Paperclip Player

Notes for supervisors

Video at https://vimeo.com/205931428

The Paperclip Player document describes the construction of a simple piano keyboard made from cardboard and paperclips. It was designed as a drop in activity for the Raspberry Pi's 5th Birthday Party at Cambridge in 2017 by Mike Cook and is fully open source.

The basic instruction "Paperclip Player document" is designed as a two page layout to be laminated and used as a resource. This document has some larger pictures and some observations gathered from practical sessions of people making the player. Their are also some notes on resources and where to get them from.

The activity

Step 1 - Pencil tips proved fragile for some small people and a more robust method was to use a scriber to mark the cardboard through the hole so the marks could be used to draw the keyboard
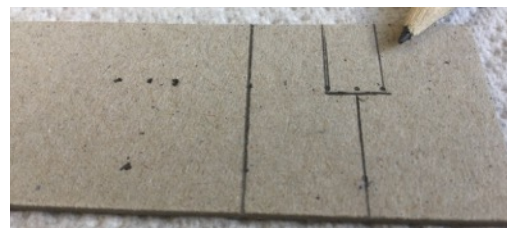

Step 2 - The crimped connectors can be pushed in the shells in two ways, one way clicks in and is held firmly but the other way just pulls out. If you find a cable has been pushed in the wrong way simply pull it out and apply a 180° twist between two fingers and push it in.

If a wire has been inserted in the wrong place then use a thin blade from a sharp knife to lift the plastic tab slightly allowing the wire to be removed.

The white and grey wires can be easily confused especially on a photograph, the order of the wires is black, white, grey, violet etc. If a mistake is made it is simplest to just swap over the position of the paperclips on the keyboard rather than change them at the header.

The location of the triangle on the photographs are not too clear in the small size they are printed in the instruction sheet. These photographs show it more clearly, in practice you have to get "the light just right" to see them on the actual connectors.
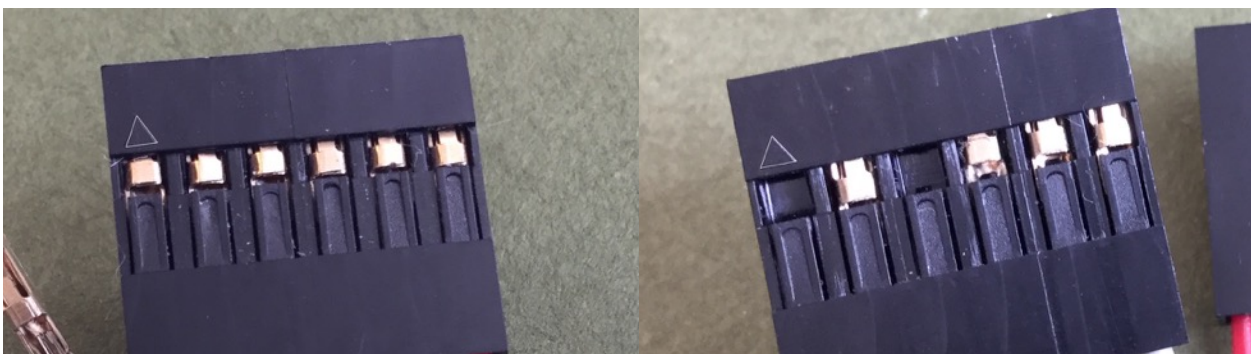
Step 5 - It can be tricky to push the end of the paperclip into the crimped connector. This is where it is useful to have a pair of pliers. These should be used to grip the paperclip and not the crimped connector. It is easy to crush the connector rendering it useless. The paper clip must be pushed in so it can be seen on the other side of the crimp. They will then be on firmly. It might take a little bit of jiggling of the paperclip to get the connector's opening wide enough to accept the paperclip.

Resources

Cardboard - The cardboard strip you need is 148mm by 38mm, so the 148 size is exactly the length of the long side of an A6 sheet. This means you can cut 4 pieces out of an A6 sheet with three cuts. Use the keyboard template to guide a stanly knife on a cutting board. Cardboard of 1mm thickness is a good compromise between rigidity and being able to fit the paper clips.
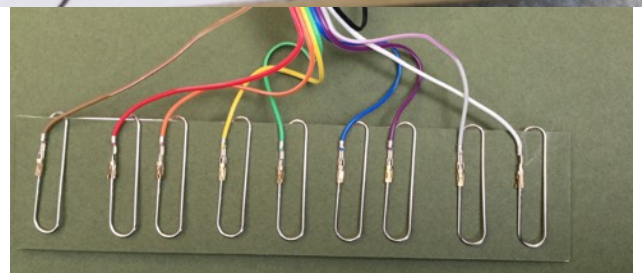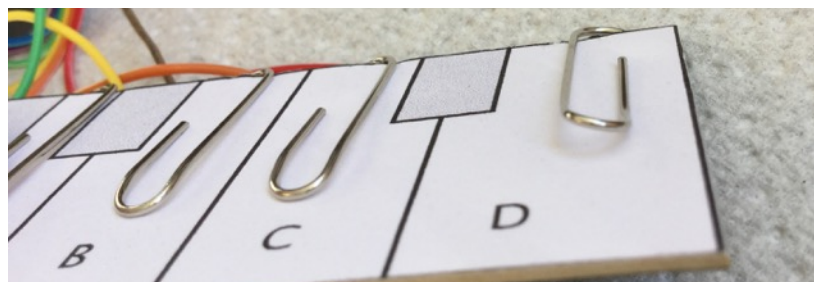
Paper clips - The ones you want are "large" being 32mm long and plain, uncoated silver colour. The price varies tremendously for a box of one hundred. Rymans stationers will charge you £1.99, where as Sainsbury's will charge £1.00. They are also available at the Post Office at prices ranging from £0.79 to £0.45.

Pliers - Small straight noise pliers are useful for pushing the paperclip into the connector. While these can cost £7.99 at Maplins on line at Rapid they will only cost £1.69 + VAT The link is :-

https://www.rapidonline.com/Catalogue/Product/91-2351

Scriber - Useful for marking through the template. Ask you metalwork department if you have one or from most DIY stores at a price. From Rapid at £1.58, the link is:-

https://www.rapidonline.com/Catalogue/Product/86-1340

Wires - The magic words to put into your search engine to find these is "Dupont female pre crimped wires". They come in various lengths but the 20cm are long enough for the project. Any shorter and they don't clear the Pi board, longer will give you more flexibility about where you can put the keyboard. They are normally sold 40 wires wide in rainbow colours which are the resistor colour code, there is a ten colour sequence that repeats four times. They are easily separated by simply ripping then apart. It is advised that you pre separate the wires into groups of the before the activity starts. One recommended place to get these is:-

http://www.oomlout.com/oom.php/oomp/RBCC-40W-Z-L200-01

or

http://www.ebay.com/itm/50pc-Dupont-Connector-2-54mm-Female-Pin-Wire-L-45cm-24AWG-300V-5pc-x10color/131863396675?_trksid=p2047675.c100623.m-1&_trkparms=aid%3D222007%26algo%3DSIC.MBE%26ao%3D2%26asc%3D40130%26meid%3Df0bbba918b8e4c0b94f23fc2bc408f1f%26pid%3D100623%26rk%3D1%26rkt%3D1%26sd%3D130465691706
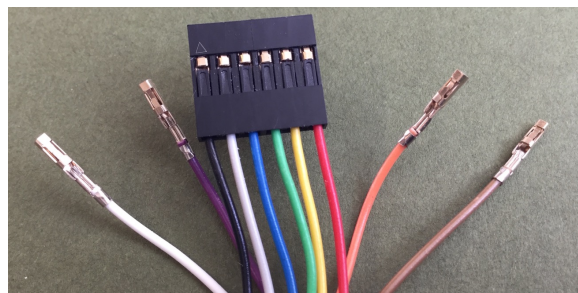

Wire housings - The magic words to put into your search engine to find these is "Dupont connector shells" The ones used in this activity are known as 6P as it will take six wires. You might have difficulty getting small numbers at a sensible price. One recommended place to get these is:-

http://www.oomlout.com/oom.php/oomp/CRHO-I01-B-06PI-01

or

http://www.ebay.co.uk/itm/Dupont-Cable-wire-Housing-5-or-10-Pack-Choose-from-1-9-pin-X2-UK-Free-P-P-/231489416755?var=&hash=item35e5d82e33:m:mYriz_iaRz_E6ek1Hi1yxAA
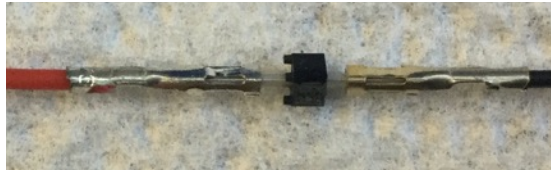
Single pin connector - These are to connect the stylus extension and you need header pins at least14.5mm long. These normally come in long strips of 36 pins or longer and you can simply to snap them apart to give a pile of single pin connectors, use two pairs of pliers to snap the last three apart. Again these can be got from many places but you might like to combine an order to oomlout:-

http://www.oomlout.com/oom.php/oomp/HEAL-I01-X-36PI-01

Marking out template - The Keyboard graphics file has the dimensions of the keyboard and several samples of keyboard. These can be used for the keyboard itself if they are cut out and glued onto the cardboard. Spray glue is best but expensive and requires a fume cupboard if you are using it a lot. Other glue will take time to dry and can delay the activity. One solution is to make a template out of more robust material, this is easily done by printing out a keyboard layout, sticking it to the surface of this material and cutting it to size. Then drilling 1.5mm holes at the appropriate point. This can be done on scrap fibreglass PCB (Printed Circuit Boards), or sheet aluminium. Another approach is to use a one off paper template and use the scriber to push through the paper to mark the cardboard.