

**Founding Communications**

Analogue and Digital

The differences between analogue and digital communication

Subjects: Science, Design & Technology, Mathematics

Approx time: 15 minutes

Key words / Topics:

- > Analogue
- > Digital
- > Signal
- > Substitution code

Suggested Learning Outcomes

- > Understand the nature of a telecommunications signal
- > Understand how interference can affect a signal
- > Explain the difference between signal being carried and power supply in a circuit

Introduction

From founding communications, such as the fire beacon, to being able to communicate with space, there is no denying that developments in communication have advanced at a rapid speed. This topic presents students with communications of the past, present and future, helping them to understand the principles that form the basis for these developments.

This activity examines the differences between analogue and digital communications methods. The effect of random wave interference was one reason that many communication systems have adopted digital encoding, even though this is more expensive and requires more hardware.

Purpose of this activity

This activity introduces students to the differences between analogue and digital communication. An analogue signal can be rendered useless by small amounts of interference, whereas a digital signal remains coherent.

Activity

1. The **Analogue and Digital** presentation can be used to help students to understand the difference between analogue and digital viewing.



Analogue and digital (Presentation).

This can be used as a paper handout, but will need to be cut into sections before use. Alternatively, it can be displayed by a data projector and cut up digitally.

Define the 'signal' as the communications message being carried by the waves.

Make sure that the students understand that an electronic system such as a phone or a radio receiver will have an electrical power supply that is a constant value, and an electrical signal that carries the message. Make sure that students know these are in separate

Teacher notes

15 minutes

The intention of this activity is to simply demonstrate that an analogue signal carrying a message is damaged by interference from outside sources.

A digital signal is not at all damaged, but requires a hardware device to encode the signal at transmission and a similar device to decode at the receiver.

Students may be aware of the need to adapt analogue TV receivers with 'digital boxes' at the point when all TV transmissions were switched over to digital signals.





electrical circuits in the device.

Define interference as electrical, radio or sound waves that get included in the signal circuit due to random effects that are hard to control.

Differentiation

Basic

The students will need to be taken through the presentation step by step. Students can make their own 'analogue interfered with' messages, as on the presentation, and find out how much interference is needed (i.e. how much of the letters get cut off) before the message becomes unintelligible.

Extension

Discuss and investigate possible sources of interference to electromagnetic or telephone wire signals.

Research and discuss the 'analogue switch off' for TV and radio broadcasts.

Students may encounter the US English spelling 'analog'.

Resources

- > Scissors and paper for analogue interference activity

Required files



Analogue and Digital (Presentation)

Additional websites

- > **BBC News** (www.bbc.co.uk/news): There are several news stories relating to analogue TV signals being turned off in favour of digital, e.g. <http://www.bbc.co.uk/news/uk-england-london-17752322>, <http://www.bbc.co.uk/news/technology-20054117>, <http://www.bbc.co.uk/news/world-asia-india-20164037>, <http://www.bbc.co.uk/news/world-africa-20984880>.

Related activities (to build a full lesson)

Starters

- > **ACTIVITY: Rosetta Code 1**
- > **DISCUSSION:** Another starter would be a discussion of codes and code breaking. Let the students research the terms Ultra (Second World War), Enigma and Bletchley Park.

Main

- > **ACTIVITY: Rosetta Code 2**

Extension

- > **ACTIVITY:** Analogue and Digital

Plenary

- > A possible plenary of a discussion session is suggested in the teacher notes for the substitution codes activity.

The Engineering Context



- > **The story:** Communications of the future
- > **Communications technology being used today:** Radar - Communications for safety





Curriculum links

England: National Curriculum	Northern Ireland Curriculum
<p>Science</p> <ul style="list-style-type: none"> > KS3 33a > KS4 1b, 2a, 7d, <p>Design & Technology</p> <ul style="list-style-type: none"> > KS3 3b, 3d <p>Maths</p> <ul style="list-style-type: none"> > KS3 1e 	<p>Science</p> <p>KS3 and KS4 Developing Pupils' Knowledge, Understanding and Skills</p> <ul style="list-style-type: none"> > Forces and energy <p>KS3 and KS4 (Objective 3) Developing pupils as Contributors to the Economy and the Environment</p> <ul style="list-style-type: none"> > Investigate a product of economic importance to determine the science behind it <p>Technology & Design</p> <p>KS3 and KS4 Developing pupils' Knowledge, Understanding and Skills</p> <ul style="list-style-type: none"> > Communication – use of free-hand sketching and formal drawing techniques and ICT tools (including 3D modelling); > Manufacturing – selecting and using materials fit for purpose; safe use of a range of tools and processes appropriate to materials, demonstrating accuracy and quality of outcome; > Control – incorporate control systems, such as mechanical, electronic or computer-based, in products and understanding how these can be employed to achieve desired effects. <p>KS3 and KS4 (Objective 3) Developing pupils as Contributors to the Economy and the Environment</p> <ul style="list-style-type: none"> > Investigate how the skills developed through Technology and Design will be useful to a wide range of careers. > Employability > Pursue design solutions using environmental friendly materials and energy sources. > Identify product needs and pursue sustainable harmonious design solutions in a local outdoor/indoor context.
<p>Scotland: Curriculum for Excellence</p> <p>Science</p> <ul style="list-style-type: none"> > SCN 3-11a, SCN 4-11a, SCN 4-16a <p>Technologies</p> <ul style="list-style-type: none"> > TCH 3-01a, TCH 3-09a, TCH 3-13a, TCH 3-14a, TCH 4-01a, TCH 4-09a, TCH 4-12a, TCH 4-13a, TCH 4-14a, TCH 4-14b, TCH 4-14c, TCH 4-14d, TCH 3-01a, TCH 4-01a <p>Numeracy and Mathematics</p> <ul style="list-style-type: none"> > MNU 3-03a, MNU 3-04a, MNU 3-07a, MNU 3-10a, MTH 3-11b, MNU 3-20a, MNU 4-01a, MNU 4-03a, MNU 4-10a, MNU 4-10b, MTH 4-11a, MTH 4-11b, MTH 4-15a, MTH 4-17b 	<p>Wales: National Curriculum</p> <p>Science</p> <ul style="list-style-type: none"> > KS3 Skills (Communication 1, 3), (Planning 1, 2), (Enquiry) > KS3 Range (How things work 1, 3, 4, 5, 6) > KS4 Skills (Communication 1, 3), (Enquiry and Practical Skills 1, 2, 3) > KS4 Range (Energy, electricity and radiations 1, 2, 3, 4) <p>Design and Technology</p> <ul style="list-style-type: none"> > KS3 and KS4 Skills (Designing 1, 2, 3, 4, 5, 6, 7, 8, 9), (Making 1, 2, 3, 4) > KS3 and KS4 Range (activities, in which they investigate, analyse and evaluate products), (activities in which they learn about the responsible use of materials), (activities in which they develop and practise particular skills), (activities in which they design and make products) <p>Mathematics</p> <ul style="list-style-type: none"> > KS3 Skills (Solve mathematical problems) (Communicate mathematically) > KS3 Range (Number 2, 3), (Measures and money 1) > KS4 Skills (Solve mathematical problems), (Communicate mathematically), (Reason mathematically) > KS4 Range (Handling data)





<p>GCSE D&T</p> <p>AQA D&T > 3.1.4</p> <p>Edexcel D&T > 1.6, 1.7</p> <p>Eduqas D&T > 2.1 Core: 5, 6 > 2.1 Systems: 1</p> <p>OCR D&T > 6.4</p>	<p>GCSE Engineering</p> <p>AQA Engineering > 3.3.2, 3.3.3</p>

Assessment opportunities

- > Ask the students to write a script for informing people of the reason why radio transmissions of high quality music are received more clearly using a digital signal. Assess the script as factual writing for a purpose (literacy).

Personal, learning & thinking skills (PLTS)

- > Reflective learners
- > Team workers
- > Effective participators

