Mini Game Console

This science project was done by:

....

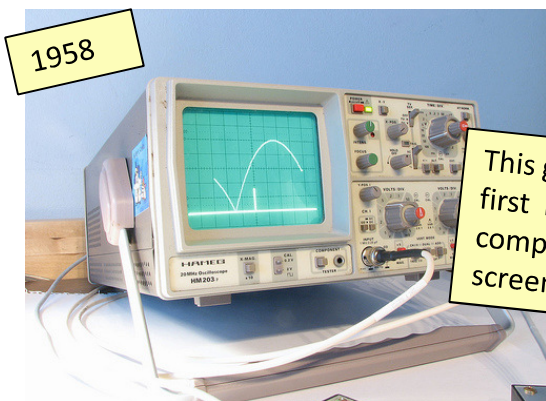With a little help from Elizabeth's mum & dad

Computers

- Today there are computers everywhere!

- There are computers in cameras, in phones and in washing machines.

- Years ago a computer took up a whole room.

Maybe not in chickens!

- Today a computer can fit on a single chip the size of you finger-nail.

- Since computers were invented people have used them to play games.
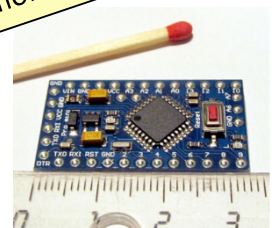
1950s

1958

This game was first made before computers had screens at all!

Which of these computers do you think is more powerful?

- Now that computers are small and cheap we can make small computer games ourselves

2014

Early Computer Games

Modern computer graphics

- Computer games now are vast and complicated with realistic "graphics".

- Even games on phones can be very complex.

- Before computers were powerful enough to make such realistic graphics, early games were much simpler but sill fun to play.


Space Invaders was another early success
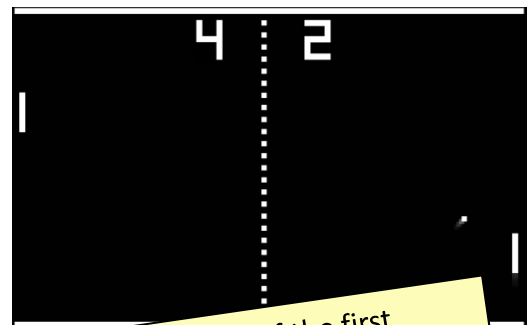
Pong was one of the first commercial computer games

Computers and Numbers

- Even though modern computers can be very complex, they still only understand numbers. It's just that they can handle them very *very* fast!

- Everything in a computer has to be expressed as a number. Sometimes a very long number! Even pictures and sounds have to be turned into numbers.

- To display a picture, a computer divides it into little squares called "pixels" each pixel is given a number which represents the colour of that square.

- In simple games like Space Invaders you can see how the characters are made up of small squares.

- The computer uses a "0" for where the pixel is black and a "1" for where it is coloured.
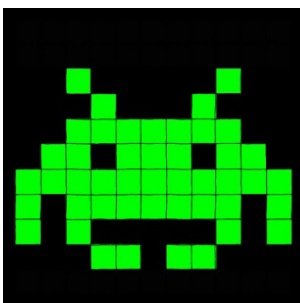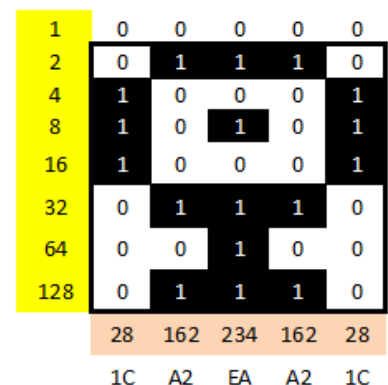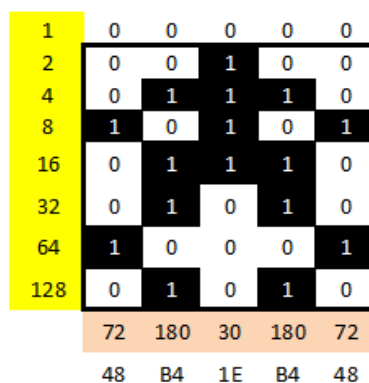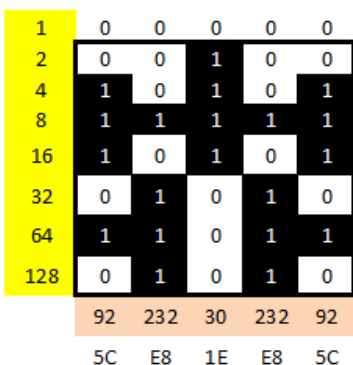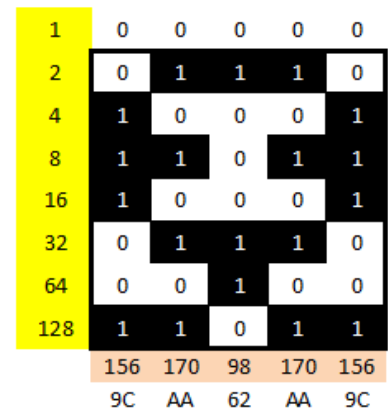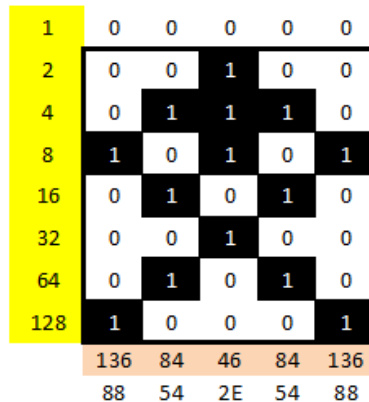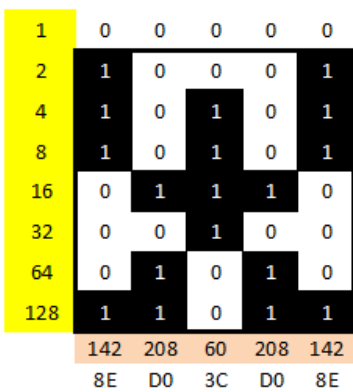
Can you see how these aliens are made up of black and white pixels in a grid?
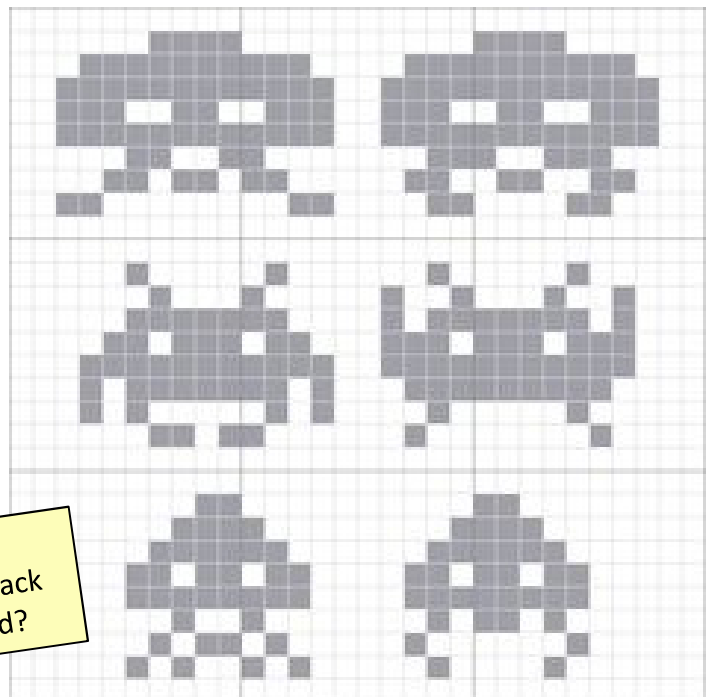
Designing Aliens

- We are going to design some aliens for our Space Invaders game.

- We will use a grid having 5 columns of 8 pixels. We put a 1 where we want a black pixel and a 0 where we want white. Then we add up the columns.

- The computer uses a special type of maths called "binary" for its numbers.

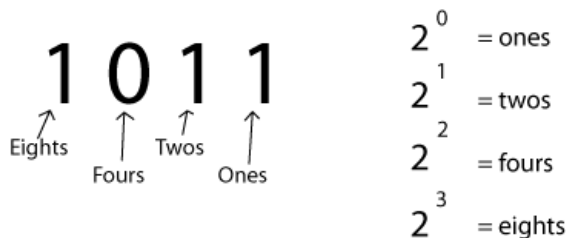- We make numbers from the digits 0 to 9. In binary you can make any number from 1s and 0s.

Grid 1

1	0	0	0	0	0
2	1	0	0	0	1
4	1	0	1	0	1
8	1	0	1	0	1
16	0	1	1	1	0
32	0	0	1	0	0
64	0	1	0	1	0
128	1	1	0	1	1
	142	208	60	208	142
	8E	D0	3C	D0	8E

Grid 2

1	0	0	0	0	0
2	0	0	1	0	0
4	0	1	1	1	0
8	1	0	1	0	1
16	0	1	0	1	0
32	0	0	1	0	0
64	0	1	0	1	0
128	1	0	0	0	1
	136	84	46	84	136
	88	54	2E	54	88

Grid 3

1	0	0	0	0	0
2	0	1	1	1	0
4	1	0	0	0	1
8	1	1	0	1	1
16	1	0	0	0	1
32	0	1	1	1	0
64	0	0	1	0	0
128	1	1	0	1	1
	156	170	98	170	156
	9C	AA	62	AA	9C

Grid 4

1	0	0	0	0	0
2	0	0	1	0	0
4	1	0	1	0	1
8	1	1	1	1	1
16	1	0	1	0	1
32	0	1	0	1	0
64	1	1	0	1	1
128	0	1	0	1	0
	92	232	30	232	92
	5C	E8	1E	E8	5C

Grid 5

1	0	0	0	0	0
2	0	0	1	0	0
4	0	1	1	1	0
8	1	0	1	0	1
16	0	1	1	1	0
32	0	1	0	1	0
64	1	0	0	0	1
128	0	1	0	1	0
	72	180	30	180	72
	48	B4	1E	B4	48

Grid 6

1	0	0	0	0	0
2	0	1	1	1	0
4	1	0	0	0	1
8	1	0	1	0	1
16	1	0	0	0	1
32	0	1	1	1	0
64	0	0	1	0	0
128	0	1	1	1	0
	28	162	234	162	28
	1C	A2	EA	A2	1C

Binary

- Computers use a special type of maths called "binary".

- Normally we use "decimal" maths where each column is 10 times bigger than the one to its right. Each column can take anything between 0 and 9
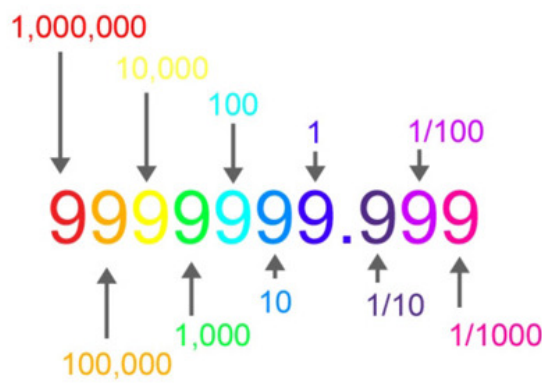
- In binary, each column is only twice as big as the last and can only take a 0 or a 1. For big numbers you need a lot of columns.

- We make numbers from the digits 0 to 9. In binary you can make any number from 1s and 0s.

2^0 = ones

2^1 = twos

2^2 = fours

2^3 = eights

For our aliens, we will count the top row as 1s, the next row as 2s etc all the way up to 128s.

1*8 + 0*4 + 1*2 + 1*1 =

1*8   + 1*2 + 1*1 = 11 (base-10)

11 (base-10) = 1011 (base-2)

Program

- Computers are very fast at maths but they can only do what they are told. To make a game, we will need to write a program to tell the computer what to do.

- The Pong program works like this:
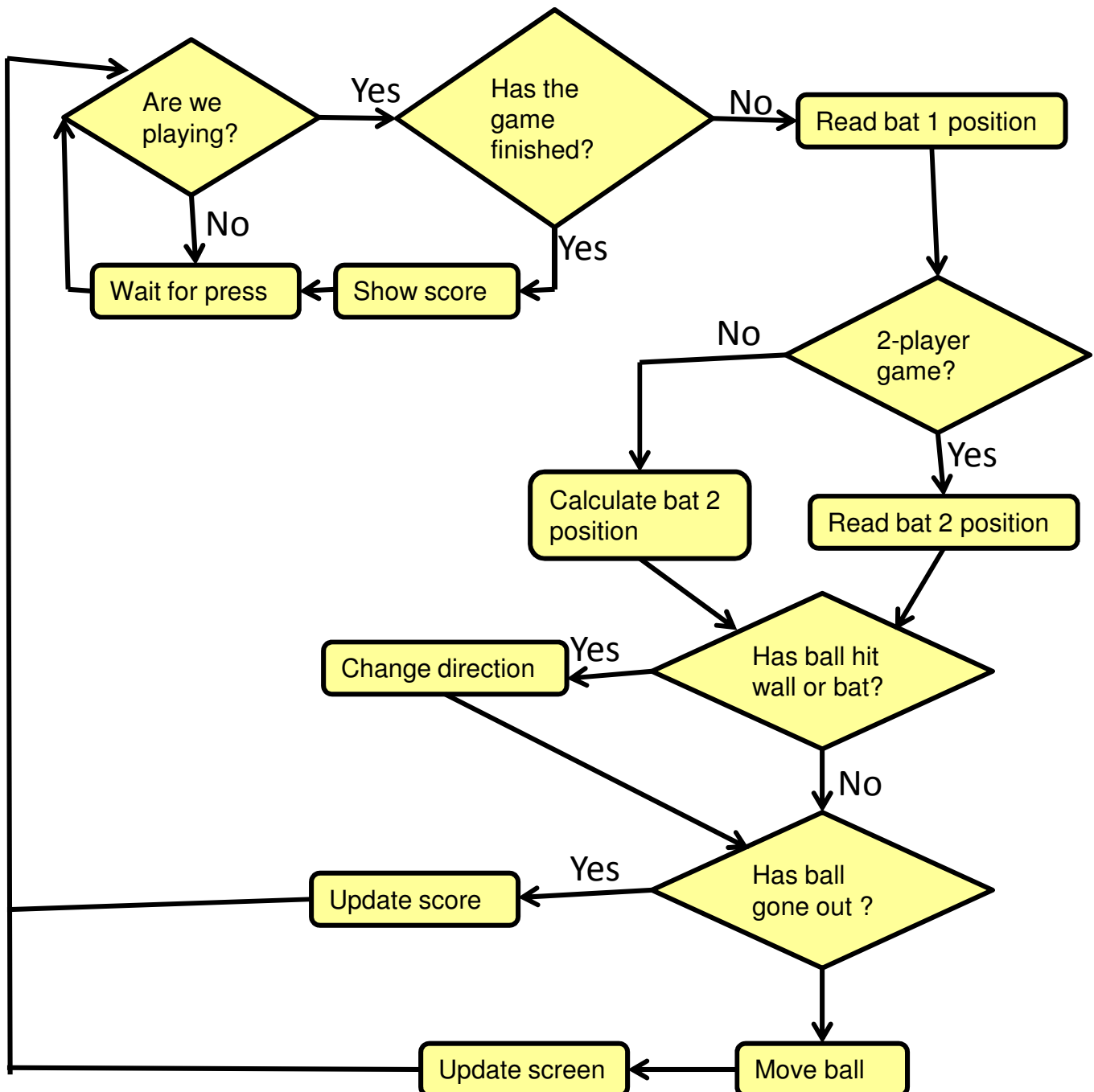
This is how it looks in the code

```
void pong()
{
   if(!gameOn) gameReady();

   while(gameOn){
     if(!endGame){
        bat1x=readBat(bat1);
        if(onePlayer){
           bat2x=autoBat(bat2x);
        }
        else{
        bat2x=readBat(bat2);
        }
        checkBall();
        checkTime();
        updateScreen();
     }
     if(endGame){
        gameOn=false;
        showWinner();

     }
   }
}
```

Can you guess what some of these functions do?

- Now, let's make our Pong-console and try out our designs

Things we need…

- You should have a tray with your name on it – see if you can collect up all of these things that we need:

Project Box
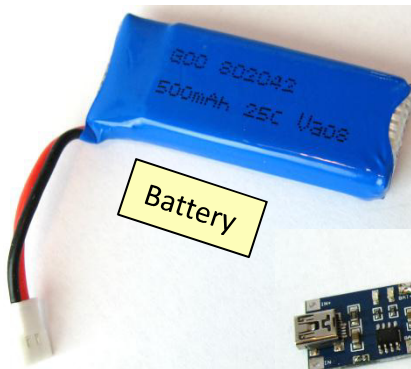
Battery
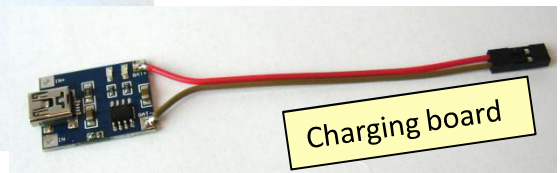
Charging board
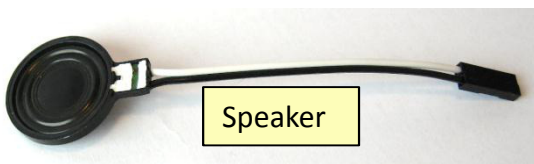
Speaker
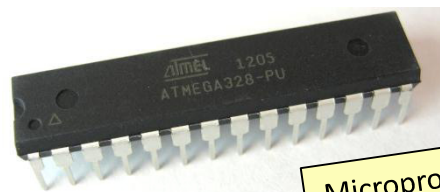
Microprocessor Chip

Small switch

2 long switches
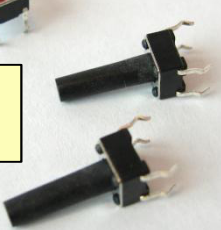
2 variable resistors & knobs

Charging cable

Circuit board
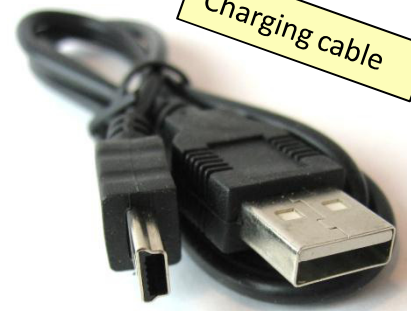
Voltage regulator

More stuff

Liquid Crystal Display

2 large capacitors

2 100nf capacitors marked "104"

2 ceramic capacitors 22pf – marked "22"

8.000 MHz crystal

Micro SD Card

Sound board

3 x 10k resistors – Brn, Blk, Blk, Red

100 Ohm resistor = Brn, Blk, Brn

1k resistor = Brn, Blk, Red

LED

4 screws

Header pins
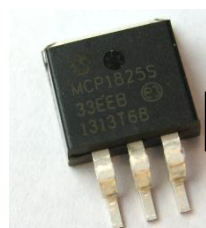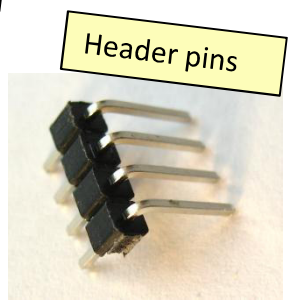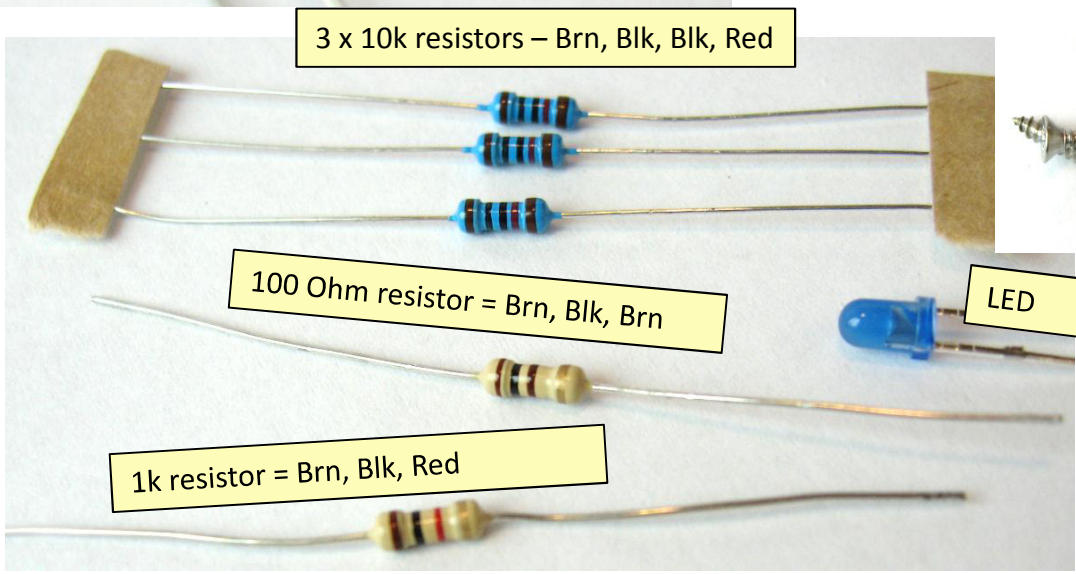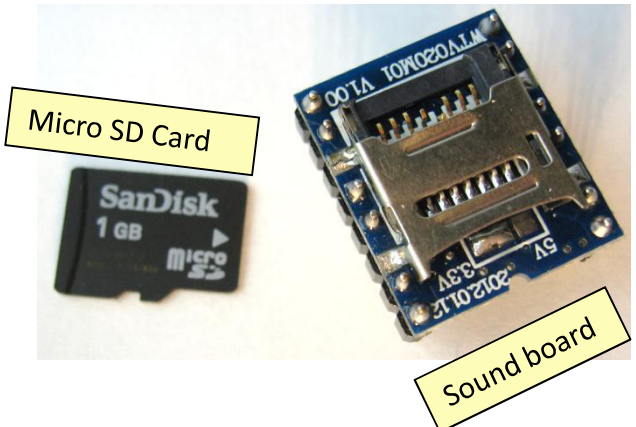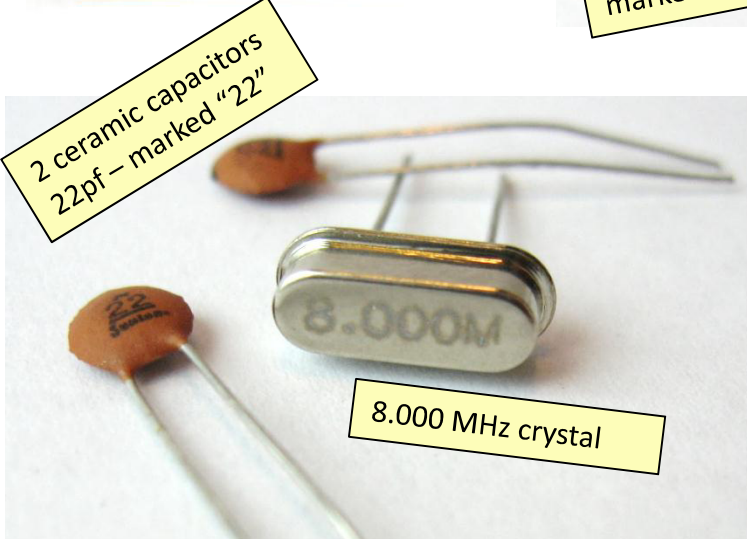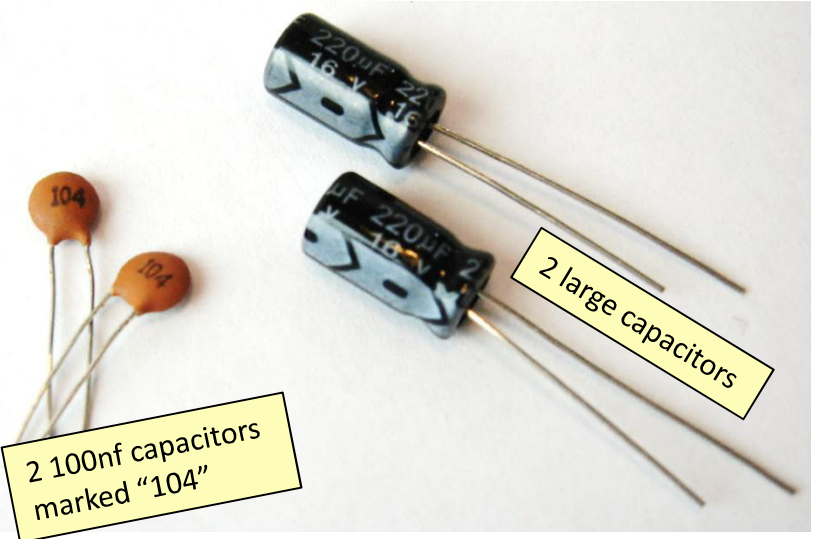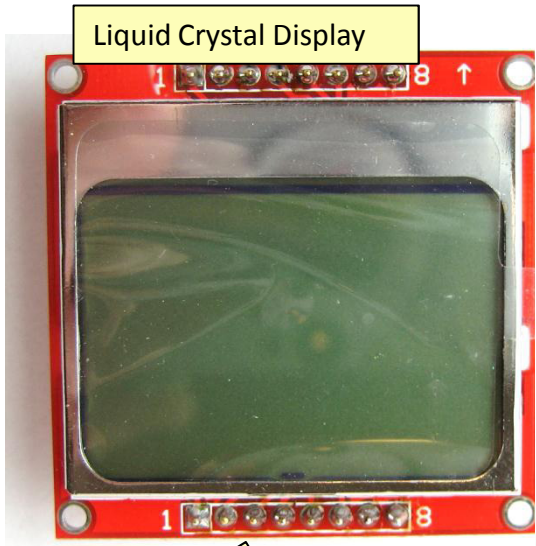
Add some components - back

100nf capacitors next to the socket

Remember to bend the legs out a little

100 Ohm resistor – Brn, Blk, Brn

Crystal and 22pf capacitors

Long leg to "+"

Large electrolytic capacitors

Voltage regulator
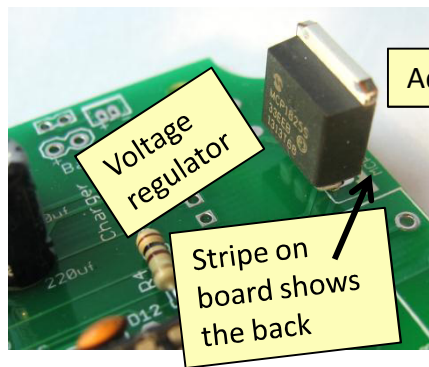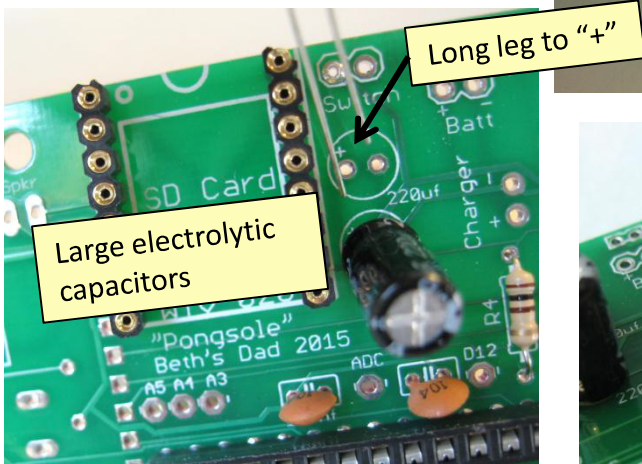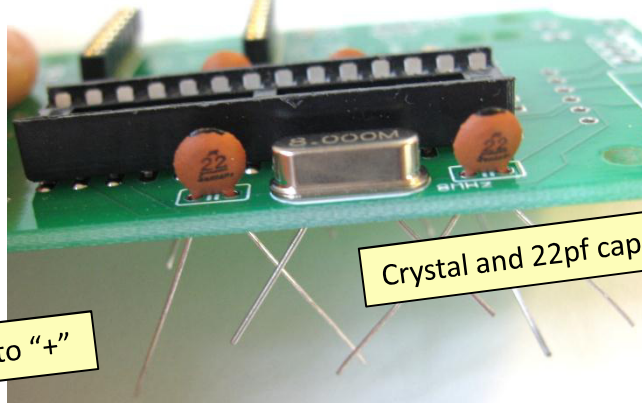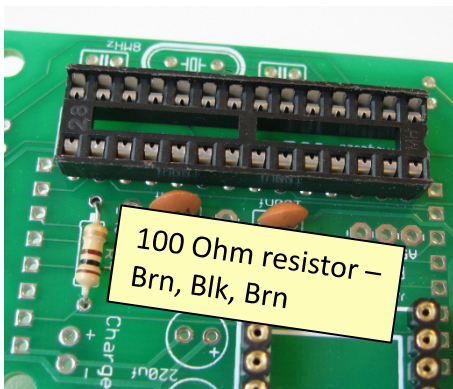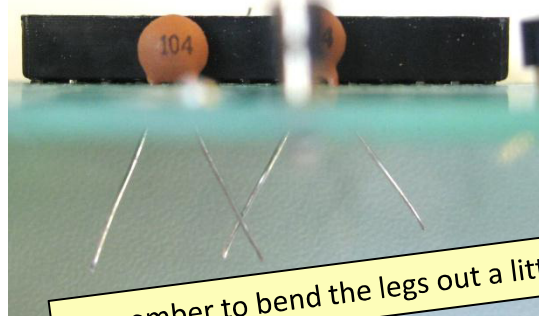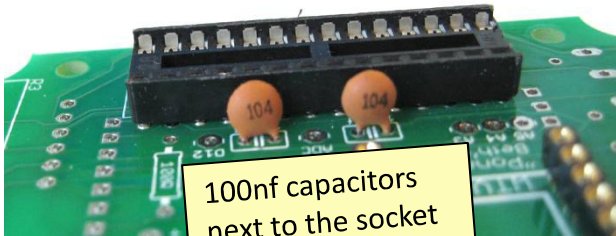
Add some tape to hold it on

Stripe on board shows the back

Solder each lead

Clip leads close
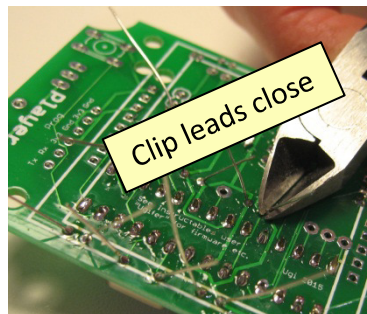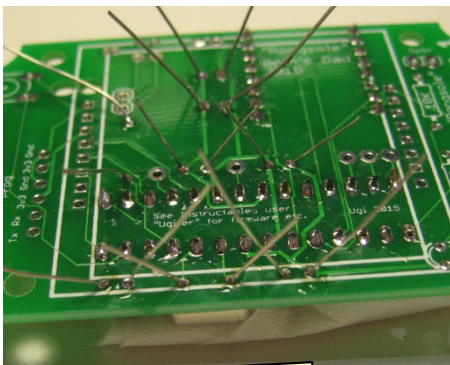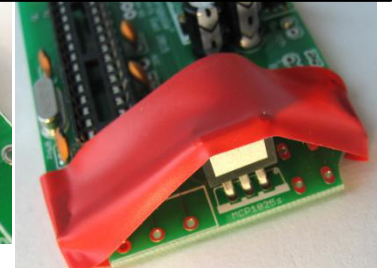
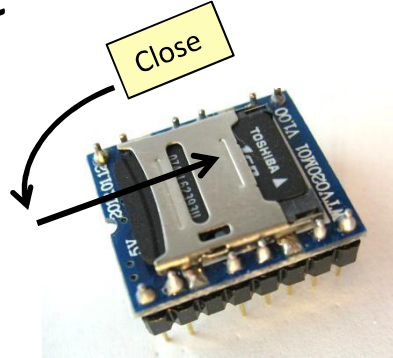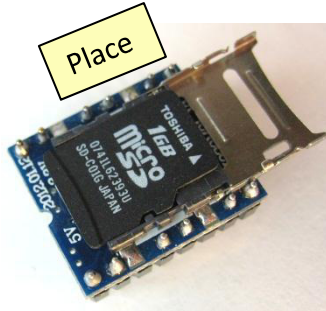Do the same with the variable resistors
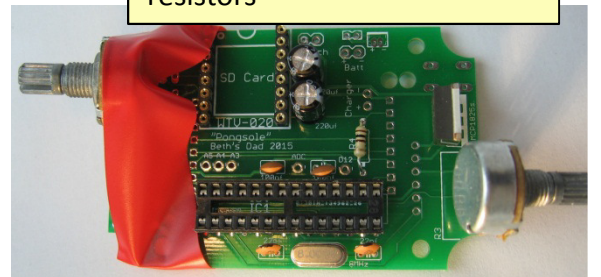
Add components: more back + front

Twist two 10k resistors with a piece of wire + solder

Feed legs through holes

Take wire round to "A3" and solder

1K – Brn, Blk, Red

10K
Brn, Blk, Blk, Red

Tall switches at corners

These holes stay empty

4-pin header

Reset switch

Short leg of LED near to edge of board (flat side)
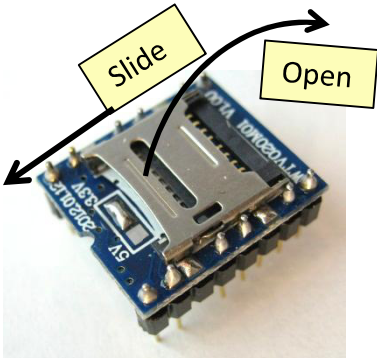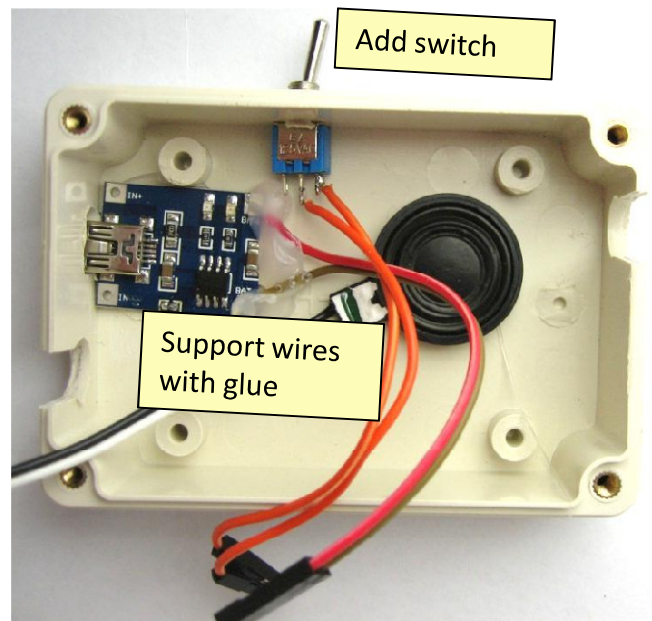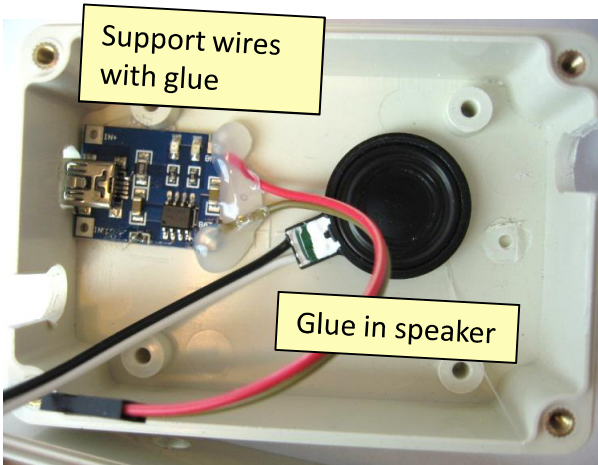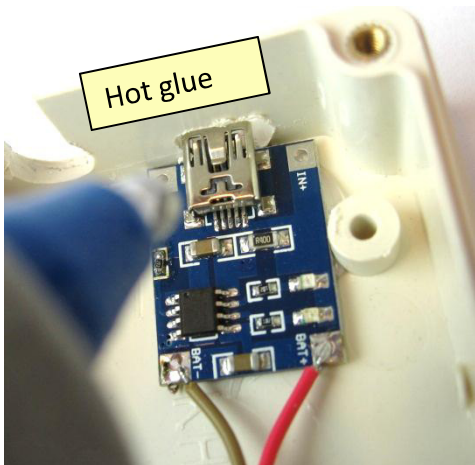
Check you have everything on the top
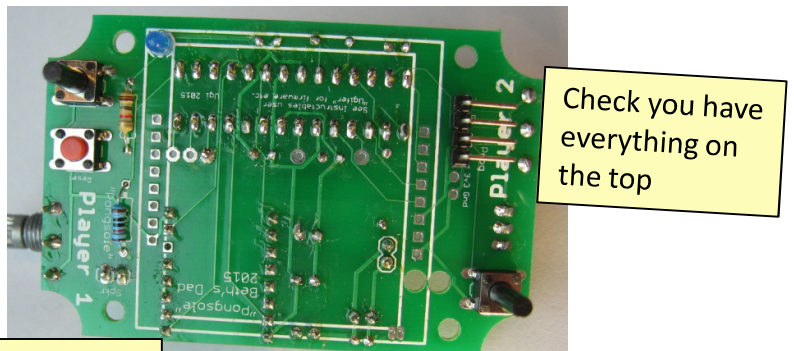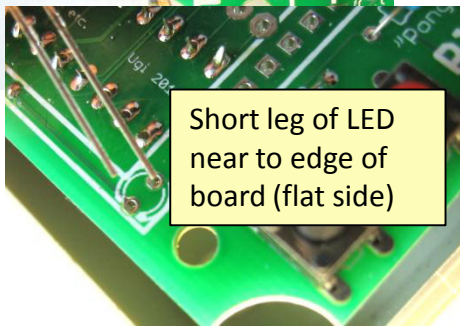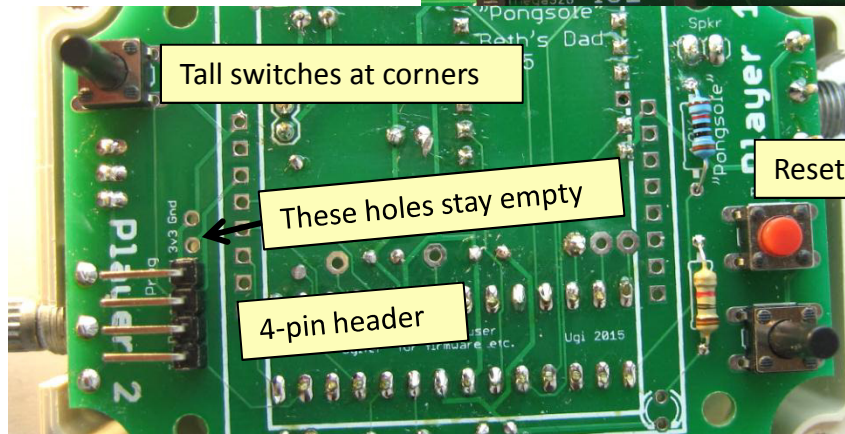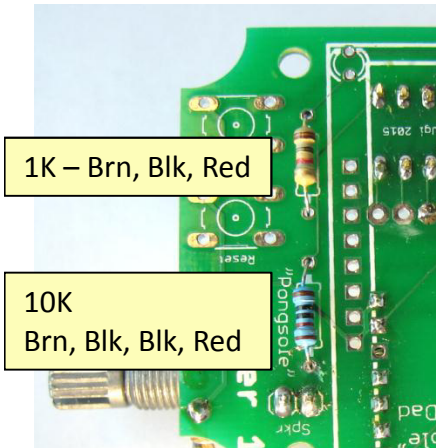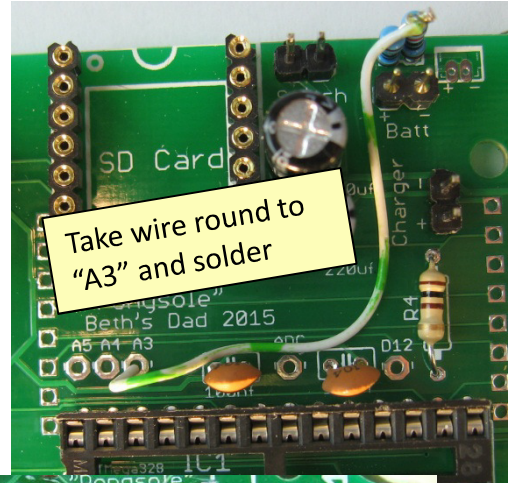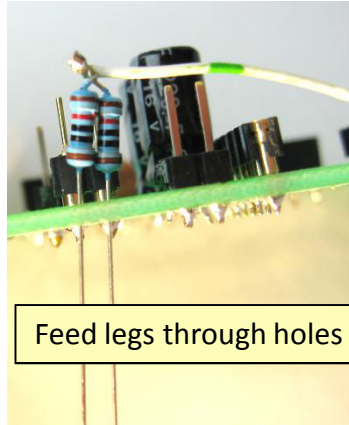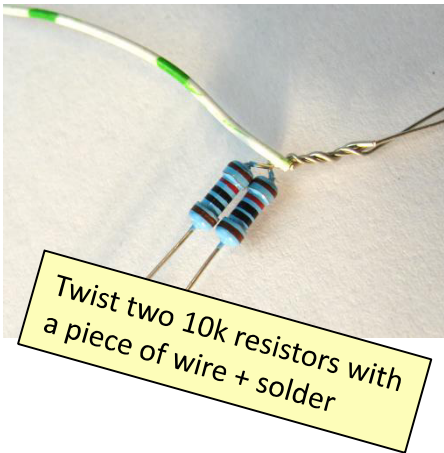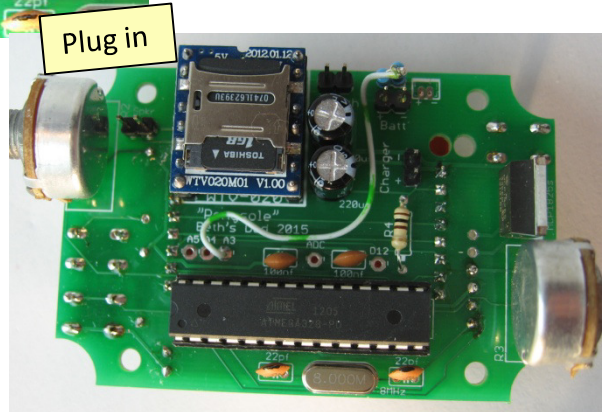
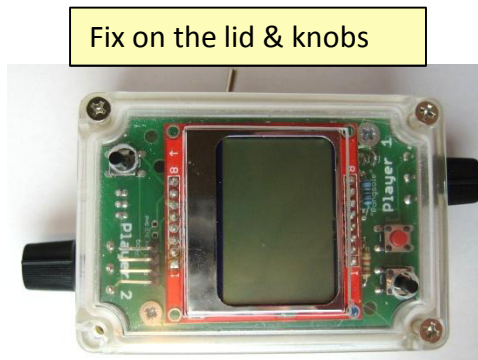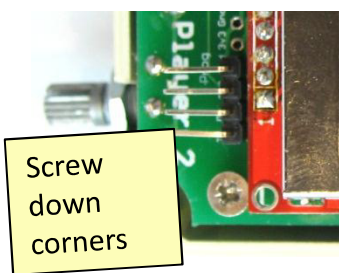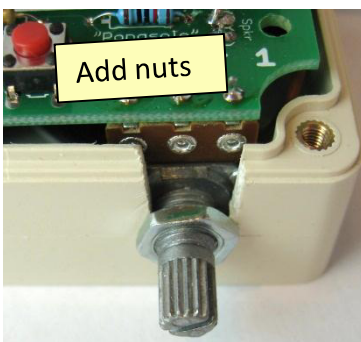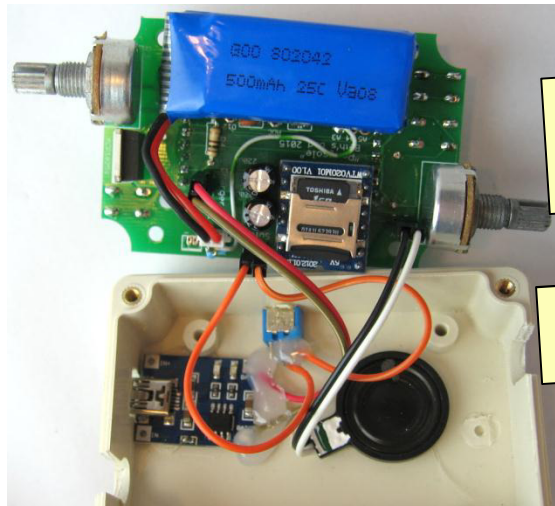And on the bottom – it will be hard to fix after this.
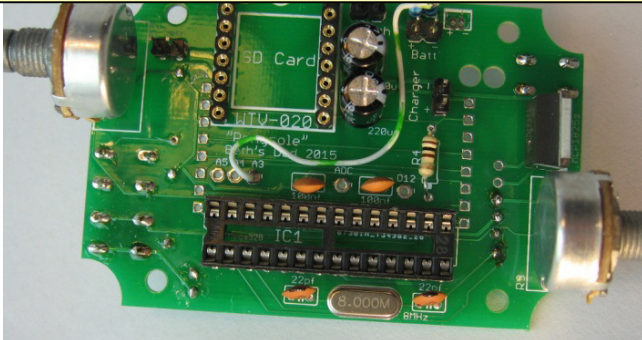
Add the LCD – be sure it's the right way up!

Arrow to Player 2

Assemble

Slide

Open

Place

Close

Notch

Notch
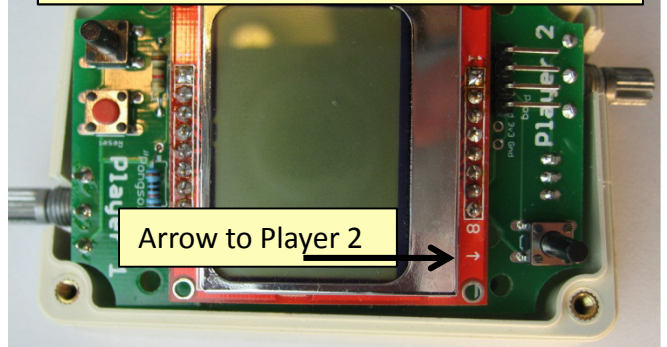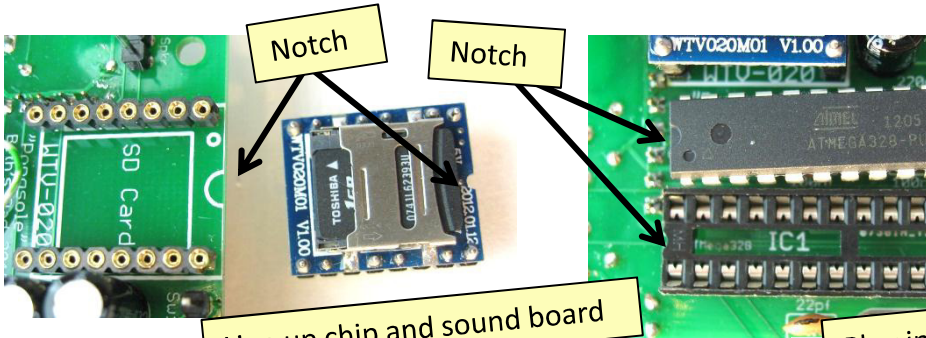
Line up chip and sound board

Plug in

Hot glue

Support wires with glue

Glue in speaker

Add switch

Support wires with glue

Final box-up

Add double-sided tape

Stick on battery (centred)

Red battery wire to +

Red charger wire to +

Connect speaker and switch

Close board onto box

Add nuts

Let's play!

Fix on the lid & knobs

Screw down corners

Programming

Connect to these programming pins

The programmer connects to a laptop
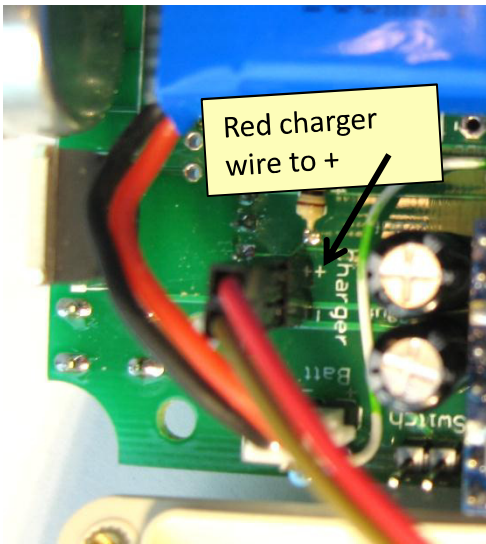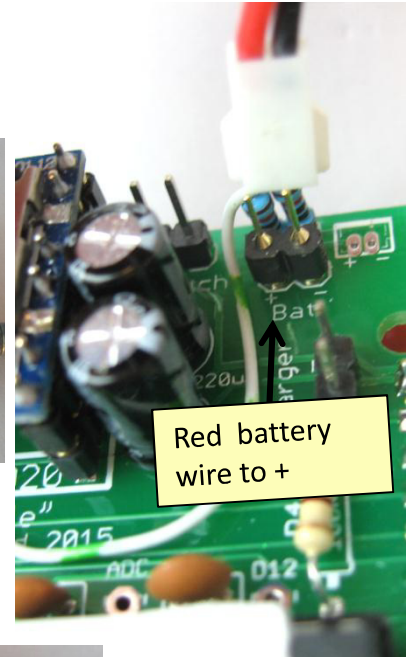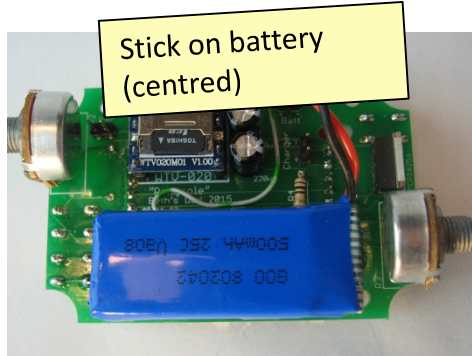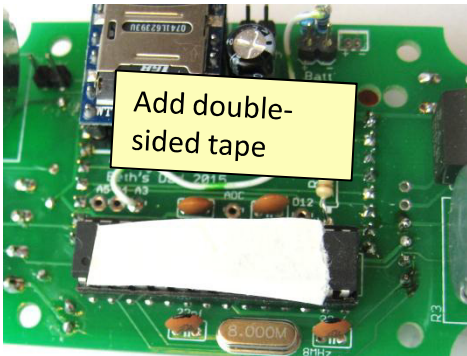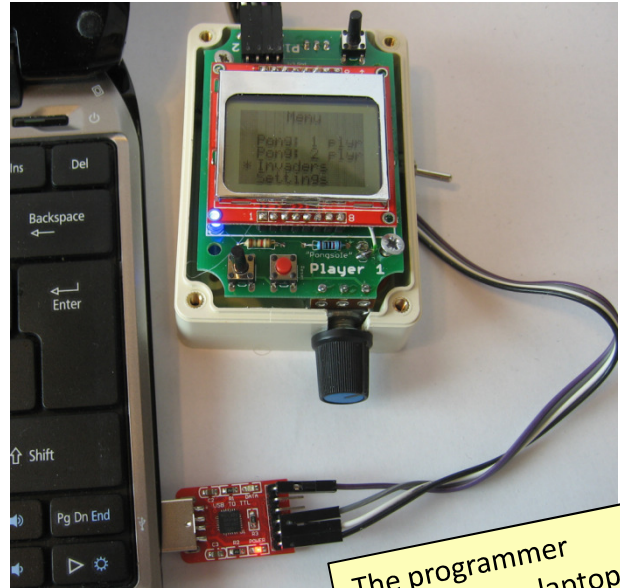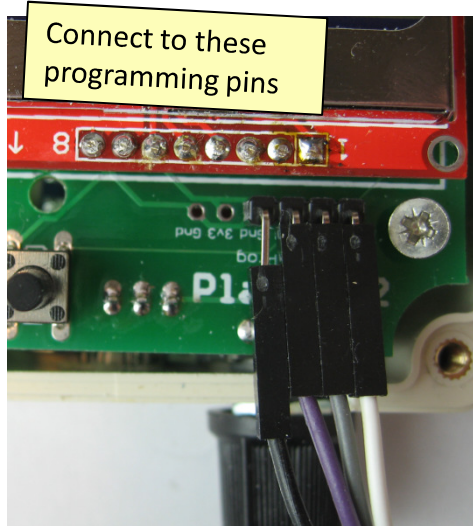
Write your code on the laptop and send it to the programmer.

Press the "Reset" button to start uploading your code.