PEHD 252 – Outdoor Education
College of Charleston
Orienteering

Basic Description

Orienteering is a sporting activity involving land navigation. The basic premise is to find marked control points located across a designated area of varied terrain. It is a timed event and requires the participant to use a map and compass to choose the best routes to follow to find the orange and white control flags.

Among the benefits participants receive are the fitness challenge of this aerobic sport, the enjoyment associated with being in the great outdoors, and there is a mental challenge paired with the physical demand. The activity lends itself well across the spectrum of competition from the intense racer to the recreational walker. Orienteering can be enjoyed by any age group and can be done in pairs or small groups.

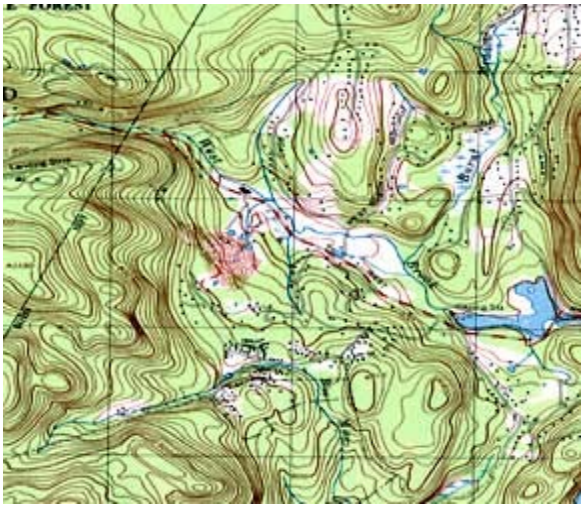
The sport got its start in 1900 in Norway. Despite navigation skills being a key element to the survival of humans throughout our history, this sport is relatively new. Interest in orienteering here in this country continues to grow.

Equipment

Topographic maps
The U.S. Geological Survey (USGS) is responsible for mapping the United States and publishing these topographic maps along with many other land use maps. To see the variety available, visit them at: http://rockyweb.cr.usgs.gov/outreach/mapcatalog .

Topos as they are called attempt to show a three dimensional perspective of the mapped area by using contour lines to indicate changes in elevation. Contours lines are always drawn in brown and connect points of equal elevation on the map. Every fifth contour line is drawn as a heavy brown line and will list the elevation numerically. The contour interval is the difference in elevation from one contour line to the next. This contour interval differs on maps and is listed in the map legend.

Two common map scales published by the USGS are the 7.5 minute and 15 minute series maps. The **7.5 minute series map** displays an area of 7.5 minutes of latitude and longitude. The map scale is 1:24,000 units or 2.5 inches per mile. The **15 minute series map** displays an area of 15 minutes of latitude and longitude. This scale is 1:62,500 units or 1 inch per mile.
For more on map scales, go: http://erg.usgs.gov/isb/pubs/factsheets/fs01502.html .



While the USGS publishes the maps, even their smallest scale maps do not show enough detail for an orienteering event. These you will have to find from area orienteering clubs and the scale of these maps is in the 1:10,000 – 1:15,000 range. The North Carolina O-club website: http://www.carolina-ok.org/ . The Georgia O-club site is: http://www.gaorienteering.org/ . No clubs have formed in South Carolina.

Identify these features of a 7.5 minute topographic map: quadrangle name, map datum, survey dates and revisions, contour lines and contour interval, declination information, UTM grid, lat/long lines, symbols used for natural terrain features and man-made objects, and what colors are used to indicate map features.
UTM grid information: http://erg.usgs.gov/isb/pubs/factsheets/fs07701.html .
USGS map symbols: http://erg.usgs.gov/isb/pubs/booklets/symbols/ .
Other USGS factsheets: http://erg.usgs.gov/isb/pubs/pubslists/fctsht.html .

Compass
There are many models of compasses available, but the orienteer will choose to use a baseplate compass. One thing that differentiates this from other compasses is that it serves as a protractor and allows the person to use it for taking bearings in both the field and from the map.

The first mention of the magnetic compass was by Shen Kua, in China in 1088 A.D. Compasses for marine use took off in the 1400-1500 period. The sighting type compass developed around 1750. In the 1930s the baseplate orienteering compass was developed. The navigator could now work with the map without first having to "orient it to north".

See if you can identify these parts of the compass: the baseplate, the magnetic needle, the compass housing, the direction of travel arrow, the orienting lines, the index line, and the scales.

Orienteering Gear
For an orienteering event, in addition to the compass and map, you will need a control description card and an electronic punching device if that is used at the meets. The control description card lists the controls and their individual code. It will also give a brief description of the land feature where you will find the control. For example, control number 1 may read "junction of dry stream bed". If the electronic punch is not being used, a paper punch with a unique imprint will be placed at each control to verify that you visited the correct location. A whistle is another good thing to carry as a way to alert others if you need help or have become lost. Gaiters, or clothing worn to protect the lower legs, are worn by many who will be trampling in the bush.

Basic Compass Techniques

Taking a field bearing

To take a field bearing of an object in the distance:

1. Hold the compass with both hands out in front of your abdominal area as you tuck your elbows against your sides. This triangular base that you formed will help improve the accuracy in sighting the compass.
2. Now rotate your body until you and the direction of travel arrow of the compass are facing the target. Next rotate the compass dial until the red end of the magnetic needle is lined inside the orienting arrow. This is known as "putting the dog in the house" or "putting red Fred in the shed".
3. Now let's double check your work. Glance from the direction of travel arrow to the target and back to the compass again. Do this three times. Do not move your head as you take your sightings, instead only shifting your eyes. If no adjustments are required, read the bearing where the index line intersects with the compass dial.

Two sites that provide excellent information on how to use the compass are:
Kjetil Kjernsmo's illustrated guide http://www.learn-orienteering.org/old/
Rick Curtis' OA Guide to Map & Compass http://www.princeton.edu/~oa/manual/mapcompass.shtml

Take a map bearing

To find the bearing from point A to point B, place the edge of the compass baseplate along the line that runs from point A to point B. Rotate the compass housing so that the orienting lines are parallel with the North lines on your map. Now read the bearing at the index line. The magnetic needle is not used during this procedure. If you are using a USGS topo map the bearing you just recorded is related to true north. You will have to compensate for the declination in your area if you wish to use the compass to set your direction in the field. Read more about declination below.

In the case of orienteering, the map is set to magnetic north. The map bearing is taken. The orienteer will then stand with the compass in the hand and rotate the body completely around and stop when the magnetic needle is in the shed. Next sight down the direction of travel arrow and follow this line to your target. There is no need to first orient the map to north.

Compass error

Regardless of how careful you are in taking your bearings some small degree of error is likely. An error of 4 degrees or less is considered acceptable. How does this error translate into how far we will wander from the intended target if we were to follow a bearing that was off by 4 degrees?

The formula is *tan* (degrees) x distance (to object). If an individual traveled one half mile and the bearing was 4 degrees in error, the person would miss the target by 185 feet. That is usually not a problem since we are usually looking for something large such as a campsite.
tan 4 degrees **x** distance to object = distance error or .0699 **x** 2,640 feet = 185 feet

Aiming off

The orienteer understanding that there will be some compass error purposefully errs to one side of the destination so as to more quickly zero in on the control. Say for example the control is located on a path a half mile down the road. When you reach the path, it is the most unlikely of events to run directly into the control by following your bearing. What will happen is you will get to the path and not see the control and then wonder which way to follow the path – to the left or to the right. Lots of time can be lost if you guess the wrong direction. A better approach is to take your field bearing and aim four degrees off to one side so that when you arrive at the path you already know that you will have to turn in the other direction to get to your target.

Triangulation

Triangulation can be used to locate your position on a map. If you can identify two landmarks in the field and on the map you can quickly approximate your position on the map. If you happened to be positioned on a baseline, one bearing is all that is needed to reveal your position on the map. A baseline on a map is typically a feature such as a road, railroad track, or stream.

To triangulate your position you must be able to account for the declination in your area. This procedure will assume that you have set the declination on your compass.

1. You must be able to identify the two landmarks in the field and on the map. It is best if the landmark positions vary by at least 90 degrees. Take the field bearing of the first landmark.
2. Place the edge of the baseplate along the point on the map of the first landmark. Now rotate the entire compass around that point until the orienting lines inside the compass housing are parallel with the map lines pointing north.
3. Draw a line along the edge of the baseplate that intersects the landmark point.
4. Follow the same procedure for landmark 2. The point where the two lines intersect shows your approximate position.

To practice triangulation, find your location on the Charleston Quadrangle using the bearings given to you by the instructor.

Declination
Declination refers to the angular deviation between true north and magnetic north at any point in this hemisphere. Most maps are oriented to true north which is the geographic point on the globe that is the northern most position. Magnetic north refers to the position on the earth that magnetic needles point. This mass below the earth's surface does move so declination values do change from year to year.

Declination differs considerably all across the U.S. See the map included below. While it is important to understand this concept for land navigation, it does seem to cause much confusion. One way orienteers have steered clear of this dilemma is by making all of their maps orient to magnetic north. In this way both the map and compass use the same system and do not require any translation.

For those who want to struggle through this, and no choice may be possible, here are a couple of mnemonics used to remember whether to add or subtract when correcting for declination.

"**Empty sea, add water**" otherwise known as MTC add W. This means when using a map bearing and setting it to the compass, add the west declination.

"**East is least, West is best**" or RALS "**Right add, Left subtract**" is another mnemonic used.

Odds and Ends

The path the sun takes each day as it rises in the east and sets in the west allows us to use it for general direction finding. Using an analog wrist watch is a quick and dirty way to determine direction. Point the hour hand of the watch at the sun. The halfway point on the watch face from the hour hand position to the noon hour spot is due south. At 9 a.m. the sun will be in the southeast. At noon it will be in the south. At 3 p.m. it will point to southwest. Ignore Daylights Savings Time as you use this method.

Definitions

Aiming Off	the orienteer aims with the intention of missing to one side of the target. This intentional error allows the individual to zero in on the target more efficiently.

Bearing	the horizontal angle measured from north to your objective.
Catching Feature	a long, natural or man-made feature perpendicular to one's direction of travel. One use of it is to indicate one has gone too far past the objective.
Contour Interval	the change in elevation from one contour line to the next.
Contour Lines	lines on the map indicating elevation changes. The lines are brown in color.
Control	marker of two colors – usually red/white or orange/white – placed in the field before the orienteering meet begins; used for locating control points on the map.
Declination	the angular difference between true north and magnetic north. Declination will be termed "x"degrees east or west, meaning east or west of the agonic line.
Dir. of Travel Arrow	the mark used to aim the compass when taking a bearing or following a bearing.
Grid Lines	lines printed on the map associated with the grid north.
Handrail	a man-made or natural feature that can lead you to your target. Railroad tracks are an example.
Housing	the part of the compass that contains the magnetic needle.
Index	where the bearing is read on the compass.
Latitude	the distance in degrees, north or south of the equator.
Longitude	the distance in degrees, east or west of the prime meridian located at Greenwich, England.
Magnetic North	the direction the compass needle points.
Orienting Lines	the parallel lines inside the compass housing. These are used in getting map bearings.
Orienting the map	turning the map until north on the map corresponds to north in the field.
Scale	the ratio between distance on the map and on the ground, e.g. 1:24,000.

Suggested Readings

Curtis, Rick. (2006). The Backpacker's Field Manual: A Comprehensive Guide to Mastering Backcountry Skills. 2nd ed. New York: Three Rivers Press.

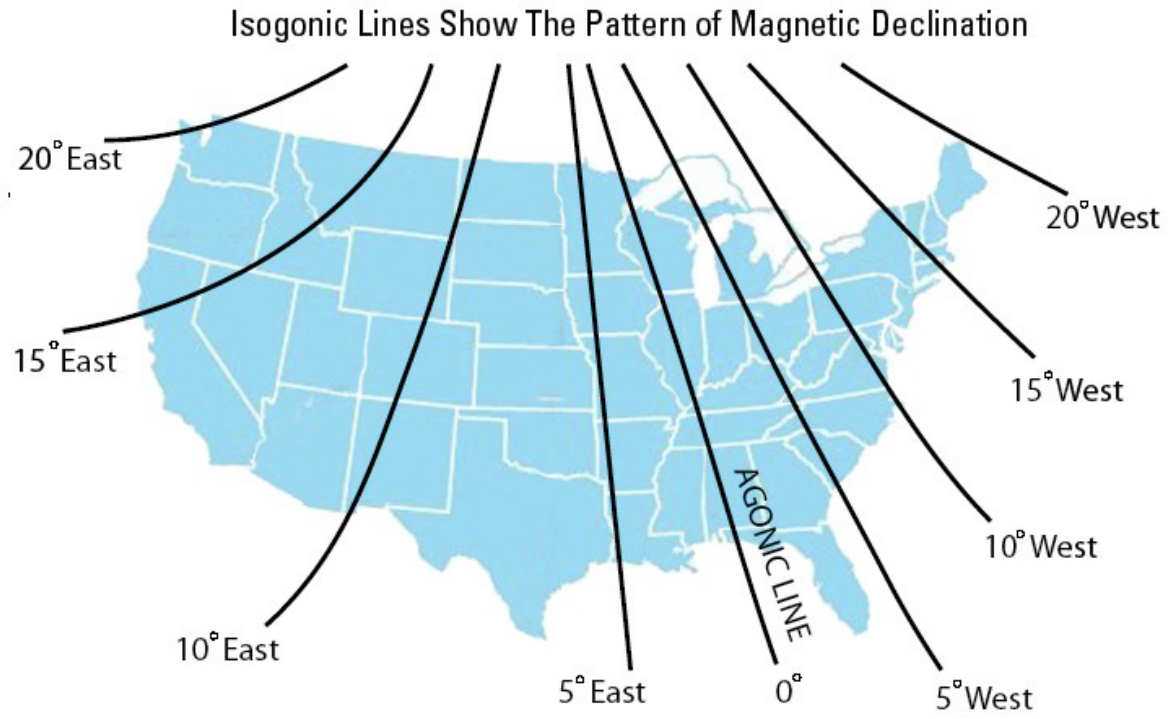
Jacobson, C. (1999). The Basic Essentials of Map & Compass. 2nd ed. CT: Globe Pequot Press.

Kjellstrom, B. (1976). Be Expert with Map & Compass. New York: Charles Scribner's Sons.

Seidman, D. (1995). The Essential Wilderness Navigator. Camden, ME: Ragged Mountain Press.

Web Sites

http://education.usgs.gov/common/lessons/gps_tips.html
http://online.wr.usgs.gov/outreach/historicPhotos/historical_photos.html
http://rockyweb.cr.usgs.gov/outreach/mapmys.html
http://rockyweb.cr.usgs.gov/outreach/topoteach.html
http://geology.isu.edu/geostac/Field_Exercise/topomaps/index.htm


Isogonic Lines Show The Pattern of Magnetic Declination
20° East
15° East
10° East
5° East
0°
AGONIC LINE
5° West
10° West
15° West
20° West