# navigation

*In the northern hemisphere, to find south, create an imaginary line between the points of a crescent moon and extrapolate to the earth.*

## what is it?

It's the art and science of getting from A to B. People have been navigating since time immemorial, driven by the need to find food and shelter, and later to trade and explore. Before accurate instruments, early navigators relied on clues in the natural world.

**Map and compass:** a map is a scaled-down representation of the real world. Topographical maps show terrain, features and elevation using symbols and drawings. Being able to interpret these allows you to move on the ground guided by the map. The scale gives the ratio of the distance between two points on the map and the same points on the ground. Scales vary but many maps are drawn at 1:10,000 - i.e. 1 of any unit of measurement on the map corresponds to 10,000 of that same unit on the ground.
A compass indicates direction. It has a magnetized metal needle that rotates to line up with the earth's magnetic field, with ends pointing north and south. Markings around the edge indicate east, west and positions in between.

**Celestial navigation:** works by taking a 'sight' or angular measurement between a celestial body (sun, moon, stars) and the horizon. It can be used wherever a flat horizon is visible – at sea, in the desert etc. Even in jungle or mountains you can make an artificial horizon with the right equipment. You also need a sextant, a nautical almanac, a pair of dividers, a set of sight reduction tables and a globe or map. A sextant measures the angle between a celestial body and the horizon. The almanac lists the latitude and longitude directly over which every celestial body will be at every second of the current year. So at any given time you can locate a star and find the latitude and longitude of the point on earth that is directly under that star at that second. This is known as the star's geographic position (GP).

**Natural navigation:** is 'the rare art of finding your way using nature' - by observing the sun, moon, stars, weather, plants and animals. You can measure rough angles using your hand. For a typical adult, holding their hand up with fingers outstretched, one finger = c. 2.5°, while a fist = c. 10°. For greater accuracy you can 'calibrate' your hand or a piece of equipment like a kayak paddle, against a sextant in advance and record the exact measurements.

**A bit of history:** sailors have been navigating by the stars for thousands of years. The ancient Greeks were the first to measure the radius of the earth and produce the first maps; the Chinese magnetised iron needles 2,000 years ago, and developed usable navigation compasses around the 11th century. Great breakthroughs occurred in the 18th century with the invention of lunar tables and chronometers (which kept accurate time).
In 1843, Thomas Hubbard Sumner developed the method of celestial navigation still used today, of drawing a 'line of position', along which the observer is located, by observing the position of several stars. In the 20th century, computers could calculate position, and quartz watches enabled accurate timekeeping.

## what are the benefits?

The world has been comprehensively mapped by GPS but it's not 100% reliable and you're at the mercy of batteries and signal. Navigation skills can literally mean the difference between life and death in certain situations. If you know how to use them, maps and compasses are 100% reliable, even in reduced visibility. Being able to navigate using the stars with a sextant means you can continually check whether you're on the right track, both on land and at sea.
Natural navigation is about enjoying the journey. It connects you to your environment and gives you an added understanding, appreciation and awareness, as well as a greater sense of self-reliance and confidence. It's also pretty cool to be part of traditions that are thousands of years old.

*A sextant.*



# what can I do?

**Map and compass:** get a compass and Ordnance Survey (OS) map, a waterproof map case and the kit you would normally take hiking. Assuming you know where you are on the map, place your compass on the map so the long edge forms a line running from where you are to where you're going. Turn the housing of the compass until the grid lines are aligned with those on the map, making sure that the orienting arrow on the compass is pointing to north on the map. Turn around until the compass needle sits within the grid north arrow on the baseplate. Look at the direction of travel arrow and off you go. Identifying landmarks on the map and sighting them as you move through the terrain lets you know you're on the right path.
The National Navigation Award Scheme (NNAS) runs good courses. Practice your skills before you need them. Learning to take bearings on top of a mountain in zero visibility is leaving it too late.

**Celestial navigation:** a good course is recommended. Sight a known star with your sextant and record the angle above the horizon. Let's say you see the North Star at 60° above the horizon. Check the star's GP in the almanac, perform the sight reduction calculations and, on a globe or map, mark the GP with an X. Then take a pair of dividers, set them to 30° and draw a circle with X at the centre. Since 1° of latitude = 60 nautical miles the circle will have a radius of 30 nautical miles and you'll be somewhere on that line. Repeat for another star. The 2nd circle will bisect the first at 2 points and you'll be at one of those points. Since these are thousands of miles apart, you can rule out one of them - or sight a third star to get your exact position.

*Trees often lean away from prevailing winds.*

**Natural navigation:** without instruments you can't do celestial navigation calculations, but stars are still good indicators of direction. The North Star (Polaris) lies above true north and can be found from the 2 stars forming the outside edge of the Plough (*Ursa Major*). Other useful constellations are Cassiopeia and the 3 stars in Orion's belt, the first of which always rises 1° east and sets 1° west of true east and west, anywhere in the world.
The position of the sun is also useful for finding east and west. However, due to the tilt of the earth in the UK it only actually rises due east and sets due west on the equinoxes. The rest of the year, the greater your latitude and the closer you are to one of the solstices, the further from east and west it is. In fact, at midsummer in the UK, the sun actually rises closer to north-east and sets closer to north-west. At midwinter, it rises closer to south-east and sets south-west.
In the UK, winds predominantly blow from south-west to north-east, so moving clouds give an indication of direction. Spiders' webs often indicate north-east, being sheltered from the south-west wind. Similarly, look for scraps of wool and damage to gorse bushes left by sheep sheltering from a sou'wester. Plants are also indicators of prevailing wind direction and can sometimes be seen 'combed' from south-west to north-east. All green plants need sunlight, and trees tend to grow asymmetrically, with denser, heavier growth and straighter branches on the south side. Northern branches grow up and over towards the light, while flowers such as daisies turn to face south.
You can even navigate in the urban environment. Look for weathering and erosion on the south-west side of old buildings. Satellites are 'parked' in a geostationary orbit over a point on the equator, so in the UK all dishes point south.

# resources

- see lowimpact.org/navigation for more info, courses, links & books, including:
- Tristan Gooley, *the Natural Navigator*
- Pete Hawkins, *Map & Compass*
- Jeff Toghill, *Celestial Navigation*
- nationalgeographic.com/downloads/Map_Skills_Booklet.pdf – free map skills booklet
- chrismolloy.com/page.php?u=p141 – free bushcraft book on time & direction
- compassdude.com – info on using a compass
- celestialnavigation.net/ - good overview