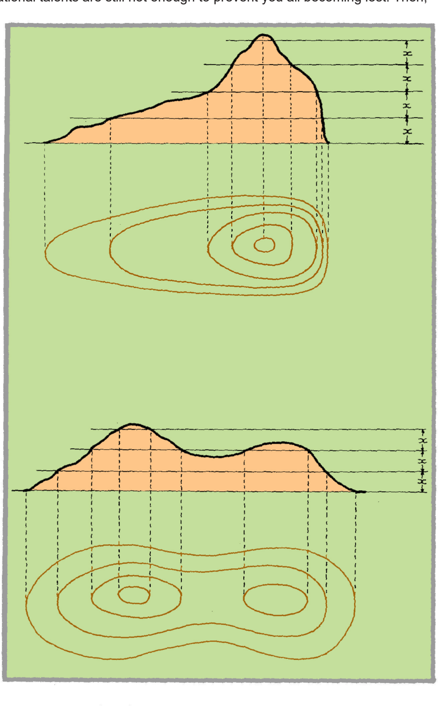
NAVIGATION WITHOUT A GPS DEVICE

(**Adaapted from the book *Australian Wilderness Skills* by Robert Rankin, 1983**)

Navigation is an important skill but one that few walkers learn well. Many people assume that there will always be someone in the walking party who can navigate, and so they never learn themselves, but one day you may find yourself in a group whose combined navigational talents are still not enough to prevent you all becoming lost. Then, you will wish you knew more! If you do acquire competent navigation skills, your trips will become much safer, and you will execute them more efficiently, which in turn will make the wilderness experience just that bit more pleasant and satisfying.

The techniques for finding the way today are not those of the early explorers who often found themselves in totally unknown and even uncharted lands. Navigation today is quite a simple thing – it's a matter of keeping track of where you are, how fast you are travelling, and what land marks you are passing. Above all it's a matter of awareness of your surroundings. It is a fact that people do get lost, often in the most populated and simple terrain, but to avoid this and to keep orientated on your planned course, commonsense, observation, and concentration are all that is called for.

There is, of course, another use for navigational skills. Not only do they prevent you becoming lost, but they can also be used to identify surrounding landmarks. Following your planned course may be easy. It may simply be a graded track calling for minimal navigational skills. The map and compass can still be used, however, to identify unknown peaks and other landforms as you pass them.



Landscape to Map Translation
The contour interval is x.

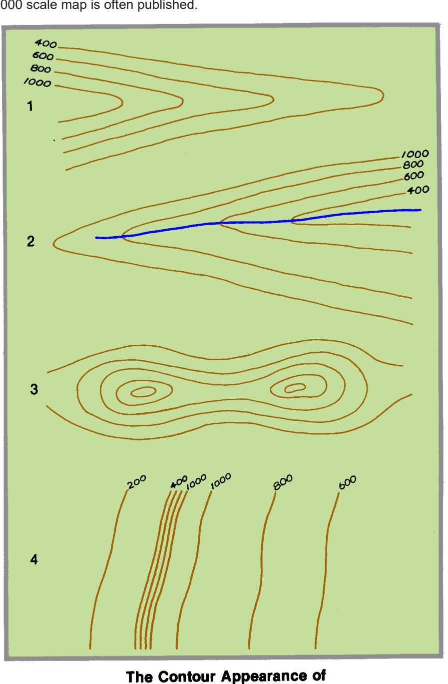
GPS Navigation
Today, of course, there is the powerful tool of GPS which gives the coordinates of your current position and indicates the direction you wish to follow. This is fine but it will not give you an understanding and ability to read the surrounding terrain to the extent the traditional map and compass method will. It is recommended you get familiar with both. Standard orienteering competitions ban the use of GPS systems, so orienteering can be a good way of practicing and mastering the traditional methods of navigation.

Essential Equipment
There are only two pieces of equipment necessary for navigation – a map of the location and a compass. Both weigh very little so there is no excuse not to carry them on all bushwalking trips, no matter how easy you think the navigational problems will be. The most suitable compass is the Silva type. It is tough, lightweight, simple to operate, and combines compass, protractor, and short ruler. There is a range of styles to choose from with features including magnifying glass and variable map-scale attachment. In most circumstances, it is not necessary to use the more expensive prismatic compass which is designed with very accurate bearing measurements in mind.

As for the type of map, it is preferable to use a topographic or contour type with the largest scale possible that still covers the area you intend to travel through. For national parks, it is often possible to obtain a specially prepared contour map of the park with many additional features, such as tracks, added. Scales vary, but 1:250,000, 1:100,000, or 1:50,000 are fairly common. Of these, only the 1:50,000 scale is useful for bushwalking, the other scales lacking the required detail. For popular areas, a 1:25,000 scale map is often published.

Basic Map Interpretation
The basic map skill to acquire is the ability to visualize, or inter- pret, from the map, a picture of what the landscape around you looks like. This is a quite complex mental skill and involves translating a plan or aerial-view map into a view from where you are standing at ground level. Conversely, you need to be able to mentally translate the landscape you see around you into a plan view map. By using both these skills simultaneously you can locate your whereabouts on a map, but proficiency at doing this only comes with practice, and the easiest way to start is to buy a map of an area with which you are familiar.

By carefully studying this map you will soon learn how physical features are translated into map language. With practice you will know, almost without thinking, what a particular feature looks like drawn with contour lines. You will come to recognize the special shape of contours on a map depicting peaks, valleys, ridges, and instantly know what they represent. Once you have mastered this feature identification, it is often quite useful to sit down and study the map of an intended trip with a broad overview – to interpret the lay of the land.



The Contour Appearance of Some Geographical Features
1. A ridge 2. A valley 3. Two peaks joined by a saddle 4. A steep cliff, ridge top, and gently sloping ground.

Wilderness landscapes have been formed by the processes of nature. These processes are consistent, and so the landscape they carve out is predictable and systematic, and will have a definite pattern to it. In Australia, erosion by running water is the most powerful landscape producing process, so keeping this in mind will help you understand the terrain and make route-planning decisions easier.

Through erosion, the land has been carved into many drainage basins, separated by ridgetops known as watersheds or divides because they separate rainfall, sending it to either side of the ridge. Australia's Great Dividing Range is so called because it divides those streams flowing east to the Pacific Ocean from those flowing west to finally empty into the Southern Ocean, one of many salt lakes, or the Gulf of Carpentaria. On a smaller scale, realizing a ridgetop is the divide between two streams can help decide the choice of route. By identifying the drainage basins, you will at the same time be able to predict where you will end up should you follow a particular watercourse. If your route crosses several catchments, it is helpful to bear in mind which catchment you are in and what general direction the streams are flowing.

As an example, imagine trying to find a particular landmark or feature which, you know from the map, lies in a particular catchment. If you are to find this feature, then it makes a lot of sense to search in the correct catchment and not cross any watershed into another. By keeping an overview of the terrain always in mind, while still studying the finer detail when necessary, it is quite difficult to become lost
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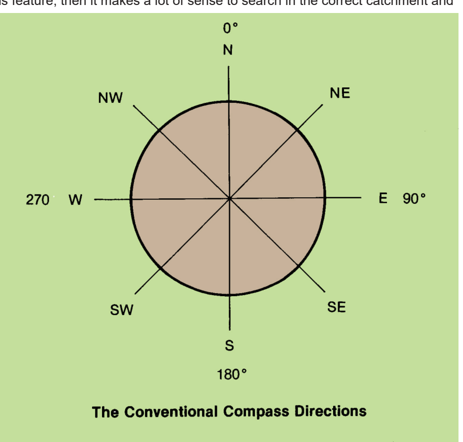
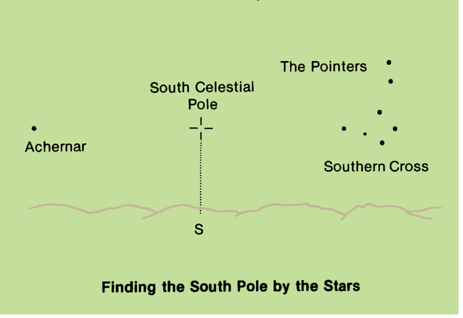


The Conventional Compass Directions

Using the Compass
One function of the compass is to help you orientate the map, and when this is done, the landscape features on the map should be in the same relative directions from where you are standing, as the real features are.

The Silva compass has many parts, not all of which will be used at one time. The main features are the needle, the parallel lines under the needle, and the numbered degrees. The red end of the needle always points to the Magnetic North Pole unless there is some ferro-magnetic material, for example iron or steel, close by. Make sure you use the compass well away from car bodies, steel pack frames and other iron objects.

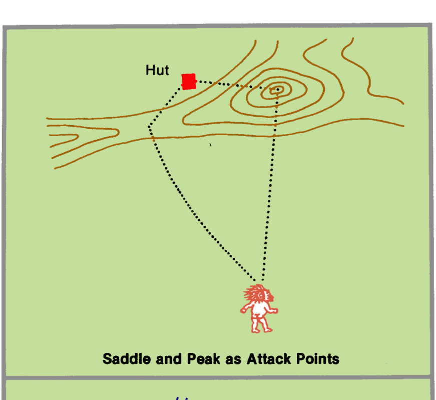


Finding the South Pole by the Stars

To use the degrees of angle marked around the compass, visualize a circle of directions surrounding you where you stand. This circle is traditionally broken up into 360 divisions or degrees, zero degrees of direction being defined as north. In a clockwise direction then, 90 degrees is east, 180 degrees is south, 270 degrees is west, and 360 degrees is back to north again. In between, 45 degrees signifies north-east and so on. Using these numbers then, it is easy to describe a direction of a feature from a point of view, and so in descriptions of views from particular lookouts, the positions of landmarks are sometimes given by their angular direction.
To find the direction of north, merely hold the compass flat in your hand and allow the needle to settle on the Magnetic North Pole – somewhere near the true North Pole, but not quite. In the corner of the map you are using there will be a group of direction arrows. These may be stated as GN (grid north), TN (true geographical north), and MN (magnetic north). Grid north is simply the north adopted for a particular map's grid pattern. To orientate the map, place the map on the ground with compass over the magnetic north arrow and rotate the map until the needle coincides with the direction of this arrow.

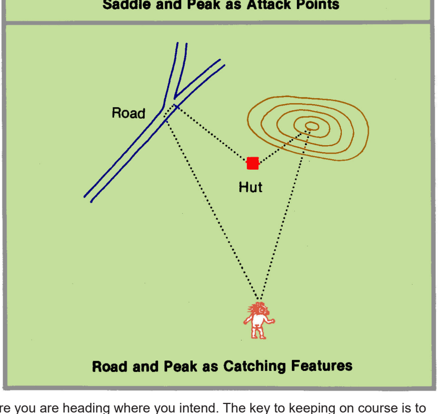
To improve this procedure, and so allow you to place the compass anywhere on the map (useful when it is folded up), it's a good idea to draw several magnetic north grid lines across the map, parallel to the magnetic north arrow, before you leave home. Then when you are in the field, place the parallel lines of the rotating compass dial parallel to your drawn lines on the map. Hold the compass firm on the map, and rotate the combination together until the needle also lies parallel to the lines. The map is now orientated. Put arrows on your drawn lines to indicate north. If you don't, it is very easy to mix up north and south directions!

An alternative approach is to use the grid north lines already on many maps. Align the compass with these and rotate the combination of map and compass as before, so that the needle also is aligned. Finally make a correction by further rotating the map by the angle between GN and MN which is stated on the map. For eastern Australia this will mean rotating the map anticlockwise until the needle traces out an arc equal to this angle. In the west of Western Australia, rotate the map clockwise.
Perhaps the best method is the first one described, as it demands less field calculations, and that is important. In difficult situations, too many calculations can lead to error. The Silva compass can be used in many ways – I have described only two variations of one basic approach. The instructions packed with it explain more, although the methods I have described will usually see you through most navigational predicaments. They are both quick to use and easy to remember.



Saddle and Peak as Attack Points

If you wish to move quickly, navigation 'on the needle' is a fast and effective method which avoids stopping to align the map each time you wish to identify your location. It is less precise, but if you keep a continual watch on the terrain you are passsing through and relate it to the map, then navigating on the needle is all that is necessary. Merely note the angular direction you wish to travel according to the map, hold the compass out in front of you, and find this direction in relation to the northward pointing needle.



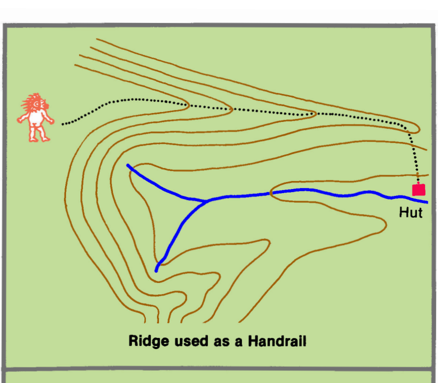
Road and Peak as Catching Features

For instance, according to the map you need to travel in a NE direction with respect to magnetic north, to reach your destination. Observe the compass needle pointing north and so merely travel at 45 degrees to the right of this. Your basic direction calculated, you can achieve accurate navigation by checking off the map features as you pass them. Often a prominent feature (rock outcrop) marked on the map, will lie on the intended course. If so, proceed to it and plot the next leg from that feature.

Compass work can be very precise, but most of the time 'rough compass' is all that is required. This merely involves frequent glances at the needle to make sure you are heading where you intend. The key to keeping on course is to keep the compass handy and check it regularly. Hang it from your wrist with the cord supplied.

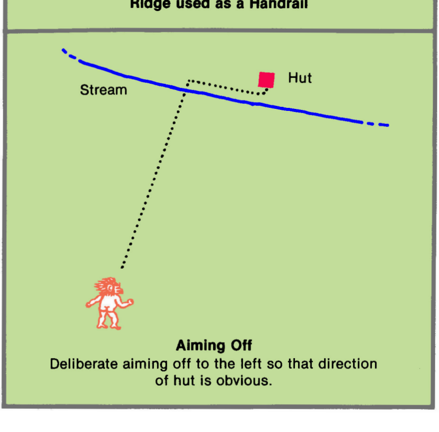
Finding your Position
If you do become disorientated, use the navigation techniques discussed in reverse to pinpoint your position. On a long line feature, such as a stream, ridge, track, or fence, take a bearing to a distant point feature, for example a peak. Plot this direction from the point feature on the map back towards the line feature you are on. Where the intersection occurs will be your position. The technique can also be used even when you are not lost but merely wish to know how far along a particular line feature you have travelled. If you are not on a long line feature, it is necessary to take bearings from two point features and plot the intersection of these bearings as your position.

Orientating the Map with no Compass
It is not always necessary to use the compass to orientate the map. If there are several striking features in the surrounding scenery and you are familiar with these, it is a simple matter to rotate the map until the map and real features align. This technique is also useful near a linear or line feature such as a long ridge, road, or fence. Merely align the map feature with the actual feature. Care should be taken not to make a 180 degree error by pointing the map along the feature in the wrong direction. The surrounding landscape should help you to avoid this problem.



Ridge used as a Handrail

Navigating without a Compass
If two members of the party each take a compass, then it is unlikely that both will get lost or broken. If however they do, then it will be necessary to find your bearings by other means. In a familiar area, local features will give a rough indication of direction from your memory of how the landscape fits together. For example, the direction of a stream or mountain range. If the day is clear and you have a good view, then it's possible to orientate the map by observing the position of prominent features, but it may be necessary to climb a hill or rock outcrop to do this. Other methods involve observing the sun by day or the stars by night. Since a rough indication of direction is all that is needed, it suffices to note that the sun rises in the east and sets in the west. South of the Tropic of Capricorn, the sun is always north of these bearings, more so in winter. Around midday, the sun will be in the north, but this will be difficult to gauge unless the season is winter and the sun is far to the north.



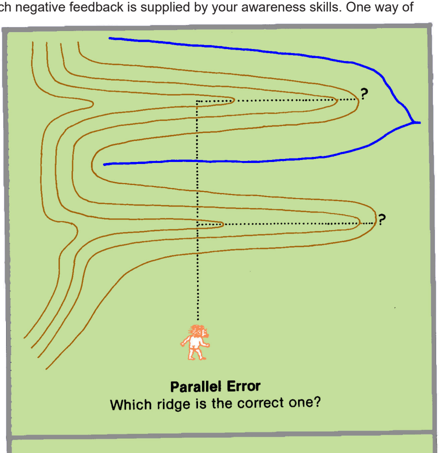
Aiming Off
Deliberate aiming off to the left so that direction of hut is obvious.

North of the Tropic, the sun will be in the southern half of the sky for some time during the warmer seasons and allowance should be made for this. The shadow of a vertical stick placed in the ground can help determine the direction of the sun, even when it is hidden behind light clouds.

At night, the south pole can be determined by first finding the south celestial pole. A point on the horizon directly below this is the direction of south. The south celestial pole is found by identifying the southern cross and pointers formation. If a line is extrapolated from the bottom of the cross for four and a half cross lengths, you will arrive at the south celestial pole. Alternatively, draw an imaginary line from the bottom of the cross until you arrive at a very bright star, Achernar. Half way between this star and the Southern Cross is the pole. Note that by using these methods, what you are finding is true south, not magnetic south.

Some Useful Concepts
The following ideas have been gleaned from the sport of orienteering which, by its very nature, has radically improved the efficiency of general bush navigation. The over-riding philosophy is not to rely heavily on accurate bearings but instead become aware of your surroundings both in actuality and on the map. Relate the two through keen observation, keeping your position continually up dated in your mind as you make progress. To learn about navigation, there is no better way than to attend several orienteering events. Here tuition is available and there is plenty of scope for you to test out many types of navigational skills. Entering a rogaine event is another useful idea. A rogaine is basically a long distance orienteering event and more closely simulates a day-long bushwalk. What follows are some important orienteering concepts which have wide applicability in bushwalking practice.

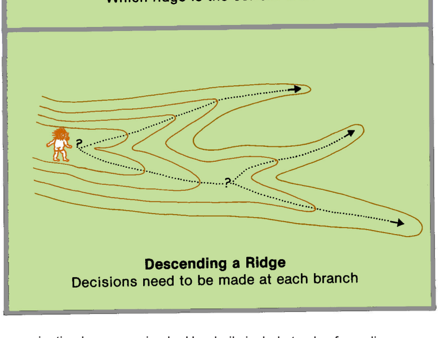
1 Route finding is a mental operation in which negative feedback is supplied by your awareness skills. One way of looking at route finding is to assume you are always drifting off course. Frequent navigational checks are employed to rectify this error so that it does not compound itself. The more frequent these navigation checks, the closer you will keep to your intended route. Too frequent checks will, of course, slow you down unnecessarily, so a workable compromise must be reached.



Parallel Error
Which ridge is the correct one?

2 Attack points are features which are close to but much easier to locate than the place you are heading for. An attack point could be a track or stream junction, a rock outcrop, a saddle or any other prominent feature near to your desired destination. Locating this feature first is much easier than trying to head directly to your destination especially if it is, say, a small hut hidden in bushes. Once at the attack point, the distance to your real destination is short and easy to locate with an accurate compass bearing.

3 Collecting features are large features which you must pass enroute to your destination. Note them before embarking on the next leg of your route and mentally tick them off as they are passed. Collecting features include peaks, tracks, vegetation changes and any other large feature which can be easily seen. A collecting feature which is also a point feature near your destination, becomes an attack point.



Descending a Ridge
Decisions need to be made at each branch

4 Often you will notice a prominent feature which is past your intended goal. These, too, have their use. Arriving at this feature, called a catching feature, immediately implies you have overshot the mark. A very useful feature.

5 Handrails are line features which run in the general direction you wish to travel. Because they are usually easy to follow, navigation becomes simple. Handrails include tracks, fence lines, stream beds, ridges and other prominent linear features. These may not lie exactly on your course but it is often advantageous to deviate to a handrail to facilitate navigation and sometimes ease of walking.

6 The previous ideas can be combined with a very useful technique known as 'aiming off'. Gone are the days of carefully logging your course across a featureless landscape in order to arrive exactly at your destination. Instead, your walk can be made in much quicker time and with greater ease from the very outset by deliberately choosing the wrong bearing!
'Aiming off' involves studying the map in the vicinity of your destination and checking for handrails which, if followed, would lead close to your destination. As an example, suppose again your destination is a hut, located beside a stream. If the stream crosses your path, it will certainly be a lot easier to navigate to it, rather than trying to aim directly at the hut. If you deliberately choose to aim off to the left or right of the hut, upon reaching the stream you will immediately know in which direction the hut is. If, on the other hand, you tried to spear the hut (aim straight for it) you may miss it even after many hours of careful navigation, especially if it is well hidden by bushes. You would arrive at the stream and not know which way to turn.

7 Parallel feature errors can be made in a landscape with lots of similar features. You may have to cross many parallel ridges and if you miscount the number or interpret the map incorrectly, you may find yourself on the wrong ridge and not know whether you have gone too far or not far enough. This can easily happen if, in the fine detail of the map, one of the ridges does not even show up. The same can happen for streams, and even tracks. Hopefully you will realize your error early when features no longer agree with what is expected. It is then a matter of sitting down and carefully figuring out exactly where you may be and deciding whether to back track or carry on to the next similar feature.

8. Do not underestimate the value of pace counting. It is especially useful in avoiding parallel errors. It is a way of introducing a degree of objectivity into the otherwise subjective art of distance gauging, which normally amounts to guessing. Although your gait may vary with the type of terrain (vegetation and slope), it is better than having no guide at all, and over short distances (up to one kilometre) can be surprisingly accurate. It is a matter of measuring your stride beforehand over a measured distance, and also having some idea how it varies with changing slopes, vegetation and with pack weight.

9 Route choice should be made by taking the 'grain' of the terrain into account. Note which way the streams are flowing or the ridges falling. Keep in mind that if you intend to ascend a watercourse you will have to make continual decisions on route choice each time you arrive at a branch. If, on the other hand, you choose to ascend via a ridge, no decision is necessary as all ridges converge towards a summit as you ascend. The opposite is applicable on the descent. This is one reason why ascending a mountain via a ridge and descending it via a creek makes good sense. If the route lies across several ravines, it is often less tiring and quicker to detour above them by following the watershed. As a check on your navigation in complex terrain, always note from the map's contours whether you should be ascending or descending. This check is an additional safeguard against faulty map and compass work.

10 In a white-out, where mist and snow combine to produce a white void, following contours is often your only means of accurate travel. If your destination is linked to your present position by a contour line, it is often feasible to follow this line as long as the terrain along it is negotiable. The difficulty with this contouring technique is to stay accurately on one level and not gradually ascend or descend. Another often surer technique for navigation in a white out is to follow line features such as spurs, stream beds, or valleys.

11 If you intend to go home the same way you came, it makes good sense to look back occasionally to become familiar with the land in the reverse direction. This is particularly important at spots where you consider there may be a problem in making a route choice when approaching the spot in the reverse direction. As mentioned previously, this problem will arise when ascending creeks or descending ridges. With each of these, problems with route choice change dramatically when you reverse your direction.