Compass Basics

Introduction

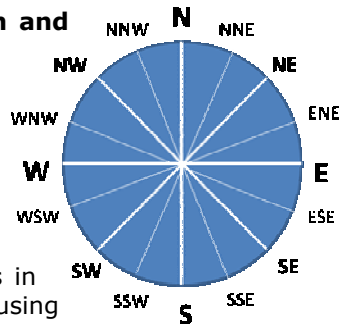
The first compass was, no doubt, a magnetised ore-bearing rock or stone, that when suspended, would always point the same way. No one knows who first discovered the compass; the Chinese understood its use 3,000 years before Europeans learnt to travel without using the sun or the stars. Marco Polo is reputed to have brought the compass back to Europe on his return from Cathay in 1260.

- All pocket compasses use a magnetic needle or card to show North-South.
- The orienteering compass is the most useful for Scouting.
- It has a magnetised steel needle, supported in the middle.

When you move the compass, the needle swings, and always comes to rest with the North end pointing to the Magnetic North Pole.

Inside the compass case are marked the 360 degrees of a circle. These degrees are used to indicate and find directions. A direction expressed in this way, in degrees, is called a Magnetic Azimuth, from the Arabic words "al zimut" or "the way".

The **Cardinal Points** of a compass are **North, East, South and West,** and always read clockwise around the circle.



- North is found at 0° (which is also 360°),
- East becomes magnetic azimuth 090 (90°),
- South becomes magnetic azimuth 180 (180°),
- West becomes magnetic azimuth 270 (270°).

More accurate directions are given by using all the numbers in between these. Always give readings in degrees, rather than using just the cardinal points; as it is more accurate.

The Silva Compass

The Silva Compass is favoured by SCOUTS NZ as it is popular, easy to use and usually affordable. It is widely used for orienteering based sport.

An orienteering compass has 3 parts:

- The needle,
- The housing,
- A transparent plate underneath.

The housing rotates on the plate.

On the top of the housing, North and the degrees of the circle are marked clearly.

On the bottom of the inside of the housing, a (red in this picture) chevron arrow is marked, fixed at 360°; this is the "orienting arrow".

The red and white needle swings within the housing; the end that points north is red; the end that points south is white.

On the transparent plate is a black arrow that indicates the direction of travel, or the line of sight. On the sides of the plate are several scales that are useful for using with maps.

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Compass Basics, Continued

How the compass works

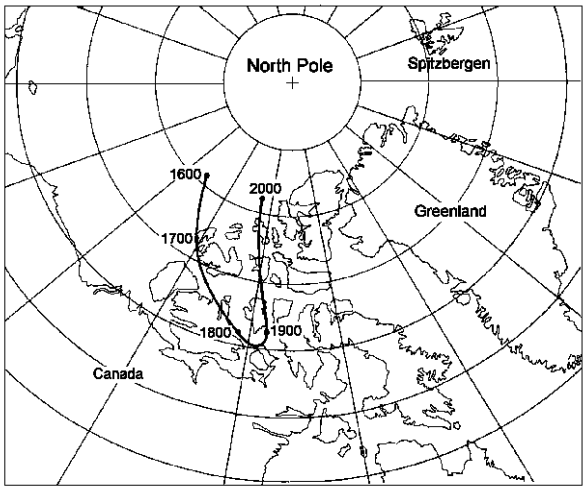
Place your compass on a flat surface and let the needle swing until it comes to rest, pointing north.

- Now put something made of iron or steel near it e.g. a knife, and move it round the compass.
- The needle moves because it is a small magnet and is attracted by iron.
- Remember this when using your compass – keep it away from penknives, bicycles, wire fences, and cars, particularly car bonnets, or it will not read accurately.

The compass needle points to Magnetic North, not True North. This is because the Earth is actually a huge magnet, although its magnetic field is not completely constant, and changes with time. The magnetic north and south poles are caused by minerals in the earth's molten outer core. As the liquid rock moves and churns down there, so does the magnetic field.

The Magnetic North Pole is actually near Ellesmere Island, in northern Canada, about 2250 km south of the geographic North Pole.

The compass needle therefore points a little to the side of the geographic north pole, and this varies depending on where you are on Earth, and also with time.



In fact, the magnetic pole moves about 11 km a year, and the movement has speeded up recently.

The picture shows where it has been over the last 400 years, and it looks as if it's now leaving Canada and heading for Russia!

Either that, or it is possible that the Earth's whole magnetic field will flip (it has done so before), and magnetic north will be magnetic south, and vice versa.

Does that mean New Zealand will be in the northern hemisphere some day in the future? Something to think about!

Sticky needles

Equally, because of the Earth's curvature and magnetic field, a compass designed for the northern hemisphere will 'stick' in the southern hemisphere, as it will basically be trying to point towards the ground.

Compasses have their needles balanced only for their own region, thus most compasses sold in New Zealand will only be most effective here and in Australia.

A map is drawn in terms of true geographic north. This means that to take accurate readings with our compass on a map, we need to know how big this difference, or "declination", between magnetic and geographic north is, and we must adjust for it.

Topographic maps used for navigating should have the declination printed on them. Always use an up-to-date map, no more than a couple of years old, because as you saw above, the declination changes with time.

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Compass Basics, Continued

Allowing for the declination

What happens if your map doesn't have the declination marked on it? Well, you could rely on old-fashioned maths, and add the declination to each bearing. In New Zealand, magnetic north is actually between 18 and 25º east of true north, depending on where you are.

Luckily for us, we usually need not rely on our mathematical skills!

- On many compasses, you are able to adjust the declination by twisting the ring, and changing where the orienting arrow sits in relation to the ring.
- Then, when you turn the compass so that the needle is inside the orienting arrow, the North indicated at the index pointer is true north and matches your map.
- Whenever you check your heading or take a bearing on a distant object, the degrees read on the dial will be the actual true degrees.
- The only thing that looks a bit odd is that the north end of the compass needle does not point directly at the **N** when you are heading due North.

Many internet sites explain these principles quite clearly, e.g.
http://www.compassdude.com/compass-declination.shtml
http://www.ampro.co.nz/products/silva/silva.htm#SILVA%201-2-3

Enough theory! – lets learn how to use the compass for real, practical purposes.

Setting a direction

Well, the first step is so easy – remember that the red part of the needle always points North. If you want to travel north, just follow the direction in which the arrow points!

But what if you want to go, for example, north-west?

- Find north-west on the *compass housing*.
- Turn the compass housing so that north-west on the housing comes exactly where the large *direction of travel-arrow* meets the housing.
- Hold the compass in your hand, quite flat, so that the compass needle can turn. Then turn yourself, your hand, and the entire compass (just making sure the compass housing doesn't turn), until the red compass needle is aligned with the *orienting arrow* inside the compass housing. Not the white end – or you will go in the opposite direction to the one you want!
- Check that there are no local magnetic attractions – bits of metal that might attract the needle in the wrong direction (e.g. a metal fencepost, a staple in your map).
- Then, walk off in the direction that the *direction of travel arrow* is pointing.

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Compass Basics, Continued

Two turns

So, remember the two turns:

1. **first, turn the housing to dial your direction;**
2. **then, turn your whole self, holding the compass in your hand.**

To avoid getting off course, check the compass regularly, but not all the time. It's best to look up, find some fixed landmark in the direction of your arrow, and head for that, checking occasionally that the bearing is still correct. This is more important when you use a map as well.

If you are taking a long hike in an unfamiliar area, you should always carry a good map. It is in this interaction between the map and a compass that the compass becomes really valuable, and the *declination* mentioned last time becomes important then.

Of course, you may well be given something more precise than just "north-west" as a heading. Compass bearings are divided into the same 360 degrees as there are in a circle, with 0° being = 360° = North.

Thus east is 90°, south is 180°, north-west is 315°, and so on. But you still use the method above – as you will see on the housing, all the degrees are marked, so it's just as easy to find, say, 157.5°, as it is to find south-south-east!

Orientating a map

Your map is "set" or "orientated" when it is aligned to correspond with the land it represents. It will make far more sense to you when it is set.

There are 4 ways to "set" a map:

1. with a compass;
2. by using visual objects;
3. using a watch and the sun;
4. by the stars.

1 Setting a map with a compass:

Here we describe how to use a topographical map with a Silva-type compass, those most commonly used by Scouts in the outdoors.

Remember that there are several "Norths"

1. True North,
2. Grid North (as marked on your map, always at the top),
3. Magnetic North (towards which your compass needle points).

We are assuming that you have an up-to-date map; if not, you may need to recalculate the declination angle between Grid and Magnetic North.

Continued overleaf

Compass Basics, Continued

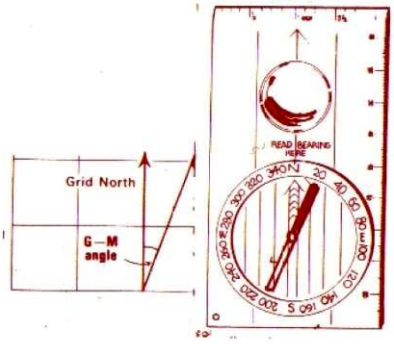
Orientating a map, *continued*

1 Setting a map with a compass, *continued*

a. Spread your map out flat on the ground or on a flat, non metallic surface (so the compass is not affected).

b. Put the compass on the map close to the diagram printed in the map margin that shows Grid and Magnetic North.

c. Turn the map under the compass, so that the magnetic compass needle (red, north-pointing end) is parallel with the Magnetic North line on the map.



This is the most accurate way to set your map.

2 Setting the map using visual objects

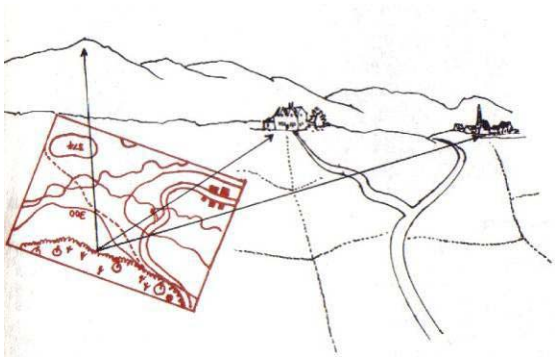
This is done by finding significant and easily identifiable objects such as hills and rivers shown on the map and them turning the map until it lines up with what you can see in the landscape.

a. Lay the map flat on the ground away from fences and cars etc.

b. Look at the landscape and identify two main points such as a mountain, a major road or a river.

c. Look down at the map and find the same objects on the map.

d. Turn the map until the objects on the map line up with what you can see in the landscape.



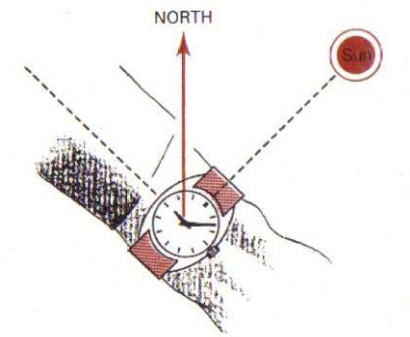
3 Finding North using your watch

If the sun is visible, and you have a "proper" watch with a "face" on it (digital watches are not so good here), you can find North very approximately with that.

a. Point the number 12 on your watch directly towards the sun.

b. True North will be approximately half way between the 12 and the hour hand on your watch.

c. In summer time you may firstly have to make allowance for Daylight Savings Time, by turning your watch back an hour.



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Compass Basics, Continued

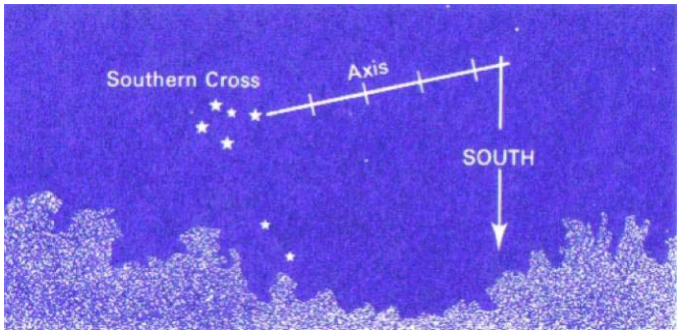
Orientating a map, *continued*

4 Finding North using the stars

If the stars are visible, find the Southern Cross in the sky.

a. Using your hand as a length guide, estimate an extension of the long axis of the Cross from its tail for 4½ times its length.

b. Here in the Southern Hemisphere, that point will be almost directly above true South, and thus if you then turn 180°, you will be facing true North.



Acknowledgement

The notes above were adapted by Anne Gunson of the Akarana Zone Team in Auckland, from the Scout handbook *The Pathfinder Awards for New Zealand Scouts* 1982 edition – an "old 'un, but a good 'un".

Another such is *Map and Compass. The Boy Scout Series #7*, from the Canadian Scouts, 1964. You can access this, along with many other very useful resources, at http://www.thedump.scoutscan.com/

GPS devices

A GPS is a modern device similar in appearance to a cell phone that is used as a means of finding your way across country or water. Instead of using magnetic North as a reference point, they use satellites based in space. They display your route on a small screen and show when you are deviating from that route.

Every brand of GPS has its own method of operation and to learn how to use them you need to sit down and read the instructions.

Three hints:

- Don't leave it until you are lost before reading the instructions.
- Take spare batteries in your pack.
- Always take a compass and a map as a back up and know how to use them.

Warning

Solar flares can damage or temporarily stop a satellite working and heavy rain can block the signals. If you are relying on the GPS and this happens, you may be lost and in trouble in no time at all.

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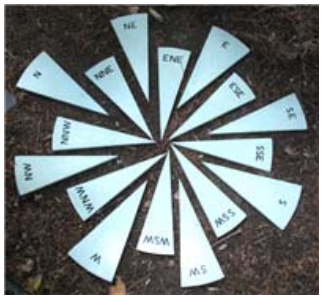
Compass Basics, Continued

A Compass game

A Compass Game (Cubs, Scouts and Venturers)
Here is a compass game using resources made out of off-cuts from a sheet of construction ply.



The reason for holding the game: We are going on an expedition soon and will need to find our way.

The game at the end of the instruction session:
Form the Troop or Pack into a circle with one Six or Patrol in the middle. Shuffle the pieces of the compass and then time the patrol while they assemble the compass. Cubs could assemble say 8 points and the Scouts all 16. Fastest team wins.

The advantage of everyone watching each team assemble the compass is they learn by watching, as well by doing. (and you don't need to make more than one set of pieces).

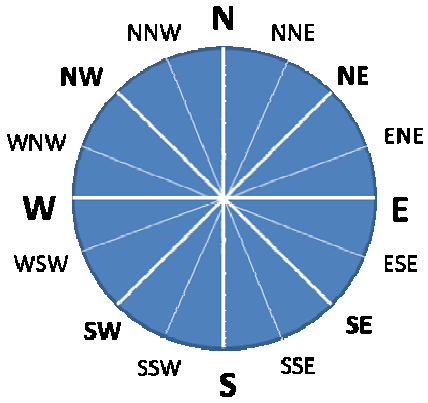
The Cardinal Points

A compass also has names as well as numbers (degrees). The names were probably used in the distant past as people may not have been able to remember the 360 numbers that make up the compass.

The Cardinal points are: North, East, South and West

The Half cardinal points are: North East, South East, South West, North West

The Intermediate Points are: North North East, East North East East South East, South South East South South West, West South West West North West, North North West.



Note how the intermediate names are made up.

Halfway between N and NE becomes NNE. It is North of North East.

Half way between NE and E becomes ENE. It is East of North East.

Following a bearing

If you have worked out that you have to travel on a bearing of say 270 degrees (West), the trick is to actually walk consistently in that direction. It's harder that you might think.

Here's how you do it.

1. Locate an object between you and the horizon that it is easily observed and is in line with the bearing .
2. Walk towards that object, checking every 15 minutes or so to make sure you are still on track.
3. Make sure that the object you choose it isn't going to move. eg. A car, cow, tractor.

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