Teaching KS3 Computing

Session 5

Theory: Representing text and sound

Practical: Building on programming skills

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Today's session

5:00 – 6:00

Representing text and sound

6.00 – 7.00

While loops and consolidation

From the national curriculum

At KS3 students should be able to:

“understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits”

Computing programme of study

What other data is stored on a computer?

Text data

Entered on a keyboard

Text data

- We talk about “storing” data on the computer when we save it
- All data needs to be converted to a form understood by the computer
- This ends up as 1s and 0s – binary code
- A coding system is needed so that each character can be represented in binary
- Two common systems are ASCII and UNICODE

Some ASCII codes

Char	Dec	Binary
1	49	00110001
2	50	00110010
3	51	00110011
4	52	00110100
5	53	00110101
6	54	00110110
7	55	00110111
8	56	00111000
9	57	00111001
Space	32	00100000
!	33	00100001
-	45	00101101
.	46	00101110

Char	Dec	Binary
A	65	01000001
B	66	01000010
C	67	01000011
D	68	01000100
E	69	01000101
F	70	01000110
G	71	01000111
H	72	01001000
I	73	01001001
J	74	01001010
K	75	01001011
L	76	01001100
M	77	01001101
N	78	01001110
O	79	01001111
P	80	01010000
Q	81	01010001
R	82	01010010
S	83	01010011
T	84	01010100
U	85	01010101
V	86	01010110
W	87	01010111
X	88	01011000
Y	89	01011001
Z	90	01011010

Char	Dec	Binary
a	97	01100001
b	98	01100010
c	99	01100011
d	100	01100100
e	101	01100101
f	102	01100110
g	103	01100111
h	104	01101000
i	105	01101001
j	106	01101010
k	107	01101011
l	108	01101100
m	109	01101101
n	110	01101110
o	111	01101111
p	112	01110000
q	113	01110001
r	114	01110010
s	115	01110011
t	116	01110100
u	117	01110101
v	118	01110110
w	119	01110111
x	120	01111000
y	121	01111001
z	122	01111010

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Activity 1: Converting text

Use the chart you have to convert this message from binary into a word

01001000	01100101	01101100	01101100	01101111
H	e	l	l	o

Now write your name or a short word in ASCII code

Ask your partner to decode it

Activity 1 (Extension)

Try to translate the binary answers to these jokes!

Why do bees have sticky hair?

01001000 01101111 01101110 01100101 01111001 00101101 01100011 01101111 01101101 01100010 01110011 00100001

What do you get when you cross a sheep and a bee?

01000001 00100000 01100010 01100001 01101000 00101101 01101000 01110101 01101101 01100010 01110101 01100111 00101110

Activity 1 (Extension)

Try to translate the binary answers to these jokes!

Why do bees have sticky hair?

01001000 01101111 01101110 01100101 01111001 00101101 01100011
01101111 01101101 01100010 01110011 00100001

Honey-combs!

What do you get when you cross a sheep and a bee?

01000001 00100000 01100010 01100001 01101000 00101101 01101000
01110101 01101101 01100010 01110101 01100111 00101110

A bah-humbug.

Activity 2: Word Smuggler

Go to http://www.wordsmuggler.com/Smuggler

Enter a word and see how it is converted into binary code.

Another activity: create binary necklaces

Coding messages in sound

This activity illustrates how anything can be coded and gives more binary practice

In this activity you will be played a tune and ask to convert it to a phrase.

Each tune has only two notes. The high note is 1 and the low note is 0.

Listen to the tune and write down the binary.

It so happens that the binary produced by the tune can be converted to 5-bit codes and will make a word. See if you can work out what that is. Use the 5-bit chart provided.

Try this one first then This one (harder)

Activity: http://csunplugged.org/modems-unplugged-2/

Follow up: You could use Audacity with the students and get them to record their own binary "message"

Answer 1 - jazzy Answer 2 - good work

5-bit chart for codes

1	2	3	4	5	6	7	8	9	10	11	12	13
a	b	c	d	e	f	g	h	i	j	k	l	m
14	15	16	17	18	19	20	21	22	23	24	25	26
n	o	p	q	r	s	t	u	v	w	x	y	z

1	2	3	4	5	6	7	8	9	10	11	12	13
00001	00010	00011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101
a	b	c	d	e	f	g	h	i	j	k	l	m
14	15	16	17	18	19	20	21	22	23	24	25	26
01110	01111	10000	10001	10010	10011	10100	10101	10110	10111	11000	11001	11010
n	o	p	q	r	s	t	u	v	w	x	y	Z

Space
00000

How is sound stored on a computer?

Input via microphone

Output via speakers

Understanding sound at KS3

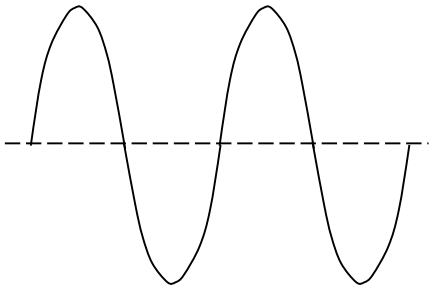
- Students can look in more detail at GCSE at:
  - Sampling sound
  - Sound resolution
  - Ways of compressing sound
- At KS3 activities can revolve around understanding:
  - Sound data is stored in binary when it’s digital
  - The best quality sound will be in larger files
  - Compressing sound a lot will make smaller sound files and worse quality
  - There is a difference between analogue sound and digital sound

What is sound?

- Sound is energy that travels through the air (or any other medium other than a vacuum) as a pattern of changing (air) pressure.
- Sound is an air pressure wave that is sensed by our ears.

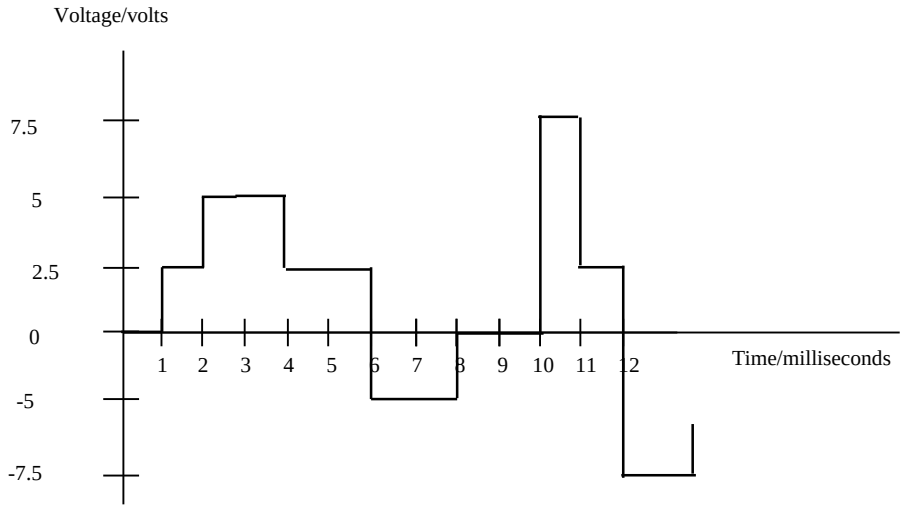
Analogue signals

- Images, sounds, and many sorts of measurement give rise to signals that vary over a continuous (or step-less) range of values
- These are called analogue signals
- An analogue signal can be defined as a continuously variable signal



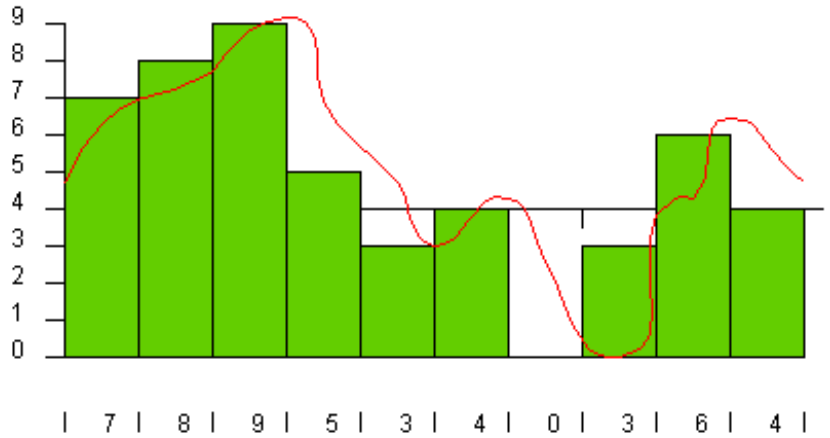
Digital signal

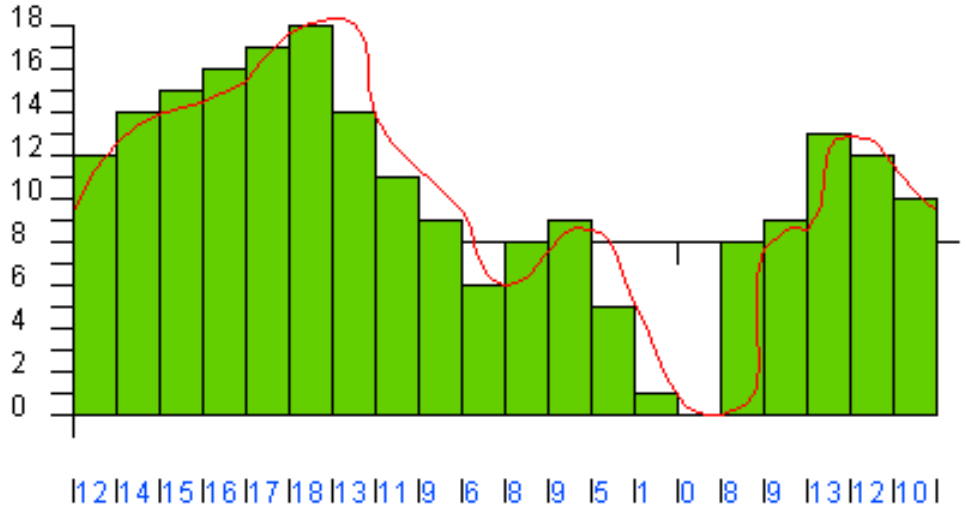
- Text, speech, images, or measurements must be represented by appropriate digital signals if they are to be stored, processed or transmitted
- A digital signal is an electrical signal with voltage changes that are abrupt or in discrete steps



Sampling sound

Digital sound is created by sampling. The more samples per second the better the quality. The picture on the left shows less samples per second than the one on the right. You can see that the green rectangles (which are samples) are closer to the red line which is the true analogue sound.





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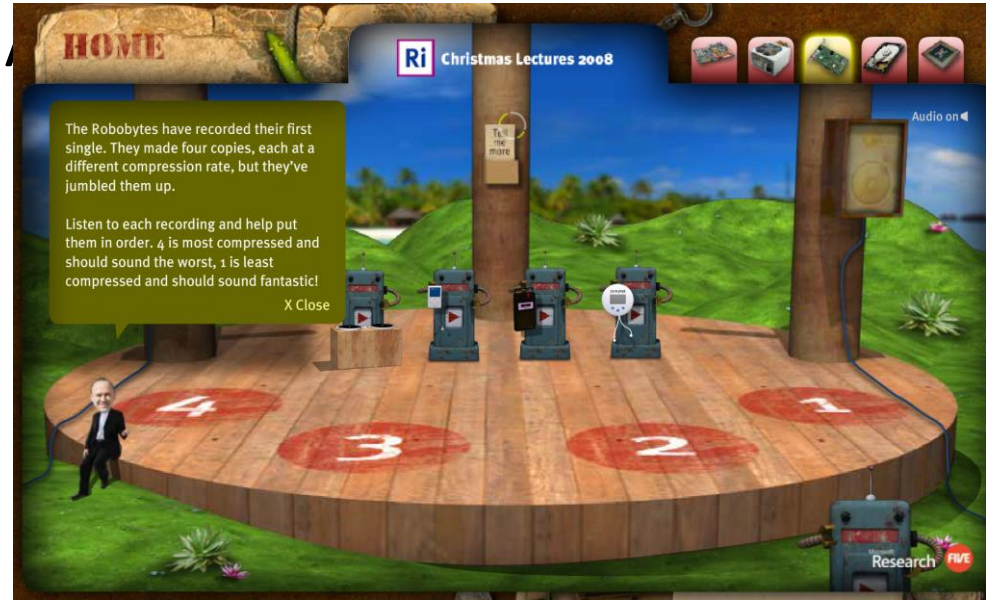
An activity around digital sound quality

This is an interactive game that requires you to listen to four clips of the same song and put them in order of quality



Access it by going to the Royal Institution lectures, then clicking on Ghost in the Machine and then clicking on the hotspot in the middle with the caption “ear ear”

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Saving sound in files - update

- There are several formats for storing digitised sound, e.g. Wav, MPEG.
- WAV is used when storing audio on a CD
- MPEG has extensions .mp3 and .mp4 amongst others
- MPEG is a compression algorithm which is based on psychoacoustic modelling that removes frequencies the brain and ear will not miss.
- One minute of CD audio can be cut down from 2.5mb as a WAV to 0.25mb as an MP3 file

Summary

- All data to be stored in a computer needs to be converted into binary digits
- This week we have looked at text and sound data
- Next week we will look at image data and start to look at aspects of a computer

Break