

# Using map and compass together

This is where the preceding sections come together and will tell you how to orient a map as well as how to correct for variation. At present, this is as far as I'm going to go on the subject of navigation, as to continue will take us into realms usually only needed if serious wilderness hiking is to be undertaken. If that is what you intend to engage in at some time in the future, I suggest that you firstly practice with map and compass until you are absolutely confident of your understanding of the techniques involved and, secondly, you try to undertake some hands-on' training with an outdoor centre or better still Outward Bound. The sort of countryside my walks describe on this site is gentle, undulating stuff in the main and map and compass work are fairly simple - indeed, in most cases a Pathfinder map is all you'll need. Please, though, be under no illusions that taking a swift hike in the Cotswolds prepares you to jaunt off on a three-day trek in the Scottish highlands. Get lost there and you may stay there for good! So follow the rules - and never underestimate the terrain, or overestimate your skill and ability, and you won't go far wrong.

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## Orienting the map

The best place for your first map check is the start of your walk. This has the obvious advantage of telling you that at least you're starting in the right place! First, find your location on the map. Usually this is easy: you are at the marked point where the path leaves the road or wherever your chosen path starts. Next, orient the map. In other words, place the map on some flat surface so that directions on the map correspond to directions in the field. It is always easiest to visualize what you **are doing** if the map is oriented. Sometimes you can orient it by eye - if there is a lake straight ahead of you, and a prominent hill to your right, turn the map until the lake lies straight ahead of **your** position on the map and the hill is to the right of that position. In similar fashion, all other directions on the map will also correspond to **reality**. Sometimes, you can't orient by eye - if the landscape lacks any obvious mapped features, you need to use your compass to orient the **map**. Here, and for the rest of this section, we are going to assume that magnetic North and grid North lie in exactly the same direction, which should enable you to grasp it a bit more easily. In the next section we'll find out how to compensate for the difference that (usually) exists between grid and magnetic North. On almost all maps, North is at the top of the sheet so, to orient the map roughly, hold the compass horizontal and glance at the needle which points North, of course. Now turn the map so the top also points North. Note that, when the map is oriented correctly, the left and right margins represent lines running north and **south**. To orient the map more accurately, set the capsule to zero degrees. Place the compass on the map so one long edge of the baseplate lies along either the left or right margin. Now rotate map and compass together as a unit until you have placed the needle in the gate, so the North end of the needle points to the North mark on the capsule. The map is now oriented and directions on the map corresponds to directions in reality! Have a look at **Fig.1** which should make this a bit clearer.

Now that you have found your position and oriented the map, take a look around and identify some nearby landmarks that are marked on the map. Determine your general direction-of-travel. Are you heading North? West? Try to develop a feel for the relationship between the cardinal points and major terrain features. You might note, for example, that the valley you will be walking up runs east and west, while the tallest hill is basically to the north. Knowing where you started and in what direction you are travelling will help prevent silly mistakes such as placing the south end of the compass needle in the north end of the gate which **erm**, some of us have been known to do! While you have the map out, try to

create a mental image of the terrain you will be travelling through. This is where you'll get the benefit of having learned to read a contour map - it will make creating this mental image a far easier task.

Make a point of getting out your map and compass every hour or so to locate your position on the map. I know that on a short country ramble this is probably not necessary but it is good practice! Note the time you started and the time it takes you to reach various points along your route. It will give you a sense of your pace that day, which will help you to keep track of your location and assist you if and when you come to plan your own routes and walks. Let's say your goal for the day is the summit of some hill or mountain. You reach it at lunchtime (because you are horribly fit, unlike me who will of course take far longer!) and sit down to admire the panorama spread out before you. Orienting your map will give you a rough idea which distant landmark is which. If you want to know exactly which one each is, I'm afraid you'll have to get a bit more technical.....

First, take a bearing on the peak you are interested in, using the technique described previously. That bearing, you will recall, is just the angle between a line heading north and a line leading to the landmark, the angle being measured clockwise from the North line. Although you used the direction-of-travel arrow (or notch in the mirror) to sight the object, note that you would have arrived at exactly the same result if you had sighted along one long edge of the baseplate (this is an important clue, Watson!).

Now you are going to transfer that angle to the map. One line of the angle, represented by the compass gate, will point North; the other line, represented by one long edge of the baseplate, will run right through your position and towards the landmark you are looking at. To make the logic of the next step easier, orient the map before continuing, then reset the compass to the bearing you have just measured. Now place the compass on the map so that the compass gate points north, towards the top of the map, and one long edge of the baseplate sits on top of your position. Note that the long edges of the gate (and the North/South lines in the capsule) run parallel to the right and left margins of the map. Don't twist the capsule in relation to the baseplate and ignore the compass needle. You are simply using the compass as a protractor now, so the needle is irrelevant (even though I have shown it!) The long edge of the baseplate that is sitting on top of your position now points directly at the landmark you sighted and took a bearing on. Fig. 2 below shows a compass placed correctly on the map. Note — this is important — that you must make sure you follow the long edge of the baseplate in the direction indicated by the direction of travel arrow. With the map oriented correctly, you will see that the long edge of the baseplate not only points to the landmark shown on the map - it also points to the real one you can see.

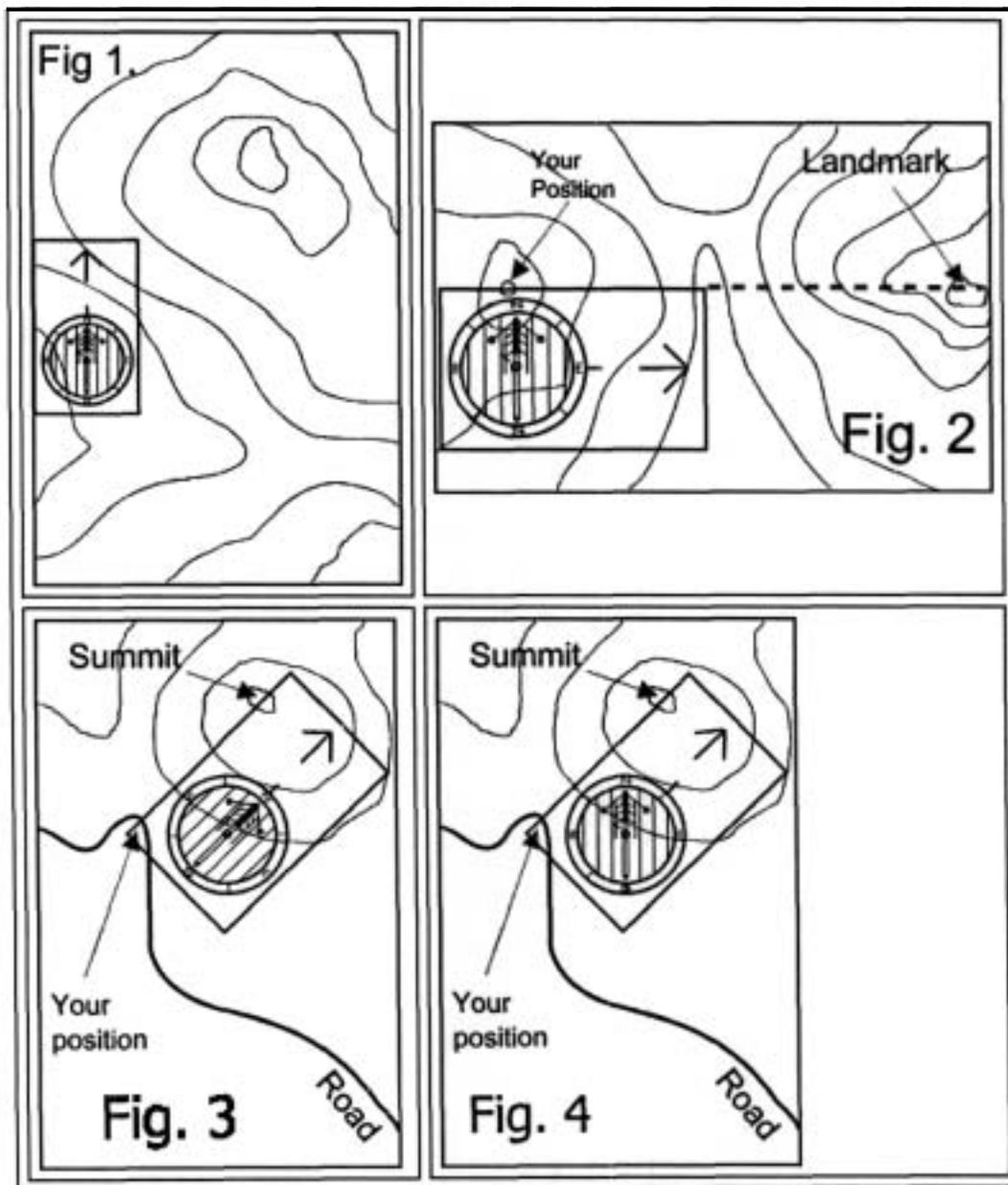
Often the edge of the baseplate isn't long enough to reach from your location to the landmark shown on your map. You need to be able to extend the line of the baseplate and for this a clear plastic ruler is ideal - one of the six - inch ones usually does nicely. Don't use a metal one! (Try it sometime and see just how far it throws the needle out!) Place one edge of the ruler alongside the edge of the baseplate that runs through your position. The ruler will now extend towards the mapped landmark, making it easy to identify the correct one.

Your map and compass will also help you to solve the opposite problem - which way to go, that is!. Once again, let's assume that you know where you are on the map. This time, you want to use the map to tell you which way to go. Suppose you are at **Roadbend** and want to know the direction to Topofthehill. To solve this problem, you need to measure an angle on the map and transfer it to the terrain. The angle, called a **course**, will be the angle between a line heading North and a line heading to your destination, with your position as the point of the angle. Sounds very confusing, but stick with it, all will be revealed!

Start by laying one of the long edges of the baseplate along an imaginary line connecting your position and your destination. Sometimes, as in fig 3, the baseplate will be long enough to extend between the

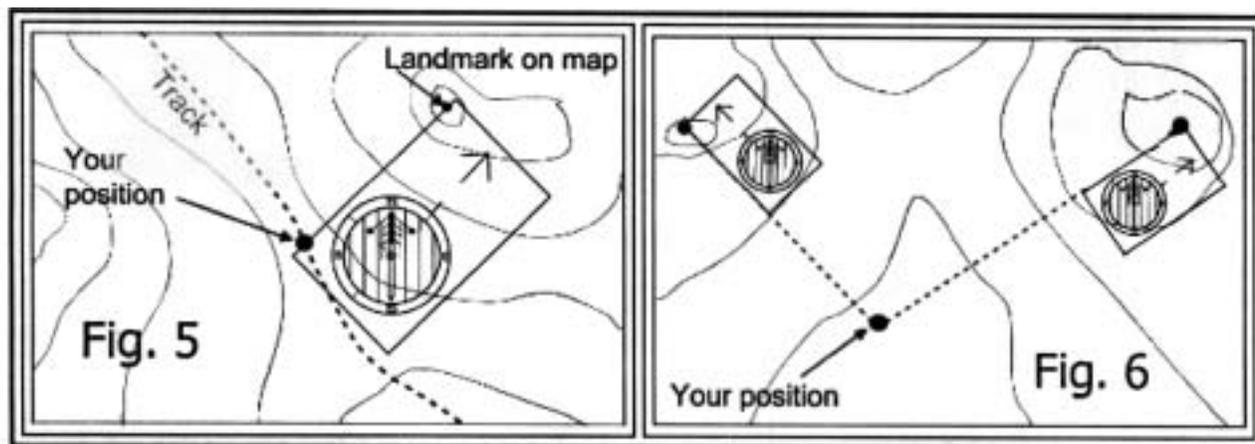
two; other times you will need to get out your ruler again to position the baseplate accurately. Be sure the direction-of-travel arrow points at your destination. Now twist the capsule until the gate points north, as shown in **fig. 4**. Both the long edges of the gate, and the **North/South** lines, will run parallel to the left and right margins of the map. Once again, you are using the compass as a protractor, so the needle's position is irrelevant. Forget it whilst you set the capsule! Read the course (the angle) at the index mark, where the direction-of-travel arrow abuts the compass dial - in the examples shown, it would be about 315 degrees (measured from North clockwise, remember?)

To transfer that angle to the field, pick up your compass and rotate it as a unit, without moving the capsule in relation to the baseplate, until you have placed the needle in the gate. When you have done this, you will see that the direction-of-travel arrow now points in the direction you want to go. Pick a landmark, walk to it, pick another landmark, and so on. This is one of the basic methods of cross-country navigation.



You can use a variation of this technique to find your position along a track, ridge, stream 

prominent linear feature in fact. First orient your map **North/South**, then lay one long edge of the baseplate along a line intersecting your rough position and a prominent landmark. Rotate the capsule until the gate aligns with the **North/South** lines on the map and the needle rests in the gate. If one end of the baseplate rests on the landmark, your position must lie along the line of the long edge of the baseplate. Fig. 5 will make this clear, I hope! If you can identify two landmarks, you don't even need to be following a terrain feature. Simply take a bearing off one, and pencil in your line of position on the map. Then take a bearing off the second, and pencil in that line of position. Your location is the intersection of the two lines. Fig. 6 shows how this works and is far less confusing than my descriptions! If you can take a bearing off a third landmark and pencil in that line of position, so much the better. Your true position should lie somewhere inside the triangle formed by the three lines of position (because unless you are a truly whizzo navigator, there will always be a slight, er, discrepancy!)



Once you have identified your location with lines of position, perform a 'reality check'. If the lines cross at a stream, and you are standing on a ridge, something is definitely wrong! A cardinal rule of navigation and map reading is this - **never make the map fit your readings or vice versa!** If in doubt, take your readings again - and again - until you are sure of them - and only then follow them!

## How to correct for variation.

Sometimes reading explanations of how to reconcile grid north and magnetic north is, to say the least, confusing. Fear not! There *is* a simple, easy to understand way to solve variation problems. You just need to remember some straightforward logic. You can forget silly rhymes such as 'grid to mag, add; mag to grid, get rid'. This was once taught by the armed services, but it only works if the variation is West - a bit unfortunate if you're a soldier on exercise in China.....

Anyway - British maps are oriented to the National Grid. If you use maps without the crossed lines of the grid, check in the margin that the map has been printed with its side edges aligned True, or geographic, North and South, and for 'grid North' below read 'true North'.

True North is the direction to the geographic North Pole — one end of the earth's axis of rotation — **but** in this section we shall use *grid North*. Magnetic North (with reservations explained later) is the direction in which a compass needle points. We are calling variation *the difference in direction between grid North and magnetic North*. Variation, therefore, is an angle, measured with grid North as the

starting point. In Britain, magnetic North lies to the West of grid North (to the left, or anti-clockwise, as we look at a map) and we say that the variation is *West*. West variation is measured anti-clockwise. (This is in contrast to bearings and courses, which are always measured clockwise - an important point to remember.) Therefore, if magnetic North lies 6 degrees West of grid North, the variation is *6 degrees West, not 354 degrees East*.

Ignoring the correction for variation can lead you seriously astray, and raise the awful possibility of eating apple twigs and beetles for dinner as you bask in the warmth of your torch. For each degree that your course is in error and each kilometre (0.6 miles) that you travel, you will be off by about **18mtr. (60ft)**. If the variation is 6 degrees, you will be off by over 200m (**650ft**) after walking just 2km (1 mile). Need I go on? One thing's for certain - if *you* go on, we may not see you again for quite some time!

Strictly speaking, it's wrong to say that 'the compass needle points to the magnetic North pole'. What the needle actually does is align itself with the earth's magnetic field. Compass needles may or may not actually point at the magnetic north pole itself, which, in 1981, lay just north of Bathurst Island in Canada's Northwest Territories. For reasons not well understood, the magnetic poles move slowly, over periods of many years, through circular paths with a diameter of about **160km (100 miles)**.

For a rambler or hill-walker, all that doesn't matter. If you are using the most recent OS map available, the variation it gives will be accurate to within a degree or two. Although variation changes slowly as you travel East or West, you can assume that the needle always points in the same direction within the bounds of the area you cover in a typical human-powered trip. For the sake of simplicity, let us just say the compass needle points to magnetic North.

Let's assume for the moment that you didn't spend the extra money to buy a set-and-forget compass. Before you can understand how to correct for variation with a standard baseplate compass, you need to **remember** the Two Facts. First, every angle that you measure on a map is measured clockwise, with *grid North* as the starting point. Forget the needle - you are simply using the compass as a protractor. Second, every angle that you measure in the field by placing the needle in the gate of the compass is also measured clockwise, but the starting point is *magnetic North*.

We'll refer to angles with grid North as the starting point as *grid bearings* or *grid courses*. (They are essentially the same. A bearing is just a direction to a landmark; a course is a direction you will follow - remember?) All angles measured with a compass, using magnetic North as the starting point, will be *magnetic North bearings* or *magnetic North courses*.

Now let's say that you are walking in the **Cairngorms** where the variation is always West. Take a look at figure 4.2. Grid north is marked zero degrees. Magnetic North is marked 6 degrees - note that it lies to the *West* of grid North. In other words, the variation is 6 degrees West. Still with me? OK - now say you measure a course on the map to a landmark and find it to be 90 degrees. That is a *grid North* course; you started measuring at grid North, just as the diagram shows. Now if you take a bearing on the landmark with your compass, you will find the bearing to be - hey presto! - 96 degrees. That is a *magnetic North bearing*, since you started measuring at magnetic North.

The grid north angle, measured on the map, is less than the magnetic north angle measured in the field with the compass by placing the needle in the gate. Furthermore, the difference is 6 degrees — exactly the amount of the variation. And that leads to our first conclusion: when the variation is West, as it always is in Britain, grid North angles (bearings and courses) are always going to be less than magnetic North angles (bearings and courses). If you measure an angle on the map and want to transfer it to your compass, you must add the variation to the grid North angle because magnetic North angles are always

greater than true North angles when the variation is West. If you measure an angle with your compass and want to transfer it to the map, you must subtract the variation, because grid North angles are always less than magnetic North angles when the variation is West.

You don't need to memorize these rules (huge sighs of relief all round!). Just remember the logic behind them. If you need to jog your memory, look at the variation diagram in the margin of your map.

Fig. 6 gives another example of the relationship between magnetic and true North when the declination is West, this time for a true north angle of 270 degrees. One picture is worth a thousand words, yes?

If you are using a set-and-forget compass, you can forget about adding and subtracting once you have set the variation and double-checked that you set it in the right direction. With most such compasses, setting the variation is idiot-proof. (Depends on the idiot, of course!) Usually you turn a small screw or perform some other simple operation to adjust the compass gate so that it points to the angle representing the variation. If the variation is 6 degrees west, for example in the Cairngorms, the compass gate (orienting arrow) would point to 354 degrees ( $360 - 6 = 354$ ). It's that easy.

When you are measuring an angle on the map with a set-and-forget compass, you ignore the needle (as always) and the compass gate (which no longer points to North on the capsule). Instead, you always use the capsule's **North/South** lines when orienting the capsule North and South, making sure North on the capsule points to North on the map. I hate to labour this point but it is in fact quite easy to have the map upside down, especially when your head is full of angles and you've just **recued** the map from a thorn bush.....

To transfer that angle to your compass, simply place the needle in the gate. Angles measured with your compass can be transferred directly to the map, again using the **North/South** lines in the capsule, not the gate. As you can see, set-and-forget compasses let you avoid mental gymnastics when you are cold, wet and would much rather think about steak pie and beer than compass courses. They also let you avoid spending lots of time drawing lines on your maps. In the time you save, you can easily earn the money to buy the better compass.

Avoid trying to learn compass use by rule-of-thumb methods. Some books attempt to make the problem too simple. Believe me, it is not simple. Straightforward, yes. Simple, no. Learn the logic of this section and you will be able to cope almost anywhere.

Now I know you're probably thinking 'well he's obviously a smart fellow and know everything about maps and compasses and how to use them.' Alas, if it were only so. It's a bit like riding a bike - you never really forget but you do get rusty! If I'm planning a walk where I know I will need to navigate - especially if there's a bit of compass work involved - I read up on it again and take my handy crib sheets with me! There is no mileage (wrong - there may be a great deal of it if you make a mistake!) in *thinking you know how it's done*. The essence is practice. Seriously, a last few rules to mull over:-

1. If in any doubt as to your readings, check again.
2. Don't make the map fit your readings or vice versa.
3. If you go wrong, retrace your steps until you're sure you're on the correct path.
4. Trust your compass - like a computer, it doesn't make mistakes - you do!

5. DONT PANIC!

6. DONT PANIC! Yes I know I said it twice but it's really crucial for you not to do this!)

Well, that's it. I do hope that this article will enable some of you to have more fun on your trips in the countryside and, should you wish to attain expert status in navigation, hopefully join Outward Bound courses or something equally heroic. Oh, and one last thing - if you're planning a Polar expedition this or any other year - don't call me!

Happy Walking!

[Reading and understanding a contour map.](#)

[Grid references - how they work and how to read them.](#)

[How to choose and use a compass.](#)

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