

# Activity 1: Communication: Codes and Combinations

## Recorder's Report

Manager:

Reader:

Recorder:

Driver:

Date:

Score: Satisfactory / Not Satisfactory

Record your team's answers to the key questions (marked with ) below.

a) Model 1, Question #5

b) Model 3, Question #12

c) Model 4, Question #19

d) Model 5, Question #25

# Activity 1: Communication: Codes and Combinations

We communicate both data and instructions to computers. This activity will explore how we encode information and what constraints the media used places on the information conveyed.

## Content Learning Objectives

*After completing this activity, students should be able to:*

- Calculate the number of values that can be encoded in a number of bits; and,
- Identify ways to increase the information encoded in a number of bits.

## Process Skill Goals

*During the activity, students should make progress toward:*

- Use a translation table to encode and decode Morse Code and Braille (information processing).

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## Sources

- [Models of Communication](#)
- “Running Antelope Pictographs 002” by [Peter Albrecht](#) is licensed under [CC BY-NC-SA 2.0](#)
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- “Morse code tree3.png” by [Aris00](#) is licensed under [CC BY-SA 3.0](#)
- [Braille Alphabet Chart](#)
- “Where’s The Any Key?” by [swanksalot](#) is licensed under [CC BY-NC-SA 2.0](#)



# Model 1 Communication

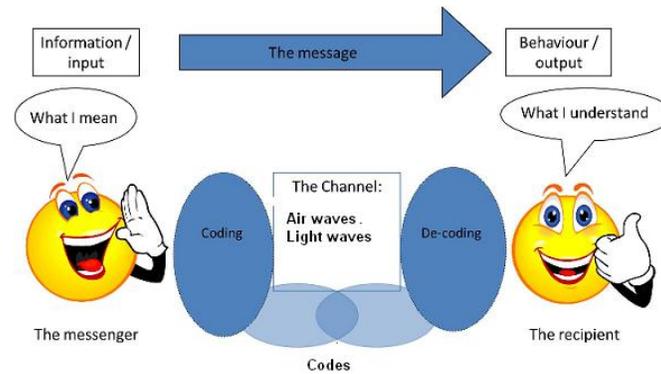


Figure 1: Schramm's Model of Communication

A model of communication by Wilbur Schramm includes the following elements:

- Messenger
- Encoding
- Channel
- Decoding
- Recipient

*Refer to Model 1 above as your team develops consensus answers to the questions below.*

## Questions (10 min)

**Start time:**

1. In Schramm's model, what elements are between the messenger and the recipient?
2. What channels are specified in the above image?
3. According to the image, what is carried on the channel?
4. With verbal communication, what are the codes?

5. Based on the model (and your personal experience), with in-person, face-to-face communication, what channel(s) are used?



6. In communication, we often find that the message doesn't get through or is misunderstood. Using this model, what are possible causes for this situation?

## Model 2 Writing

One limitation in communication is when the recipient is distant in space or time. In that case you can write your message and deliver it to the recipient (or wait for them to find it). That writing needs to be encoded in a medium that the recipient can decode.



*Refer to Model 2 above as your team develops consensus answers to the questions below.*

### Questions (10 min)

**Start time:**

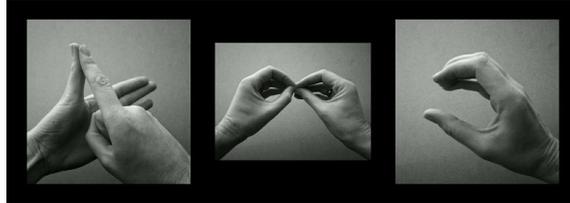
7. What items are depicted in this picture?

8. Pictograms are little schematic pictures of things, actions, or concepts, and form the basis of cuneiform and hieroglyphs. Ideograms are graphical symbols that represent ideas. Logogram is the name of the symbols that are used in writing Chinese, Japanese, and Korean. In what sense would it be easier for children to learn to read if dog were written as '狗'?

9. While there are over 100,000 Chinese characters, a literate person needs to know only 4,000–5,000 characters. Printing using movable type (each letter is a separate piece) was invented in China several hundred years before Gutenberg created his press in 15th century Europe. Why might it have caught on more quickly in Europe?

10. Even when words are made up of letters, the letters themselves can have different presentations. Consider the following examples of the letters A, B, and C. What does that suggest about the difference between a letter and how it is written (a glyph)?

*ABC abc ABC*



## Model 3 Morse Code

As suggested by above with American Sign Language, there are ways of presenting letters that don't involve placing ink on paper. Morse Code transfers letters using combinations of short (dot) or long (dash) bursts of light, electricity, radio, or sound.

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

Refer to Model 3 above as your team develops consensus answers to the questions below.

### Questions (10 min)

Start time:

11. Using the chart above, encode 'COMPUTER'.

12. Decode the following:

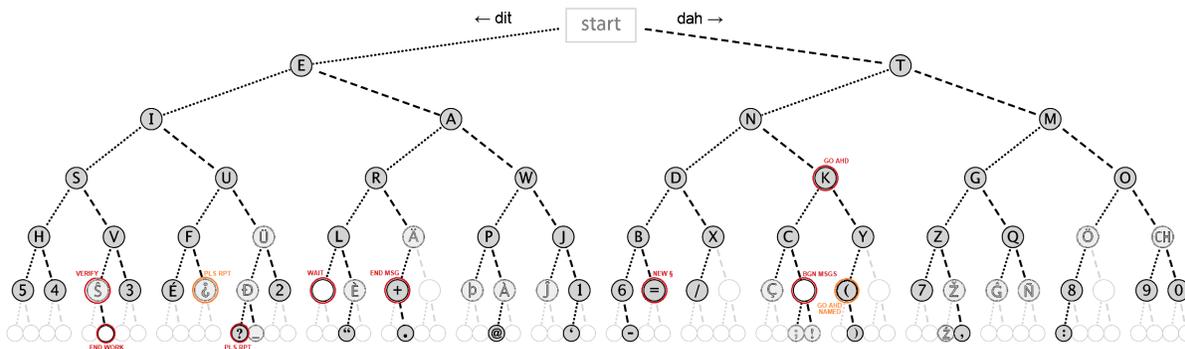


• • •   - • -   • • • •   —   —   • - • •

13. Using the chart above, how many tests or comparisons would you have to make to find each of the letters in question 12 (how many rows would you examine starting your search at the top)?

14. Using the tree below, how many tests or comparisons would you have to make for each of the letters in question 12 (how many lines would you follow starting your search at the top)?

Decode Morse Code by following dots to the left and dashes to the right.



# Model 4 Braille

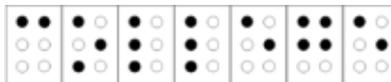
As already mentioned, there are ways of presenting letters that don't involve placing ink on paper. Braille uses raised dots on heavy paper (represented here as black dots since raised dots is more difficult!).


Refer to Model 4 above as your team develops consensus answers to the questions below.

## Questions (10 min)

Start time:

15. Using the information above, give the Latin letters equivalent to the following:



16. Looking at the top right dot for B and C, how many possible unique values are there for one dot?

17. Looking at the middle row for A, E, F, and G, how many possible unique combinations can two dots take?

18. How many dots are possible in one Braille block (or cell)?

19. How many unique combinations of dots can exist in one Braille cell?



20. How did you calculate that value?

21. Imagine an alphabet with two letters, O and X. How many words could exist in this encoding if the word size were the following values (the first two have been done for you)? What is the formula for this calculation?

1	2	3	4	5	6	7	8	9	10
2	4	8							

## Model 5 Shift and Shift Lock

One way to reduce the cost of a keyboard is to reduce the number of keys. Early typewriters often left out the digit 1 (see image). Even today's modern computer keyboards (with over 100 keys!) do not have separate keys for uppercase and lowercase letters.



*Refer to Model 5 above as your team develops consensus answers to the questions below.*

### Questions (10 min)

**Start time:**

22. How would someone type (encode) the digit 1 (one) on a typewriter missing that key?
23. How would someone read (decode) the typed page and know that the digit one was intended instead of letters or something else?
24. If we think of the keys as codes that tell the typewriter what to print on the paper, how do we type (encode) the '\$' symbol (shared with the '4' key)? How many codes (keys) are used?
25. If we have a continuous sequence of alternate values (say, four uppercase in a row), what option do we have to reduce the number of codes (key presses)? 