The Emotion Machine

Age group: 7 – 12
Abilities assumed: None
Time: 40-60 minutes
Size of group: 1 upwards

Focus
Programming
Sequences
Low-level code and high-level commands
Compilers and interpreters
Abstraction

Summary
Students create and program a 2D robot made of card to show different emotions. They create a table that can be used to translate emotions (high level commands) into low level machine instructions.

Technical Terms
Sequence, Decomposition, Abstraction, Computational Thinking, Compilation, Interpreter, high-level command, low-level code.

Materials
For each student
Emotion Machine Sheet
Table of Codes for Emotions Sheet
Instruction Sheet

Scissors
Card, Stick Glue (optional but makes sheets more durable)
What to do

Give everyone the Emotion Machine sheet and have them do the following (as given on the Emotion Machine sheets).

1. Cut along the red dotted lines, so you've got the emotion machine and face containing empty slots, plus three strips to slide through the slots. (For younger groups you may wish to cut out the strips with the eyebrows, eyes and mouth first, as well as the slots to take them.)

2. Weave the strips through the slots for the eyebrows, eyes and mouth so that the letters appear in the emotion machine and parts of the face appear on the face.

Now either give the students the work sheet to follow or guide them through the steps. Also give each student a blank Emotion Machine table sheet to fill in.

At the end summarize the computing lessons from the activity. Programs are sequences of instructions that when followed lead to something happening like a robot showing different emotions. Computer instructions are really low-level codes. Programming languages use high-level commands to make programs easier to write – this uses abstraction to hide the detail of the low level codes. We can take a program of high level commands and compile it to a program that is used to actually operate the machine. Or we can use an interpreter that translates the instructions as we get to them.
Programming the Emotion Machine Instruction Sheet

1) Start programming the robot! Slide the strips back and forward to give different expressions, making the robot show different emotions.

2) What combination of letters appearing on the emotion machine will make the robot look happy? Give one letter for eyebrows, one for eyes and one for the mouth. Now try it out to check it works.

3) What other expressions can the robot make and so emotions it can show? Write a list of all the different emotions the robot can show in the table given. For each write the three-letter code that makes that expression next to it.

4) You can now use the names of the emotions instead of the codes. You can use the table to later look up the code to give any emotion. You have created a simple language of **high-level commands** to replace the **low-level codes** of the machine. This makes their instructions much easier to write and understand. You are using **abstraction** – the words like happy and sad **hide the detail** of what the actual codes on the machine for them are.

5) Work out the sequence of low level codes to make the robot do the following:
   - happy then
   - surprised then
   - sad.

   This is what a **compiler** does for a programming language. It takes **high-level commands** like the above that make sense to humans and translates it into low-level code that makes sense to the machine. You can write a program – a **sequence of high level commands** – to control the robot without having to worry about the codes at all when writing it. You can work them out later.

6) Write a little story about the robot that involves it having a sequence of different emotions, mentioning each emotion in the story at the right point. As you read the story make the robot show the right emotion when the appropriate word is said, by looking up the code in the table. Here you are acting as an **interpreter**: rather than compiling the program to the codes in one go and then following the instructions, you are translating the instructions only when you need to execute them.
## Emotion Machine: Table of Codes for emotions

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eyebrows</td>
</tr>
<tr>
<td>Happy</td>
<td></td>
</tr>
</tbody>
</table>

[Table continues with empty rows for other emotions]
The emotion machine

Try programming this robot face!

1. Punch out along the dotted lines, so you have got the emotion machine and face with some empty slots in them, plus three strips to slide through the slots.
2. Weave the strips through the slots for the eyebrows, eyes and mouth.
3. Get programming! Moving the strips to different letters will give you different expressions.

Things to try
What combination of letters makes the robot look happy? Can you come up with different expressions for mild happiness and utter joy? How about a series of combinations to make the robot look happy, surprised, then sad?

Create your own new emotions by drawing different eyebrows, eyes and mouths. What expressions would the robot need to do if it were going to be someone's friend?

Our robot face is based on a real design used in the LIREC research project. To see the real one in action go to www.lirec.eu.
Variations and Extensions

**Draw your own expression strips**
Have the class create their own expression strips with different collections of eyes, eyebrows or mouth so that it can show a wider range of expressions. What expressions would the robot need to do if it were going to be someone's friend?

**Draw your own puppets that show expressions**
Have the class design their own faces (or whole puppets). Use the robot as a template for where the slots need to be. Then write and tell a story about the character, as above.

Further Reading

**Computing without computers**
A free booklet by Paul Curzon on programming, data structures and algorithms explained using links to everyday concepts. Available from http://teachinglondoncomputing.org/resources/

Links to other activities

**The Create-a-face Activity**
*Make a giant programmable robot face from kids that shows emotions.*
Demonstrate what a program is and get students writing their first program, then act it out making a giant robot face react to different sounds with different expressions. Introduce computational thinking ideas like abstraction and decomposition in the context of objects.

**The swap puzzle**
*Solve a puzzle, coming up with an algorithm that your team can follow faster than anyone else.*
This gives a way to introduce the idea of the solution to a problem being a set of instructions that allow others to ‘solve’ it with no understanding. It also explores how different algorithms can solve the same problem but may not be equally good – some may be faster.

Live demonstration of this activity

Teaching London Computing give live sessions for teachers demonstrating this and our other activities. See http://teachinglondoncomputing.org/ for details. Videos of some activities are also available or in preparation.