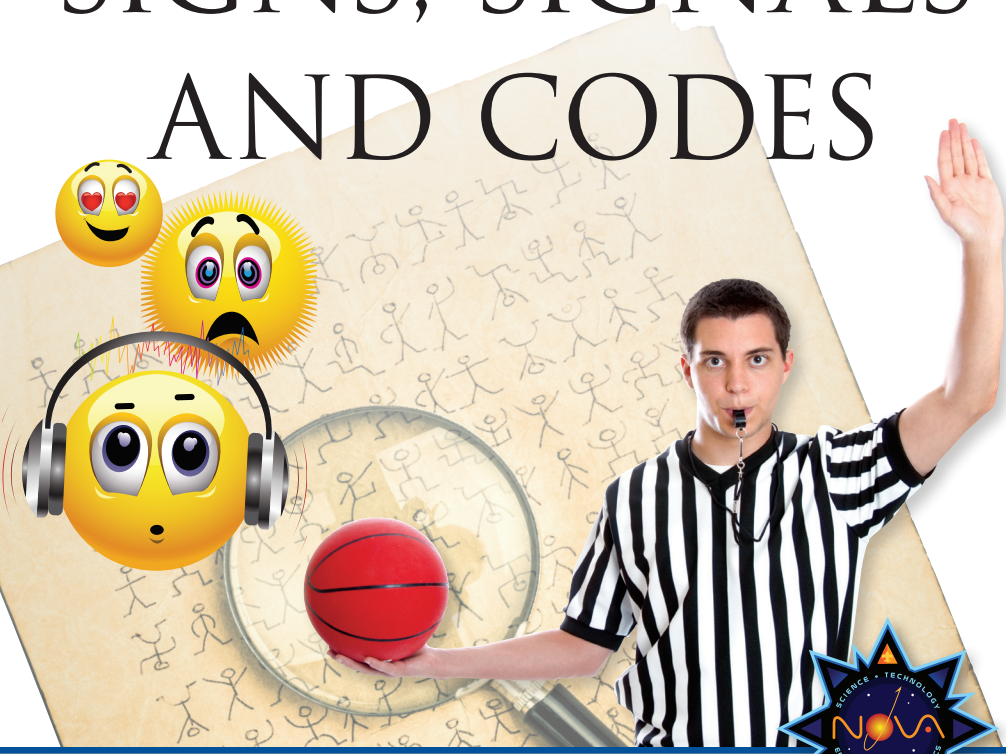
MERIT BADGE SERIES

SIGNS, SIGNALS AND CODES



Scouting America

STEM-Based

SCOUTING AMERICA
MERIT BADGE SERIES

SIGNS, SIGNALS, AND CODES

"Enhancing our youths' competitive edge through merit badges"

Scouting America

Note to the Counselor

Thank you for offering your talents as a merit badge counselor. Scouting's merit badge program succeeds because of the dedication and generosity of people like you.

The requirements for this merit badge are intended to familiarize Scouts with several forms of communication that may or may not be new to them. Traditional skills are covered, such as signaling by Morse code and semaphore. Scouts also will learn the basics of braille and American Sign Language and how these systems aid communication for people with disabilities. Additionally, the requirements highlight the ways in which signs and signals are essential in public safety, from traffic signs to tornado sirens, hurricane flags, and rescue signals.

Given the breadth of requirements for this merit badge, you, as counselor, are not expected to be an expert in all these methods of communication. Rather, you will help to guide Scouts as they explore the signs, signals, and codes introduced in this pamphlet, making the learning experience fun and hands-on. Where practical, Scouts should demonstrate the skills in an outdoor setting and use the means of communication referred to in the requirements.

Many references and resources are available to help Scouts meet the challenges presented by the requirements and to assist you, the counselor, in guiding the Scouts as they learn these skills of communication. Candidates for this merit badge are encouraged to explore beyond what is presented in this pamphlet. Local libraries and online sources offer a wealth of information including helpful illustrations, as well as opportunities for interactive practice of Morse code and other skills. For a few recommendations, see the resources section of this pamphlet.

Thank you again for your service.

35777
ISBN 978-0-8395-0060-2

2025 Printing


STOP

Requirements

Scouts should go to www.scouting.org/merit-badges/Signs-Signals-And-Codes or check Scoutbook for the latest requirements.

Contents

Introduction: A World of Signals

You live in a world of coded messages, with signs, signals, and symbols all around you. In a typical day, you will likely encounter scores of signals and signs. You will recognize many of them at a glance, from the icons on a smartphone to the traffic signs along a roadway. These are so familiar, their meanings are instantly clear to you.

Others, however, may not be so obvious. Have you ever noticed the dots next to the elevator buttons in a multistory building? Do you know what they mean? If you were seaside one summer and saw a flag flying that had a black block centered on a red field, would you recognize the warning? Do you know which rescue signals to use if you get lost in the wilderness?

In fulfilling the requirements for the Signs, Signals, and Codes merit badge, you will learn all these signals and more. You will get to know the special languages used by sports officials, military teams, and people with disabilities. You'll have an opportunity to create your own secret code and write messages that others cannot read without the code key.

Along the way, you will practice skills that Scouts have learned since Scouting began. Maybe you will never need to send a signal by Morse code or semaphore, but by learning these methods, you will be prepared to communicate in an emergency, should the situation arise. Your life and the lives of others might depend on your ability to send a distress signal when all other methods of communication fail. It's good to be ready.

The Development of Signaling

The first signals probably grew out of people's gestures. Someone long ago waved a hand, beckoning to another person to come closer. Or perhaps a stick was raised, warning a stranger to keep a distance. Though instantly recognizable, these kinds of hand signals were limited to the immediate distance over which they could be seen.

Long-distance visual communications became possible when people discovered how to make and control fire. A bonfire built on a hilltop could signal danger, or it might be understood as a summons, calling across the miles to anyone who saw it. To have clear meaning, its message would need to be decided in advance—a prearranged signal that everybody understood.

The ancient Greeks established long chains of message beacons. Each signal crew lit a fire as soon as a flicker was seen on the far horizon, passing the message from beacon to beacon. The Greek armies also discovered that, when the sun's rays fell at the proper angle, the brightly polished surfaces of their shields blazed with a glare that could be seen for miles. From this came the *heliograph*, a signaling device for flashing sunlight from a mirror.

Like beacon fires, smoke signals are also an old form of long-distance communication. In ancient China, soldiers stationed along the Great Wall signaled with smoke from tower to tower, transmitting a message hundreds of miles in a few hours. Aboriginal Australians would send up smoke to announce their presence, especially when they entered lands that were not their own. The native peoples of North America used elaborate smoke-signal codes, with each tribe having its own system of sending news, signaling a warning, or calling people together.

People also learned to send audible signals. Pounding on a hollow tree trunk produced sounds that could be heard a long way. Over time, the equipment improved, and techniques of drum signaling developed that are still used today.

In the United States, when the Erie Canal was completed in 1825, the news was sent from Buffalo to New York City in 90 minutes by a booming line of cannons spaced within hearing distance of each other.

Coded Messages

You probably know the story of Paul Revere's midnight ride of April 18, 1775, to warn of the approach of British soldiers. The famous phrase, "One if by land, two if by sea," is an example of a prearranged signal. The participants had decided beforehand what the lantern signal would mean.

Two lanterns blazing from steeple of Old North Church in Boston, per description from the church's website: "… the church sexton, Robert Newman, and Vestryman Capt. John Pulling, Jr. climbed the steeple and held high two lanterns as a signal from Paul Revere that the British were marching to Lexington and Concord by sea …"

For more complex communications, signal codes were needed. To read or decipher the message, the recipient would require the code key but would not need to know beforehand what the message said.

In the United States, Jonathan Grout had the job of building a series of semaphore relays from the island of Martha's Vineyard to Boston, Massachusetts. The system relayed news of incoming ships in Nantucket Sound. Even today, many towns along Boston's South Shore still have their Signal Hill.

A practical method of sending encoded information was designed by the Chappe brothers in France in the late 18th century. The eldest brother, Claude, was in a boarding school about a mile from the other two, and the boys wanted a way to communicate. They set up a post with movable arms attached, something like a windmill, and used levers to operate the arms from the ground. Before long, they had devised a code with dozens of different signal positions. Their system was called semaphore, from the Greek for "signal carrier."

The ingenuity of the Chappe brothers attracted official interest. After refinements were made to simplify the code, the French government financed the building of a test line. In 1794, the first "télégramme" in history creaked toward Paris over the "windmills" of the Chappe system. One station would receive the message and relay it to the next by duplicating the position of the signal arms, until finally the message was read at the last station. The French army adopted semaphore for military communications, and the system soon spread to other countries in Europe and North America.

The Electric Telegraph

During a European vacation, a young American named Samuel Morse saw the most advanced semaphore systems in action. They inspired his idea for transmitting messages using electricity instead of with mechanical movable arms. A telegraph line with 40 miles of wire was built from Washington, D.C., to Baltimore, Maryland. On May 24, 1844, before a small group gathered in the nation's capital, the first message was sent humming over the wires to Baltimore. Within a few moments, it had been interpreted and telegraphed back to the waiting crowd. The successful test marked the beginning of the modern era of communications.

By 1851, more than 20,000 miles of telegraph lines had been strung across the United States. The first successful cable across the Atlantic Ocean was completed in 1866, linking the United States with Great Britain. By 1872, the world was wired with more than 600,000 miles of telegraph lines and 30,000 miles of transoceanic cables.

Wireless Telegraphy

The next step in the development of signal communications was from wired to wireless: that is, using radio waves. By 1897, the Italian inventor Guglielmo Marconi had built the first commercial wireless telegraphy system based on radio transmissions. This system relied on Morse code for transmitting messages. (Morse code is covered in detail in the next section of this pamphlet.)

By 1920, voice transmission began to gain ground for many applications and became the basis for radio broadcasting. Wireless telegraphy continued for many military communications.

Radio voice and satellite communications have replaced many uses of Morse code and semaphore. However, both systems remain important communications methods that are still practiced in some military and ham radio settings, especially in emergency situations when regular means of communication break down. For this reason, Scouts continue to learn and use these signals.

International Morse Code

For use with his electric telegraph system, Samuel Morse developed a code of dots and dashes. The principle of Morse code is that each letter of the alphabet is formed from combinations of something short and something long, whether those "somethings" (the dots and dashes) are short and long sounds (dit and dah), short and long light flashes, or interrupted electrical pulses. Morse code can be sent using a great variety of visual or sound signals—by flashlight, headlight, searchlight, lantern, blinker, mirror, flag, horn, whistle, or radio.

Learning Morse Code

The quickest and most effective way to learn the code is by sound. You can use anything that makes a suitably short and long sound to indicate dit and dah. To tap out the code, you might practice with a switch-operated electric buzzer or maybe a Morse code smartphone app. Or you could simply use your voice and say "di," "dit,"and "dah."

Morse code was adopted by radio operators worldwide. Morse code sent by radio could be heard and understood when other types of signals, including voice communications, were disrupted by interference.

Character	Code	Sound
A	● —	di-dah
B	— ● ● ●	dah-di-di-dit
C	— ● — ●	dah-di-dah-dit
D	— ● ●	dah-di-dit
E	●	dit
F	● ● — ●	di-di-dah-dit
G	— — ●	dah-dah-dit
H	● ● ● ●	di-di-di-dit
I	● ●	di-dit
J	● — — —	di-dah-dah-dah
K	— ● —	dah-di-dah
L	● — ● ●	di-dah-di-dit
M	— —	dah-dah
N	— ●	dah-dit
O	— — —	dah-dah-dah
P	● — — ●	di-dah-dah-dit
Q	— — ● —	dah-dah-di-dah
R	● — ●	di-dah-dit
S	● ● ●	di-di-dit
T	—	dah
U	● ● —	di-di-dah
V	● ● ● —	di-di-di-dah
W	● — —	di-dah-dah
X	— ● ● —	dah-di-di-dah
Y	— ● — —	dah-di-dah-dah
Z	— — ● ●	dah-dah-di-dit
1	● — — — —	di-dah-dah-dah-dah
2	● ● — — —	di-di-dah-dah-dah
3	● ● ● — —	di-di-di-dah-dah
4	● ● ● ● —	di-di-di-di-dah
5	● ● ● ● ●	di-di-di-di-dit
6	— ● ● ● ●	dah-di-di-di-dit
7	— — ● ● ●	dah-dah-di-di-dit
8	— — — ● ●	dah-dah-dah-di-dit
9	— — — — ●	dah-dah-dah-dah-dit
0	— — — — —	dah-dah-dah-dah-dah
,	— — ● ● — —	dah-dah-di-di-dah-dah
?	● ● — — ● ●	di-di-dah-dah-di-dit
.	● — ● — ● —	di-dah-di-dah-di-dah

There is no single right way to learn Morse code. You may choose to learn the alphabet in order from A to Z. Or you might start with the letters composed only of dits, then the letters made of dahs, and then learn the letters with both dits and dahs. Or you might work according to the frequency with which letters are used in the English language: ETAOINS HRDLUCM PFWVYB GJQKXZ. Break the letters up into groups of six or seven and learn one group at a time until you can recognize each letter quickly and without hesitation.

The best method for you is the one that seems easiest or most logical. No matter how you go about it, the secret is practice and more practice.

As soon as you know a few letters, practice sending and receiving. For most people, receiving is harder than sending, so you will need to practice with a buddy to master both. Have your buddy send code while you receive it. Then switch places and have your buddy receive while you send.

Send single letters at first. Don't worry about speed. The important thing is to accurately communicate. Proceed at a pace that allows the receiver to clearly hear and write down each letter. As you become proficient with the individual letters, move on to the slow sending of complete words and then short, simple messages.

The distress signal SOS (•••———•••) is an internationally recognized call for help, whether sent by radio, flags, flashing lights, or any other signaling method.

When using a buzzer, whistle, or other sound-producing device, make each "dit" short and snappy. Make the "dah" about three times as long as the "dit." The break between the dits and dahs of a letter should be the length of a dit; the interval between letters should be the length of a dah. When sending Morse code by flashlight or blinker, make the dits, dahs, and intervals the same length as in signaling with sound.

International Morse code consists of combinations of dots and dashes representing the letters of the alphabet and numerals. To sound out the code, say "dit" for a dot (•). For a dash (—), make the sound "dah." When you say "dit" and "dah" together quickly, shorten "dit" to "di." For example, the sound for the letter A is "di-dah."

Procedure Signals

Besides learning the Morse code letters, for communicating complete messages you also must know a few procedure signals. In sending, you use the procedure signals for "attention," "error," "end of word," "end of message," etc. In receiving, you need the signals for "go ahead," "repeat," "word received," and "message received."

During emergencies, ham radio operators may handle messages for the Red Cross and other agencies. Sometimes, if power lines and cell towers are down, Morse code messages can be heard much better than voice messages.

Procedure Signals

Used by SENDER		
Morse Code	**Meaning**	**Explanation**
AAAA	Attention	I have a message for you. Are you ready to receive?
8 E's	Error	I made a mistake. I will start again on the word.
Pause (interval)	End of word	End of word. More coming.
AAA	Period	End of sentence. More coming.
AR (sent as one letter)	End of message	Message completed. Did you get it?
Used by RECEIVER		
Morse Code	**Meaning**	**Explanation**
K	Go ahead	I am ready to receive. You may start sending.
IMI	Repeat	Please send again; I missed it.
T	Word received	I understood the word.
R	Message received	I got it OK.

Amateur (Ham) Radio

Earning the Radio merit badge no longer requires knowledge of Morse code because the code is no longer used extensively in business, government, or the military. However, the code is still used by radio hobbyists worldwide, and you can hear it on shortwave radio bands today. For fun, Scouts still use Morse code or wigwag flags to communicate, just as Scouts always have. It is also valuable in emergency situations when other methods of communication fail.

To satisfy the Morse code requirement for this merit badge, you can copy the series of dits and dahs that make up each letter of the message you receive. When you have finished copying the dots and dashes, compare what you have written down against the list of Morse code characters in the chart, and write out the English-letter equivalents to see what message was sent.

For example, if you hear dah / di-di-di-dit / dit, write it like this: — / • • • • / •. Then use the chart to translate this string of dashes and dots into the word "the." Use this process to copy each word you hear, translate the Morse characters to English letters, and read the message.

Wigwag

In the past, Scouts traditionally used wigwagging to signal with Morse code. The sender would swing a single signal flag to the right for a *dit*, to the left for a *dah*, and dip the flag down in front to indicate an interval. The flag is about 2 feet square, attached to a staff 4 to 6 feet long. For signaling against a dark background (trees, for instance), the flag used is white with a red center that is about 8 inches square. For signaling against a light background, such as the sky, the flag used is red with a white square in its center. In an emergency, you can wigwag with your Scout neckerchief.

In wigwagging, letters with several dits or dahs must be made without stopping between swings of the flag. If the sender stops in the middle of A (di-dah), for instance, the receiver will read it as the letters E (dit) and T (dah).

Semaphore has been a traditional code in the U.S. Coast Guard, the Army, and especially the Navy, where its speed and simplicity have made it useful for silent signaling from ship to shore and between ships close together. The code remains in worldwide use. The Royal Canadian Mounted Police have used hand semaphore for signaling in the mountains or other situations where voice or electronic communication is difficult.

Semaphore and Nautical Flags

In the hands of a skilled signaler, semaphore is the quickest method for sending a flag message (even quicker than wigwag). But like any method of flag signaling, semaphore can be used only in the daytime and only over short distances (typically not more than a mile). The visibility must be good, with sender and receiver in plain sight of one another.

Semaphore may be signaled with hand-held flags, disks, or paddles. Flags are not required; their purpose is to make the semaphore characters more obvious. You might want to learn to signal not only with flags, but also with your bare or gloved hands—a potentially useful skill in an emergency when no flags or other signaling devices are available.

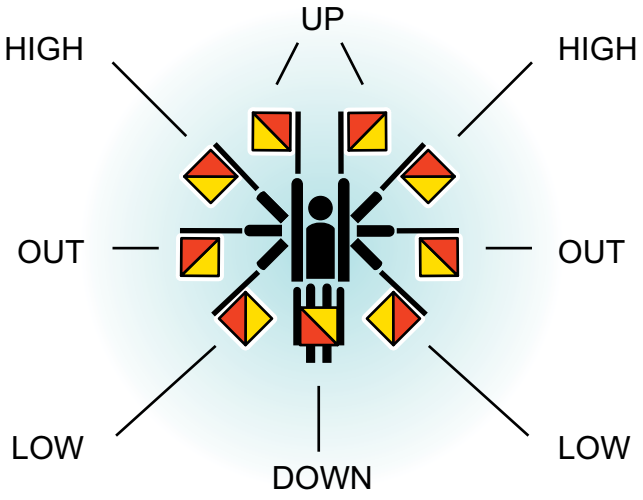
Each of the two flags commonly used in semaphore is 18 inches square and is divided diagonally into red and yellow triangles. The flags are attached to lightweight poles or staffs about 2 feet long, with the red triangle at the top and next to the staff. (Semaphore flags used at sea are red and yellow. On land, the flags are typically blue and white or red and white.)

To signal with semaphore flags, you hold a flagstaff in each hand, grasping each so that the staff is a continuation of your forearm. Place your forefinger along the staff to help you maintain the correct angle. Get a buddy to help you from the start by checking to see that you hold the flagstaff as a rigid extension of your arm.

Semaphore flag signaling takes its basic movements—as well as its name—from the earlier semaphore system of mechanical movable arms.

Learning Semaphore

Semaphore is an alphabet signaling system, with the letters formed by extending each arm in one of eight directions and placing the two flags at specific angles to each other. The pattern resembles a clock face divided into these positions for each hand: up, high, out, low, and down.



Semaphore flag positions

As you can see in the chart, the letters from A through G are made with one flag in a specific position of the "clock face" while the other flag remains at the "down" position. Similarly for succeeding groups of letters, one flag is held in a particular position while the other flag is placed at the proper angle to it. These groups of letters are called circles.

Learn and practice the letters of the first circle, then send your buddy several words made from only those letters: ACE, BAD, CAGE, EDGE, FADE, GAB, etc. As you send each letter, move crisply from the position of one into the position of the next. That is, do not flail or flutter the flags, but do insert a definite pause before you form the next letter of a word. If you must think of the next letter, hold the previous letter until the next one comes to mind.

Keep your arms stiff. Have your buddy check that you make the angles correctly. If your technique is sloppy, the receiver won't be sure of the flag's exact position. You might be holding your arm straight out in the 9 o'clock position, but if you crook the flag out at an angle, the receiver might read it in the 10:30 or "high" position.

When you have learned the first circle of letters, proceed to the next group: H through N (except J). Note that as you make each of these letters, you hold one flag in the "low" position. Practice sending words made from these letters: HILL, HIM, KILN, MILK, etc. Whenever double letters appear in a word (such as the double L's in HILL), use the rest or interval signal to separate them. Make the first letter, then make the interval signal, then immediately bring the flags again to the position of the letter.

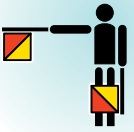
Proceed to the next group of letters, O through S. These are made with the right arm straight out from the body. Practice making words with these and the other letters you have learned: PAIR, POOR, QUAIL, RAN, SEND, SHARP, etc.

Next, learn the letters T, U, and Y, each of which is made with the right hand held high. J and V have the right hand up. Practice making these words: JAY, TOY, URN, VAN, YOU, etc.

W, X, and Z require the right hand to cross the body. Whenever you cross a flag in front of you so that both flags are on the same side, twist your body slightly in the same direction. Practice making these words: EXIT, WAY, WEST, ZERO, etc.

Instead of spelling out numbers, you may use the "numeral" signal. The first 10 letters of the alphabet, when sent after this sign, are read as numbers: A is 1; B, 2; C, 3; D, 4; E, 5; F, 6; G, 7; H, 8; I, 9; and K, 0. Generally, however, it is better to spell out numbers to avoid mistakes and confusion. Navy signalers always spell out any numbers ("ONE," "TWO," etc.) in their messages. Additionally, no punctuation marks are used in semaphore. If they are needed, they, too, must be spelled out.


A

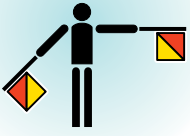

B

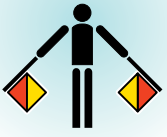

C

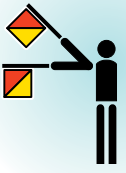

G

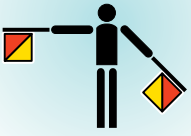

H


I


M

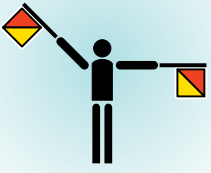

N


O

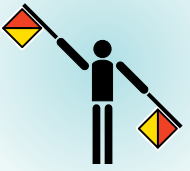

S

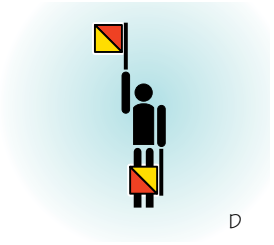

T

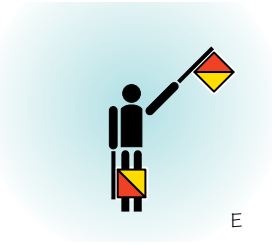

U

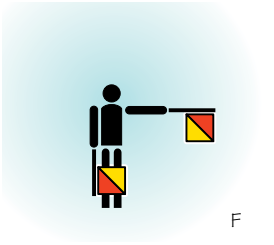

Y

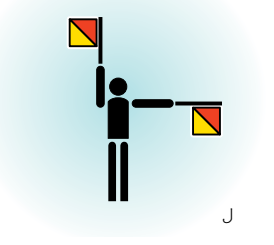

Z

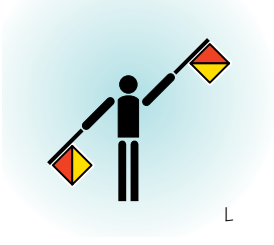

Cancel/Disregard previous signal

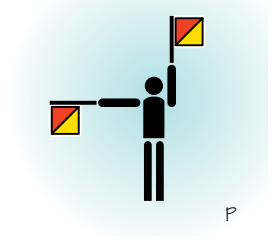


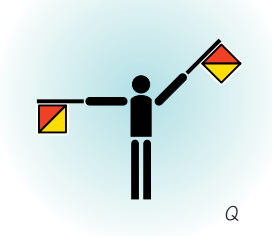


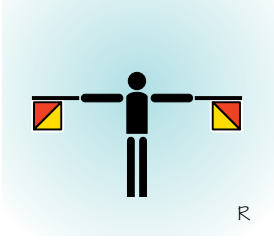


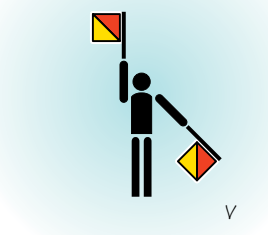


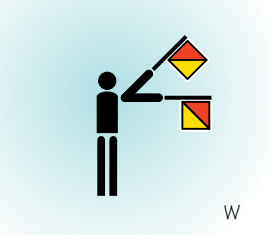


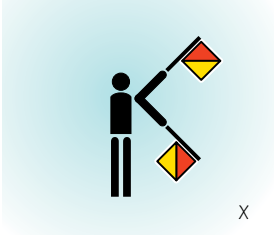












The semaphore characters presented here are shown as you would see them when facing the signaler. To learn the semaphore code, work in short sessions to memorize each character or each group of letters. There is no easy shortcut; learning the positions takes time and practice. Start slowly with emphasis on letter distinctness. Make your movements crisp so the receiver immediately knows the exact position of each flag. Practice with another Scout until the flags become extensions of your arms.

Sending and Receiving Semaphore

To send a semaphore message, first get the receiver's attention with the attention signal, made by repeatedly waving both flags up and down in a scissor-like motion. When the receiver sends the letter C, then you can go ahead. To indicate the end of a word, make the rest or interval signal by bringing the flags down in front of you with their poles crossed. Two "rests" indicate the end of a sentence. Except for the interval or rest position, the flags do not overlap.

The receiver acknowledges each word by sending C. If the receiver sends IMI ("I missed it"), it means they did not catch your last word. You repeat the word and continue from there.

If you make an error, immediately send eight E's and start again from the beginning of the correct word you want to send. End the message with AR and wait for the receiver to make the letter R (short for "Roger"). Then you will know that your message has been correctly received.

Because it is easier to send than to receive semaphore, you should practice at least half the time with a buddy sending messages for you to receive and translate. Write down each letter you see and note the intervals or pauses between words.

Nautical Flags

Though semaphore flags may traditionally be associated with ships and the sea, they are far from being the only flags seen on or near the water. Ships fly national flags to identify their countries of origin. They may raise various signal flags in emergencies ("Man overboard!") and to communicate their movements and intentions ("I am altering course"); to make requests ("I need medical assistance"); or to warn of hazards ("I have a diver in the water—keep clear," or "I am disabled and cannot maneuver," or "You are running into danger!").

As shown in the chart of flags and pennants, nautical flags (also called maritime signal flags) not only have meanings all their own, they also can be arranged to spell out words. Compare the alphabet flags illustrated here with the semaphore characters that are pictured earlier in this section. While semaphore denotes each letter by means of two identical flags that are positioned relative to a person, each alphabet flag is distinct and stands alone for an individual letter, A through Z.

ALPHABET FLAGS

Alfa — Have diver down, keep clear

Bravo — Dangerous goods

Charlie — Yes

Delta — Keep clear, maneuvering with difficulty

Echo — Altering course to starboard

Foxtrot — Disabled, communicate with me

Golf — Require a pilot. Fishing: Hauling nets

Hotel — Pilot on board

India — Altering course to port

Juliett — On fire, have dangerous cargo, keep clear

Kilo — Wish to communicate

Lima — Stop instantly

Mike — My vessel is stopped, making no way

November — No

Oscar — Man overboard

Papa — In harbor—All persons report on board. At sea-Fishing: Nets on obstruction

Quebec — Request free pratique

Romeo

Sierra — Engines going astern

Tango — Keep clear, engaged in pair trawling

Uniform — You are running into danger

Victor — Require assistance

Whiskey — Require medical assistance

Xray — Stop your intentions, watch for signals

Yankee — Dragging my anchor

Zulu — Require a tug. Fishing: Shooting nets

SUBSTITUTES

1st Substitute

2nd Substitute

3rd Substitute

CODE (Answering Pennant or Decimal Point)

NUMERAL PENNANTS

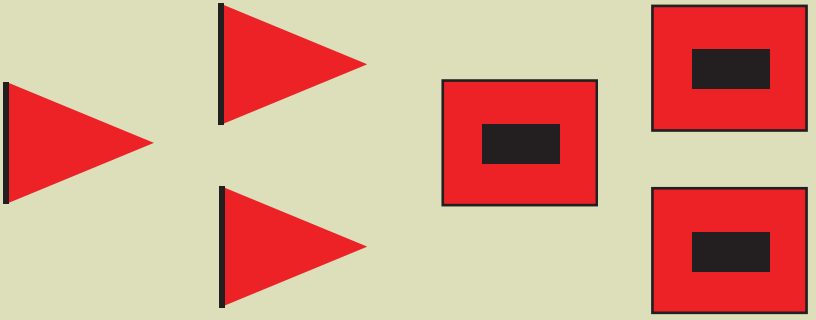
1 2 3 4 5 6 7 8 9 0

Commercial ships and naval vessels use signal flags for communications in international waters and when arriving in ports. In a vessel's signal flags, harbormasters, the Coast Guard—and anyone who knows the "language"—can read a ship's status and intentions. For example, naval vessels hoist the "B" hazard flag when loading munitions. Cruise ships in port fly the "P" flag as a signal to passengers that the ship will soon go to sea.

Besides communicating specific information, signal flags also are used in a colorful tradition called "dressing ship," in which the flags are displayed from bow to stern. "Dressing" is done for special occasions, such as launching a new craft on its first voyage, entering a port for the first time, honoring special visitors, or celebrating holidays. Stop by a marina, especially one with larger boats, on the Fourth of July and see the flags fly! It's a beautiful sight.

Maritime Warning Flags

Have you ever watched a broadcast about an approaching tropical storm or hurricane that showed two red-and-black flags flying from a U.S. Coast Guard Station? The two flags signal that a hurricane warning has been issued. Similarly, one flag signals a storm warning (with strong but less than hurricane-force winds). Two pennants warn of gale-force winds; a single pennant is a small-craft advisory. This system of indicating hazardous sea conditions tells people to seek shelter in the face of an approaching storm. If you see any of these four warning flags flying, you should not go out in a boat.



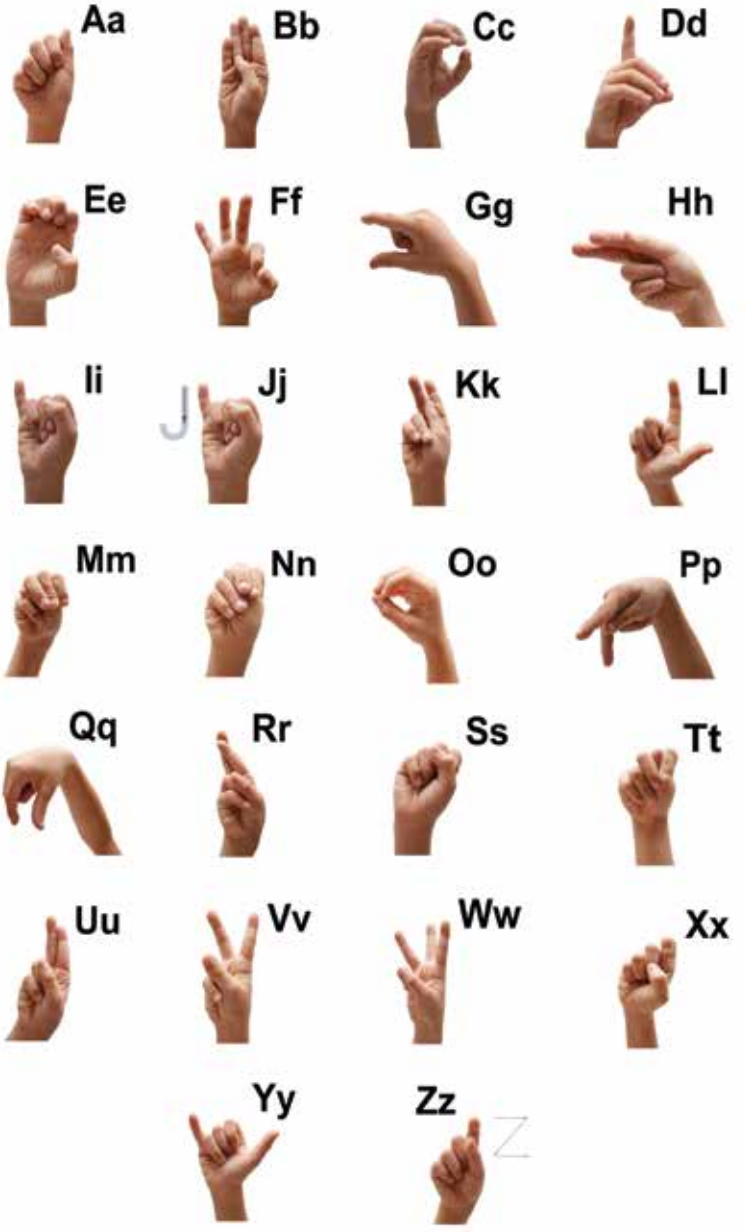
Small-craft advisory (winds up to 38 mph)

Gale warning (winds 39–54 mph)

Storm warning (winds 55–73 mph)

Hurricane warning (winds in excess of 74 mph)

With your parent or guardian's permission, find a "nautical flag translator" on the internet. Type in a phrase such as "Do a Good Turn Daily" to see how the words are represented using alphabet flags. Enter the same phrase in a semaphore translator and compare the two results. Use the two translators to spell your name with flags.



People use the American Manual Alphabet for fingerspelling to communicate with others in conjunction with American Sign Language.

American Sign Language

"Signing" is a common method of communication among people who are deaf. Signing is also done by people who can hear but who cannot physically speak. More than 100 sign languages are in use around the world. Countries have their own, native sign languages. American Sign Language (ASL) is the main sign language of deaf communities in the United States and most parts of Canada.

American Sign Language is generally considered to have originated about 200 years ago when the first schools for deaf children were opened. At the beginning of the 19th century, America had no schools specifically for deaf children. A recent college graduate named Thomas Hopkins Gallaudet had a young neighbor, Alice Cogswell, who had been deaf since she was 2 years old. Gallaudet was able to teach Alice words using drawings and writing in the dirt.

The girl's father asked Gallaudet to go to Europe to learn teaching methods for the deaf. Gallaudet studied at a school in Paris, France, learning manual communication methods (sign language) from the school's faculty members who were deaf. One of the teachers, Laurent Clerc, returned to the United States with Gallaudet to help teach American children. The two men helped to establish what would become the American School for the Deaf in Hartford, Connecticut, in 1817.

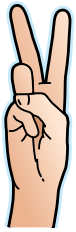
American Sign Language is a visual language that is distinct from other languages. In fact, ASL is often accepted as a "foreign" language for meeting degree requirements at many colleges. Like any language, ASL has its own rules of grammar and syntax (how words are put together). ASL has regional "dialects" or varieties, and it is a living language that grows and changes over time.

As ASL developed at the American School for the Deaf, it included features of Native American sign languages as well as French Sign Language and the personal signing systems that students brought to the school.

Learning ASL

Several components make up each ASL sign. Signs are made by either one or both hands. Each sign has a *handshape*—the shape a hand takes when making the sign. Because your hand is three-dimensional, the *orientation* of the handshape (facing you or facing away from you) is important. Where you make the sign in relation to your body is also important. For example, in the word "think," the tip of the finger touches the forehead, while the same handshape touching the chin means "disappointed."

Signs may also require movement or a distinctive body posture or facial expression. The movement can be in a circle, forward or backward, up and down, etc. Changing the movement can change the meaning. For example, the sign for "chair" is made by moving the hand up and down twice; the sign for "sit" is made by moving the hand down once. A simple change of movement alters the sign's meaning.



V handshape

Bent V

Closed hand

Flat hand

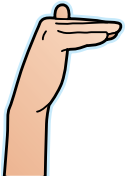
Curved hand

Claw hand

Cocked index

Open hand

One-hand index



Bent hand

Shown are some common handshapes used in American Sign Language. Knowing the names of these handshapes is important because ASL classes, dictionaries, and instructors use these terms to describe how to make signs. It is also important to know how to correctly form these handshapes because changing the handshape of a sign changes the sign's meaning.

As you begin to learn ASL, keep in mind that the language is not based on English. Its grammar does not resemble the grammar of spoken English. ASL is a different language entirely.

When you are beginning to learn ASL, it's generally easiest to start with common signs and phrases. These include signs or phrases for greetings, introductions, family members, numbers, colors, frequently used nouns and verbs, the Scout Law, and the Scout Oath or Promise. You might also learn signs for giving directions, helping in first aid or emergency situations, telling time and dates, and asking common questions.

Learning ASL is similar to learning any foreign language. It takes time, patience, hard work, and practice. Work with your merit badge counselor to arrange basic lessons with someone who is fluent in ASL. Or for information on self-study courses, online video tutorials, and practice apps, see the resources section of this pamphlet.

Stop

Go

Busy

Native American peoples used sign language to communicate between tribes that did not share the same spoken language. The manual signs represent not only things in nature, such as rivers and mountains, but also emotions, sensations, and ideas. For example, slowly turning the hand, relaxed at the wrist, indicates doubt or possibility; a similar gesture, with quicker movement, is the question sign. The sign language of the Plains Indians of North America is so sophisticated that a detailed conversation can be carried on using gestures alone.

Fingerspelling

Many people who are deaf learn to fingerspell by using hand shapes and positions that stand for the 26 letters of the English alphabet. Fingerspelling is like writing in air. The chart at the beginning of this chapter shows how each letter of the American Manual Alphabet is formed.

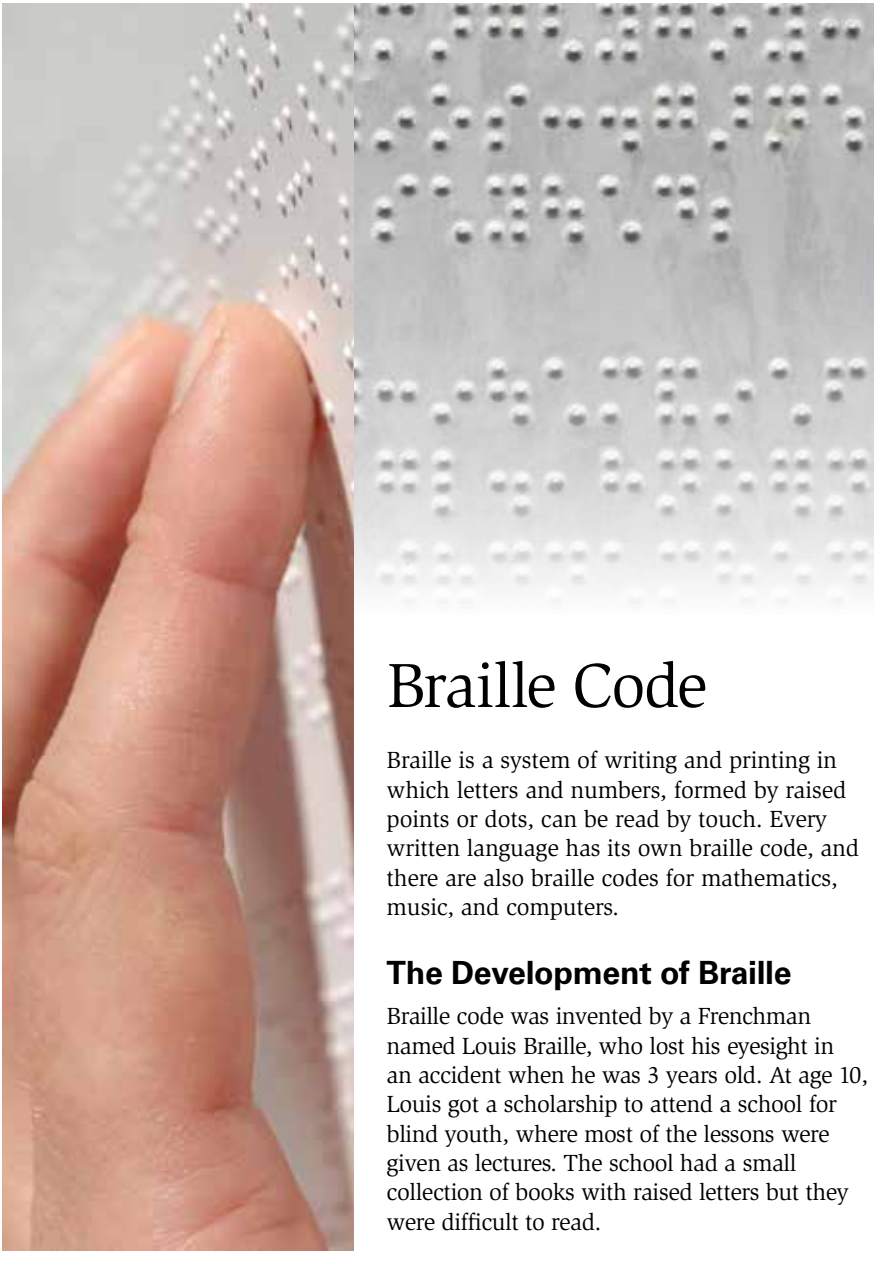
Fingerspelling uses the handshapes of ASL. Notice, for example, that the signs for P and K use the same handshape but different hand orientations.

Be aware that fingerspelling and American Sign Language are not the same. Fingerspelling is only a minor part of ASL. The manual alphabet is used mostly for spelling out proper nouns (like people's names) and for terms that have no matching sign in ASL. You can use the manual alphabet to spell your first name as part of fulfilling the requirements for this merit badge.

Practicing ASL

When you communicate with someone who is deaf, maintain eye contact. Looking away is considered rude. Do not expect the person to read your lips. Not all people who are deaf are able to read lips.

As you sign, go slowly. Don't be embarrassed to ask the person to repeat a sign or to slow down. Most people who are deaf will welcome your attempt to communicate and will be patient with you. Remember that ASL is a gestural language that does not follow the same pattern as spoken or written English, but if you aren't sure how to sign a word or phrase, then fingerspelling it letter-by-letter is appropriate.



Braille Code

Braille is a system of writing and printing in which letters and numbers, formed by raised points or dots, can be read by touch. Every written language has its own braille code, and there are also braille codes for mathematics, music, and computers.

The Development of Braille

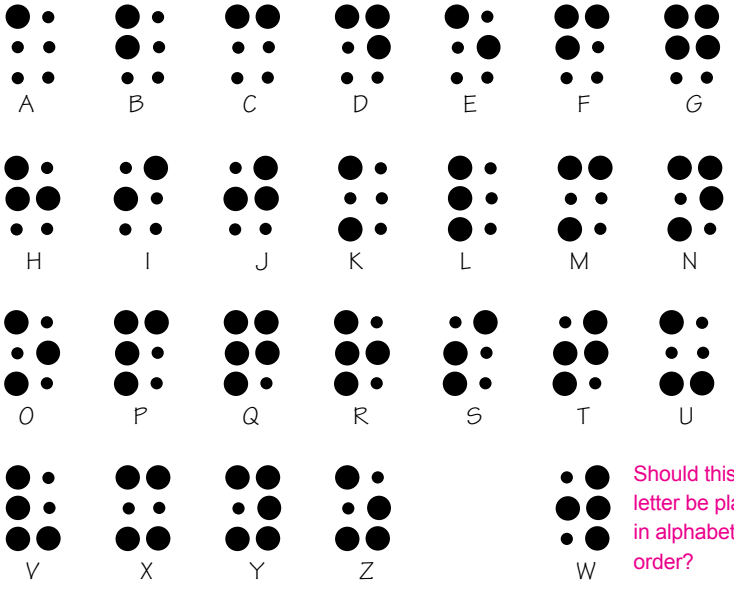
Braille code was invented by a Frenchman named Louis Braille, who lost his eyesight in an accident when he was 3 years old. At age 10, Louis got a scholarship to attend a school for blind youth, where most of the lessons were given as lectures. The school had a small collection of books with raised letters but they were difficult to read.

When Louis was 12, a former soldier named Charles Barbier visited the school and demonstrated the "point writing" code he had invented. Barbier had developed the code at the request of Napoleon Bonaparte so that soldiers could communicate secret information silently and without a light at night. The code used a *cell*, or template, with two columns of six dots each. This meant that a total of 12 raised dots could be required to represent a single symbol or character. The cell was too large to fit under a fingertip—it could not be recognized with a single touch—and Barbier's code was too hard to read and learn, so it was not successful.

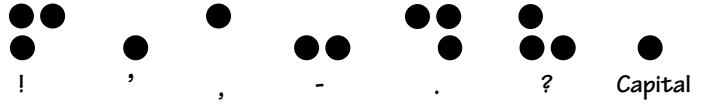
Louis, however, saw the code's possibilities for enabling people who are blind to read and write. He set out to revise and simplify the code. By 1829, he had reduced Barbier's 12 dots to six, creating the braille cell that is the basis for modern braille code. Each letter, number, and punctuation mark is made up of one to six raised dots arranged in a cell that is two dots wide and three dots high. People read braille by lightly passing their fingertips over the dots.

Louis Braille (1809–1852)

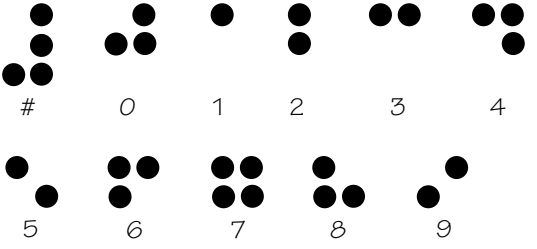
Born Jan. 4, 1809, in a small town near Paris, Louis Braille was an intelligent and creative child who had a good ear for music. After accidentally blinding himself while toying with an awl—a pointed tool for making holes—in his father's workshop, Louis went on to become not only a top student at the Royal Institute for Blind Youth, but also an accomplished cellist and organist. As a teenager, he developed the tactile (touchable) code that bears his name, and he published the first braille book when he was 20. At first, his code was not widely used. Even at the school where Louis became a professor after he graduated, braille was not taught until after his death. By 1868, however, braille began to spread worldwide and today nearly every country uses braille.



The braille alphabet



Most punctuation marks are formed using the dots in the lower two rows of the cell. A lower-right dot placed in front of a word indicates that the word begins with a capital letter.



Numbers are formed by placing the braille number sign (#) before the braille letters A through J.

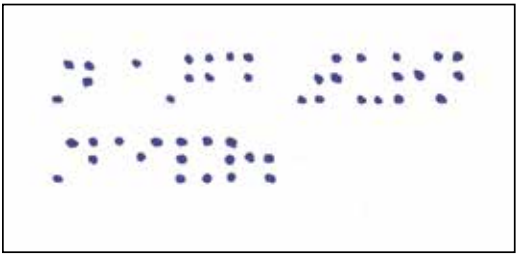
The Braille Alphabet

The braille alphabet is shown here. Notice that the first 10 letters (A–J) use only the dots in the upper two rows of the cell. The next 10 letters (K–T) are formed by adding the lower-left dot to each of the first 10 letters. The remaining letters (except W) are formed by adding both lower dots to each of the first five letters. The letter W is an exception because the French alphabet did not have a W when Louis Braille created the code in the 1820s. The symbol for W was added later.

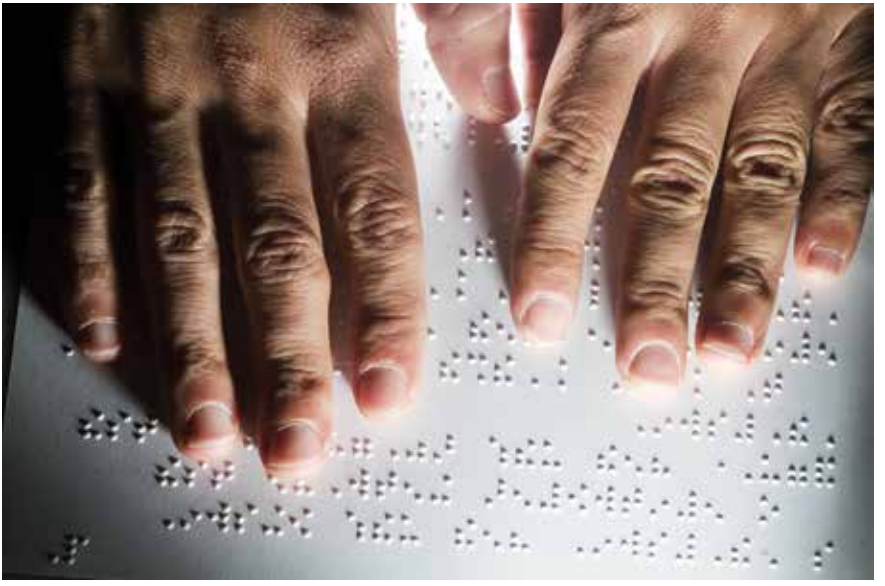
Writing Braille

The raised dots are embossed in heavy paper by hand or by machine. The characters are embossed from the back of the paper, working in reverse, and are read from the face of the paper in normal reading direction.

People can write braille code by hand, using a slate and stylus; or the code can be typed by striking keys on a braillewriter. Software programs also exist to translate braille, special computer printers can emboss braille dots on thick paper, and braille displays can make the characters on a computer screen appear on a touchable surface. Other devices in use today include electronic portable note-takers with braille keyboards and synthesized voice readouts.



To satisfy the braille writing requirement for this merit badge, you do not need to emboss braille dots in thick paper. Rather, you may use a pencil or pen to draw the dots on ordinary paper, copying the characters of the braille alphabet to spell out your message letter by letter.



Reading Braille

People who are blind learn to read braille by touch, and people who have vision learn to read it by sight. A person who is blind must learn to recognize all of the braille characters before learning how to read.

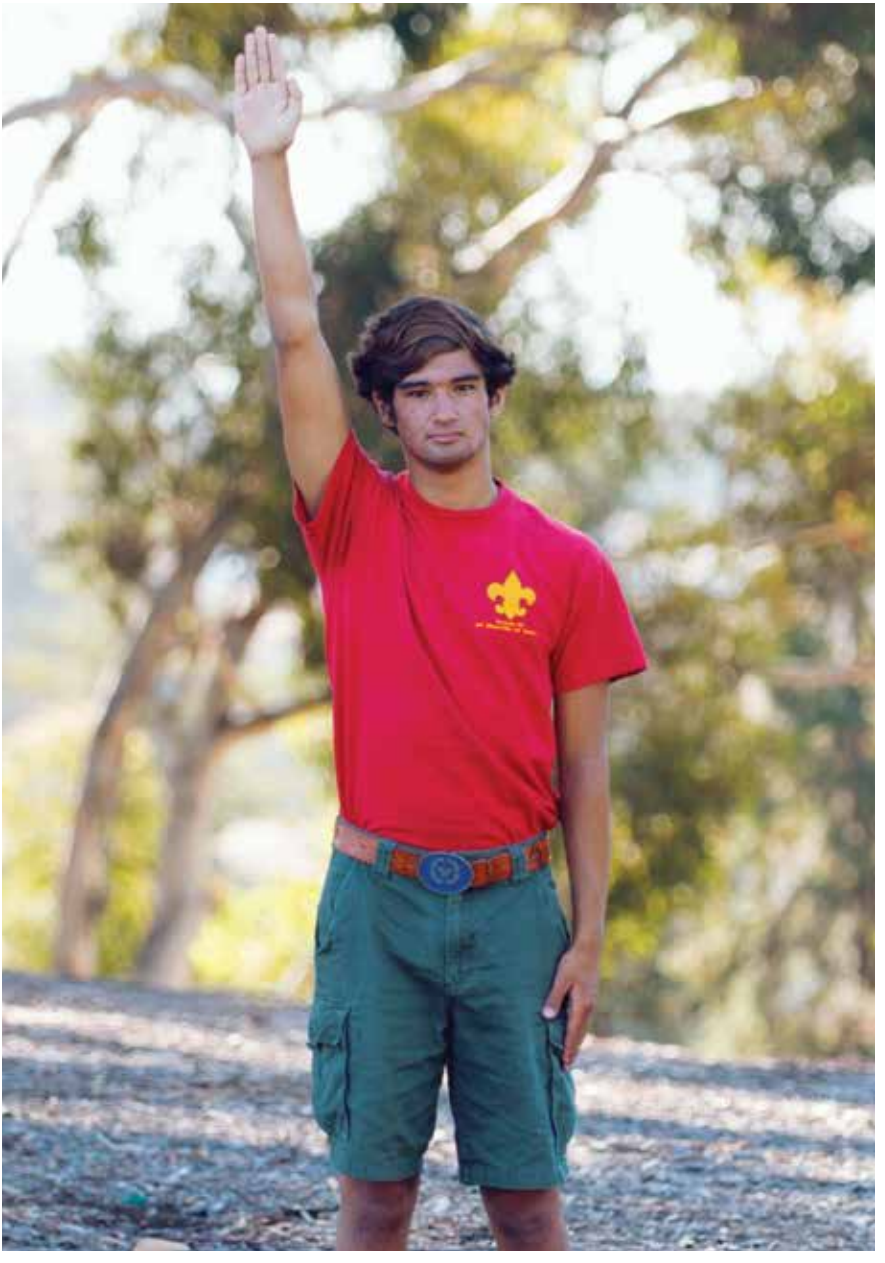
To recognize the braille characters by touch, a person must first develop the ability to tell the difference between line thicknesses and symbols using the fingertips. In a technique called tracking, the fingertips glide lightly and quickly across the lines of raised dots, moving from left to right (horizontally). Vertical tracking, or rubbing the dots up and down, is considered poor technique because it slows the speed and accuracy with which a person reads braille. Reading vertically is called "scrubbing."

If you are learning to read braille by sight, try making a set of flash cards to help you memorize braille letters, numbers, punctuation marks, and special symbols. You can make your own cards, or search the internet (with your parent or guardian's permission) for free printable flash cards.

A skillful braille reader may use the "scissor" reading technique: the left hand reads to the middle of the line, then the right hand takes over and reads to the end of the line, and then the left hand drops down to the next line of dots and continues reading. A good braille reader has a light touch, only "tickling" the tops of the dots.

Helen Keller (1880–1968)

Alabama-born Helen Keller was only 19 months old when a serious illness left her unable to see or hear. She was largely cut off from the world, frustrated by her lack of language and limited ability to communicate, until age 7, when her parents hired a teacher named Anne Sullivan. Anne taught Helen letters by making the signs for them in her palm. Relying on her sense of touch, Helen learned sign language and braille. As a 10-year-old, she learned to speak. At 24, Keller graduated with honors from Radcliffe College, becoming the first deaf-blind person to earn a bachelor's degree. She worked as an author, political activist, and lecturer, traveling extensively to speak on behalf of people with disabilities. The lifelong relationship between Helen Keller and her teacher and companion, Anne Sullivan, inspired a famous play, "The Miracle Worker," by the author William Gibson.



Silent Scout Signals

Scouts use silent signals to direct their patrol and troop in activities at camp, meetings, ceremonies, and other events. As with any visual signal, silent Scout signals require attention from the receivers and a clear line of sight to the sender. The signals can be anything the group wants to use, as long as the sender and the receivers understand beforehand what the individual signals mean and how to respond to them. For example, the Scout sign, when held high, calls the group to silent attention.

Gathering

For gathering the group together, the leader may use an arm held high above the head and moved in a circular motion.

After getting the group's attention with the gathering signal, the leader may extend the arms straight out to the sides at shoulder height, which directs the members of the unit to line up in straight lines in front of the leader. Holding the arms partway up is a signal to form a half circle facing the leader. The leader could also gather the members of the unit and then hold one arm straight out to the side or straight in front, directing everyone to line up in single-file formation. Then the leader might use an overhead pulling motion while moving off in the desired direction of travel, indicating "follow me."

In the outdoors, loud shouts frighten away the wildlife. Silent signals preserve the peace of the wilderness and enhance the possibilities of seeing animals in their natural habitat.

Other Common Signals

Other familiar hand signals include:

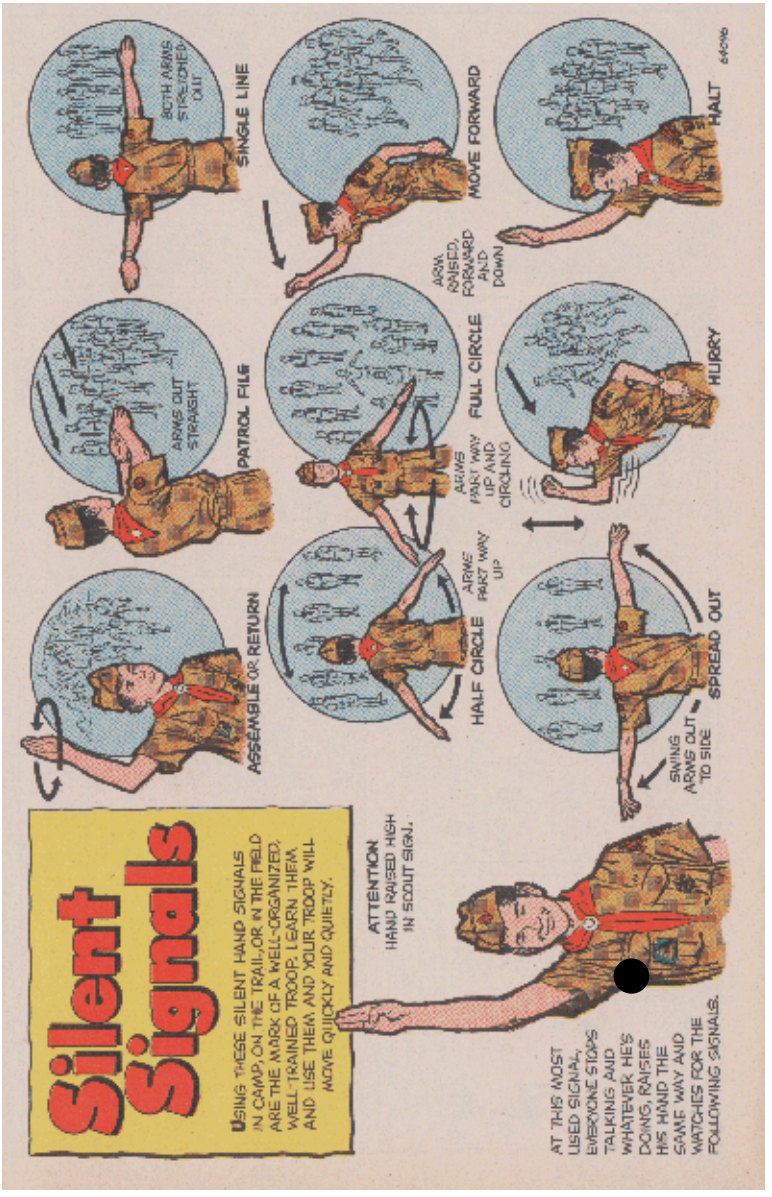
- "Go that way" or "Move farther out"—Hand held high and moved away from the body in a certain direction
- "Hurry up" or "Faster"—Hand held in a fist and pumped up and down over the head
- "Stop"—Hand held motionless above the head
- "Get down!"—Hand held palm out at the end of the outstretched arm, then moved sharply toward the ground (accompanied in an emergency by a vocal signal yelling out the command, directing the group to squat or lie down)
- "No" or "Disregard"—Hand held open and moved several times from side to side across the face

Flags and Lights

One or more flags can be used to convey silent signals over longer distances. A flag such as a patrol flag is larger than a hand and can be seen from farther away. To improve the distance over which group signals may be seen and understood, lights may also be used, especially in darkness.

Other Messages

The group may establish any number of signals to convey other messages, as many or as few as the group members need and can remember. The signals should be easy to remember, but they also must be practiced until they become second nature for the group using them. In an emergency, there will not be time to look up the signal in a book or ask someone what it means.



These silent signals appeared in the October 1964 issue of *Boys' Life* (now called *Scout Life),* but they can still be used today to communicate quietly and effectively.


QUEENS GARDEN
END OF TRAIL
TO NAVAJO LOOP
SUNSET POINT 1.4 MI.

Trail Markers and Rescue Signals

Trail signs help hikers find their way. Many recreational areas have established trails that are well-marked. In some areas, however, networks of trails intersect with no signs to help hikers travel to their destination. Other, more remote areas may have few or no well-defined trails. On your Scout outings, especially wilderness treks, you need to know how to follow and how to make trail markers.

Cairns and Blazes

A cairn, a traditional method of marking trails, is simply a pile of stones. Some cairns are small and identify the trail along which you are traveling. Other cairns are large and high enough to be visible over long distances such as in the desert, along waterways and coastlines, or in mountainous regions.

Another traditional marking method is trailblazing. Originally, blazes were marks chopped into trees to show the direction of travel. This method is not used today because it damages the environment. Instead, modern blazes take the form of metal, wood, or plastic pieces attached to posts or other objects. Or marks may be painted on trees, rocks, or other surfaces along the trail.

During the era of westward expansion in America, large cairns were built, often on high hills and mountains, along trails like the Oregon Trail, Santa Fe Trail, and California Trail. Travelers could see the cairns for miles, and maybe for days, marking the safe crossings of rivers and through mountain passes. Some of these cairns still stand today, more than a hundred years later.

In mountainous areas, different colors of blazes may indicate the difficulty levels of hiking trails, similar to how green circles, blue squares, and black diamonds are often used to identify the difficulty levels of downhill or cross-country ski trails and hills.

Blazes are often brightly colored to contrast with the surrounding forest or terrain. Usually they are placed from knee high to eye level and are spaced so that the next blaze is visible from the last blaze along the trail. When following markers and blazes, hikers may find multiple marks of different colors or designs on the same tree, rock, or signpost. The different marks typically indicate side paths branching off from the main trail. To avoid taking the wrong path, hikers must stay alert to changes in trail markers and watch for places where the trail forks or turns aside from the desired direction of travel.

Always prepare ahead by studying the area where you plan to hike. Learn about the terrain, whether and how the trails are marked, the dangers you may face, and any special no-trace considerations. Remember that it's best to stay on established trails and limit or avoid cross-country travel to avoid damaging the environment. Always carry a good compass and a map of the area—do not rely entirely on GPS, which can and does fail. Always have a plan and a backup plan, and let others know when and where you are going and when you expect to return.

Well-known trails like the Pacific Crest and Appalachian Trails use a variation of blazes. Emblems on posts mark the thousands of miles of these national trails.

Marking Trails

Following trail signs can be tricky when the markers have faded or crumbled from age, weathering, or other types of damage. In situations where signs are absent or inadequate, hikers may create temporary trail markers using the available materials, such as twigs or pebbles. Or you can leave simple trail signs for others to follow by scratching in the ground with a stick. A pointed arrow means "This is the trail," while an X warns "This isn't the trail—don't go this way." A square with a number in it and with an arrow can mean, "Proceed in this direction, as many steps as the number says." A circle with a dot in its center specifies that "This is the end of the trail," or it may mean "I have gone home."

Scout trail signs

"This is the way." **"Proceed 3 steps this direction."** **"This is not the trail."** **"End of the trail" or "Gone home."**

When following a trail marked with these kinds of impermanent or improvised signs, use your eyes and do not rush. Be sure each sign is actually a marker and not something you are imagining. If you suspect you have missed a sign, return to the spot where you brushed out or undid the last one and start again. (If you fail to erase the signs as you go, you may cause great confusion for other hikers or even yourself the next time you travel the same path.)

Markers may be adapted from Native American trail signs, using grass knotted into tufts, sticks pushed into the ground, small stones stacked in low cairns, or pebbles arranged as arrows.

Leaving No Trace

Trail signs can be either permanent or temporary. Temporary blazes are used especially in wilderness areas. No-trace principles apply, however, regardless of whether the area is heavily hiked or virtually untrammeled. When you lay out a trail for your patrol or troop to follow, be sure afterward to remove your temporary trail markers. Generally, the person who marked the trail is responsible for removing the markers. Or, in a group of hikers, the last person down the trail may have the job of clearing away your temporary markers. *Do not* remove or alter permanent trail signs.

Rescue Signals

Knowing basic rescue signals could save your life, the life of a fellow Scout, or even your family. To attract the attention of rescuers, use signals to make yourself audible or visible.

Audible Signals

If you become separated from your group, shout for anyone within earshot, and use your whistle (which you should always carry with you). Searchers may be close to you but unable to see you. To signal your location, blow on a whistle in groups of three blasts. (A combination of any three signals is a universal sign of distress.)

Ground-to-Air Signals

To attract the attention of aircraft overhead, lay out large, angular ground signals. You can make standard ground-to-air symbols (shown in the illustration) by arranging brightly colored tents, tarps, rescue blankets, or strips of fabric in an open area; by stamping down sand or snow with your boots; by pulling out clumps of turf; or by lining up branches, logs, stones, or any available materials that contrast in color with the background. Make the symbols as big as you can—10 feet high or larger, if possible.

Construct these signals quickly, if you have reason to expect an air search. Search planes will likely cover a large expanse in a systematic pattern, flying over small sections of the area one after another and crossing off a section if no trace of you is seen there. If you are in that section and searchers fail to see you, then you might have a long wait before they return for a second look. To make your position known as soon as possible, lay out ground signals without delay.

V	X	N	Y	↑
REQUIRE ASSISTANCE	REQUIRE MEDICAL ASSISTANCE	NO	YES	PROCEEDING IN THIS DIRECTION

Ground-to-air signals are passive visible signals, requiring no further effort once completed. Such signals work even if you are asleep or ill when a search plane comes. Upon rescue, dismantle all ground signals.

Use any items you have that might help rescuers see you. An orange cloth, orange garbage bag or poncho, bright clothing, or anything brightly colored can help attract rescuers' attention. Search-and-rescue personnel report that it is difficult to see someone who is standing motionless on the ground and not trying to attract attention. Things that move are more noticeable than things that stay still. You can increase your chances of being seen by making a tripod to suspend your orange poncho or bright clothing so that it flutters in the breeze.

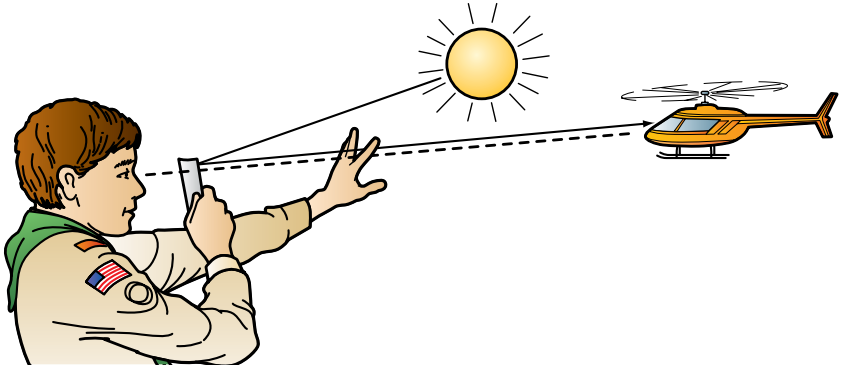
People sometimes hide from rescuers, mistakenly thinking they will get in trouble for being lost. Do not hide! Focus on getting found. Do what you safely can to help rescuers see or hear you, but avoid putting yourself in danger. Do not do anything that might cause you physical harm. An injury would only make matters worse. Also avoid aimless wandering, which could get you even more lost. You might move to a clearing so that rescuers can see you more easily, but do not move far from where you were when you first realized you were lost. Rescuers might be Scout leaders, police officers, national guard members, or firefighters, but often they are volunteers. Don't make their job harder than it already is. Stay put in a safe location. Rescuers may have a large area to search—do not make it bigger by moving around a lot.

Active Visible Signals

Besides constructing ground signals, use *active* signals such as mirrors, fires, smoke, and flares. Smoke is most visible in daylight; fire at night. Much of the United States is under a constant fire watch, and any unusual smoke will be investigated (probably by air) even if no one knows you are missing. Make a dense column of smoke by laying wet, green leaves and branches, evergreen boughs, or moss on a fire.

Three fires, spaced equally apart, make a standard distress signal. Build the second and third firelays about 50 yards from the fire that is burning, locating them so the three form the points of a large triangle. Keep a torch of flammable material near the blazing fire, and as soon as you hear an approaching aircraft, quickly light the additional fires. *Be certain you can contain any fire you start*. An out-of-control blaze would put you in grave danger.

On a sunny day, airborne rescuers can see the flash of a mirror from many miles away. If the mirror in your survival kit has an aiming device, use it. If not, hold the mirror in one hand near your face, extend your other hand in front of you, and tilt the mirror until you can fill your empty palm with reflected light. Make a V with your illuminated fingers, then sight across the top of the mirror and through the V toward an approaching aircraft and drop your empty hand out of the way. Repeat these steps frequently to adjust your aim. A glass mirror reflects light best, but if you have no mirror you can use a bright can lid, a piece of foil, or any other shiny, reflective object.



If using rescue flares or smoke devices, follow the directions carefully. Such devices typically can be used only once, so activate them only when you have sighted or heard the approach of a search plane.

Survival Kit

Always be prepared by carrying the Scout Basic Essentials. In an emergency, they can help you out of a jam.

- Pocketknife or multitool
- First-aid kit
- Extra clothing
- Rain gear
- Water bottle
- Flashlight
- Trail food
- Matches and fire starters
- Sun protection
- Map and compass

Also carry a whistle and a mirror. Signaling mirrors are available in most Scout shops, sporting goods stores, and outdoor-supply stores.

Wear or carry something bright. An orange poncho, a space blanket (Mylar® emergency blanket), or a colorful piece of plastic is light, packs easily, and can be used as a shelter as well as a signaling device. By being prepared, you give yourself the best possible chance of being found.

Improvised Signals

If you did not carry signaling devices with you, look around for whatever you can find or make. Use rocks or logs to lay out ground signals. Use a piece of broken glass or a shiny credit card surface to reflect light like a mirror.

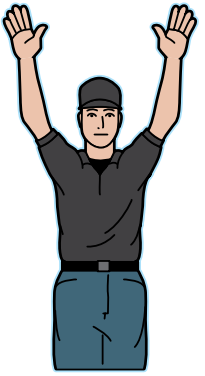
If you have ever heard a beaver slap its tail on the water, you know the sound can carry a great distance in the woods. To improvise a sound-signaling device, imitate a beaver by smacking two hard logs together.

Radio Beacons

Emergency, position-indicating radio beacons are monitored by aircraft and orbiting satellites. The satellites work together (through triangulation) to determine your location and provide the information to operations centers, which then mobilize search-and-rescue personnel. If you carry a radio beacon, use it if you need help, but remember that it is not a toy. Do not play with the beacon or allow others to play with it, and never experiment with it. Do not test it—it has a self-test function.

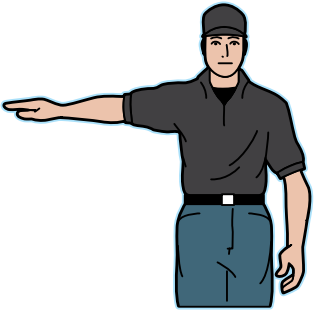
Emergency radio beacon

PLAY BALL

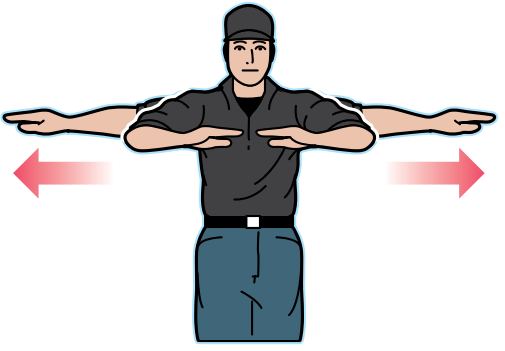


TIMEOUT, FOUL BALL, OR DEAD BALL

STRIKE OR OUT



FAIR BALL



SAFE

In baseball, umpires use hand gestures to call balls and strikes, to call a player out or safe, to indicate foul and fair balls, and to enforce other rules of play.

Signals in Sports and at Work

A police officer directs traffic with hand signals, a construction foreman signs instructions to a crane operator, and a baseball umpire signals that a runner is safe: These are a few of the many ways in which signs and signals are used in sports and in workplaces. Many types of activities have their own standard hand signals, but these may vary from place to place and among different users. As with any kind of signal, both the sender and the receiver need to know and understand the signals that are being used.

Sports Officials Hand Signs and Signals

Many sports rely on umpires, referees, or other types of officials to ensure that the game is played by the rules. Illustrated here are examples of the hand signals the officials use in popular team sports.

Other sports such as soccer, field hockey, lacrosse, rugby, and water polo also have officials using well-established signals to control play and to inform players and spectators about rule infractions.

A football game is full of signs, signals, and codes. Coaches signal plays with signs and gestures, the quarterback calls plays using codes, and the defense calls its counter plays, to which the offense may respond with another flurry of signs and verbal codes.

FOUL

JUMP BALL

TRAVELING

TECHNICAL FOUL

INBOUND PASS

Basketball referees use hand gestures to start and stop the clock, to signal shooting and scoring, and to call fouls and violations.

TOUCHDOWN

FIRST DOWN

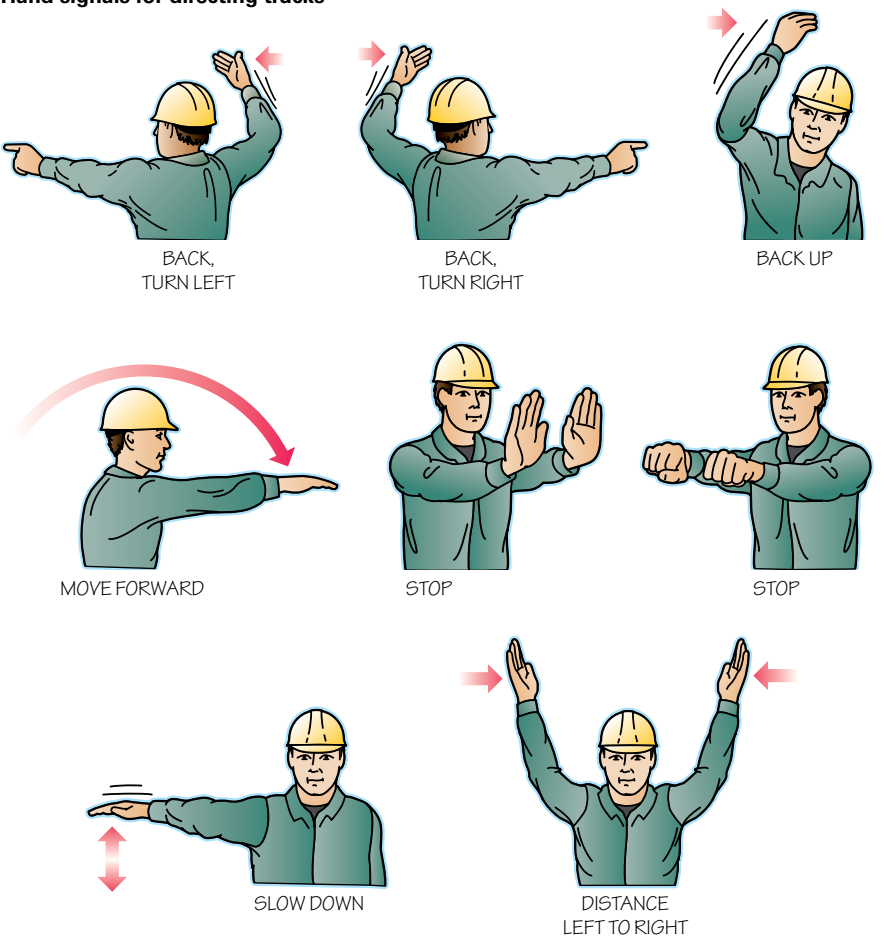
PERSONAL FOUL

TIME OUT

HOLDING

Football referees use gestures to signal such things as first downs, touchdowns, timeouts, and infractions of the rules.

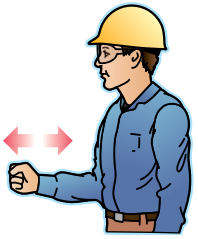
Hand signals for directing trucks

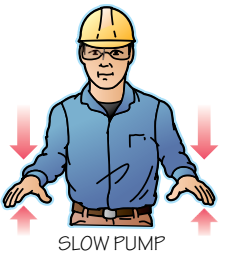


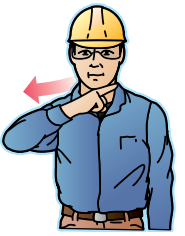
Equipment Operator Hand Signs

Construction sites can be dangerous and noisy places—so noisy that shouted instructions cannot be heard above the din of machinery and equipment. For communications on construction sites, standardized systems of hand signals have been developed. Different hand signs may be used at different worksites or by different equipment operators, so it is essential that both the signaler and the receiver know beforehand what the hand signals mean.

Concrete truck driver hand signals


START PUMP
SPEED UP


SLOW PUMP
DOWN


STOP PUMP


LITTLE BIT


BOOM UP

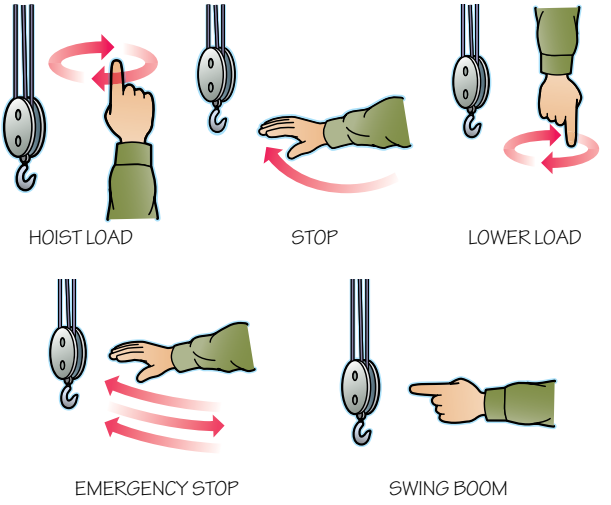

BOOM DOWN


BOOM LEFT


BOOM RIGHT

As trucks or equipment come onto a construction site, a guide is usually assigned to direct the driver to a particular location using a set of directional hand signals. If the truck is delivering concrete, a specific set of signals is used to direct the positioning of the boom for pouring the concrete, and to start the pump, adjust pump speed, add water to the concrete mix, and stop pumping.

Crane operator hand signals



For a crane operator, hand signals sometimes mimic the actions of the machine. For example, the signaler may move a hand in a circular motion overhead to direct the operator to hoist (move up) the load, or circle a hand held downward at the level of the waist to signal for lowering the load. Other signals direct the positioning of the boom to safely deliver the load. In crane operations, the standard signal for "stop" is the arm extended straight out to the side and held rigidly. The hand moved rapidly left to right from the stop position signals an emergency stop.

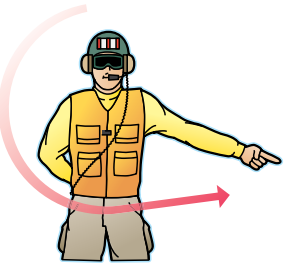
Aircraft Carrier Catapult Crew Signals

The flight deck of an aircraft carrier during flight operations has been described as "controlled chaos." Jets are catapulted into the air while other aircraft are landing or being parked, refueled, or loaded with armaments. The noise of jet engines and rotors is so great, members of the deck crew must communicate mostly through hand signals.

To direct a plane on the flight deck, more than 30 hand signals are used. The general sequence to launch a jet is to position the plane at the rear of the catapult (a device for slinging a plane off the deck at high speed), attach a launch bar and holdback to the plane's nose gear, raise the jet blast deflector behind the plane, make final safety checks, and then release the holdback to launch the plane down the deck for takeoff. Throughout this process, hand signals relay vital information between the deck crew and the pilot. Only a few of the many signals are shown here.

Aircraft carrier catapult crew signals

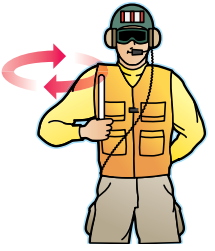
FIRST READY/
CATAPULT READY



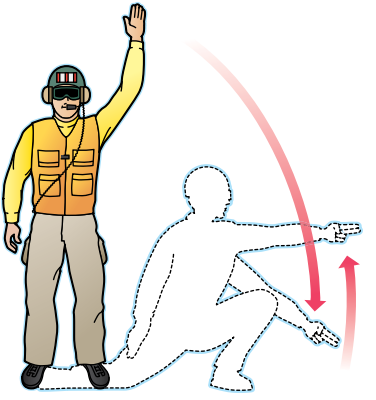
TAKING TENSION

FINAL READY

FINAL TURNUP (DAY)

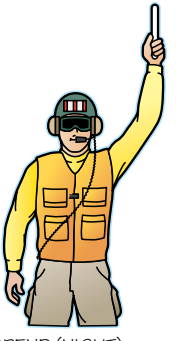


FINAL TURNUP (NIGHT)



FIRE/LAUNCH (DAY)

SUSPEND (DAY)



SUSPEND (NIGHT)

Cyclist Hand Signals

Cyclists (and some motorists) make hand signals to indicate their intentions to other traffic. Similar to automobile signaling, cyclists use three main signals: left turn, right turn, and stopping. Cyclists in a group may use additional signals to communicate with other riders.

Left turn: Extend left arm straight out in the direction of the turn.

Right turn: Extend right arm straight out in the direction of the turn.

An alternative right-turn signal is to extend the left arm out to the left, bent at the elbow with the forearm pointing upward.

Stopping/braking: Extend left arm out to the left, bent at the elbow with the forearm pointing downward.

When cycling in a group, a stop may be signaled by holding the hand straight up in the air for greater visibility.

To signal to a group of cyclists to slow down, extend the arm outward and move the hand up and down as if gently patting an invisible dog.

Sound Signals

You might not often think of them, but you are familiar with sound signals in many parts of your life. Most schools use a bell system to start and end the school day and to signal class changes, breaks, and lunch. Car alarms are sound signals that are meant to attract attention and discourage thieves. Fire alarms are mainly sound signals, with some also flashing warning lights. Outdoor sirens are sounded to signal emergencies such as severe weather and tornadoes.

Trains

As a warning to motorists and pedestrians, trains must sound their whistles or horns continuously for at least 15 seconds as they approach railroad crossings, giving the required long-long-short-long sequence of whistle or horn blasts. This sequence, which is similar to the letter Q in Morse code, is not so much a letter as it is a sequence of sound fluctuations that are unmistakable from other nearby noises to make it useful as a warning. About a dozen other standard train-whistle calls are also used, mostly to communicate with railroad workers along the rails or in rail yards. Whistles are used to give instructions, as a safety signal, and to warn workers when a train is about to start moving.

Horn Signals

Engine Horn "O" is a short blast; "~" is a long blast.	Meaning
O	Apply brakes. Stop.
OO	Engineer's answer to any signal unless otherwise specified.
OOO	When standing, back up; when running, stop at next station.
OOOO	Engineer's request for signals.
OOOOOOOOOO, etc.	Person or livestock on track (series of short blasts).
~~, etc.	Approaching stations, junctions, or railroad crossings at grade (series of long blasts) without stopping.
~OO	A second section is following; call for other trains to signal.
~OOO	Flagman to go out to protect rear of train.
~~	Release brakes. Proceed.
~~O~	Train is approaching public crossing at grade.
~~	Flagman may return from west or south.*
~~	Flagman may return from east or north.*

*These horn signals may be followed by "O" or "OO" or "OOO" when several tracks are in use. The number of short blasts corresponds to the track number.

Military Communications

The armed services have traditionally used various sound signals, such as bugle calls to signal reveille, morning colors, assembly, attention, retreat, and taps. At sea, boatswain (bosun) pipes were first used because their high pitch could be heard above the sound of wind and waves. Aboard ships today, boatswain's pipes are still used to call activities and ceremonies such as "pipe aboard," "away boats," "all hands on deck," and "carry on."

Military units may use whistle signals in drill or formation maneuvers and short-range communications.

1. One long blast means "silence," "attention," or "look for my next signal."
2. Two short blasts mean "all right."
3. A succession of long, slow blasts means "go out," "move farther way," "advance," or "scatter."
4. A series of short, sharp blasts means "rally," "come together," or "close in."
5. Three short blasts followed by one long blast means "leaders, come here."
6. Three short blasts mean "danger," "alarm," or "caution."
7. A succession of alternating long and short blasts means "mess call."

Boatswain's pipe

Boating Signals

Vessels operating in U.S. waters that exceed certain length and propulsion (power or sail) requirements must have a whistle, horn, or bell and use sound signals when navigating in low-visibility conditions, to get the attention of other vessels, or to signal danger or distress. Often, these signals are repeated every two minutes until the situation is resolved: the fog lifts, for example. Sound signals notify other vessels that someone is near them.

These signals are commonly used:

- Irregular sounds that cannot be mistaken for other signals are used to attract attention.
- Long continuous blasts signal distress.
- One short blast means the vessel intends to turn to starboard (to the right).
- Two short blasts means the vessel intends to turn to port (to the left).

When you use any type of watercraft, make it a point to carry some sort of sound signaling device. Your rescue whistle (which you should always have with you) can be used to signal distress when you are canoeing or kayaking.

Sound-only signals have their limitations. Louder noises can drown them out. Motorists with the volume cranked up on their car stereos may not hear the wail of a fire truck or the whistle of an approaching train. Pedestrians listening to music through headphones may fail to hear an oncoming car. To be more noticeable, therefore, warning signals often combine sounds with lights. Many buildings have fire alarms with flashing lights, and emergency vehicles such as ambulances are equipped with both sirens and lights. People who are deaf or hard of hearing may use devices that flash or dim the lights in their home whenever the doorbell rings. Cellphones can be set to vibrate to signal incoming calls when the ringer is turned off or inaudible.


Summit
BECHTEL RESERVE
metal
aluminum, steel & tins cans recycle here
no scrap metals, please

Symbols

In its simplest sense, a symbol is a picture, letter, character, or object that represents something. Symbols can be created to stand for ideas, words, actions, organizations, or almost anything.

One familiar example is the universal recycling symbol that appears on plastic bags, aluminum cans, and many other everyday objects. The recycling symbol represents an unending loop (like a Möbius strip) with three half-twisted arrows forming a triangle. It was designed by 23-year-old college student Gary Anderson to honor the first Earth Day in 1970. The symbol indicates that an object or material is recyclable, and it is also used on bins for storing and sorting recyclables.

Look for other symbols around your home, school, or troop meeting place. Your school mascot is a symbol. Your town or city might have its own symbol, or you might belong to a group that uses a special emblem.

Scouting has many symbols with meanings that are woven into the designs. Consider the Tenderfoot badge, a trefoil like the north point of an old compass. The shape of the badge signifies the way a Scout points the right way in life just as a compass does in the wilderness. The three points of the trefoil, like the three raised fingers of the Scout sign, represent the three parts of the Scout Oath.

Map Symbols

Knowing what map symbols mean is an essential skill. Map symbols use shapes and often colors to represent what is on the land. Similar symbols appear on topographical maps, highway maps, nautical charts, aeronautical charts, and other map types. The symbols are explained in the map key or legend located in a map's margins.

Basic map symbols

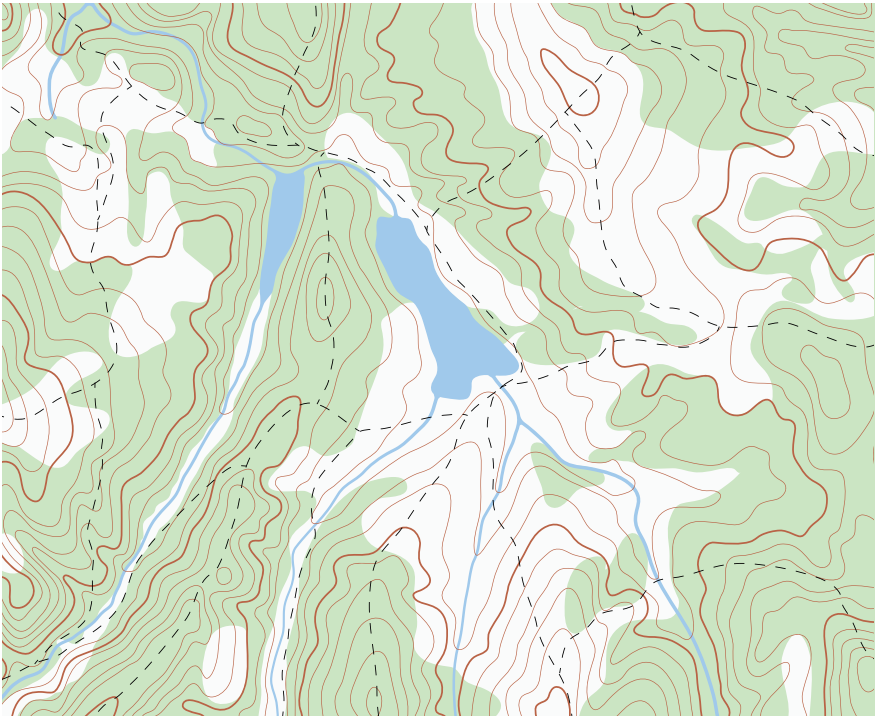
The legend, or key, typically provides other essential information:

- **Directions.** North is toward the top of most maps. A map will often have a true north arrow in its margin and an arrow showing the direction of magnetic north.
- **Scale.** The scale of a map compares the size of the map with the size of the area it represents. A map scale of 1:24,000 means that one inch on the map represents 24,000 inches or 2,000 feet on the ground.
- **Distances.** Bar scales can be used for measuring feet, meters, and miles on a map.
- **Date.** A map's date tells when it was drawn or last updated. An older map will not show new buildings, roads, trails, or other recent changes on the land.

The best maps for hiking are topographical maps that use contour lines to show the shape of the land—its hills, valleys, mountains, and plains. Each point on a contour line is the same elevation above sea level. Where the lines are close together, the land slopes steeply. Where the lines are far apart, the terrain is almost flat.

Contour lines are drawn in brown. Topographical maps use other colors for other features:

- Blue for water—ponds, lakes, streams, rivers, reservoirs
- Green for vegetation—forests, woodlands, grasslands, orchards
- Red or black for human-built structures—roads, rail lines, trails, buildings, boundaries
- White for open areas—fields, meadows, rocky slopes



These colors, while common, may not mean the same thing on all maps. Some maps show larger cities in yellow, airports in pink, and areas such as military bases in orange. Some maps are printed in only one color and may rely on shapes, symbols, patterns, and different styles of lettering (fonts) to indicate particular features, such as a flag atop a black square to represent a school, all-capital letters for the name of a road, and speckled patterns for marshes and swamps. Whenever you use a map that is new to you, be sure to check the map key or legend to familiarize yourself with the map's specific symbology (its system of signs and symbols).

Hazard and Safety Symbols

Hazard symbols are meant to alert people to dangers such as radiation, toxins, and chemical, flammable, and electrical hazards. Distinctive symbols also indicate the need for personal protective equipment like eye or hearing protection.

The general caution sign displays an exclamation point to attract attention. The skull and crossbones is often used to label poisons. The radioactive symbol's symmetrical three-sided shape can be easily recognized from any angle. The electrical hazard symbol warns of the danger of electrocution. Signs and symbols indicate when eye or hearing protection or other personal protective gear is required.

Besides providing information to help you stay safe, symbols may indicate the availability and locations of restrooms, litter containers, public transportation, and countless other conveniences and services.

Evacuation Route and Exit Signs

In many parts of the United States, natural disasters occur so frequently that evacuation routes have been established. Blue signs designate these routes, directing people to primary highways away from the danger.

In any building you enter, look for the fire exit or emergency exit signs or symbols, building maps that show the locations of evacuation routes, and signs or symbols that identify assembly areas where people should gather when they are clear of the building. Look for the fire hose or fire extinguisher signs. Also find the symbols that designate the locations of first aid kits, automated external defibrillators (AEDs), and emergency medical care.

Hurricane evacuation route

Traffic Signs

If you have gone any distance along a roadway, highway, or city street, you will have noticed traffic signs. Anyone who uses public roads, whether cyclist or motorist, must understand and know how to respond to traffic signs.

Traffic signs come in a great many shapes and colors, but they can be grouped into fewer than a dozen basic types:

Signs that are red are limited to stop, yield, and prohibition signs like "Do Not Enter" or "Wrong Way." These are regulatory signs.

Other regulatory signs usually have a white background with black letters. These include speed limit, one way, road closed, and keep right (or left) signs.

Yellow is used for warning signs about road conditions, lane changes, intersections, turns and curves, merging traffic, and much more.

Orange is the background color for temporary traffic-control signs. During road construction, orange signs warn of detours, closed lanes, changes in road conditions, and the presence of flaggers and construction workers.

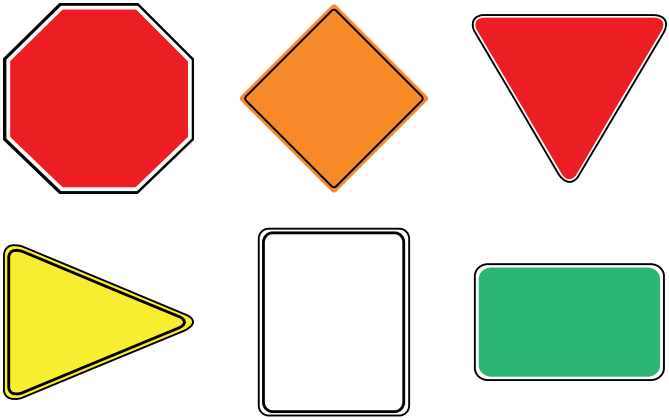
Signs for school zones, pedestrian crossings, and bicycle lanes are yellow or fluorescent yellow-green.

Mileposts, street names, freeway entrances and exits, and other types of destination, distance, and guide signs have green backgrounds.

Blue is used to inform travelers about nearby services such as food, gas, lodging, tourist information centers, and hospitals.

Brown indicates public recreation and historical or cultural sites such as parks, landmarks, and historical markers.

Night speed-limit signs and truck regulatory signs have black backgrounds.



Sign Shapes

Certain types of signs have special shapes so that travelers can recognize them quickly and react appropriately. In general, the more sides a traffic sign has, the more critical is the message the sign sends.

A stop sign is an octagon (eight sides). Stop signs are the only traffic signs in the United States that can have eight sides.

Warning signs are diamond-shaped, and yield signs are downward-pointing triangles. A "No Passing Zone" sign is a triangle pointing to the side; that is, a pennant.

A rectangle that is higher than it is wide is used for regulatory signs such as speed limits. A wider-than-tall rectangle is used mainly for guide signs about highway entrances, exits, destinations, distances, and similar types of information.

The only circle-shaped road sign gives advance warning of a railroad crossing. A 12-sided crossbuck (X shape) also marks railroad crossings. These signs are uniquely shaped to help call drivers' attention to the extreme dangers of collisions between trains and vehicles.

Text Symbols and Emoticons

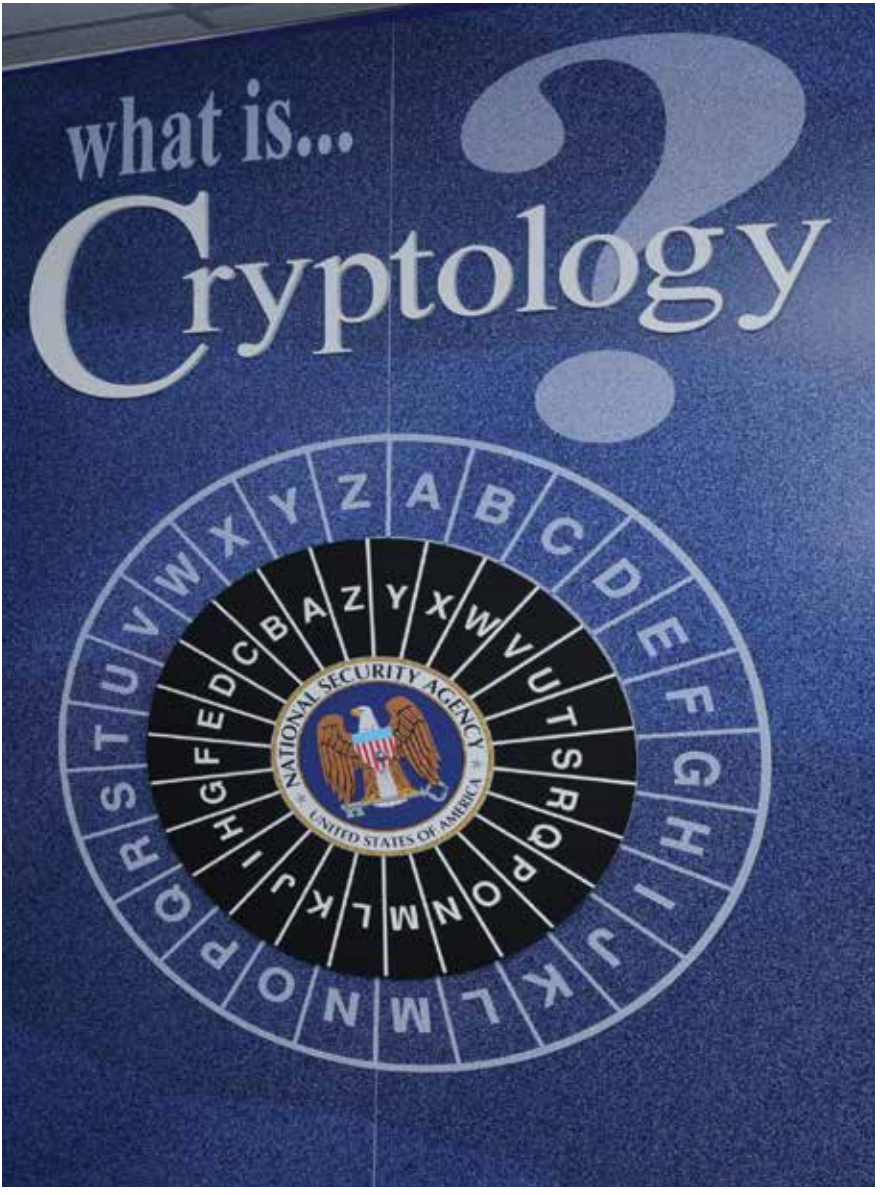
In emails and cellphone text messaging, symbols save space and let users type less, communicate faster, and show their state of mind. Text symbols and emoticons typically represent facial expressions or suggest attitudes or emotions. They can also stand for objects, with complicated symbols that resemble pictographs (prehistoric drawings on rock walls). The chart shows a few standard emoticons as well as less-common text symbols. Dozens of such symbols are used.

EMOTICON	TEXT SYMBOL	MEANING
	:-)	Smiling
	:-D	Grinning
	:-(	Sad
	:-\	Skeptical or undecided
	:-|	Determined
	:0	Surprised
	d:-)	Baseball (cap)
	T+	Think positive
	(:::X:::)	Adhesive bandage
	/\(00)/\	Spider

Designing a Symbol

To design your own symbol, you must first decide what message you wish to communicate. Do you want to give information, convey a feeling, provide inspiration, or encourage action? What shape(s) and color(s) best match the message you wish to communicate? Is your design simple and easy to recognize?

Think about the elements of familiar symbols and what makes them effective. For instance, the three arrows of the universal recycling symbol can remind people to "reduce, reuse, and recycle." The symbol of your school or your favorite sports team may express traditions or inspire loyalty. Your city or town's symbol might convey the community's "personality" or its residents' way of life. In designing your own symbol, decide on its basic purpose and use simple, uncluttered elements of shape and color to clearly communicate your message.



While *cryptography* is the science of writing or creating hidden messages, *cryptology* is the science of reading or deciphering hidden messages.

Cryptography

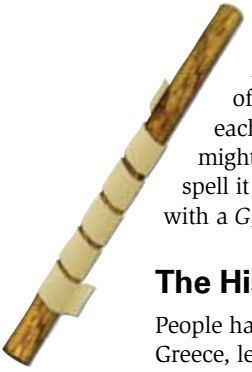
In cryptography, secret codes or ciphers are used to hide (encode or encrypt) the true meanings of messages. Strong codes and ciphers use highly complex mathematical formulas and algorithms (multistep procedures) to secure them and keep them secret.

What Is a Code?

A code is a way to replace the actual words in a message with other words or symbols that hide the message's true meaning. One example is a dictionary code, a system in which two identical copies of a dictionary are used, one by the sender and one by the receiver of the message. The sender might create an unencoded message (called "plaintext") and then look up the page number in the dictionary where each word in the message appears. Each word is coded according to the word's position on the dictionary page. For example, the code number "4625" might mean, "Go to page 46 and look in the 2nd column for the 5th word down from the top." That word might be *bird;* using this system, the word *bird* when sent in code is "4625." The same procedure is followed to encode each word in the message, creating a coded message that consists only of numbers, with each group of numbers representing a word.

This type of "book code" has many variations. In fact, any book can be used, not just a dictionary. Two copies of the same editions of the *Scouts BSA Handbook for Boys* or *Scouts BSA Handbook for Girls* could be used, for example, and the code number "4625" might mean "go to page 46 and find the 25th word appearing on that page."

Cryptographers are people who are skilled at creating codes and ciphers. *Cryptanalysts* are skilled in code-breaking. Both kinds of specialists are usually well-educated in math.



Early cipher device of ancient Greece

What Is a Cipher?

A *cipher* differs from a *code* in that letters, instead of words, are replaced. A cipher changes or rearranges each letter in a message. For instance, a *substitution cipher* might replace the letters in the word TRUSTWORTHY to spell it AGWCADEGAMP, replacing each *T* with an *A*, each *R* with a *G*, etc.

The History of Cryptography

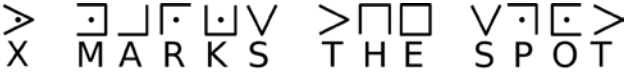
People have used secret codes for thousands of years. In ancient Greece, leaders of the city of Sparta wrote messages to their generals across the edges of strips of parchment wrapped in a spiral around staffs, or batons. Once the parchment was unrolled, the message could be read only by wrapping the strip around an identical staff belonging to the general to whom the message was addressed. This method is a type of *transposition cipher*—the message's letters or characters are reordered (transposed) instead of being replaced.

Hiding in Plain Sight

Some secrets rely not on ciphers, but on clever concealment. You are probably familiar with invisible ink made from milk or lemon juice, a method of concealment that dates to antiquity. The Roman philosopher and military commander of the early Roman Empire, Pliny the Elder (A.D. 23–A.D. 79), recommended using the milky juice of a common plant that turned clear as it dried. Messages also could be hidden in written material (whether ancient scrolls or modern books) by punching tiny holes under selected letters or words. The pinpricked letters spelled out the message when the page was held up to the light. Another method of revealing certain letters or words was to lay a grille (a cutout pattern of paper, metal, etc.) over written material to disclose a secret message hidden within the text.

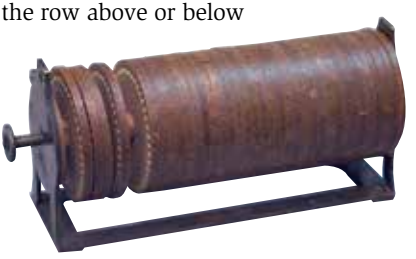
The Italian philosopher and architect Leon Battista Alberti invented a cipher disk in 1467. He used two different alphabets arranged in two rings, with the larger ring encircling the smaller one. Lining up a letter from one ring with a different letter in the other ring created a simple substitution cipher that could be used to encrypt or decrypt a message.

In the early 18th century, the Freemasons began using a cipher commonly known as the "pigpen cipher" to keep their records and communications private. The method replaces letters with symbols that are fragments of a grid. Evidence suggests that George Washington's army used the cipher during the Revolutionary War, and it was used by both sides during the American Civil War. It is a simple substitution cipher. Using the example key shown in the illustration, the message "X MARKS THE SPOT" is enciphered as follows:



Replica of a Confederate cipher disk; only five originals are known to exist today.

Thomas Jefferson invented a cipher wheel in the early 1790s. The device had a set of wooden disks, each with the 26 letters of the alphabet arranged around its edge. The order of the letters was random and different on each disk. The cryptographer spelled out a plaintext message on the cipher wheel and then copied down the line of characters above or below it to encipher the message. The receiver deciphered the message by rotating the disks on a matching cipher wheel so they spelled out the encrypted message on one row, which made the plaintext message appear on the row above or below it. Jefferson's cipher was among the most advanced of its day. The U.S. Army used a version of this cipher wheel from 1922 until the beginning of World War II.



Thomas Jefferson's "wheel cipher"

During the American Civil War, signalmen waved flags back and forth in the wigwagging system to send messages in Morse code. The messages were sometimes encrypted with the cipher wheel before being transmitted by wigwag. Both sides in the Civil War tried to intercept and decipher the other side's messages to learn their plans.

In 1942, during World War II, United States military intelligence successfully broke Japanese naval codes and learned that a large Japanese force was headed for the U.S. base on the Pacific island of Midway. Knowing the Japanese plan helped the U.S. Navy defeat the enemy force. The Battle of Midway was a major turning point in the war in the Pacific.

During the early days of World War II, cryptology experts in Poland—with help from the French—broke the seemingly unbreakable German Enigma cipher and shared their success with the British, who in turn shared the secret with their ally, the United States. Great Britain depended on supplies arriving by ship from the United States, but the ships were in constant danger of being hit by German submarines. The breaking of the Enigma cipher helped the allies locate and sink German subs before they could attack the supply ships, and ensured that allied commanders had the information they needed about enemy plans and movements. Many historians believe this cryptanalytic success was vital in shortening World War II in Europe.

The United States also began to analyze communications of the Soviet Union, and in 1946, partially decoded the ciphers that were used by Soviet spies in the United States. This project, called "Venona," took nearly 40 years, not ending until about 1980.

Modern Codes and Ciphers

The invention of machines and computers made codes and ciphers harder to break and easier to use, which has in turn made the art of codebreaking both harder and easier. Machine ciphers are stronger (less breakable) than manual systems and are widely used to secure important information. Modern encryption protects people's data and privacy. Cellphones, tablets, computers, and software use strong encryption technology to help protect banking and financial details, emails, text messages, and other personal information.

The National Cryptologic Museum, near Fort Meade in Maryland, displays many exhibits on the history of cryptology, including an Enigma machine.

The federal government is among the largest employers of mathematicians in the United States, and many of these mathematicians work to make or break codes and ciphers. Cryptographers and cryptanalysts are employed by the Department of Defense, the military, and other federal, state, and local agencies.

The Code Talkers

During World War II, the United States military had a secret code that baffled the enemy: Navajo "code talkers" adapted their complex native language to create an unbreakable system. They used everyday Navajo words to represent terms that did not exist in the Navajo language—"iron fish" for submarine, "tortoise" for tank, "potatoes" for grenades, etc. The code talkers often worked 35 hours straight without food or rest, relaying vital military communications without error. Only recently has the code talkers' exceptional service been publicly recognized and honored, because the Navajo language remained potentially valuable as a secret code long after World War II ended. For more about Navajo and other Native American code talkers, see the *Indian Lore* merit badge pamphlet.

Creating Your Own Code

To create your own secret code, you can use any of the methods discussed above, such as a substitution cipher, pigpen cipher, or book code. You could make a device with rings or disks of letters, similar to the Alberti cipher disk or Jefferson's cipher wheel. Or do research to find the code system you want to use, or make up your own code.

Whatever type of encryption you use, you must also make a *key* that gives instructions or shares the secret for deciphering the messages you write in that code. Give the key to the recipients of your messages so they will know how to convert the coded text back to the original (plaintext) information.

Resources

Scouting Literature

Scouts BSA Handbook for Boys; Scouts BSA Handbook for Girls; Fieldbook; *Communication, Digital Technology, Disabilities Awareness, Emergency Preparedness, Graphic Arts, Indian Lore, Programming, Radio, Railroading, Search and Rescue,* and *Wilderness Survival* merit badge pamphlets.

With your parent or guardian's permission, visit Scouting America's official retail site, **scoutshop.org**, for a complete list of merit badge pamphlets and other helpful Scouting materials and supplies.

Websites, Tutorials, and Apps

American Sign Language

American Sign Language University
lifeprint.com

Handspeak®
handspeak.com

Signing Savvy
signingsavvy.com

Braille

Braille Works
brailleworks.com/braille-resources/braille-alphabet

BrailleBack
A tablet/smartphone app

Braille Bug®
braillebug.org

Braille Flash Cards
printableflashcards.net/preview/Braille

Cryptography

Break the Code
cia.gov/spy-kids/games/games_code.html

CryptoClub
cryptoclub.org

Crypto Museum
cryptomuseum.com

Journey Into Cryptography
khanacademy.org/computing/computer-science/cryptography

Secret Language: Cryptography & Secret Codes
exploratorium.edu/ronh/secret/secret.html

Morse Code

Learn Morse Code
learnmorsecode.com

Nautical Flags
International Code Flags
or Signaling Flags
boatsafe.com/international-code-signaling-flags/

Nautical Flags and Their Meanings
marinewaypoints.com/learn/flags/flags.shtml

Nautical Flags—International Code Flags
soundkeepers.com/kids/alphabet

Rescue and Distress Signals
Basic Survival Strategy
cap-es.net/zips/bsssh.PDF

Boating Distress Signals
boatsafe.com/nauticalknowhow/distress.htm

Ground-to-Air Signals
cap-es.net/zips/gnd2airsignals.PDF

Semaphore
Semaphore Flag Signaling System
marinewaypoints.com/learn/flags/semaphore/semaphore.shtml

Trail Signs
Trail Signs & Blazes
inquiry.net/outdoor/skills/seton/blazes.htm

Trail Signs of Direction
inquiry.net/outdoor/skills/beard/signs_direction.htm

Trail Signs: Traditional
inquiry.net/outdoor/skills/b-p/signs.htm

Wigwag and Other Signals
The Science Notebook
science-notebook.com/gilbert-signal01.html

Sending WIGWAG Code
cranburyscouts.org/WigWagBL.htm

Signalman Sam's Signaling Resource Page
cranburyscouts.org/SamsPage.htm

Smiley Symbols Dictionary
planetpals.com/smiley.html

Wikipedia List of Emoticons
en.wikipedia.org/wiki/List_of_emoticons

Books and CDs

American Radio Relay League. Your Introduction to Morse Code (audio CDs). ARRL, 2008.

Araujo, Lynn. *Historical Signals and Semaphores*. U.S. Games Systems, 2006.

Blackwood, Gary. *Mysterious Messages: A History of Codes and Ciphers*. Dutton, 2009.

Collins, Harold S., et al. *Braille for the Sighted: Beginning Braille.* Garlic Press, 1998.

Fletcher, Archibald Lee. *Boy Scouts Signal Sender, or When Wigwag Knowledge Paid.* Big Rock, 2011.

Hubler, Michael S., and Lillian J. Hubler. *Scout Sign Language.* CreateSpace Independent Publishing Platform, 2013.

Janeczko, Paul B. *Top Secret: A Handbook of Codes, Ciphers and Secret Writing.* Candlewick, 2006.

Johnson, Bud. *Break the Code: Cryptography for Beginners.* Dover, 2013.

Lunde, Paul. *The Book of Codes: Understanding the World of Hidden Messages.* University of California Press, 2009.

National Imagery and Mapping Agency (NIMA). *International Code of Signals.* Starpath, 2009.

Seton, Ernest Thompson. *Sign Talk: A Universal Signal Code.* Nabu Press, 2014.

Signal Corps. *Manual of Visual Signaling.* United States Army Signal Corps, 2013.

Sternberg, Martin L.A. *American Sign Language Dictionary.* Harper Perennial, 1998.

Warner, Penny. *Signing Fun: American Sign Language Vocabulary, Phrases, Games, and Activities.* Gallaudet University Press, 2006.

Acknowledgements

Scouting America thanks the following members of the Signs, Signals, and Codes Merit Badge Development Team, who worked diligently to develop the merit badge requirements and content for this pamphlet.

Timothy I. Malaney—Eagle Scout and team lead

Shane T. Hensley, MBA—Certified by the Registry of Interpreters for the Deaf (Certificate of Interpretation and Certificate of Transliteration); video relay interpreter; native user of American Sign Language

James Lindfors—Patrol sergeant, sheriff's office, Hennepin County (Minnesota); amateur radio operator; SKYWARN® spotter; National Weather Service instructor; active Scouter

Michael J. Lopez—U.S. Army radio operator for International Morse Code; active Scouter and troop committee member

Gary McKee—U.S. Coast Guard Radioman First Class; technical supervisor, RCA Global Communications; member, U.S. Power Squadron; park manager, Florida State Parks; active Scouter

Patricia Mitchell, M.Ed.—Special education teacher (retired); braille instructor and certified teacher of the visually impaired

James Mize—U.S. Navy Reserve cryptologic specialist; amateur radio operator; active Scouter

Ralph Rivera—U.S. Army cryptologist; M.S. in telecommunications management and M.A. in national security and strategic studies; Naval War College graduate; Scouter

Catherine Summ—Certified teacher of the visually impaired, State of Connecticut, Bureau of Rehabilitative Services, Bureau of Education and Services for the Blind; Scouter

Shannon Way—Major, U.S. Army (Strategy and Policy); Master of International Public Policy; mission scanner, Civil Air Patrol; Scouter

Photo and Illustration Credits

Crypto Museum, courtesy—page 85 (*Confederate cipher disk*)

Library of Congress Prints and Photographs Division, courtesy—page 41

NASA Goddard/Rebecca Roth, courtesy—page 55

National Security Agency/National Cryptologic Museum, courtesy—pages 82 and 87 (*Enigma exhibit*)

Wikipedia.org, courtesy—pages 11 (*smoke signaling*) and 84

Wikipedia/Bundesarchiv_Bild_101I-769-0229-0A,_Frankreich,_Guderian,_"Enigma".jpg: Borchert, Erich (Eric), courtesy—page 87 (*Enigma being used in German command vehicle*)

Wikipedia/Daniel Case, courtesy—page 48

Wikpedia/Dbaisley, courtesy—page 47

Wikipedia/Lokilech, courtesy—page 12

Wikipedia/Nemilar, courtesy—page 11 (*lantern*)

All other photos and illustrations not mentioned above are the property of or are protected by Scouting America.

John McDearmon—All illustrations on pages 22, 24, 25, 33, 50, 53, 56, 60, 61, 62, 64