Navigate

With your class

- Was communication one of the uses of EM radiation that we identified as having fully explained, or was it one that we still needed to investigate further?

Navigate

With your class

- What kind of information can our modern wireless communication devices transmit to other devices?

- What kind of information do we think was sent in the first long-distance wireless message, in 1898?

Slide C

Navigate

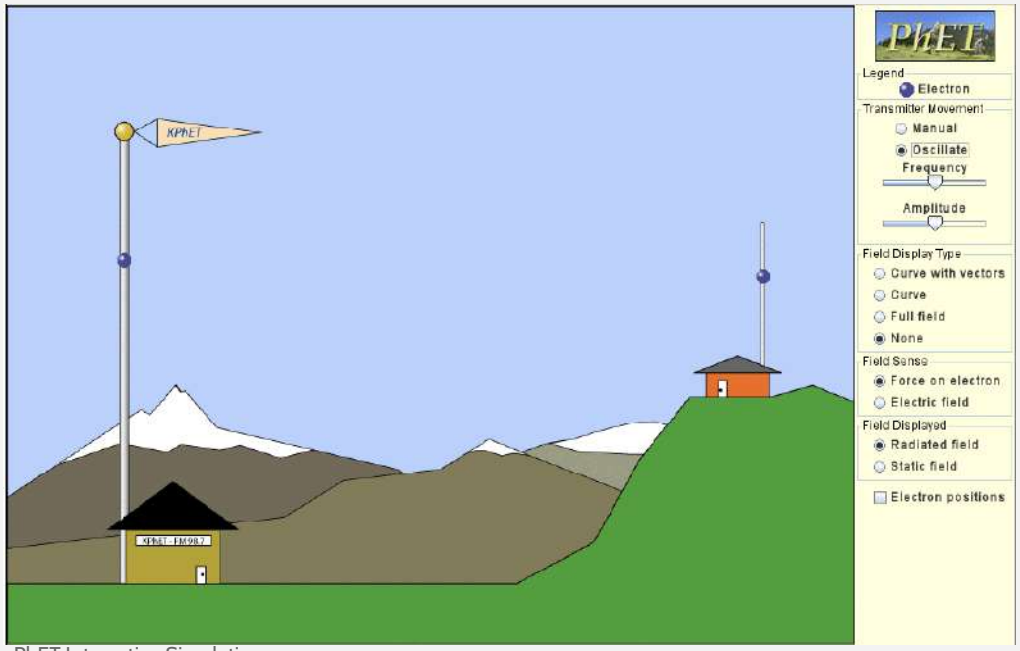
In the next few years after 1898, long-distance wireless communication was still limited to relatively few places. People used it to send relatively short text messages.

With your class

- What types of really short text messages do you think people would have sent back then?

Sending Information Using Wave Behavior

We used this simulation to explore energy transfer through a radio antenna.



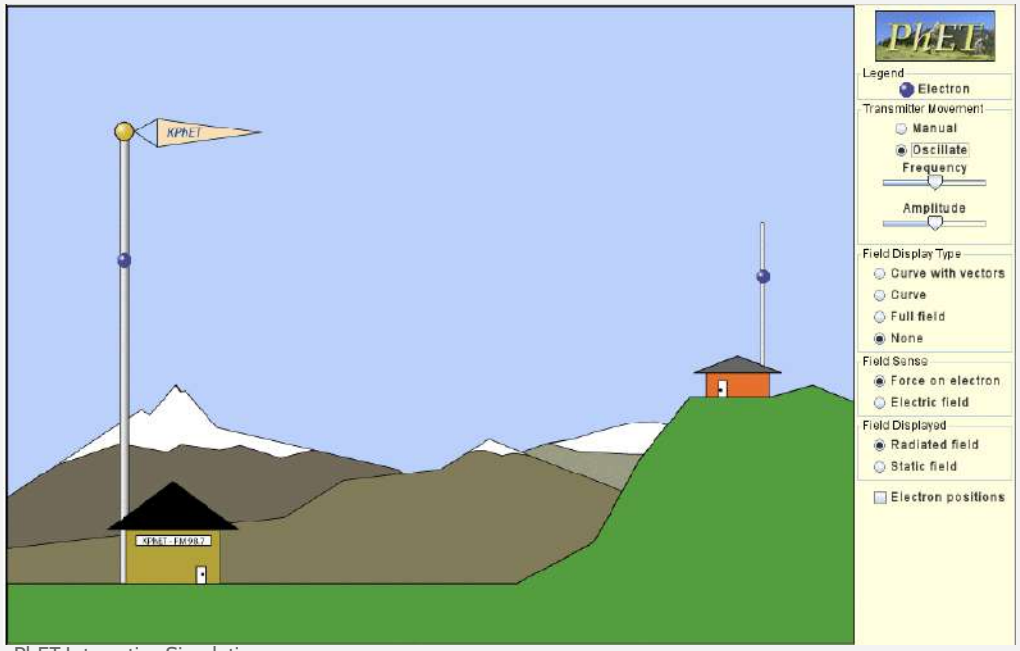
PhET Interactive Simulations

With your class

What did we change in the system to transfer different amounts of energy from the transmitting antenna to the receiving antenna?

Sending Information Using Wave Behavior

We used this simulation to explore energy transfer through a radio antenna.



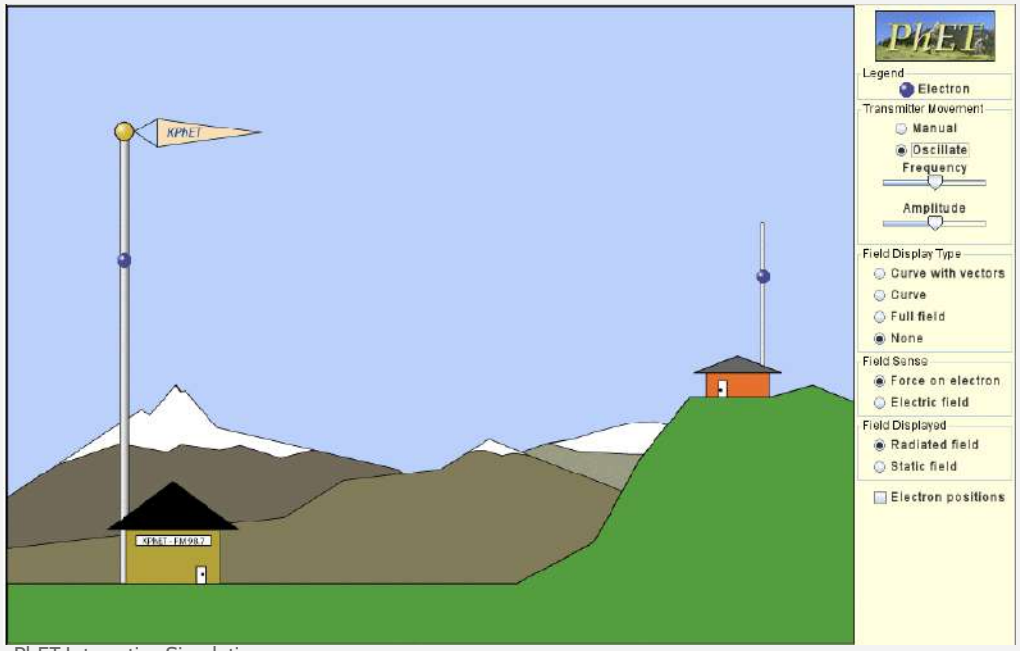
PhET Interactive Simulations

With your class

What changes did we observe in the receiving antenna?

Sending Information Using Wave Behavior

We used this simulation to explore energy transfer through a radio antenna.



PhET Interactive Simulations

Individual Think Time

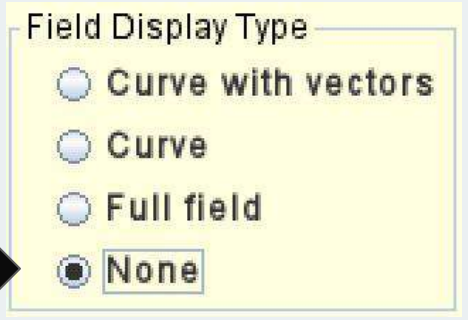
How could we use the changes in the electron in the transmitting antenna to send any of the 3 messages you chose to the receiving antenna?

Sending Information Using Wave Behavior

With a partner

- Use the simulation to develop a way to distinguish which of 3 messages was sent using movement of the electron in the receiving antenna.

Make it more challenging: Use this setting, along with a paper divider to split the 2 ends of the screen between you and your partner.



→ Be ready to share with the class!

Sending Information Using Wave Behavior

With your class

Different transmitter-receiver pairs will demonstrate their communication system with the class.

- **Transmitter:** Select a message you want to send to the receiver. Send it.
- **Receiver:** Interpret the message the transmitter sent.
  - If you were successful, describe how you knew this was the message. If not, why was it hard to tell?

Evaluate Our Communication Systems

With your class

- What are the limitations of the communication systems we just developed?
- What would be the characteristics of a better communication system?

Develop a Model

With your class

- What parts did we need in the system to send a message using EM radiation wirelessly from one person to another?
- What needed to happen in our system to communicate information?

Compare Systems for Sending Information

An earlier form of long-distance communication used a digital code to transmit information.

Observe an example of this.

With your class

What types of patterns do you notice in the signal?

Compare Systems for Sending Information

A 4-word question was the message being sent in the previous example. This was the question:

What do you notice?

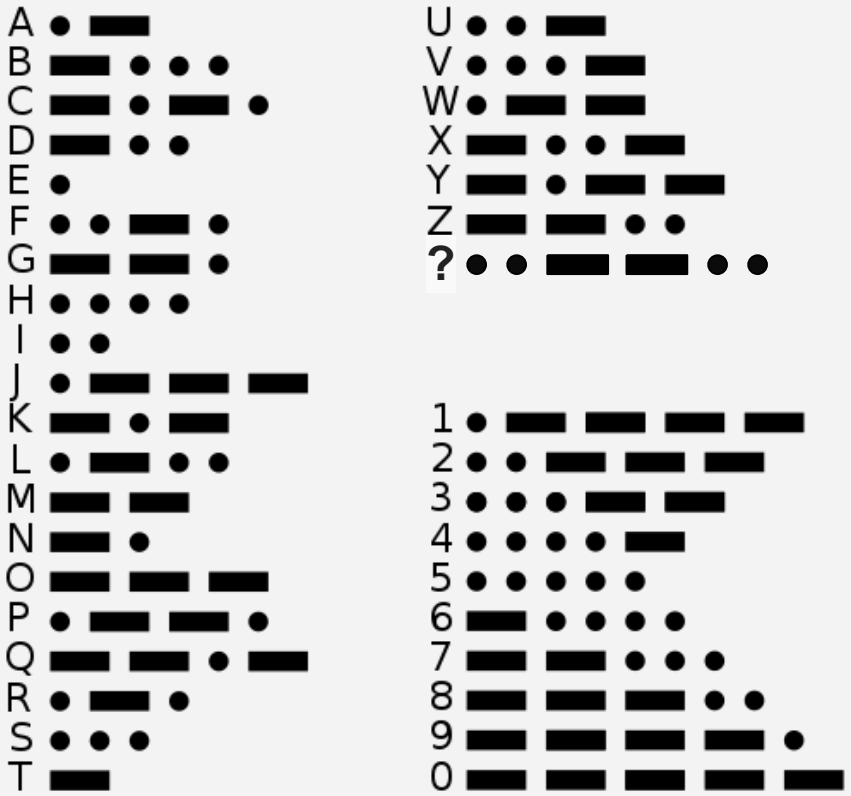
With your class

How could the patterns we observed have communicated such a complex question?

Compare Systems for Sending Information

The message was in Morse code, which was used starting in 1844 to send text messages between 2 people.

Morse code uses 1 to 5 long or short signal pulses to represent different characters.

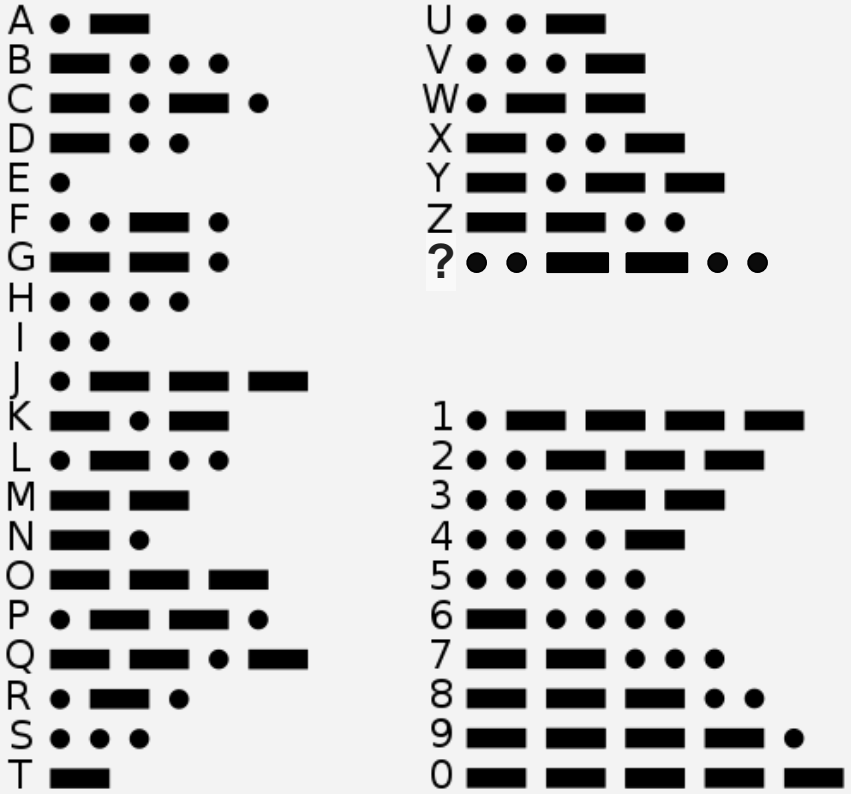


Rhey T. Snodgrass & Victor F. Camp, 1922, Public domain

Compare Systems for Sending Information

With your class

What sort of waves were we detecting each time we saw or heard a short or long signal pulse?



Rhey T. Snodgrass & Victor F. Camp, 1922, Public domain

Morse code is a 5-bit digital code.

Develop and Use a Model

Modern computer chips use a digital code to store, encode, transmit, detect, and decode information.

Devices that communicate wirelessly use antennas to send and receive billions of EM pulses per second, which allows them to send and receive many kinds of information quickly.

With your class

Revise your class model to represent these new structures and functions of modern wireless communication devices.

Navigate

With your class

What were the new sub-questions in our model that we identified at the end of the last class?

Slide Q

Gather and Communicate Information

With your group

Visit the first of your 4 assigned stations.

Review and carry out the directions for that station.

Record your findings on your handout.

Every 10 minutes, you will be cued to move to the next station.

Read about Digital Information

On your own

Synthesize all the information you gathered to help explain:

How are our wireless electronic devices designed to use EM waves to reliably communicate different types of information?

Navigate

Scientists and engineers have argued that using even higher frequency EM radiation in future wireless communication technologies could provide some advantages.

Turn and Talk

What might be some trade-offs in using even higher frequency EM radiation to send and receive information?

Be ready to explore this question further in an individual assessment next time.

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