Codes and Ciphers

UNIT 14 *Morse Code* Lesson Plan 1

Activity		*Notes*
		T: Teacher P: Pupil Ex.B: Exercise Book
1	**Historical Introduction** (See Teachers Resource Material for historical details. Explain to Ps the method whereby telegraph messages were sent by tapping out the code letters using special machines.) T: Who knows how the code works? *(Dots and dashes)* T: But how? *(Each letter has a unique code)* T: For example ...? *(SOS: dot, dot, dot, dash, dash, dash, dot, dot, dot)* T: Is this the most efficient code to use for the letters SOS? *(No)* T: Why not? *(You could use: dot, dash, dot)* T: Look at your copy of the code: what three letters would 'dot, dash, dot', in fact, give you? *(ETE)* T: So why isn't the most efficient coding used for SOS? *(Morse code was devised for all messages, not just for SOS, so the most frequently used letters are coded with the simplest codes)* *10 mins*	Interactive discussion using Ps' ideas and knowledge, with T giving information on the historical perspective of Morse code – at the time of its invention it was an enormous breakthrough in communication! T gives out copies of **OS 14.3**, or shows it on OHP, for Ps to find the letters represented by 'dot, dash, dot'.
2	**Transmission Time** T: The time for sending messages needs to be standard for the words to be understood. Units of time are allocated: *Character* / *Time* Dot – 1 unit of time Dash – 3 units of time Letter pause – 3 units of time Word pause – 7 units of time T: Let's see how long it takes to send SOS. Who can calculate this? P (on OS or board): $3 \times 1 + 3 + (3 \times 3) + 3 + 3 \times 1$ ↑ S, ↑ pause, ↑ 0, ↑ pause, ↑ S $= 3 + 3 + 9 + 3 + 3$ $= 21$ units of time T: Well done. T: What does the actual time taken to transmit the letters depend on? *(The speed of the transmitting operator)* T: Yes – in fact, experienced operators can average 30 words per minute! *20 mins*	**OS 14.1** is shown on OHP; T explains what it means. It would be even better if T could have a Morse code transmitter to actually use in the classroom. (The Science department might be able to provide something similar.) There are also pictures on the various websites on Morse Code; these could be shown to Ps to help their understanding. **OS 14.1** Volunteer P writes answer on board, saying aloud what is being done. Other Ps agree/disagree. Discuss errors. T praises. Again, it would be really helpful to have a transmitter, but one P could use a ruler to tap out the message on their tabletop.

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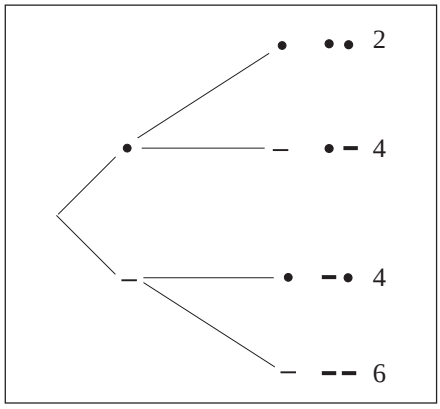
3	**Possible Codes** T: For Morse code we can use up to four dots or dashes for each letter. What is the quickest code to transmit? *(One dot)* T: Yes – just one unit of time. What else? *(One dash)* T: OK, but how many units of time is this? *(3)* T: Is there a shorter code? *(Two dots)* T: That's right. Two dots take only two units of time to transmit. T: What other codes have just two characters? *(dot dash; dash dot; dash dash)* T: And the length of time for transmitting these ...? *(4, 4, 6 units of time)* T: Now we can use a tree diagram to obtain all the possible codes and their lengths.  *35 mins*	This is a good activity for Ps to work on in pairs, after it has been introduced to the whole class. T should put tree diagram on the board and get Ps to complete it. Other Ps watch and help if necessary: agree/ disagree. Ps each have a copy of **OS 14.2**. T gives them 5 minutes to complete the sheet. T monitors and checks progress; then Ps complete the list of codes in transmission-time length order. T gives praise when appropriate. Use **OS 14.3** to review.
4	**Allocating letters and codes** T: How many possible codes are there? *(30)* T: How many do we need? *(26)* T: How do we know which ones to use? *(26 with shortest transmission times)* T: How are they allocated? *(According to letter frequency)* T: OK: here is the usual order of letter frequency for the alphabet. Complete the allocation of letters to codes. T: Here are the actual codes used in Morse code. What do you notice? Complete the table in Appendix 3. *(Not all the shortest are used, but there is fairly close agreement)* *45 mins*	Interactive discussion on how best to allocate the codes. T gives out list of letter frequencies (may write on board). Ps each have a copy of Appendix 2 and later Appendix 3 for comparison. Discussion on the similarity between Morse code and the expected codes according to letter frequency.
	Homework Use a mathematical method (e.g. correlation) to compare the two allocations of codes found above.	