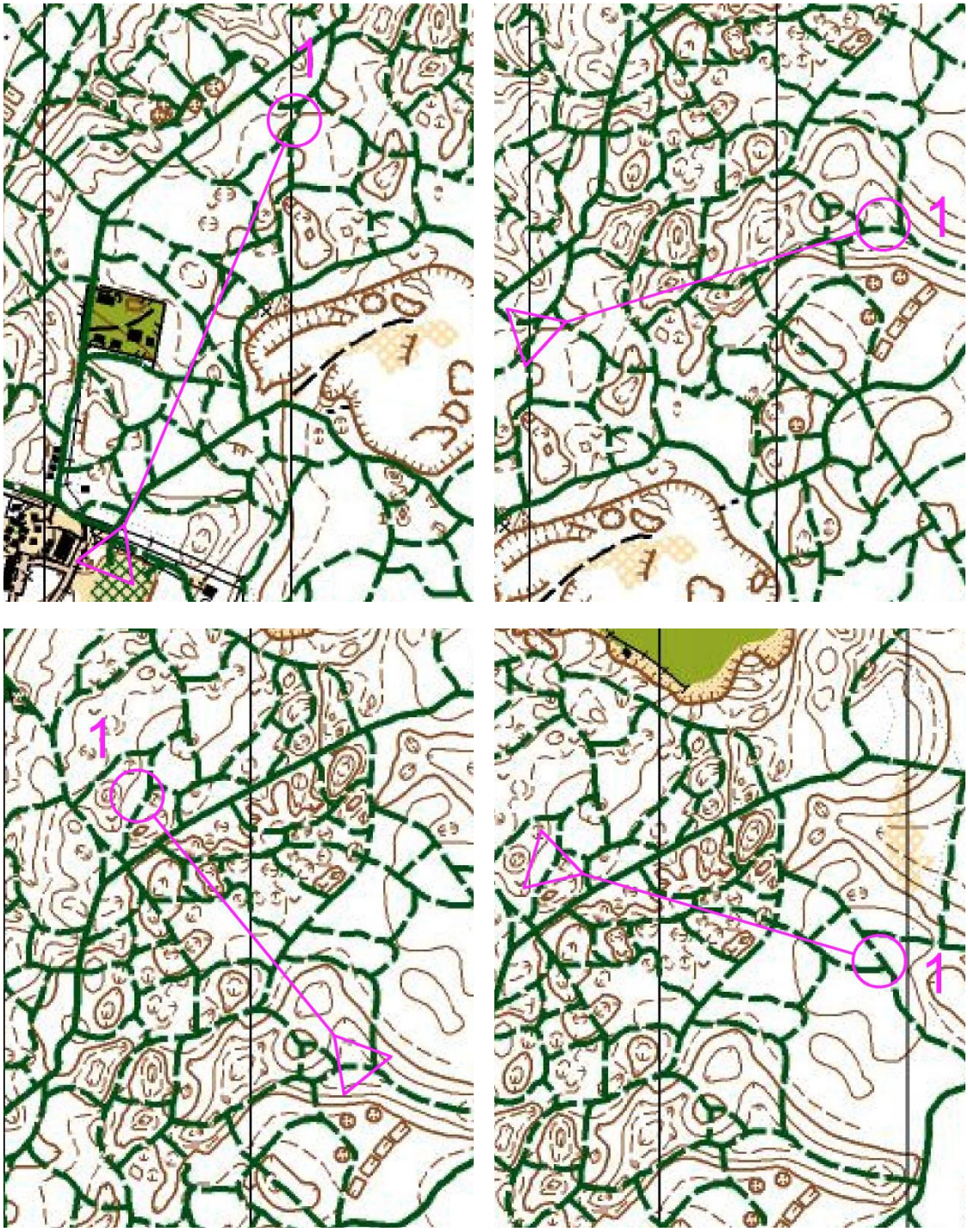
Difficulty	Hard
Technical factors	• Simplifying • Memorising
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	Alone or two and two
Preparations:	Much – Track network, maps, courses and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

Description:
The athletes are going to try to memorise a whole leg, and find the control without looking at the map along the way.

The exercise can be done as a normal Ski Orienteering course except that the athlete stops at the controls, tries to simplify and memorise the next leg, then turns the map upside down and finds the next control without looking at the map on the way. It is also possible to just hang a map with the next leg at the controls, and the athletes then have to memorise the leg before they leave the map at the control. If they don't find the next control, they have to try to find their way back to the previous control.

Another way of doing this exercise is to do it as the Follow John exercise: the skier that is going to find the control has to simplify and memorise the route at the control before turning the map around, and then tries to ski by memory to the next control.

The memorising exercise can be a very difficult exercise if the legs are long and there are a lot of crossings. Memorising exercises are maybe not the most relevant for modern Ski Orienteering, where the athletes try to read the map as often as possible, but they definitely challenge the athlete's memory.



Map example 19: Memorising with a new map hanging at each control

Orienteering star

Difficulty	Easy to hard
Technical factors	• Route choice • Map reading • Stress by others* • Simplifying • Memorising*
On – Off snow	On snow (alt. off snow)
Track system	All kinds - harder orienteering technical demands if more difficult
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit for the exercise as long as there are enough maps, but the athletes ski alone or two and two
Preparations:	Much – Track network, maps, orienteering star course and control placing
Equipment	• A Ski Orienteering track network • Maps with tracks and course • Controls

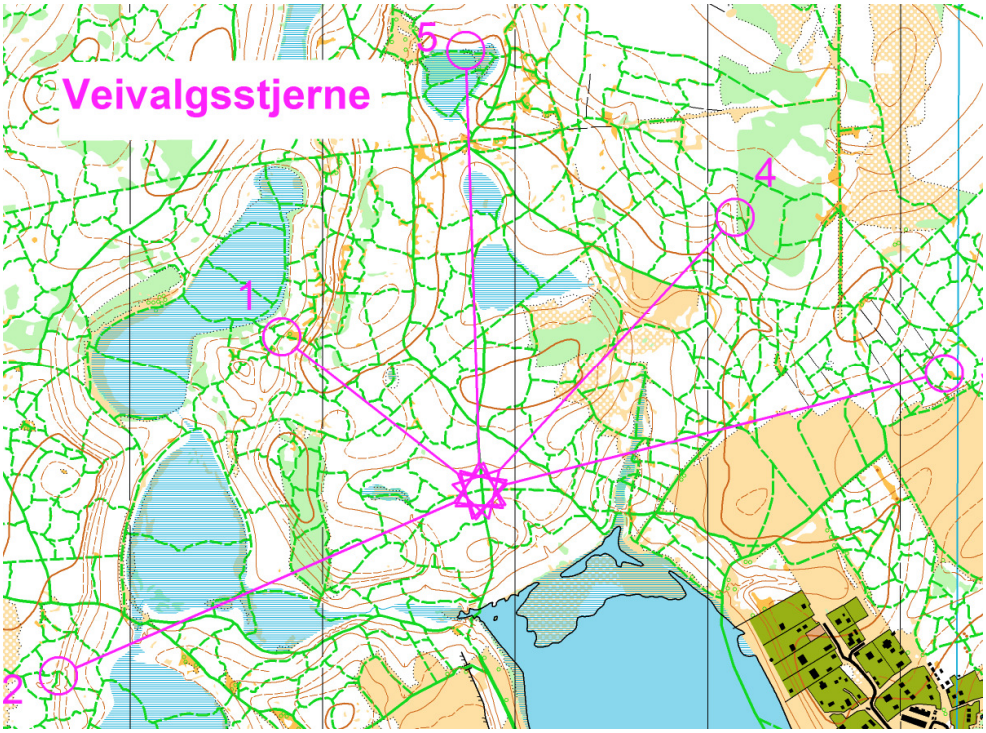
Description:

The orienteering star can be done in many ways. But the principle is that the athletes get one map with a start and a control (see map example 19). The athlete skis from the start to the control and then back to start/finish. When they have finished one control they will get a new map with another control to go to.

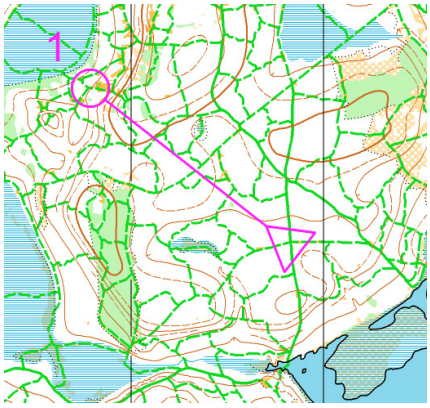
One way of doing this exercise is that the athletes ski to the controls as usual with the map and then back to the start/finish. To make it more interesting it is possible that they have to take another route back to the finish than that they took to the control.

It is also possible to do the exercise as memorising. Then the athlete has to simplify and memorise the leg at the start, and then try to find the control and get back to the start/finish.

The exercise can also be done as a route choice exercise. Then the athletes ski two and two against each other. The athlete that is skiing first can choose the route choice they want but the other has to take another route choice. At the control they stop and wait for each other before they do the same to get back home, but then they have to take another route than that they took on the way to the control.



Map example 20: Orienteering star



Map example 21: One of the athletes' maps in an orienteering star

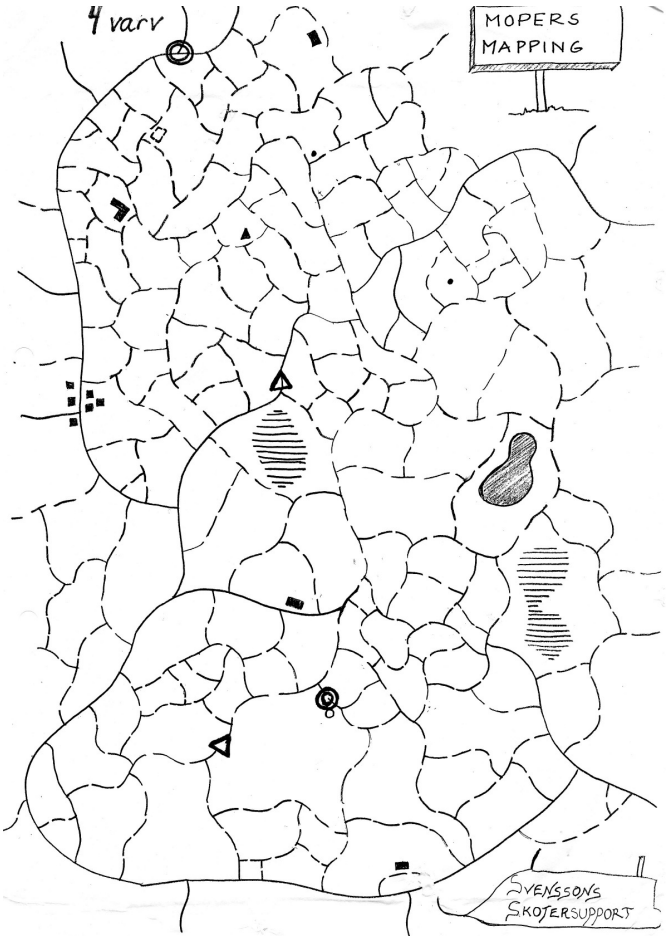
Physical orienteering technical exercises without track system:

Arrow orienteering

Difficulty	Medium
Technical factors	• Map reading
On – Off snow	On snow (alt. off snow)
Track system	No track network, only a normal ski track in a ca. 500 metre loop
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit
Preparations:	Some - A map with a fictitious track network, arrow signs; find a suitable start and finish in the map
Equipment	• A Ski Orienteering track network • A map with a fictitious track network, and start and finish marked on the map • Arrow signs

Description:

Arrow orienteering is an exercise for training map reading when you don't have access to a track network. The athletes do the exercise by skiing in a 500 metre loop. Along the track, signs are placed every 30-100 metres with arrows pointing to the left or to the right. The athletes' task is to ski the loop and watch for the signs. Each arrow shows which way they are 'turning at the crossing' and the athlete should try to follow where 'he is skiing' on the map. After a determined number of loops the athlete should have reached the finish. If not he has turned wrong somewhere.



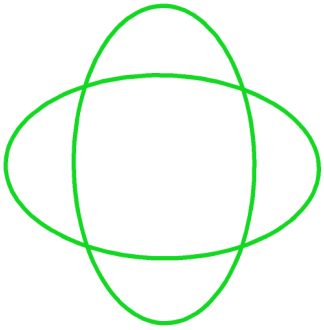
Map example 22: Arrow orienteering map by Mora Skidgymnas

Batong

Difficulty	Medium to hard
Technical factors	• Map reading • Fast route choices*
On – Off snow	On snow (alt. off snow)
Track system	No track network, but a specially constructed batong (explained in description)
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	Depends on the size of the batong. In a small batong, only 1-3 persons. But in wider batongs it is possible with up to 10 persons at the same time.
Preparations:	Some – A Batong, maps with or without line and controls, control signs, key
Equipment	• A batong • Control signs • Maps with tracks and course

Description:
Batong is an exercise for training map reading and flow when you don't have access to a track network. It's also a very good exercise for summer training on roller skis in empty parking lots.

In a batong you are supposed to ski the crossings as on the map. You should take right, left or straight each time you come to a crossing. The batong can be made in two ways. The original batong is like two elliptical circles crossing each other, see the example figure. The batong can be made by a snowmobile in an open, non-piste area or be marked up in a big, flat, open-piste area such as at the bottom of an alpine track or at a ski stadium. The Batong should be around 8 times 8 metres wide. If you make the batong small and narrow it is harder for the athletes, but if you make it bigger and with wider tracks it is possible for up to 10 persons to ski in the same batong at the same time. This also makes it very demanding, since the athletes also have to watch out for each other. If there are many athletes wanting to do the batong at the same time, it is also possible to make more batongs close to each other. The athletes are then supposed to follow the track and each time they come to the crossing they should take left, right or straight.



The Batong shape

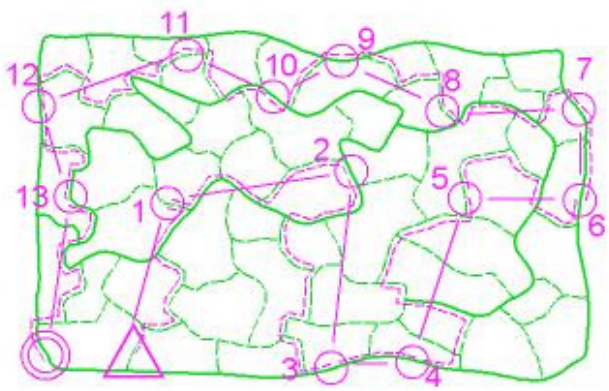
An easier way of making a batong is to do it like a figure-8, see the example figure. The athlete shall follow the figure-8 formed track and each time they are coming to the centre crossing they should choose right, left or straight. This is an easy way of making a batong if the athlete

The 8th Batong shape

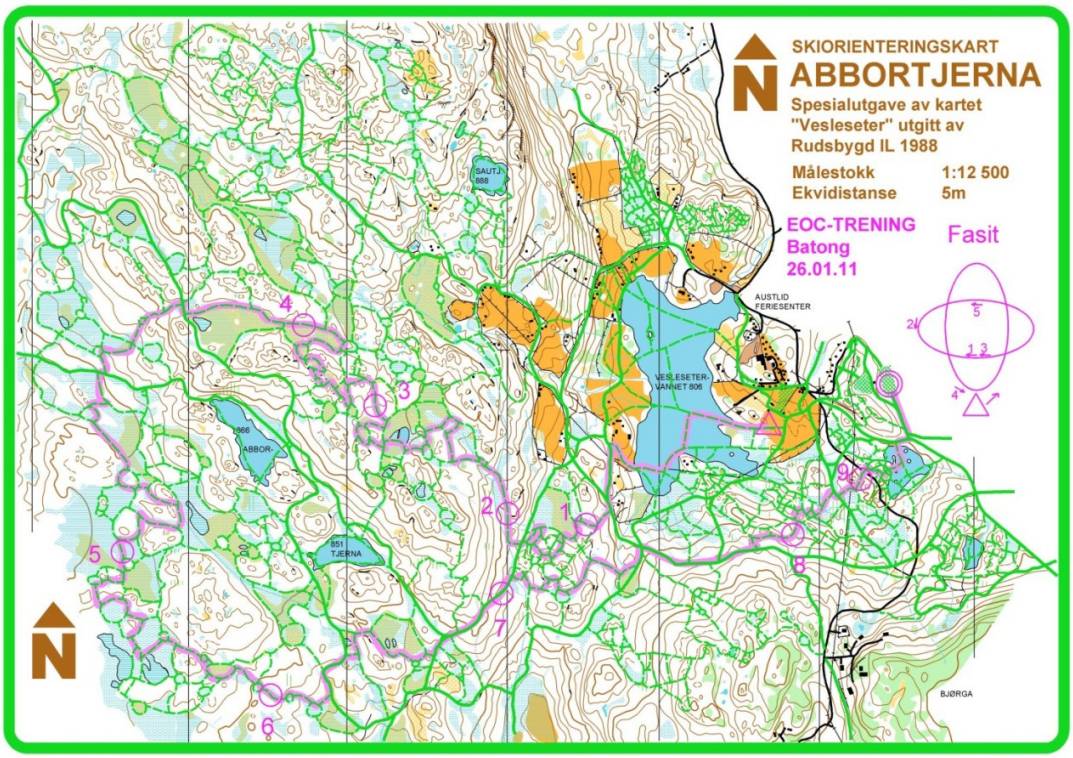
is going to do the batong by themselves. Then they can make it in a normal wide ski track by just using two markers in each circle.

The batong can be done as a follow-the-line exercise, where the athletes get a map with a line they are supposed to follow between each control. Then the coach can make a key and place out control signs, with an arrow showing where the athletes should be in the batong when they are at the control on the map and which direction they should be skiing.

It is also possible to let the athletes also decide the route choices in a batong. Then they are skiing with a normal Ski Orienteering map and have to make the route choices by themselves. But then it is not possible to have any key to show the controls.



Map example 23*: Batong, easy*



Map example 24: Batong. difficult with key to the right

Crust snow SkiO

Difficulty	Hard
Technical factors	• Reading other features • Crust snow and short-cutting • A different way of using the map – think 'outside the box' • Another way of thinking about route choice • Map reading • Map understanding
On – Off snow	On crust snow
Track system	No track network but an open forest with crust snow
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	No limit since they are not starting together
Preparations:	Some – A normal foot orienteering map, course setting, control placing
Equipment	• Maps with a course • Controls

Description:
In the spring there is often crusty snow formed when the nights are cold and the days are warm. This makes it possible to do Ski Orienteering without any tracks. You just use a normal foot orienteering map and draw a course on it. The athletes will not be met by the same challenges as in normal Ski Orienteering, but they will get the map reading training and also get a better map understanding when they are reading different features than usual.

To make it harder and with route choices more like Ski Orienteering, it is also possible to draw a fictional track network on the map. The athletes are only allowed to ski in the terrain where there is a track on the map. Then they have to make a route choice as in Ski Orienteering, but they still need to read other features very carefully to be able to follow the 'tracks'.

This exercise is also possible to do when there is little snow at the beginning of the season – on the grass in parks or ski stadiums. And when there is 5-10 cm snow and the temperature is changing between above and below freezing point, it is possible to go skiing on snow without any tracks being made. This can give the athletes useful Ski Orienteering training when it is hard to do other kinds of orienteering technical training.

Map example 25: Crust snow map with just 5-10 cm snow without any tracks in the terrain

Reading map while skiing

Difficulty	Easy to medium
Technical factors	• Map reading rhythm and flow • Route choice
On – Off snow	On snow (alt. off snow)
Track system	No track network, only a normal ski track
Physical intensity	All speeds – higher speed, like intervals, will make the orienteering more difficult
Training method	Continuous or interval
Number of athletes	No limit since they are not starting together
Preparations:	Little – course setting
Equipment	• Map with a track network and a course

Description:
One of the easiest ways to get map training when you don't have any access to any track network is to just read the map while you are skiing, trying to imagine yourself skiing the course and making the route choices.

This can be done as a part of slow distance training but is also suited to interval training.

Lead John without a track system

Difficulty	Medium
Technical factors	• Practice map reading in advance • Route choice
On – Off snow	On snow (alt. off snow)
Track system	No track system needed, only a normal ski track
Physical intensity	All speeds – higher speed will make the orienteering more difficult
Training method	Continuous
Number of athletes	Two and two together
Preparations:	Little – course setting
Equipment	• One map with control 1, 3, 5 … etc. • One map with control 2, 4, 6 … etc.

Description:
The Lead John exercise can also be done without any track network. The athletes each have their map where one of them has the map with controls 1, 3 ,5 … and the other has the map with controls 2, 4 ,6 … . While they are skiing, the skier with control number one starts by telling the other what he is thinking and how he would ski to get to the first control, while the other skier follows on his map. At the control they change, and the other skier is supposed to continue without asking where they are on the map.

This exercise can also help them understand how other Ski Orienteers are thinking. See map example at Lead John.

Mental technical orienteering exercises:

Practicing orienteering technique doesn't have to be done while you are skiing. It is also possible to do it as a mental exercise when you are resting, or in combination with other training.

Draw the map

Difficulty	Hard
Technical factors	• Map memory
On – Off snow	
Track system	
Physical intensity	None, after training, race
Training method	Mental map memory exercise
Preparations:	None
Equipment	• Blank paper and a pen

Description:
After a Ski Orienteering competition or training it is possible to try to draw the map from the competition or training on a blank piece of paper. This puts big demands on the athlete to try to remember the map reading on the course. If the athletes know they have to do this when they are skiing, they maybe will also pay more attention to the map while they are skiing, and might notice more details that can be of importance. But this kind of training is not liked by all athletes – many of them feel that when they are orienteering they get into some kind of 'trance' where they are not memorising what they are doing, because all their focus is on the orienteering and skiing. Many athletes get this feeling when they are performing at their best and it is called flow. If the athletes always know they are going to draw the map after the competition or training, it can make it harder for them to enter this flow zone. That is why drawing the map after each race as a routine may not be preferred. But now and then it can be a good test to see how much the athlete can remember from a competition, and to see what he paid attention to.

Route Choice

Difficulty	Easy to medium
Technical factors	• Route choices
On – Off snow	
Track system	
Physical intensity	Can be done as a part of a training or at rest
Training method	Mental exercise
Preparations:	Little – map with course
Equipment	• Map with a track network and a course • Pen

Description:
When you are doing route choice training as mental training, you should draw your chosen route with a pen. Then you are focusing more on the route you choose; you have to make a proper choice, as you have to do in a competition. After the exercise you can look again at your routes and discuss them with others, and discuss the route choices with them. Then you will learn how other athletes make route choices.

This exercise can be done when you are resting at home, but also as a part of other training like strength training. Then you decide a route choice for a new leg in every pause, for example.

Map example 26: Example of a route choice exercise

Imagine yourself orienteering

Difficulty	Medium to hard
Technical factors	• Focusing • Working on the feeling of rhythm and flow • Route choice
On – Off snow	
Track system	
Physical intensity	None (or while you are training)
Training method	Mental exercise
Preparations:	Little – map with course
Equipment	• Map with a track network and a course

Description:
To imagine yourself when you are competing is a good mental exercise. Ski Orienteers can do this by looking at a map and trying to imagine themselves doing the race. First they have the map upside down and are thinking through their pre-start preparations. Then they imagine themselves coming to the start and focusing on the same things they are trying to focus on before starting the race. Then they turn the map and start the race 'mentally': feeling how they are attacking the race, the legs, the route choices and the crossings, trying to read the map as they would do in the competition, and trying to get the good feeling and the flow.

Some athletes find it very easy and natural to imagine, while others find it harder. But all should try to improve their imagination skills, since they can be very important in pre-race preparations. Many athletes are doing this exercise the day before and the same morning as they are going to compete, with old maps of the area or another map from a competition where they did a perfect race.

To be able to imagine as well as possible, the athletes should try to make their imaginations as detailed and life-like as possible, that is to say as real as possible. To do that, they should try to make imaginary pictures by using all their senses. They should try to feel how the skis are gliding, how poles are feeling and the feeling of wind and snow in their faces. They should try to smell the cold winter morning, hear the start clock beeping and the sound of skis creaking on the cold snow. To improve their imaginary picture they should also try to create the same feelings as when they are competing, get the same concentration, the same energy and so on.

To get a good mental picture, the athletes should also try to see themselves from both an inner and outer position, which will say both from their own eyes and from a bird's-eye view. That will give them the chance to work with their feelings and thoughts, and also see their movement pattern and how they are skiing.

To make it easier to make mental imaginary pictures, the athletes should use memories from earlier competitions where they had a good performance. All this will prepare the athlete for up-coming

competitions, and if they have done a good job it should feel like they have done the competition before when they stand at the start line.

The newspaper

Difficulty	Easy to medium
Technical factors	• Finding the shortest route choice
On – Off snow	
Track system	
Physical intensity	None
Training method	Mental exercise
Preparations:	Little – a newspaper column or paragraph
Equipment	• Newspaper • Pen

Description:

One very easy way to get some extra training in finding the shortest route choices is by drawing a start triangle at the bottom of a newspaper column or a paragraph and a finish at the top, and then trying to draw a short-as-possible line between the start triangle and the finish without splitting any words.

Map example 27: Example of The newspaper

Catching Features

Difficulty	Medium to hard
Technical factors	• Focusing • Map-reading rhythm and flow • Route choice
On – Off snow	
Track system	
Physical intensity	None
Training method	Computer gaming, mental exercise
Preparations:	Some – Converting the OCAD map into Catching Features and making courses
Equipment	• Computer with Catching Features installed

Description:

In the orienteering computer game Catching Features it is also possible to play Ski Orienteering. This is really good Ski Orienteering training, where the athlete is challenged by the same route choice solving as in Ski Orienteering. The athlete also has to practice map-reading rhythm, so that he can read the map when it is possible and not when it is difficult to stay on the track. The athlete also has to read the map as in Ski Orienteering when the track network is difficult, forcing map reading between every crossing. It is difficult to find any mental exercise for Ski Orienteering that is more realistic than playing the Ski Orienteering version of Catching Features.

Catching Features is possible to buy at www.catchingfeatures.com. Here there are also instructions about how to make a Ski Orienteering version of the game and how to convert OCAD files to Catching Features. This way you can play on any map in Catching Features.

Illustration picture of the Ski Orienteering version of Catching Features

How to prepare for competitions

In Ski Orienteering, as all other sports, the athletes should try to be as well prepared as possible when they get to the start line. The athlete should therefore try to know as much as possible about the terrain and get as much information about the races as possible, without entering embargoed areas or breaking other rules. That is why it is of great importance that the team leader gives out to the athletes all the information that is given at the team leaders meeting. The athletes should also try to get information about the course, start, service and drinks controls, public controls, map exchanges, last control and the finish. This is information the athletes legally and easily can access, and it is therefore unnecessary to lose time or make mistakes in the competitions at these points since it is possible to prepare for them.

To prepare for the competitions the athletes should also try to get as much information about the terrain as possible. But since the terrain is embargoed from the date it is announced the competition will be held in that area, the athletes have to find information about the terrain in ways other than entering the area. If an athlete has too much knowledge of the competition area, the athlete should, in the name of fair play, not take part in the competitions. Google Earth is a good way to get a picture of the terrain. Before all IOF World Championships, Regional Championships and World Cups old maps of the terrain will be published. These maps are a big help for the athlete to get a get to know the terrain. From these maps the athlete can get to know the height differences in the terrain and what the map is like. This will make it much easier for the athletes to navigate during the competition, since they know the map and know where the terrain is steep and if the land is going up or down. If there are old Ski Orienteering maps of the area it will be possible to see a pattern in how the track system is in this terrain. Often in earlier competitions they made the tracks wherever it is possible to make them, and many of the tracks will therefore be the same. And the standard ski track network of wide tracks is almost the same every year. If the foot orienteering map is published too, it will be possible for the athlete to look also at details that are not shown on the Ski Orienteering map, such as the runability in the terrain. If the foot orienteering map is green the terrain is most likely not good for short-cutting. From the foot orienteering map it is also worthwhile looking at the path network, because often many of the tracks are driven on the paths because it is easier to drive the snow mobiles there.

One way to get to know the terrain is to draw fictional track networks on the old maps and do the physical orienteering technique exercises without a track system on them.

To be as well prepared as possible, the athletes should also try to do some earlier competitions in the same type of terrain with the same organisers. Then it is possible to learn the course-setters' way of course setting and the kind of track network the organisers are making. Often the World Championship organisers will have a pre-camp the year before, or earlier the same winter, that is open for all competitors.

The day before the competitions there is a model event organised which should be representative of the competitions. At the model event, maps will be given out in all the map scales that are going to be used in the coming competitions, and the map will be drawn the way they will be in the competitions. In the

terrain there will also be some controls that are set up the same way as they will be in the competitions. This model event is very important for the athlete to get to know the width and firmness of the tracks and to get a preview of how the track network will look. The athletes should also try to get familiar with the way the map is drawn and the punching routines.

Before the start it is important that the athletes find their own optimal tension level. The optimal tension level is individual, but it is important that the athletes feel they can perform at their best and that they are well prepared. To get the right focus on map-reading, many athletes read maps from older competitions when they are warming up, trying to get their map-reading and orienteering technique in focus just before they start. Note that it is not allowed to have a map of the competition area at the start. Especially before sprint races this can be a good part of the preparation, since every second lost to the first few controls, as a result of the athlete not being into the map-reading yet, is difficult to catch up later in the race. If the model event area is close to the warm up area, the athletes can also use this to prepare.

Competing - How the best athletes think

In a Ski Orienteering competition the aim is to ski the best route choice as fast as possible and make as few mistakes as possible. For each mistake the athlete makes, he will lose more time than it would take him to read the map an extra time to be sure where he should ski. But if an athlete needs to stop or slow down he will also lose much time. This is why a controlled race without any mistakes or stops will be the fastest, not the race with top speed combined with stops and mistakes.

To be able to do a fast, controlled race the athlete needs to be fully focused when racing. To be able to have top focus, the athlete should only have a few specific tasks to focus on in the race. These tasks should be reminders that make the athlete focus on the right things in a race, for example to keep calm, technical skiing tasks, or technical orienteering tasks. The tasks should also be positive and give the athlete inspiration to push themselves.

One of the tasks that can be used in Ski Orienteering is to focus on where to ski in the next crossing or the two-three coming crossings as fast as possible after leaving the last crossing. If an athlete always knows where he should ski in the coming crossings, and where the next crossing will be, he will not make mistakes. This will also make the athlete read the map often, and he will better recognise where he is on the map. The problem is that in a race, the athlete can lose focus and forget to read where he is going to turn at the coming crossings. Then the athlete will not know where he is going to go when he enters the crossing, and either have to stop to read the map or take a chance on one of the ways. Both of these will in the long run make the athlete lose much time.

It is impossible for any athlete never to lose focus in a race, because this happens to everyone. But the best athletes are better than the not-so-good athletes at recognising when they have lost focus, and can in seconds be back in focus. To recognise when you have lost focus, and get back in focus when you lose it as fast as possible, requires practice. This is why it is important to have tasks to focus on during a race. If your task is “Where am I going to ski in the coming crossings?” and you cannot answer this question, you know you have lost your focus and you need to read the map to know where you are going to ski.

Other tasks that can be used in a race are to ‘ski effectively’ or ‘ski like a tiger’, ‘always take the time to check out the best route choice’, ‘read the map’, take a deep breath’, ‘keep calm’, ‘take the right choices on the important legs’, ‘you know it is not over before the finish line’ etc. All athletes need to find the tasks that fit them best, for that kind of terrain or for the shape they are in for that race.

There are also differences in what kind of competitions the athlete needs to focus on, for example the distances or mass starts. In a sprint everything happens much faster and it is extremely important that the athletes are fully focused on where to ski next, while in a long distance the athlete should focus more on finding the best routes and skiing them as economically and as fast as possible. In a mass start the athlete should try to do their own race without getting too disturbed by other athletes, whilst at the same time trying to use them. All of this makes Ski Orienteering a very demanding sport, and that is why it is so interesting.

Links

International Orienteering Federation, IOF: www.orienteering.org

IOF Ski Orienteering Events: http://iof.6prog.org/wr_home.aspx?HOW=S

IOF World Ranking: http://iof.6prog.org/wr_home.aspx?HOW=S

Punching systems

Emit: http://www.emit.no/en

SPORTident: http://www.sportident.se/english/default.aspx

GPS analysing programs

Please read first the instructions before doing the analyses.

GPS Seuranta: http://www.gpsseuranta.net/eindex.php

MapandCoach (only in Swedish): http://www.mapandcoach.se/

3DRerun: http://3drerun.worldofo.com/index.php

QuickRoute: http://www.matstroeng.se/quickroute/en/

Maps

Maps from IOF Events: http://orienteering.org/ski-orienteering/maps/

GPS Seuranta trackings: http://www.tulospalvelu.fi/gps/

3DRerun: http://3drerun.worldofo.com/index.php?type=showoverview&search=1&tl=1&s=lastdate

Movies

Swedish SkiO presentation: http://www.youtube.com/watch?v=-4vj9Kc5m4Q&feature=related

SkiO headcam movie: http://www.youtube.com/watch?v=DOXmX6zJDTs&feature=related

Swedish SkiO movie: http://www.youtube.com/watch?v=z7CCQpZ4kng&feature=related

WSOC 2007: http://www.youtube.com/watch?v=AB-yRLOdp_E&feature=related

Ski Orienteering presentation from WSOC 2004: http://www.youtube.com/watch?v=WBOokaLLBeU

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Ski Orienteering web pages

Nordic SkiO news: www.ski-o.com

Estonian SkiO team: http://estonianskio.blogspot.com/

Italian SkiO team: http://sci-o-line.blogspot.com/

Swedish SkiO Team: http://skido.blogg.se/

Swiss SkiO team: http://ski-o.blogspot.com/

Ski Orienteers' web pages

Carmen Strub: http://carmenstrub.blogspot.com/

Christian Spoerry: http://chrigispoerry.ch.vu/

Gion Schnyder: http://o-gion.ch/typo3/

Johan Granath: http://www.johangranath.se/

Kajsa Richardsson: http://richardson.blogg.se/

Marte Reenaas and Christian Hohl: http://marteandchristian.blogspot.com/

Martin Hammarberg: http://indiepop.blogg.se/

Olga Novikova: http://olganovik.blogspot.com/

Olli-Markus Taivainen: http://www.freewebs.com/omataivainen/

Sindre Haverstad: http://haverstad.com/

Staffan Tunis: http://staffantunis.blogspot.com/

Team Avancia – Barbro and Hans Jørgen Kvåle: http://teamavancia.com/

Tove Alexandersson: http://tovealexandersson.se/

Comments:

This handbook has been prepared as a help for new athletes and coaches in the sport of Ski Orienteering, and also as inspiration for technical training for both young and established athletes. If you know any other exercises or other things that are missing from this Handbook, or have any other comments, please send them to hans_jorgen89@hotmail.com.

Kind regards
Hans Jørgen Kvåle