

# 3D Educational Resources

## WHAT IS MORSE CODE?

One of the ways to communicate using a telegraph is with Morse code. In Morse code letters, numbers and punctuation marks are represented by a series of short and long signals.

## ONTARIO CURRICULUM LINKS

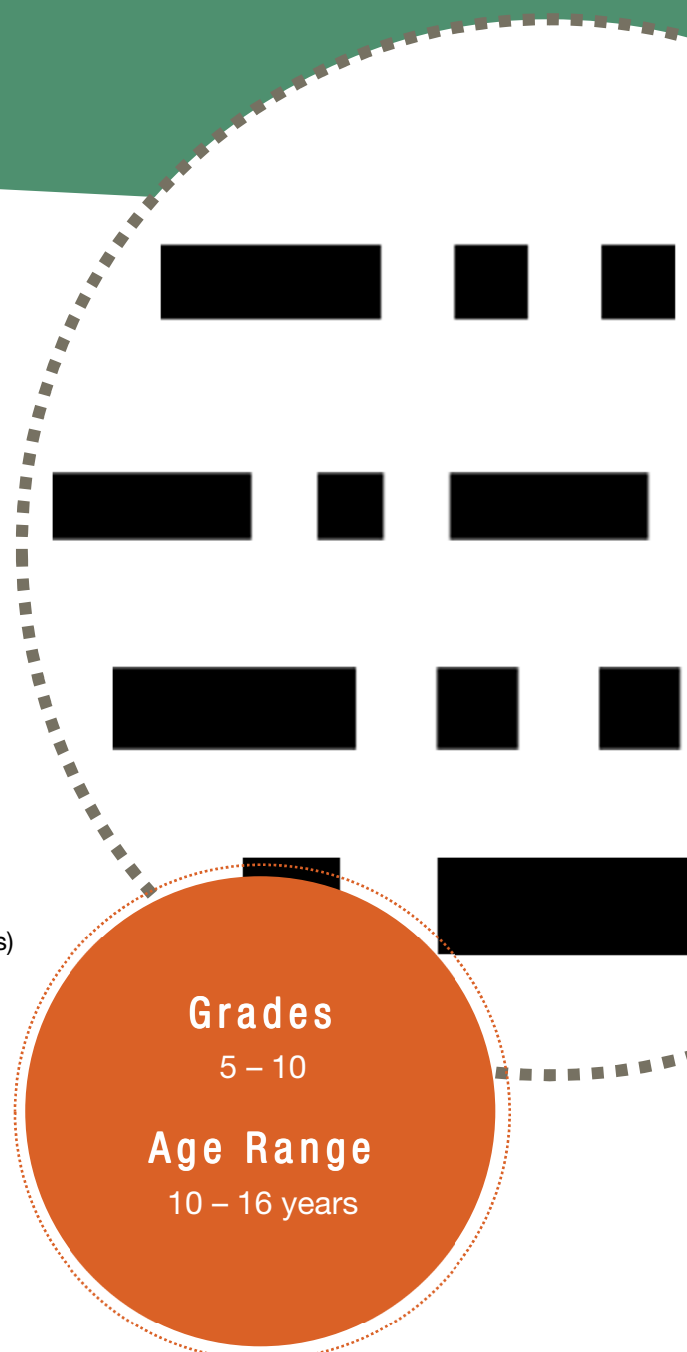
Through this activity your students will explore how the telegraph (an important early communication device) was used both in the everyday lives of Canadians as well as during the First World War. They will also be able to explore the concept of code breaking, an important aspect of the First World War.

This activity can be linked to multiple points in the Ontario School Curriculum, a couple of suggestions are:

- Grade 7 History (Canada, 1800–1850: Conflict and Challenges)
- Grade 8 History (Creating Canada, 1860–1890; Canada, 1890–1914: A Changing Society)
- Grade 10 History, Canadian History since World War 1 (Canada, 1914–1929)

## MATERIALS

1 - Functional 3D printed telegraph key



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## INSTRUCTIONS

1. Explain the basics of Morse code to your class and show them this chart

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

2. Explain the meaning of the dots and dashes. The dash represents a long signal, and the dots represent a short signal. Samuel Morse and Alfred Vail (inventors of Morse code) arranged it so that the most common letters have the simplest codes (such as "e").
3. Tap out some messages or words using your telegraph key to demonstrate how Morse code works. After each letter there is a short pause. If you are using multiple words, after each word there is a slightly longer pause (about three times as long as the pause between letters). Some possible words to start with:

SOS:

S	O	S
...	---	...

Canada:

C	A	N	A	D	A
- . - .	.-	-.	.-	-..	.-

Museum:

M	U	S	E	U	M
--	..-	...	.	..-	--



**TRY THIS!** Tap out a different word, but this time only give your students a small clue to your students to see if they can decipher what you've tapped. For example, for the word "school" your clue could be "Where you learn."

**TRY THIS!** If you have multiple telegraph keys, divide your students into groups and allow them to create their own Morse code messages. You can also set it up so that the student(s) receiving the message (from the LED light or electric buzzer) cannot see the student tapping it out.



## CAN YOU BREAK THE CODE?

Breaking an enemy's code is an important element in any kind of conflict, including the First World War. Below are two activities that you can do with your students to explore this intriguing concept.

### CHALLENGE #1

In this activity, your students will see how fast they can decipher a code, when given some possible coding systems.

1. Show the two coding systems below to your class. One is the Morse code system shown previously. The other is a rearrangement of the Morse code.

#### MORSE CODE

A	. -	I	..	Q	--- .-	Y	-. - -
B	- ...	J	. - - -	R	. - .	Z	- - ..
C	- . - .	K	- . -	S	...		
D	- ..	L	. - ..	T	-		
E	.	M	--	U	.. -		
F	.. - .	N	- .	V	... -		
G	- - .	O	- - -	W	. - -		
H	....	P	. - - .	X	- .. -		

#### JUMBLED MORSE CODE (code patterns given to alternate letters)

A	. - .	I	....	Q	- . - -	Y	- - . -
B	- .	J	. - - .	R	. -	Z	- .. -
C	- . -	K	- . - .	S	.		
D	. - ..	L	- ..	T	- -		
E	...	M	--	U	. - -		
F	... -	N	- ...	V	.. - .		
G	- - -	O	- - .	W	.. -		
H	..	P	. - - -	X	- - ..		



2. Tap out a word or short message on the telegraph key and provide a clue. The challenge is for your class to decide which coding system is being used.

How fast can your students decipher your message?

You can also create your own “jumble”. With more than two possible options, this challenge becomes more difficult.

## CHALLENGE #2

In this activity your students will try to see how fast they can decipher a code without being given a coding system. For this activity you will need multiple telegraph keys.

1. Set up teams or groups.
2. Have each group **create** a unique coding system.
3. Have each group challenge another to **decipher** their code.
  - Have one group code a word or short message, and send it by tapping it out on a telegraph key. Have them provide a clue as well.
  - Decode! Have the other group try to decode the word or short message. This is a trial and error process that also involves decoding something that unlocks the rest.
  - Tell the decoding group to start with smaller words and look for repeating letters as these can be important hints as to what the word might be. Here are some other hints that you can give them:

**Hint – Look at FREQUENCY:** Look for the most common letters and combination of letters to see if they make sense.

**Decreasing frequency of single letters:**

E T O A N I R S H D L C W U M F Y G P B V K X Q J Z

*(“e” is the most frequent letter in English, “z” the least)*

**Hint – Look at COMBINATIONS:** Look for frequent combinations of letters to see if they help.

**Decreasing frequency of two-letter combinations in words:**

th er on an re he in ed nd ha at en es of or nt ea ti to it st io le is ou ar as de rt ve

*(“th” is the most frequent combination in English, “ve” the least)*

**Decreasing frequency of three-letter combinations in words:**

the and tha ent ion tio for nde has nce edt tis oft sth men

*(“the” is the most frequent combination in English, “men” the least)*



**Decreasing frequency of double letters in words:**

ss ee tt ff ll mm oo

*("ss" is the most frequent combination in English, "oo" the least)*

**Hint – Look at the STARTING LETTER:** The starting letter in each word may provide important clues.

**Decreasing frequency for first letters in a word:**

TOAWBCDSFMRHIYEGLNPUJK

*("T" is the most frequent letter in English, "K" the least)*

**Hint – Look at the LAST LETTER:** Sometimes the last letter in each word can be helpful.

**Decreasing frequency for letters that end a word:**

ESTDNRYFLOGHARMPUW

*("e" is most frequent letter in English, "w" the least)*

**Hint – Look at WORD LENGTH:** Word length can help you decipher important words in order to reveal a hidden message.

**Words with one letter in English:**

a, I

**Most common words with two letters in English:**

of, to, in, it, is, be, as, at, so, we, he, by, or, on, do, if, me, my, up, an, go, no, us, am

**Most common words with three letters in English:**

the, and, for, are, but, not, you, all, any, can, had, her, was, one, our, out, day, get, has, him, his, how, man, new, now, old, see, two, way, who, boy, did, its, let, put, say, she, too, use

**Most common words with four letters in English:**

that, with, have, this, will, your, from, they, know, want, been, good, much, some, time, very, when, come, here, just, like, long, make, many, more, only, over, such, take, than, them, well, were

Source: <http://www.exploratorium.edu/ronh/secret/secret.html>