

### Overview

During this lesson, students will gain understanding of the evolution of communication, especially the telegraph and how Morse code enabled efficient, fast communication over long distances before voice transmission was possible. They will learn how people met challenging circumstances and resolved them through technology. Students will integrate and exhibit learning by creating a functioning Morse Code transmission system and using it to send messages.

### Key Information

Level 3: (Ages 10-11) US Grades 4 or 5

Time: 45/90 minutes

<a href="#">Warm-Up</a>	5 minutes
<a href="#">Mini-lesson</a>	10 minutes
<a href="#">Worked Example</a>	7 minutes
<a href="#">Challenge 1</a>	7 minutes
<a href="#">Challenge 1 - Debug</a>	5 minutes
<a href="#">Challenge 2</a>	7 minutes
<a href="#">Tidy Up / Exit Ticket</a>	4 minutes

### Lesson Topics

- **History**
  - The history of communication and the break from physical transport
  - The combined revolution in communication brought about by Morse code
- **English Language Arts**
  - How change occurs, change-making inventions in history
  - Informative/explanatory texts
- **Engineering Design**
  - Designs can be conveyed through models
  - A situation that people want to change can be approached through technology
  - There is always more than one possible solution to a problem
- **Computing**
  - Inputs, outputs, debugging

### Learning Objectives

- ***As a result of this lesson, students will be able to***
  - Understand the concept of Morse code
  - Use basic Morse code
  - Understand the working of the early Telegraph and its importance
  - Understand the function of
  - Build a simple Morse 'transmitter'

### Materials

- SAM Labs Kit
- SAM Labs Student Workbook
- Pony Express clip: [https://youtu.be/kvEyY\\_VhXks](https://youtu.be/kvEyY_VhXks)
- Telegraph clip: <https://youtu.be/pkafFxtc8A8>

### Warm Up – Then and Now

5 minutes

*How has communication developed?*

**Objective:** Understand briefly the history of communication in order to situate Morse code and the telegraph.

**Procedures:** Teachers asks the students to look at the pictures. 'Can you see how these things fit into a history of communication? Can you put the pictures in order from the earliest to the latest?'



**Sample photo ideas:** Stamp, telephone pylon, mobile phone, Morse code machine, old style telephone, landline telephone

**Link forward:** The teacher helps students identify how we now take for granted that communication is divorced from physical transport but that this has only been so for a relatively short time

### Mini-lesson:

10 minutes

*The Telegraph and Morse Code*

**Objective:** Students learn about the radical change brought about by the telegraph and Morse code in that for the first time, communication was not limited by the physical speed at which people or animals travel.

**Procedures:** Explain that almost 200 years ago, there were no phones, internet or anything else. How were urgent messages transmitted? Well they were carried by horse, but even with fast riders letters could take 10 days from coast to coast. (See: [https://en.wikipedia.org/wiki/Pony\\_Express](https://en.wikipedia.org/wiki/Pony_Express) and [https://youtu.be/kvEyY\\_VhXks](https://youtu.be/kvEyY_VhXks)). Early settlers were effectively as far from the East coast (where the biggest centres of population were) as a person might be on the Moon nowadays. Later in the 19th century there were wires but they couldn't transmit voice, just buzzes. So you could transmit over a long distance but only by buzzes. So what use was that? Explain that Samuel Morse, in 1837, invented a system of representing letters by combination of buzzes.

## Lesson 3.2 - Morse Code

Morse could have simply assigned each letter to a different number of buzzes, eg:

Letter	Buzzes
A	1, 'buzz'
B	2, 'buzz, buzz'

### Examples:

- Z would have been 26 buzzes
- it would have been very slow
- it would have been very difficult to know when one letter finished and the next one began

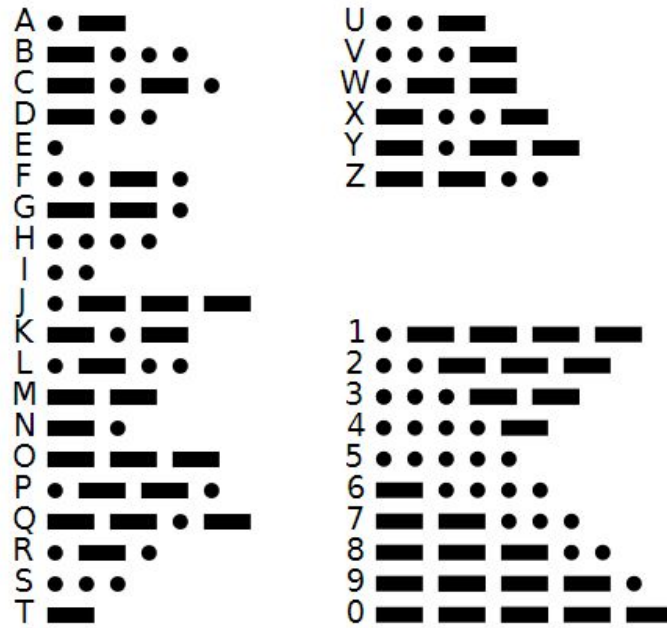
**So Morse decided to differentiate between long buzzes and short buzzes**

Letter	Buzzes
A	buzz, buuuuuuzz
E	buzz
I	Buzz, buzz
S	Buuuuuuzz, buuuuuuzz, buuuuuuzz

**This way, he could represent all letters and number with a maximum of 5 long or short buzzes. Morse called the short buzzes 'dots' and the longs ones 'dashes'. We will use this from now one, eg:**

Letter	Buzzes
A	. _
E	.
I	..
S	_ _ _

## Lesson 3.2 - Morse Code



**Encourage students to make the buzz for a few letters. Demonstrate yourself if you dare!**

Mention that, unlike most codes, which are designed for secrecy, Morse was designed for efficient transmission of information.

**Explain that we are going to:**

- Make a Morse buzzer
- Transmit some messages

### Key Words

- morse
- dot
- dash
- telegraph
- communication

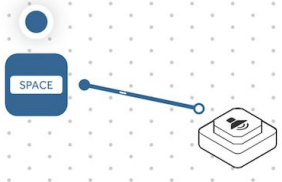
**Let's Discuss:** *The telegraph could only transmit buzzes: How does Morse code translates buzzes into letters? Why was this so important? In your workbooks or with a partner, record, discuss, or share why you think Morse and the telegraph were an important step forward.*

**Link forward:** The teacher prepares students to designing a system to enable them to send Morse code

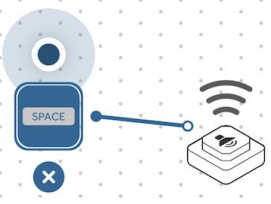
## Worked Example

**7 minutes**

*Make a SAM system to send Morse Code*

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Turn on and pair a LED Light block or Buzzer block. Drag the Key Press block and a Buzzer block onto the Workspace and connect these together.		<i>If you do not have a buzzer, a light can be used, using long and short flashes</i>

## Lesson 3.2 - Morse Code

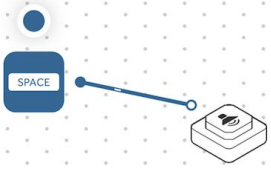
<p><b>Step 2.</b> Make sure your partner can hear and see your light or buzzer.</p>		<p><i>This may sound trivial, but you will have to concentrate against background noise</i></p>
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**Checks for understanding:** *How, in real life, would the buzzer would be repeated at the listeners destination?*

### Challenge 1

**7 minutes**

*Send a Morse code message*

Instructions	Workspace	Notes for Teachers
<p><b>Step 1.</b> Use the System from the Worked Example.</p>		<p>You can use a Morse table:  <a href="https://upload.wikimedia.org/wikipedia/commons/1/1f/International_Morse_Code.PNG">https://upload.wikimedia.org/wikipedia/commons/1/1f/International_Morse_Code.PNG</a>  or use this Morse Translator:  <a href="https://morsecode.scphillips.com/translator.html">https://morsecode.scphillips.com/translator.html</a></p>
<p><b>Step 2.</b> Choose an easy word and send to your partner.</p>	<p>Hi</p> <p>.... ..</p>	<p>On this first Challenge, don't be over ambitious. for example 'Hello' is:</p> <p>....   .   .-..   .-..   ---  h e l l o</p> <p>Whereas:</p> <p>'We' is .- -.</p>
<p><b>Step 3.</b> Now choose a short phrase of 2 - 3 words and send to your partner.</p>	<p>WE CAN</p> <p>... . -.-. .- .-</p>	<p>This may be difficult, so try something simple first. People need between 2 - 4 months of a lesson a day, even to get to a basic level. It may be helpful to have the Morse Code Key on the projector</p>

**Checks for understanding:** *Why it is necessary to use very short messages when we begin to use More Code? Why is it difficult to send our first messages in Morse code?*

### Challenge 1 - Debug it

**5 minutes**

*How do we know when one letter stops and another begins?*

Instructions	Workspace	Notes for Teachers
<p><b>Step 1.</b> In Morse, letters or words are separated by a space = three dots (one dash), and the words are separated by a space = seven dots (two or three dashes)</p>	<p>WE / CAN</p> <p>... . / -.-. .- .-</p>	<p>You should make a noticeable pause between letters, and a longer noticeable pause between words.</p> <p>Students can conduct some internet research on the exact length of the pauses between letters and words.</p>

## Lesson 3.2 - Morse Code

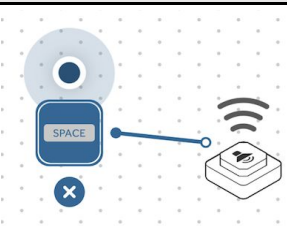
<b>Step 2.</b> Send your messages again, but using pauses between letters and words	<b>WE / CAN</b>  .- .- . / - . - . - . - .	Send your original messages again, but using noticeable pauses between letters and words
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**Checks for understanding:** Why do we need pauses between words and letters. Why do these have to be noticeable and differentiated?

### Challenge 2

7 minutes

Improve your Morse code

Instructions	Workspace	Notes for Teachers
<b>Step 1.</b> Take turns sending messages.		Don't get frustrated if you find this difficult. The important thing is to understand the <b>principles</b> of Morse
<b>Extension Activities:</b> <ul style="list-style-type: none"> <li>• <b>History</b> <ul style="list-style-type: none"> <li>○ Early settlers in the US</li> </ul> </li> <li>• <b>Science:</b> <ul style="list-style-type: none"> <li>○ Inventors and inventions</li> <li>○ Information transmitted over long distances</li> </ul> </li> <li>• <b>English Language Arts:</b> <ul style="list-style-type: none"> <li>○ Write an informative/explanatory text to examine the topic of communication since the invention of the telegraph</li> <li>○ Write an opinion piece explaining how Morse's artistic background combined with this interest in science helped him to become such a successful investor and agent of change</li> </ul> </li> <li>• <b>Art and Design:</b> <ul style="list-style-type: none"> <li>○ Make a real Morse code key: <a href="https://int.samlabs.com/blogs/projects/morse-code">https://int.samlabs.com/blogs/projects/morse-code</a>.</li> <li>○ Use a Button or a Light Sensor operated by the key if you do not have a Tilt Sensor</li> </ul> </li> </ul>		

**Checks for understanding:** What is the purpose of Morse code? What was so revolutionary about Morse Code?

### Tidy Up / Exit Ticket

4 minutes

Reinforcing the learning objectives of the lesson, students can reflect on key takeaways by completing and submitting an exit ticket.