Understanding & Using a Map

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The idea of "map" is apparently a fundamental concept. The term is often used, literally and symbolically, without explanation, suggesting that "map" is so well understood that no definition is needed. This is a delusion.

When analyzed, a map is seen to be a complex representation for area or a refined method for communicating knowledge about an unforgiving environment. Because maps are fundamentally different from other forms of communication, they must be specially perceived, and singular assumptions are a necessary basis for their creation.

Mapping is based on systems of assumptions, on logic, on human needs, and on human cognitive characteristics. The apparent simplicity of an ordinary sketch map is deceptive. In fact, even the simplest map is a remarkable instrument for understanding and communicating about the environment. Like writing, a map is a way of graphically expressing mental concepts and images.

The traveller into an unknown region should carefully examine all potentially useful information about that area, in the hopes that some of the data will be relevant to problems he may face. Maps, by their very nature, are discarded when a new and better one comes along. Even the name suggests this, which is Latin for "napkin".

The earliest maps must have been based on personal experience and familiarity with local features. They probably showed routes to neighbouring tribes; where water, game, salt and other necessities might be found; and the locations of enemies and other dangers. Nomadic life stimulated such efforts by recording ways to cross deserts and mountains; the relative locations of summer and winter pastures; and dependable springs, wells and other vital information.

Maps of Mesopotamia have been found and dated at 3800 BC. These maps were related to the development of the natural resources and to establish land ownership boundaries. Spring floods would wash away fences and boundary markers so some other method had to be used to keep track of the land. You will see there were only two reasons to motivate individuals or governments into developing maps. The first was for locating and exploiting resources and the second reason was for planning for or participating in war. Even though maps have changed, the reasons for mapping remains pretty much the same.

Early Man was known to be possessive and aggressive so when he found something he kept it for himself. When he came across something that someone else had that was better than he had he would just take it if he could. Eventually alliances were formed which became villages. Now the village had to be protected. This was done by locating the village where it was not easily seen but would be easy to scare off intruders. Looking at it from the intruders point of view, if he wanted to get into a village, he would have to find a route that he could use to sneak up on it. So the intruder, by trial and error, would draw a map that would show the high and low ground and anything else that he could hide behind.

When man discovered the wheel, he could bring the resources to the village, and the supplies for war. Maps had to be improved because the wheel needed even ground and made it possible to travel greater distances than on foot. In 196 B.C., a Greek Scholar by the name of Eratosthenes decided that the whole world should be mapped. The first thing he needed to know was just how big is the whole world? He found that for a few days every year the sundials in Syene cast no shadow at midday. He also knew that midday was at the same time in Alexandria, but the sundial cast a 1" shadow. He was told that the distance between the two cities was 500 miles. The shadow on the Alexandria Sundial was 1/10 the height of the dial pointer, so 1/10 of the distance between the two cities had to be the ratio of the arch of the earth. He had the circumference figured out to 25,000 miles, which is close. The actual average distance is 24,899 miles, a few feet and a few inches, depending on tide, and the prevailing wind at the time of measuring. I don't know if he did it right or not, but back then they didn't care, they thought he was nuts, because nothing could be that big. He drew his map anyway with all this blank space at the end of the known world.

A few years later a fellow by the name of Strabo got hold of Eratosthenes map, and decided that the known world needed to be divided into sections. He is believed to be the first to put lines of longitude on a map. He divided the map up into 9 sections and used all the blank space that was on Eratosthenes map to write down the folklore and philosophy for the randomly spaced sections.

A few years later, Ptolemy took on Eratosthenes's map. Ptolemy was sure that Eratosthenes's measurement of the earth had to be wrong, so he set out to make his own measure the earth. He concluded that if the noon sun was tracked for one hour, he would have 1/24 of the diameter of the earth. He thought he could just put a stick in the ground and at noon he would walk for one hour, with a second stick to track noon for one hour, then measure the distance between the sticks. But this didn't work, the sun went too fast. He got the fastest horse he could find, but it still didn't work. So he decided to measure 1 minute and multiply the distance by 1440. That didn't work either. The sun was still too fast. So he tried 1 second and multiply by 86,400. He enlisted a number of people and gave them a stick. He placed them in an east/west line 200 ft apart. He then calculated how high a rock had to be held to take 1 second to fall. As each stick showed noon his helpers were instructed to call out. There was a lot of confusion but Ptolemy calculated the distance at about 1000 ft. That made the world about 16,000 miles, which was more believable than 25,000 miles.

It doesn't say anywhere in the history books, but this could be where the expression time flies came from. The relative perpendicular movement of the sun across the surface of the earth is 3043 feet per second or 2075 miles per hour.

Ptolemy set out to draw the new world map. While he was doing this someone else made it their business to find out where the Equator and the Tropic of Cancer were. There was no useful reason for this at the time, they just wanted to know where the middle of the earth was, and how far north the sun came in the summer. Once they knew where these were it was just a matter of measuring to plot the Tropic of Capricorn.

Since this was new information Ptolemy put them on his map. Ptolemy liked the idea of longitude, but felt they should be evenly spaced. He knew that the Astrologers in Babylon had determined that there were 360 days in a year, so he divided the world into 360o. To avoid cluttering the map, he marked only every fifth degree. He didn't like the idea of the known-world being divided into West and East, so he put the Prime Meridian at the extreme west of the known world, which happened to be the Canary Islands. He liked the East/West division so much he decided to do the same for North and South, and the equator was a good place to start. He marked the equator 0o, and the top of the map was 90o N, and the bottom as 90o S.

Before the discovery of America, there were three broad categories of maps; the Ptolemaic maps, which had all known formation on them, and was only used by the scholars; the Ecclesiastical maps, which had minimal information on them, for the use of the common people; and the Portolan maps which were charts that were used only by the mariners. Our modern map and chart has evolved from the Ptolemaic and Portolan types. The Ptolemy maps were so popular that in 1477 in Bologna 500 copies were printed for anyone who could pay the price.

When Christopher Columbus set sail for India, he was using a Ptolemy map. You can imagine Chris's surprise when he bumped into America. Ptolemys' map said it couldn't be there, there just wasn't enough room for it to be there.

For the next 1500 years, Ptolemys' map stayed the same. Filling in some of the blanks were the only changes that were made. As late as 1924, big mistakes have been found in reputable maps. All the maps that showed the Isthmus of Darien had a mountain range running down the middle of it like a backbone. When the Isthmus was explored, it was found to have two ranges running parallel with a valley 40 miles wide between them. When this was checked into, it was found that the Isthmus was only mapped from the shore from both sides, and it was assumed that the mountains that were seen from each side were the same. So the map was fudged to make one range fill the space.

About 2500 years ago lodestone was known to have the peculiar property of always pointing in the same direction. The seafaring countries all came to realize the value of this at about the same time. The Chinese are believed to be the first to use the compass to grid their land maps. This was the first known grid system used on any map.

It took 500 years for the Romans and other land based empires to get their hands on the compass so that they could grid their maps. The compass that these people were using was still quite crude, so the biggest grid they could use was about 700 meters. Today we use a 1000 meter grid because it is an easier number to work with and our compasses have evolved to the point that we can quite accurately plot at that size.

Somewhere between 1311 and 1325 AD, two men, Petrus Vesconte and Angellino di Dalorto drew the first charts that had a circle with a cross that denoted the Cardinal points and used a star to indicate North. They also had a scale to measure distance with limited accuracy. It wasn't until 1520 that someone thought that the land that Columbus ran into should be put on a map. It took until 1607 before the name "America" replaced "Unknown" on the maps.

In the time of the renaissance new ideas and instruments were developed to improve mapping. In 1569 a Flemish map maker by the name of Gerard Kremer produced the first accurate map projections. He signed his maps "Mercator" which was Flemish for "merchant". It was assumed to be his name, not his title. His map projections were so popular that he became widely known as Gerard Mercator. To avoid confusion he adopted the new name.

There were three basic types of projections, the cylindrical, the conic and the azimuthal.

The first type is called the Cylindrical projection. These projections treat the earth as a cylinder, in which parallels are horizontal lines and meridians appear as vertical lines.

The second type is called the Conic projection. This group is derived from a projection of the globe on a cone drawn with the point above the North or South pole, tangent to the earth at a selected parallel.

The third is called the Azimuthal projection. These picture a portion of the earth as a flat disk, tangent to the earth at a specified point, viewed from a point at the centre of the earth.

The familiar Mercator projection is of the cylindrical class and has many advantages in spite of the great distortions it causes in the higher latitudes. All compass bearings can be plotted as straight lines on these maps. On cylindrical projections, places of similar latitude appear at the same height. Parallels and meridians may, if desired, be omitted from the body of the map and simply be indexed at the margins. Among the variations of cylindrical projections is the Transverse Mercator, in which the axis of the cylinder is parallel to the equator. This has advantages in drawing maps that are long in the North/South directions.

During the 18th century Britain became the foremost maritime power of Europe, and the Admiralty sponsored many developments in charting as well as improvement in navigation facilities. Because of the Admiralty's prestige, other maritime nations accepted its proposal that

Greenwich be the prime meridian for longitude reference. This may sound like a great honour, but everyone was glad to get rid of it. No one wanted it cutting their land in half. Now it had a home, and everyone was happy.

At the end of WWI there were a lot of planes left that weren't shot full of holes, and a lot of pilots with no jobs who were willing to work cheap and loved to fly. During the war, they found that if pictures were taken from a plane, they could see very accurately what was up ahead, whether it be the enemy or just bad ground. The edge of one picture would not line up with the edge of the next picture, and at the time it was thought that this was because of the pilots being shot at. Later it was found to be caused by the perspective of the uneven ground. After a close look they found that this wasn't a problem, but a bonus, because they could measure the height of the land from the differences in perspective.

With all these planes and pilots, 1921 was a good year for the advancement of mapping by air photography. In 1940 the U.S. Air Force reported that less than 10% of the world was mapped in sufficient detail for even the minimal details that the pilots require for their charts. The Cold war atmosphere of the 40's and 50's promoted a continuation of military oriented mapping activity. Both NATO and Warsaw Pact countries continued to improve their maps. NATO developed common symbols, scales and formats, so that maps could be readily exchanged among the forces of member countries.

In 1891 all the countries got together to standardize a scale for a world map. The scale they settled on was 1:1,000,000. Shortly after agreeing on this, they also established specification and format for the world map. The map they produce is called the International Map of the World (IMW). NATO, the UN and some international technical societies all aided standardization. They set up an office that is called the "The United Nations Office of Cartography" and their purpose is to talk to all mapping agencies world-wide, to produce a map of the world and to act as a clearing house for all aspects of mapping.

All the highly sophisticated equipment in use today had been designed during WWII. Computers and automation have been added to make things lighter and to reduce human error.

Up to this point you have been given some of the back ground history of maps. This was meant to give you a quick overview of the How's and Why's for some of the lines that appear on todays' maps.

Maps are made for many different purposes, so they can differ in size, scale, and information shown. Most maps are drawn to a particular scale. The greater the area a map covers, the smaller the scale. A map that only covers fifty square miles would be a large scale map. The larger the scale, the more detail that can be shown. On large scale maps, the spherical distortions inherent to their projection, is less than the variations in the paper from changes of humidity or folding.

It was agreed that maps with a scale of 1:70000 or less, would be called "large scale" maps.

The inherent spherical distortions on large scale maps is less than the variations in the paper from changing humidity or by the simple act of folding it.

Most maps will fit into one of two categories. The first is Planimetric, the second is Topographic. Planimetric simply means flat, literally "in one plane". Road maps are planimetric. Topographic are graphic representations of the earth, and are made from aerial photos. They use contour lines to show elevation. Each line represents a specific elevation above sea level. From the shape and interval of contour lines, ridges, peaks, canyons, and other land forms can be identified.

Most maps have a legend which explains the symbols used on that map. UTM grid is a grid that is superimposed on topographic maps and serves as an alternative method of describing a location. UTM stands for Universal Transverse Mercator. Universal means that the scale and symbols used, on that map, are by international agreement. Transverse means that the projection is parallel to the equator, and Mercator is the type of projection used. Instruction for using this grid is printed on the right-hand margin of topo maps printed by the Department of Energy, Mines and Resources. The Department also produces a very useful pamphlet called, "Everyone should be able to use a Map".

We tend to think of a map as a bird's-eye view, or more recently as an astronaut's view, but such an analogy is misleading. Maps are a construction, an abstraction, an arrangement of markings that relate to "reality" only by agreement, not by sensory testability. What this means is that for clarity, "manmade" details are replaced with symbols. As cartography becomes more complex, there is an increasing need for an understanding of the processes by which the map acquires meaning from its maker and evokes meaning to its user.

As you can see, the "map" is a language, and this language is a system of assumptions. You have to learn the language, because you can only "fake it" for so long before you get into trouble. The systems of assumptions are; Description, Details, Direction, Distance, and Designation. These are the five "D's" of map reading.

1-DESCRIPTION

Top margin	Name of Country, map number, scale, edition.
Right margin	Detailed map reference no., conversion scale for elevation, declination angle, where this map comes from, how to use a roamer, the number of the adjoining maps.
Bottom margin	Name of main feature of the map, date of the map, scale, legend for roads, contour interval.
Back of map	Legend for all other symbols on the map.

2-DETAILS - MAP SYMBOLS

Map symbols are mapping's alphabet, they explain the lay of the land. These symbols are not random marks. On the contrary, the people who developed them made every effort to have the signatures look like the things that they represent in as far as relative size, shape or colour. These lines, symbols, colours and words will be used in one of two ways on any given map. These two ways are MIMETIC and ARBITRARY.

Mimetic: means to mimic, to be relative to shape, size or colour.
the size of the name will reflect the size of the town.
the shape on the map will reflect the shape of the town.
the line on the map will reflect what it is.
the colour on the map will reflect a true colour.

Arbitrary: means to appoint a symbol regardless of size, shape or colour.
one colour is one thing.
one symbol is one thing.
size of symbol is relative size of thing.

For Orienteering purposes you are mainly interested in four types of map symbols, each with its own distinctive colour.

BLACK	Man-made or cultural features.
BLUE	Water or hydrographic features.
GREEN	Vegetation features.

BROWN Elevation or hypsographic features.

Under the "Man-made" category there are roads, trails, houses, public buildings, railroads, power lines, dams, bridges, and boundaries set between areas. These features are shown in black, except for heavy duty highways, which are shown in red, and medium duty highways which are shown in orange. This is done to distinguish them from less important roads. Generally speaking, the symbols are much larger than they should be. This is done for clarity. If measuring on a map involves a road, use the middle of the road as the actual point of measurement.

Under "Water features" there are rivers, canals, lakes, oceans, swamps, and marshes which are printed in blue. The exceptions are glaciers and snow packs, which are printed in white with blue shading or contour lines.

Under "Vegetation", all areas that have year round vegetation, such as trees, brush and wild grass, are coloured green, except for areas within city or town limits and residential or commercial development areas which are white.

Under "Elevation" there are all the up's and down's, which make up the hills, mountains, valleys and planes, which are shown as thin brown lines called contour lines. Most of the other map symbols are self evident, but contour lines will need some explanation.

A contour by definition, is an imaginary line on the ground along which every point is at the same height above sea level. (Although occasionally, some other reference datum [starting point] is used.) When you study the map, you will discover that every fifth line, known as an index contour line, is heavier than the others. Follow one of the heavier lines and you will find a number on it. This number indicates that every point along that line is that many feet above average sea level of the nearest ocean. Let's say that the number you found was 500. Let's also say that the Pacific ocean suddenly rose 500 feet above its' mean level of 0 feet and poured into the land. The contour line marked 500 would become the new shoreline. The distance in height between one contour line and the next is called the contour interval. The contour interval is stated on the map and if the water were to rise by that much, then that is what the new shore line would look like.

The contour interval varies from map to map. On a great number of topo maps the contour interval is 100 feet. On a map of a rather level area, the contour interval may be as little as 20 feet, or 500 feet or more on a map of mountainous territories. The contour interval is determined by the scale of the map. There has to be enough contour intervals to show the 'ups' and 'downs' on relatively even ground, but not so many in hilly ground that they clutter the map.

You will probably find the contour lines a bit confusing in the beginning, but you will soon look at each hill and mountain in terms of contour lines. Then, when successive contour lines are far apart and evenly spaced they will suggest to you a gentle slope. When they are close together they will tell you the area is steep. When they run together they will show a cliff.

When contour lines cross a river or stream, they will form a 'V', and the point of the 'V' will point uphill. A 'U' shape denotes a spur or ridge - 'U' points downhill. Contour lines getting closer together on the way up indicate a concave hill. Contour lines which are spreading apart on the way up show a convex hill. Contour lines which are spreading apart on the way up show a convex hill. The heights of many points, such as road intersections, summits, surfaces of lakes and benchmarks, are also given on the map in figures, which show altitude to the nearest foot.

3-DIRECTION

A quick glance at a map will show you the relative direction in which any point lies from any other point. But when you want to find the actual direction between two points as related to the north or south of the landscape, you need to know what is north and south on the map. So where is

North? That depends Who you are, and Why you want to know, because there are four different Norths. There is Axial North, which the earth rotates on; there is True North, where the globe shows north; there is Magnetic North, where the compass points; and there is Grid North, which is the top of the map. Axial North is not always in the same place, because the earth wobbles on its axis. This is the only north that you will never use, or even hear of again. True North is the only north that doesn't move around. The only problem with True North is that nothing points to it. True North is calculated from Magnetic North. Another problem is that Magnetic North moves around, a lot. It varies from 1400 to 2200 km south of True North. Every year True North has to be recalculated, and this will be marked on the right margin of the map.

When you place a topo map before you, with the reading matter right side up, you can be reasonably certain that what's up is North, and what's down is South. If there is any doubt in your mind about the directions on the map, then look in the right margin for a drawing of two angles. This drawing will tell you where True North [TN], Magnetic North [MN], and Grid North [GN] are. True North is usually marked with a star at the end of the line, Magnetic North is usually marked with an arrow, and Grid North is marked with a square at the end of a line.

On most maps, TN will run parallel to the left and right border of the map. GN will be parallel to the vertical grid lines on the map. MN will be given in the right margin, along with the date that it was calculated for the drawing. Along with the date, will be the amount of change that there will be for that particular map.

4-DISTANCE

The first scale on the map is the "representative fraction", which is stated as a ratio, eg: 1:50,000. What this ratio means is, that if you took "1 unit" of measure from the map, it would be equal to "50,000 units" of the same measure on the ground. The next scale is the bar scale. It will be in three different units of measure. These units will be:

- miles and tenths of a mile.
- thousands of meters and tenths of one thousand meters.
- thousands of yards and tenths of one thousand yards.

There will also be, on most maps, another scale, on the bottom, or right side, that is called a conversion scale. When Canada was "Metric-fied", it wasn't practical to give odd ball metric numbers for the contour intervals, so this scale was included to convert feet to meters and vias versa. As the areas are surveyed again, the maps will be redrawn with metric contour lines.

5-DESIGNATION

Places, and other map features, are designated by name in various lettering styles. Place names, boundary names, and area names will be done in black upright or regular Roman type. Hydrographic, or water features, will be done in blue Italics type. Hypsographic, or elevation features, will be done in black Block letters. Back leaning block letters will be used for public works and for special descriptive notes.

Now that you have been given the basic language of "Map", you will have to use it in order to understand it. You have learned about compasses and maps, now you will have to learn how to put both of these travel aids together.

You will remember that the compass only points to Magnetic North, while maps are drawn to True North. You will also remember that we talked about declination. It is generally expected that all compass bearings are to be given in True North, unless stated differently. Declination is the difference between TN and MN, or TN and GN. This difference is stated in degrees east or west. Some calculation will be involved to find the declination, because MN moves around. The map will tell you what the angle of declination was at the time the map was printed or revised. The map will also tell you how much and in which direction to correct the declination each year.

The best way to set the declination on a compass is to make the calculation, then place the compass over top of the drawing on the map and adjust the declination indicated by the angles. This way there is no chance of adjusting the compass in the wrong direction. The drawing is not and was never meant to be the correct angles. The only purpose of this drawing is to show the directional relationship of the three Norths.

The declination for the south coast of BC is easterly, decreasing about ten minutes a year. If the compass doesn't have a declination adjustment, then the declination will have to be added or subtracted from the magnetic bearing to get the true bearing. Another way to allow for declination on a non-adjustable compass is to mark an orientation line, the amount of the declination, on the face to orient to. This would allow you to read the true bearing directly from the compass. Now that the compass is adjusted to the land, you are ready to use the map and compass together.

The two main reasons that map and compass are used together are:

- to plot a course for a trip.
- to plot your location while exploring.

When a course is plotted in advance, landmarks will have to be on land, from the map. To do this, the map will have to be oriented to the land. When this is done, the landmarks on the map will be in the same direction as on the land. By doing this, you will be able to get a better perspective of the land that you will be travelling on.

When a course is plotted as you go, it becomes even more important to identify the landmarks that you will be navigating by. Hills and mountains have a very nasty habit of looking just like any other, or even changing shape while out of sight. It's very important to know your landmarks for sure. If you did shoot a bearing on the wrong landmark, you could be a long way from where you want to be or think you are. A good practice is to pick a back-bearing landmark as well. This is not only insurance for the trip in, but will also help on the return trip if you decide to come out by the same trail.

The only way to understand the scope of the information that a map can give you is, sit down and play "what if" with it. By this I mean, pick a point on the map as your present location. Then pick an other point, about 5 or 6 inches away. This second point is your destination. Now that you have a start and finish point, the game can start. The point of the game is to find out how many kilometers the trip is, how long will it take, and what clothing, supplies, and equipment are needed. Your route will be planned with three different conditions, shortest route, fastest route, and easiest route. Each of these routes will have three conditions; by your self, with several others, with a heavy load. Each of those conditions will have three conditions, ideal weather, heavy rain, snow. Your route will be planned 27 times. Each time, time, distance and equipment is wanted.

Lets say that the two points you picked were 5.5 inches apart. Lets also say that the straight line is diagonally through a valley. The first "what if" is; shortest distance, by yourself, ideal weather. The first thing you do is, draw a straight line from start to finish. Now look very closely at that line. Is it a practical route? Are there any barriers like cliffs, lakes, rivers, swamps, etc? For the sake of this explanation, I'll say that there are no barriers, but the valley is very steep. Remember that shortest distance is the criteria for this route. Now you have to measure to find out if detouring over to the floor of the valley will be longer or shorter than following the straight line route. By using the scale at the bottom of the map, you will find that the straight line "as the crow flies" distance is 7 km. When you measure the detour over to the floor of the valley, you find that the "flat" distance is 8 km. The key word here is "flat" distance. It has been found, through practical experience, that if the contour lines that are crossed, are counted and multiplied by the contour interval, and then added to the "flat" distance, will give you a practical "actual" distance. Your straight line route takes you up over the shoulder of a hill, down into a valley, up over the other shoulder and down to your destination. Detouring over to the floor of the valley, which has much less of a rise, and then angling back to your destination could be "actually" shorter.

The only way to tell is to measure the flat distance and then count every contour line that will be crossed, to get "actual" distance. The next thing you have to find out is, how much time is needed to travel this route? To do this you will have to find out how fast you can walk on level ground, up hill, and down hill. A grade that is 5% or less is considered as "flat". A grade of 20% or less is considered a hill. A grade that is more than 20% is considered climbing.

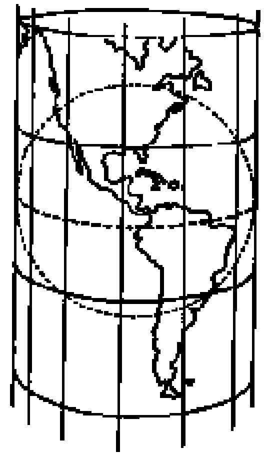
Transport Canada will not allow any public road to exceed 15%. A logging truck cannot stop on a grade that exceeds 20%. Grade % is the number of units raised in 100 units. Now that you know this, you can count all the uphill contours, plus flat distance, and get a time. Do the same for down hill to get that time. When you add all three times together, you will have the time that it will take to cover that ground. If the time is one hour or less, then that will be your travel time. If the time is over one hour then 15 min. will have to be added for each hour or part of an hour.

A responsible hiker needs to rest 15 minutes each hour to keep his legs dependable. When muscles consume energy, they give off a poison called lactic acid. The body can only deal with this in small quantities, so it stores the excess in the muscles. If the muscle has too much, it will cramp. It takes the body about 15 minutes to deal with about half of the acid that is produced. It takes several hours to deal with the other half. By stopping 15 minutes of each hour you will prevent a dangerous build-up.

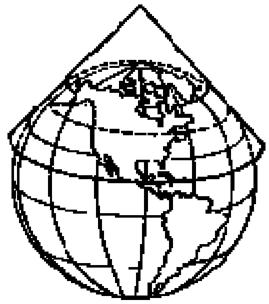
If you don't know your walking speed, there are charts that will give you a good average times for the basic hiking conditions and skill levels.

In the first "what if" situation, you now have the answer to the first two questions. The third question, equipment needed, will depend whether you know the area or not. If you don't know the area, you will have to do some detective work to find out what type of ground cover is in the area. As you gain experience reading the map, you will find that the map will give you clues as to the type of vegetation that could be there. The map will tell you how high the ground is, which way the ground faces, how steep the ground is and whether or not the ground is shaded by surrounding hills. Your detective work may involve phoning someone in the local area that can tell you what the ground cover is like. Local fire departments or police departments are a good place to start.

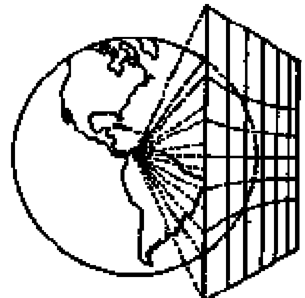
The more you use a map, the better you will become at getting the information from it. Learning to read a map is as important for the outdoorsman as reading a recipe is to a cook, and not much more difficult. Take care of your map. Rain or mist combined with folding, sweat and dust from brush, can render your map unreadable in a short period of time. You have to use your map, so protect it by putting it in something waterproof.



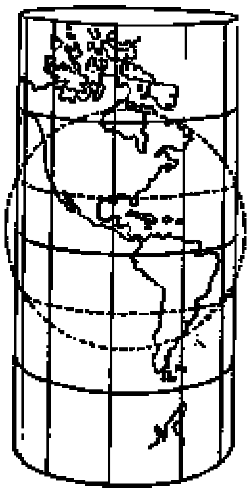
Cylindrical with one standard parallel



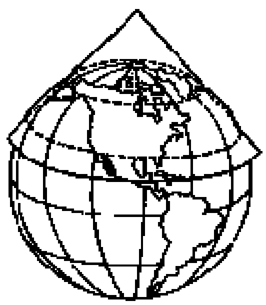
Conic with one standard parallel



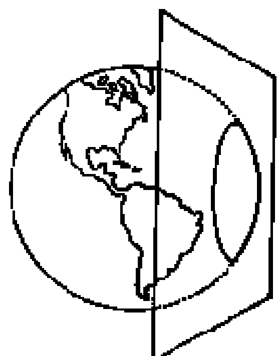
Azimuthal in contact at one point



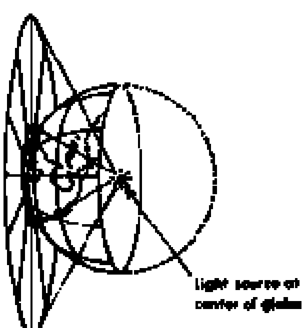
Cylindrical with two standard parallels



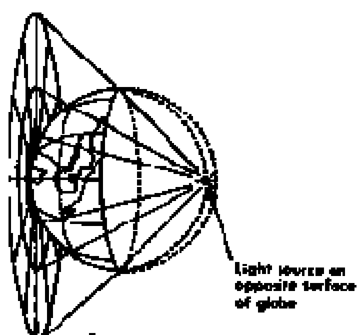
Conic with two standard parallels



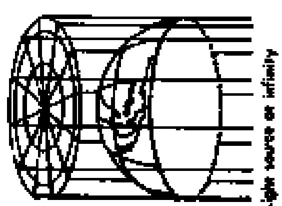
Azimuthal intersecting globe



Gnomonic



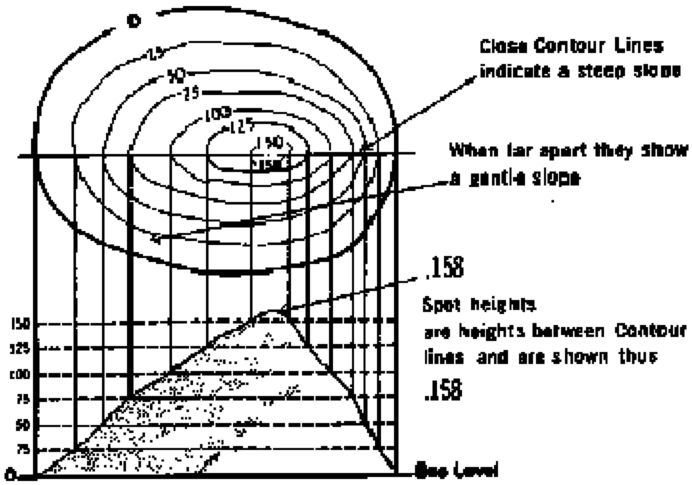
Stereographic

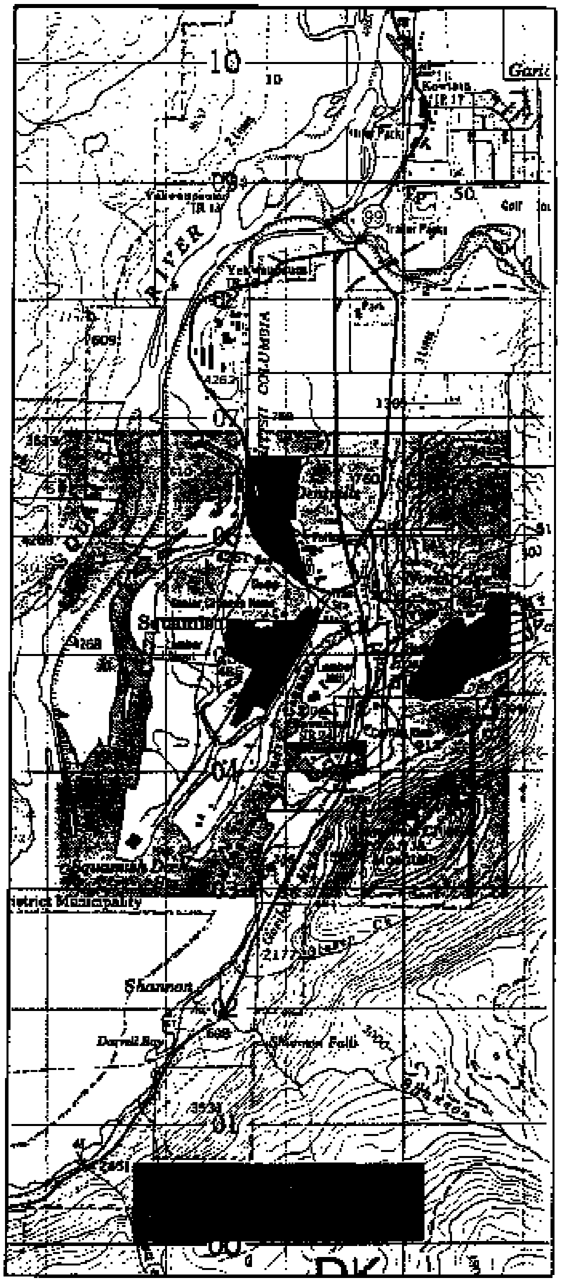


Orthographic

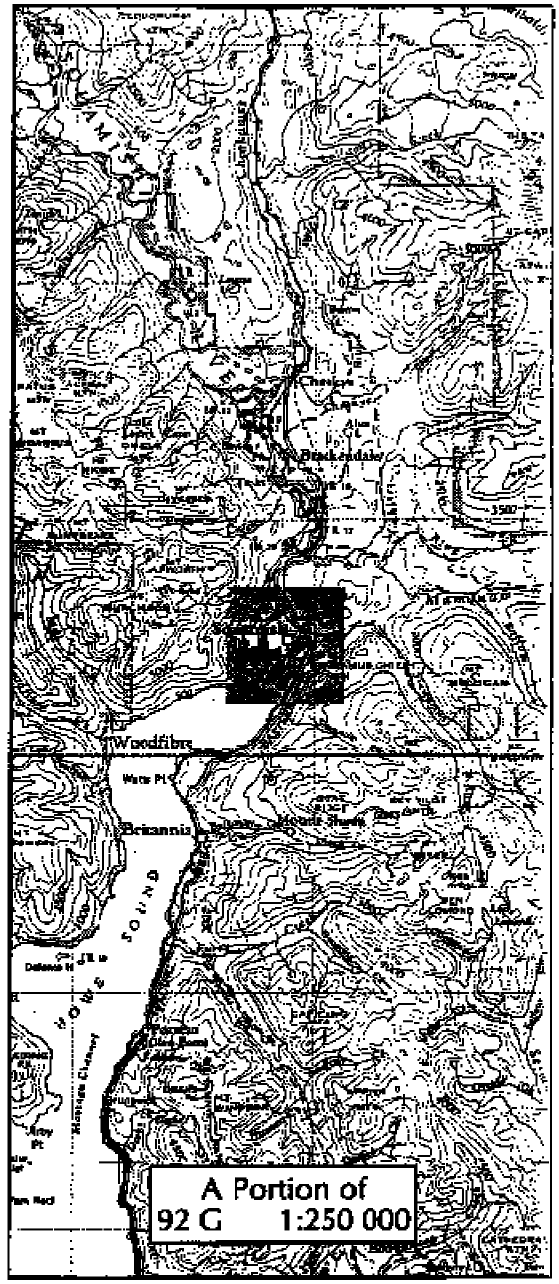
CONTOUR LINES

These are drawn through points having the same elevation. They show the height of ground above sea level in either feet or metres and can be drawn at any desired interval.

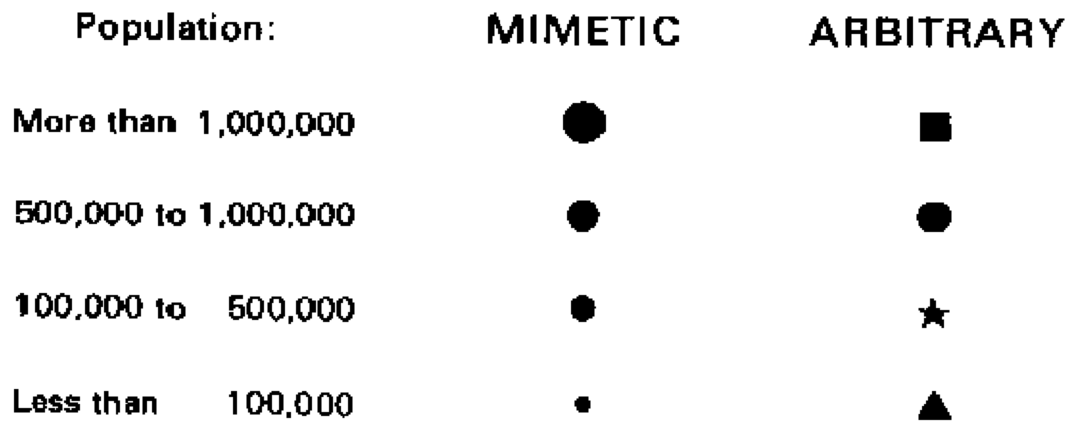


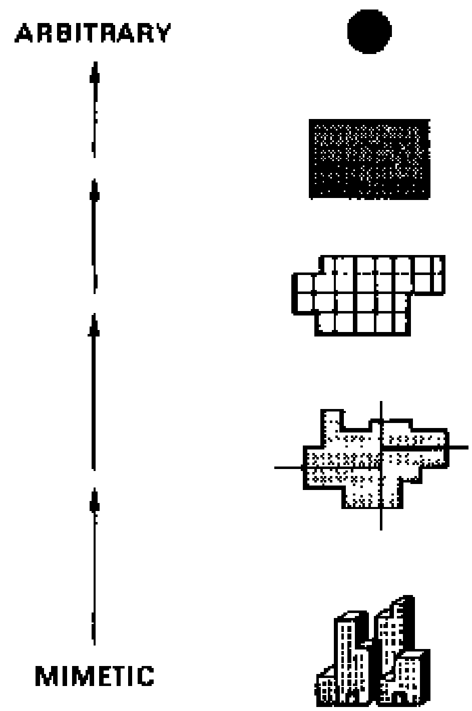


10
Squamish
District Municipality
Shannon
Shannon Falls
Darrell Bay
[redacted]

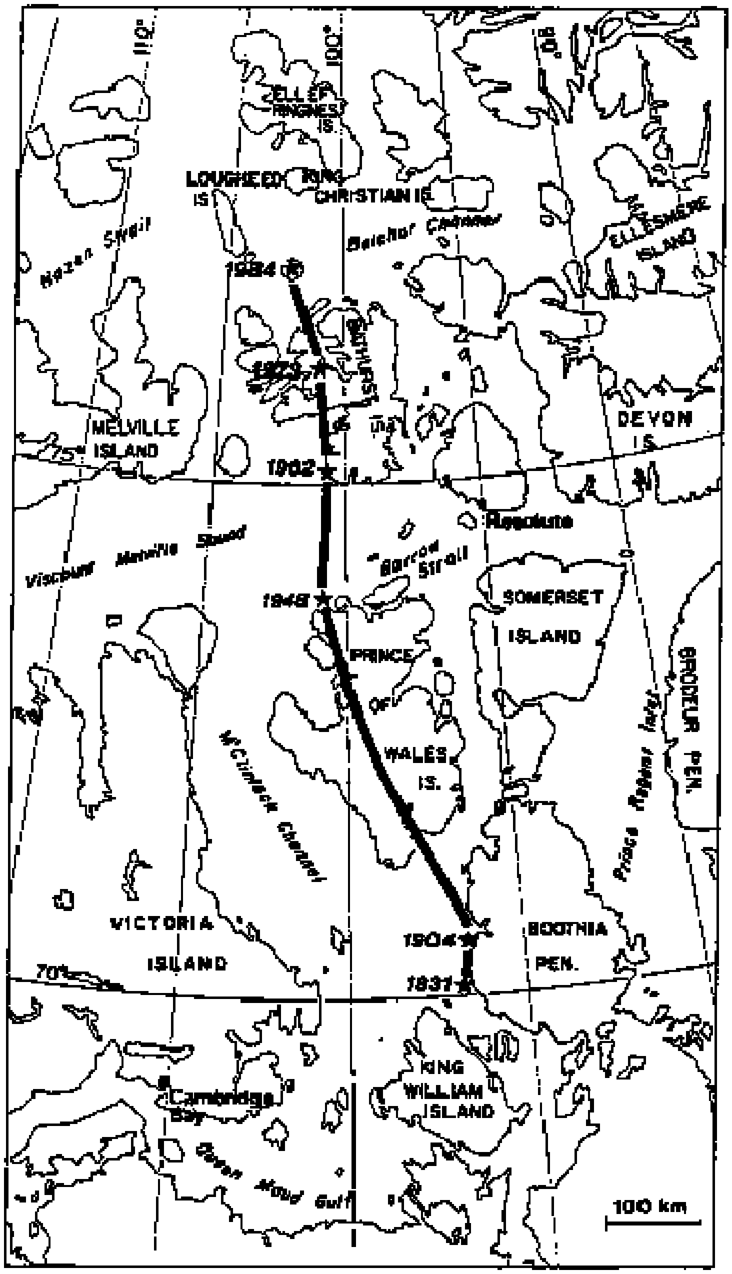


Brackendale
Woodfibre
Britannia
HOWE SOUND
A Portion of
92 G 1:250 000





An example of the mimetic to arbitrary range in representation of cities.



110°
100°
90°
ELLEF RINGNES IS.
LOUGHEED IS.
KING CHRISTIAN IS.
Belcher Channel
ELLESMERE ISLAND
Hazen Strait
1984
1973
BATHURST
1962
MELVILLE ISLAND
75°
DEVON IS.
Resolute
Viscount Melville Sound
Barrow Strait
1948
SOMERSET ISLAND
PRINCE OF WALES IS.
BRODEUR PEN.
M'Clintock Channel
Prince Regent Inlet
VICTORIA ISLAND
1904
BOOTHIA PEN.
70°
1831
KING WILLIAM ISLAND
Cambridge Bay
Queen Maud Gulf
100 km