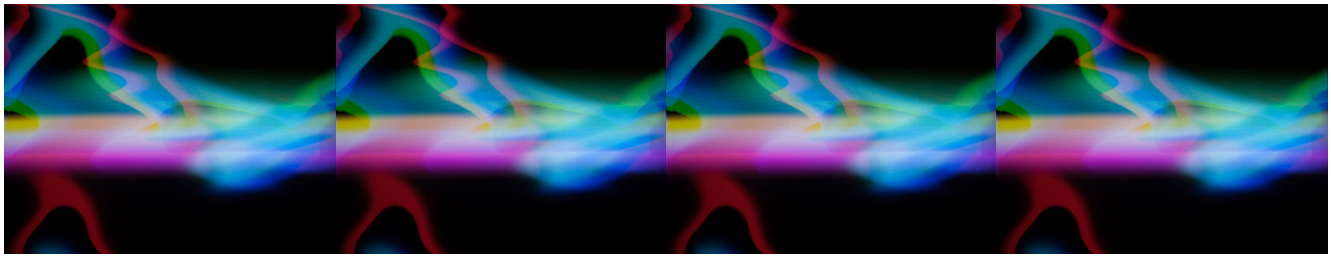
RGB.VGA.VOLT TUTORIAL 2: HACKING A VGA CABLE TO BEND VIDEO INTO AUDIO

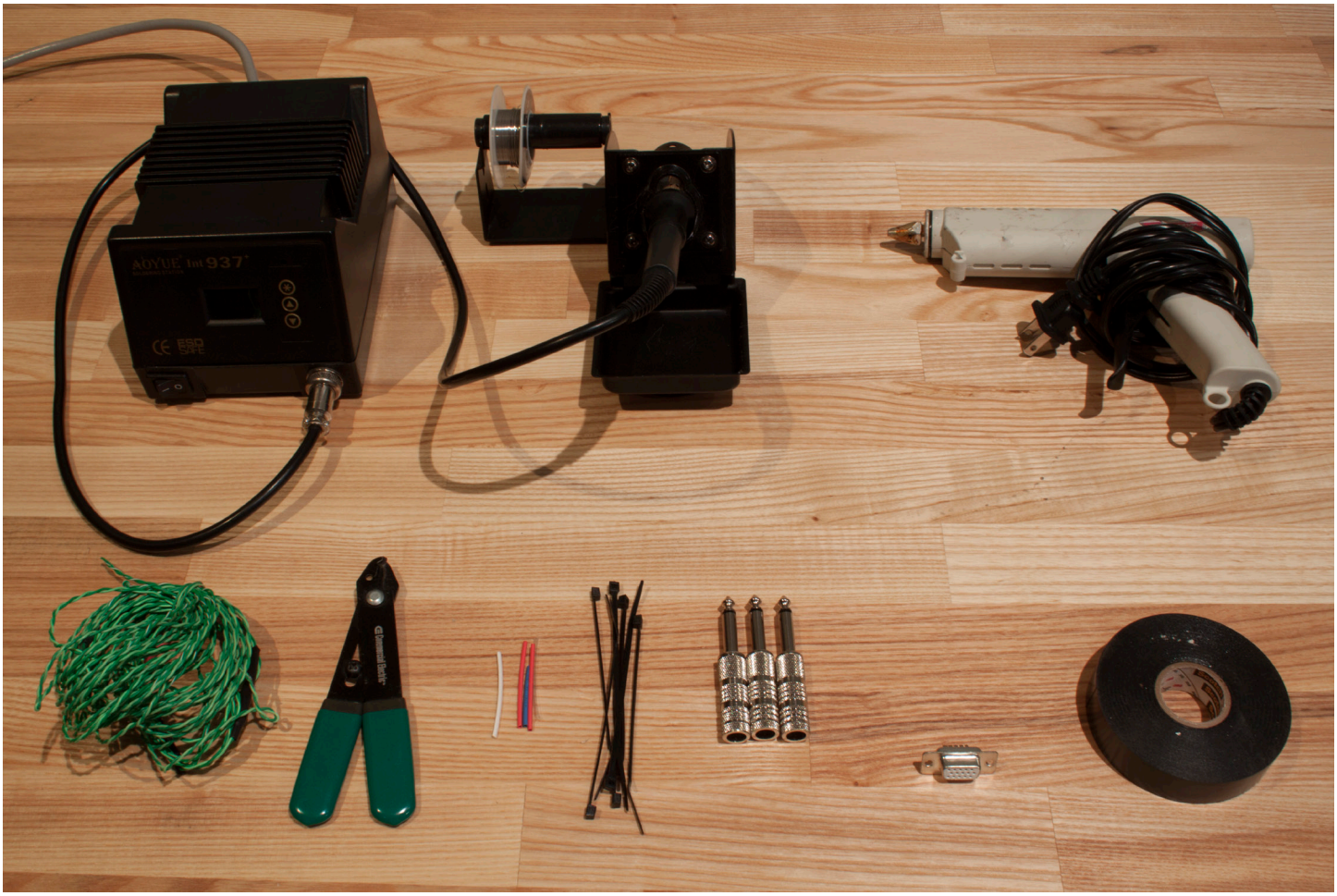


SUPPLIES NEEDED:

- A soldering iron and solder
- Wire clippers/strippers
- Electrical tape
- Stranded wire (22 gauge or smaller is easiest to solder)
- Female 15 3-row d-sub connector
- Three directional diodes
- Two 1/4” audio jacks with solder terminals

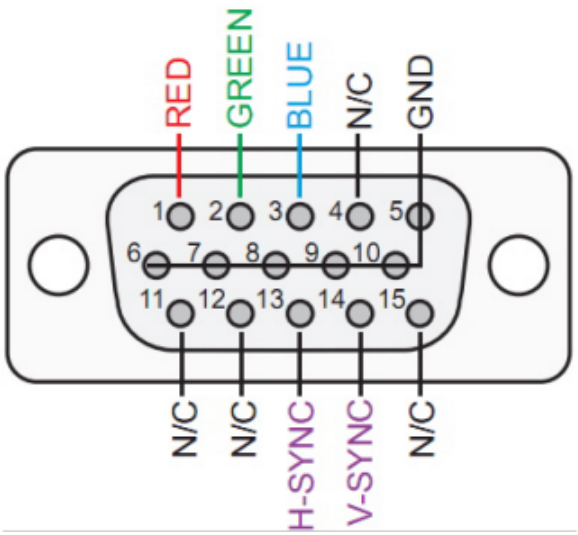
OPTIONAL SUPPLIES:

- Small heat-shrink tubing
- Hot glue gun and glue
- Several small zip ties



UNDERSTANDING A VGA CABLE

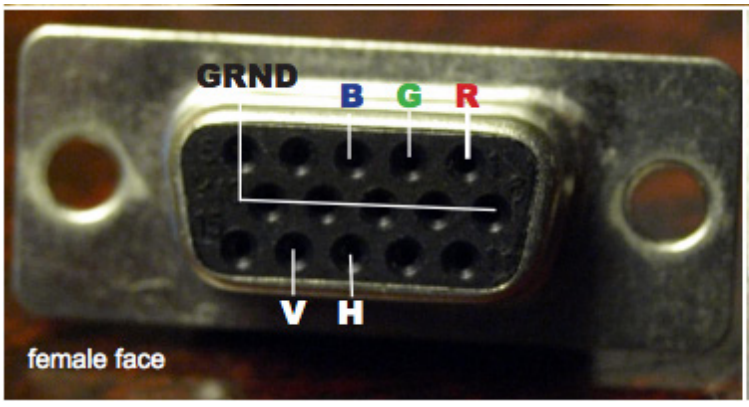
A cathode ray tube (CRT) computer monitor receives a video signal through a video graphics array (VGA) cable. VGA cables have adapters at either end with 15 pins (3 rows of 5) that send discrete (and, therefore, hackable) **RGBHV** (**R**ED, **G**REEN, **B**LUE, **H**ORIZONRAL-SYNC, AND **V**ERTICAL SYNC) analog signals.

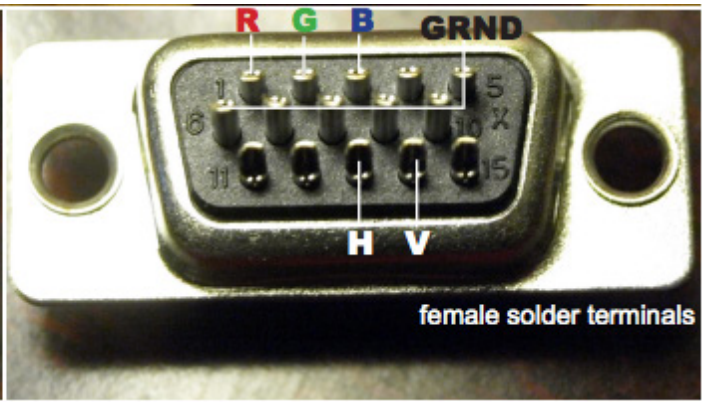


PIN 1:	RED
PIN 2:	GREEN
PIN 3:	BLUE
PIN 4:	-
PIN 5:	GROUND
PIN 6:	RED GROUND
PIN 7:	GREEN GROUND
PIN 8:	BLUE GROUND
PIN 9:	-
PIN 10:	SYNC GROUND
PIN 11:	-
PIN 12:	-
PIN 13:	HORIZONTAL-SYNC
PIN 14:	VERTICAL SYNC
PIN 15:	-

The VGA pin-out graphic above and its corresponding table show the function of each of the cable's 15 pins. This hack requires connecting the red, green, and blue video pins (pins 1-3) that drive their corresponding ray guns inside of the monitor, the ground signal (pins 5-8 and 10), the horizontal sync (pin 13), and the vertical sync (pin 14).

Note: For this hack, I use one female D-sub connector that, once modified, will connect to a standard male to male VGA cable to receive a video signal from a VGA distribution amplifier. D-sub connectors with soldering terminals are labeled with small numbers to ensure that you're soldering to the proper pins. They're also organized so that the center row is offset from the top and bottom rows, forming a sort of arrow.





Note that the diagram above corresponds to the reverse side of the female d-sub connector (the solder terminal side). Be sure to double-check the numbered holes/terminals before soldering.

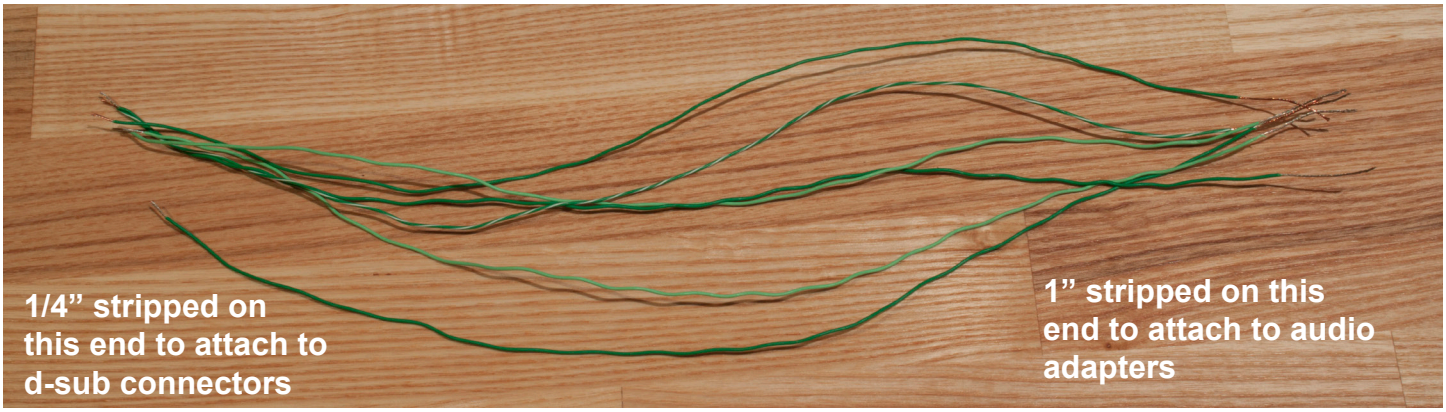
THE HACK

1. SOLDERING WIRES TO THE D-SUB CONNECTOR

This hack turns the red, green, and blue signals of the VGA cable into three discrete audio signals by connecting their positive and ground signals to audio adapters.

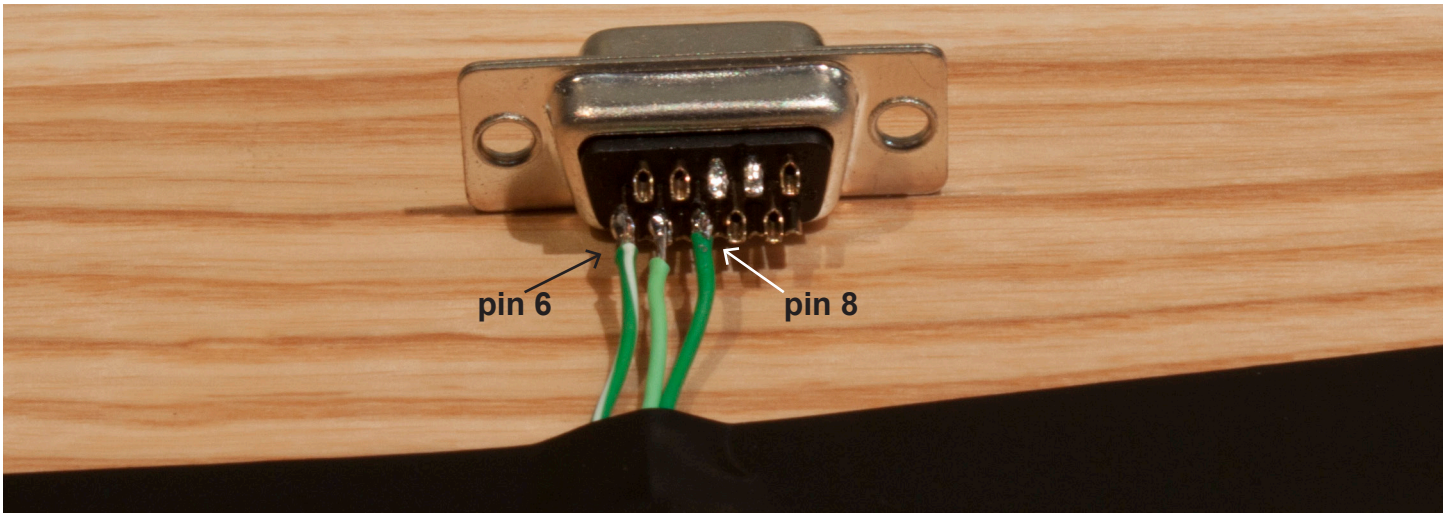
1.1 PREPARING

1. Cut 6 pieces of wire the exact same size. I recommend 12-16 inches (30-40 centimeters) in length.
2. Strip one end of all 6 wires about 1/8- 1/4 of an inch (3-6 millimeters) on both sides and about 1/2 to 1 inch (1 - 3 centimeters) on the other side.



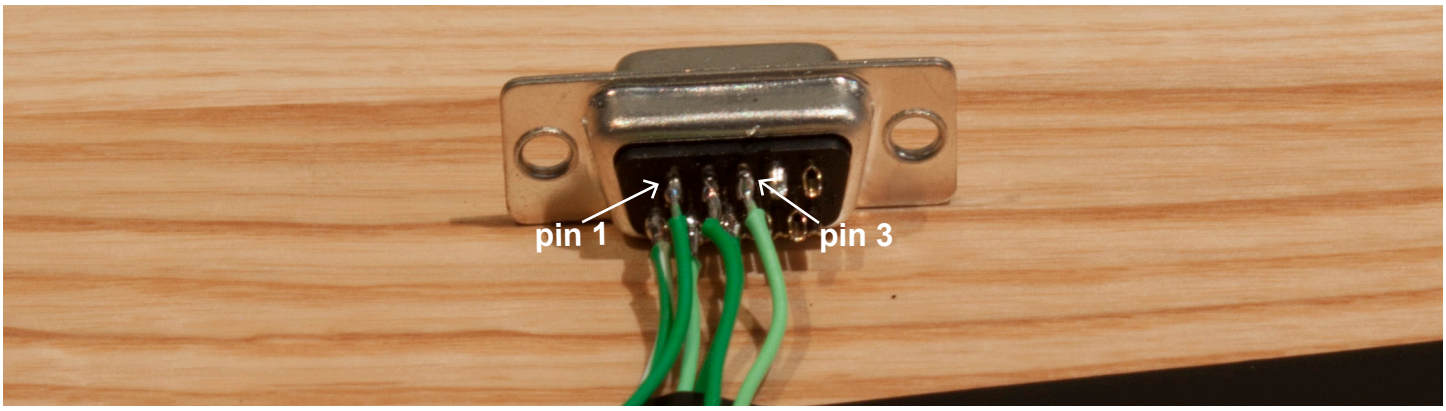
1.2 SOLDERING THE CENTER ROW/GROUND PINS (PINS 6, 7, and 8)

1. Place the female D-sub connector so that the center row’s solder terminals are facing up.
2. Place the small stripped end of three of the cables into the solder terminals for pins 6, 7, and 8 (the solder terminals read from right-to-left on male d-sub connector and left to right on female d-sub connectors; pin 6 is easy to locate because it extend beyond pins 1 and 11 which are aligned to be directly in line with one another.) **NOTE:** you may need to trim some of the wire’s strands in order to successfully fit the wire into the terminal.
3. Tape the wires to the table with electrical tape to help hold them in place. You may also want to tape the d-sub connector down.
4. Solder the wires to the solder terminal: place a small amount of solder onto your soldering iron and make contact with the wire and terminal. In a different area of the wire and terminal, hold the solder into place until it melts into the wire and terminal, forming a good bond.



1.3 SOLDERING THE TOP ROW/RED, GREEN, AND BLUE PINS (PINS 1, 2, and 3)

1. Place the 1/4” strippe end of the remaining three wires into terminals 1-3, and tape the wires down to the table to hold them into place.
2. Solder the wires to the solder terminal: place a small amount of solder onto your soldering iron and make contact with the wire and terminal. In a different area of the wire and terminal, hold the solder into place until it melts into the wire and terminal, forming a good bond.

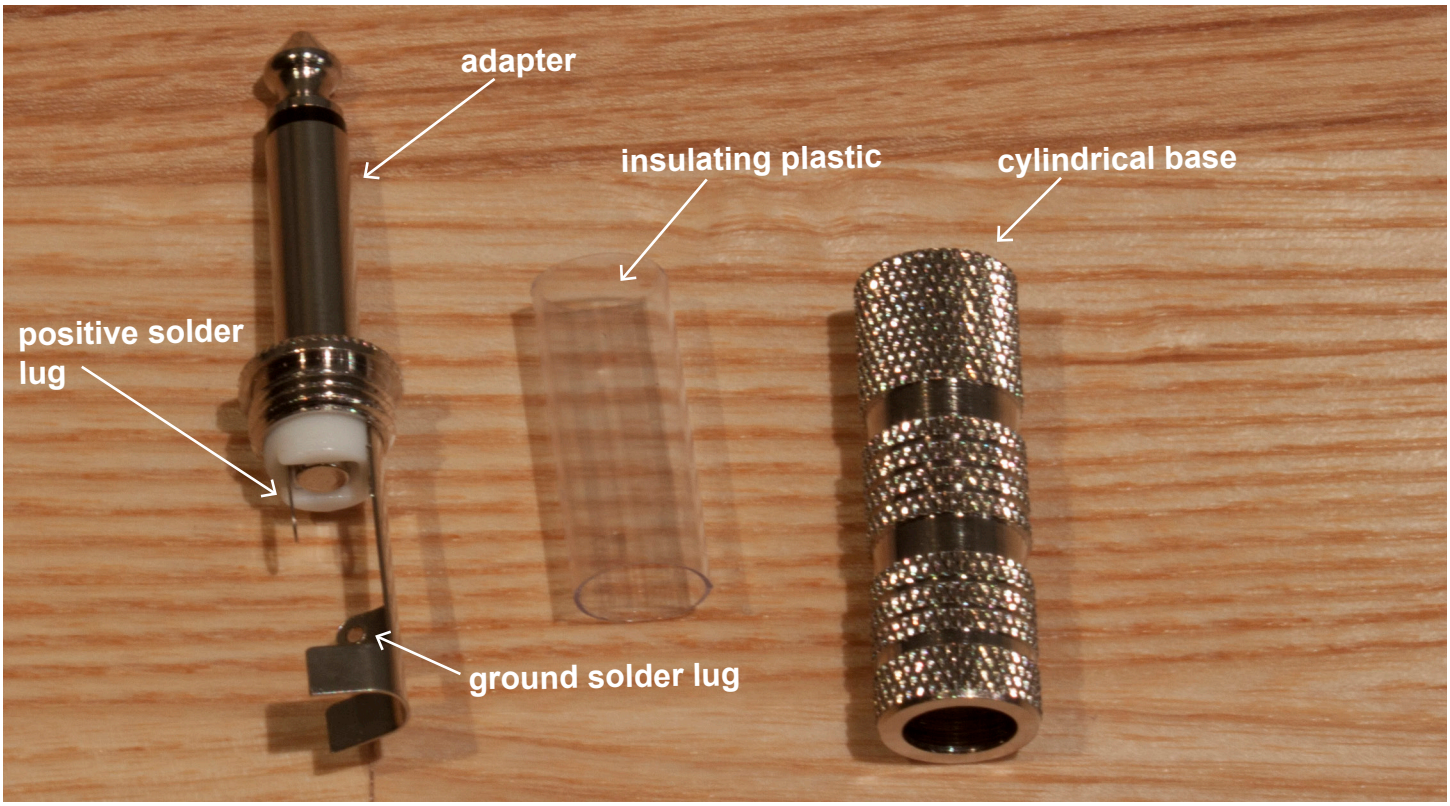


3. Apply heat shrink tubing at this point if you’re using it.

UNDERSTANDING A 1/4” AUDIO ADAPTER WITH SOLDER LUGS

Unscrew your 1/4” audio adapter with solder terminals to remove the cylindrical base and see the contents of the piece of hardware. Usually, you will find a clear plastic tube to help insulate the wires once they’ve been soldered in. You’s also see two solder lugs: one connected to the outside of the adapter, and the other surrounded by plastic and going into the center of the audio adapter.

The lug connecting to the outside of the adapter is the ground signal; attach this to one of the wires soldered to the second row of pins (pins 6-8/ground pins). The central lug surrounded by plastic is the positive signal; attach this one to one of the wires soldered to the top row of pins (pins 1-3/red, green, and blue).

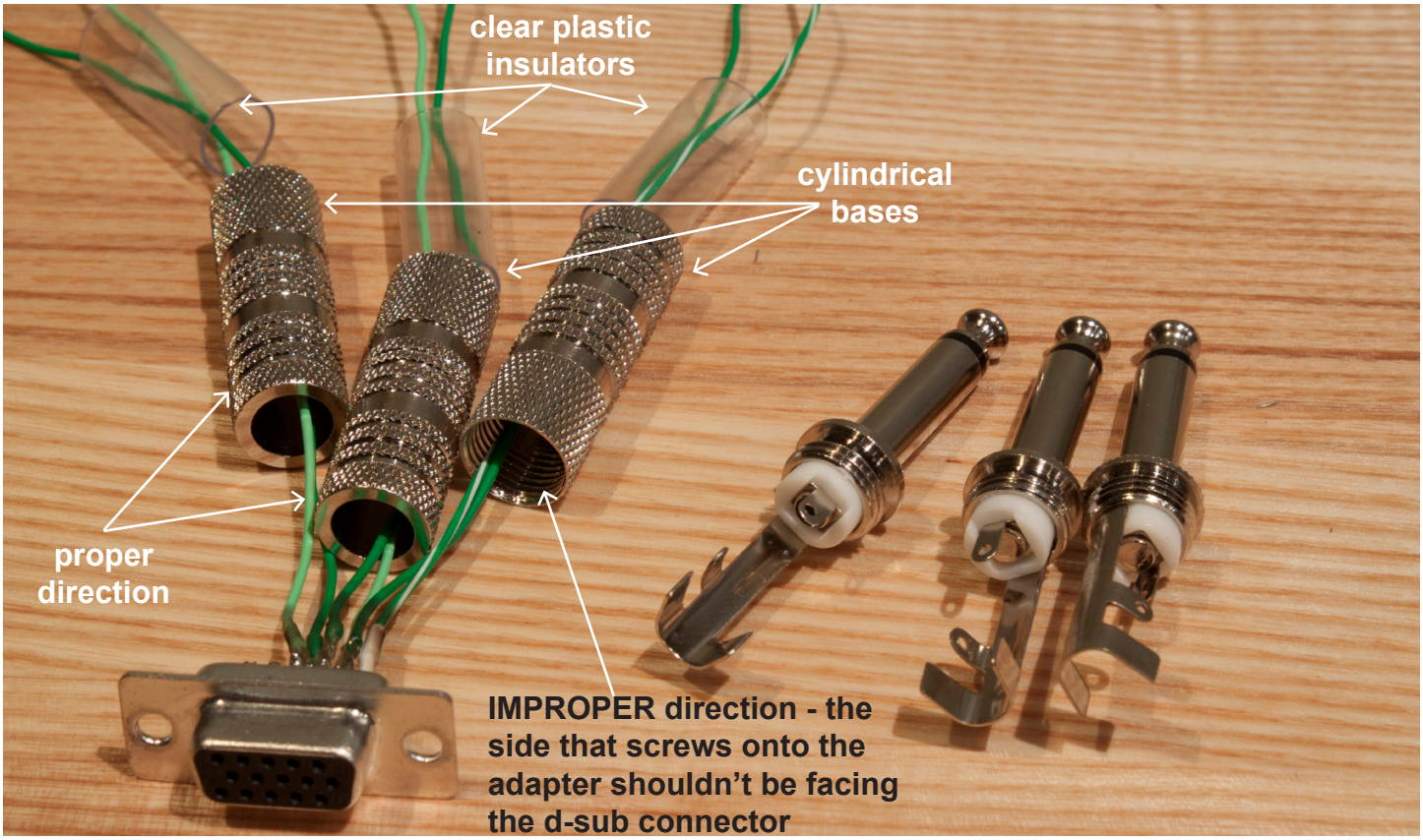


2 SOLDERING THE AUDIO ADAPTERS

This part of the hack connects the positive solder lugs of the audio adapters to the red, green, and blue pins (pins 1-3) of the audio adapter and the ground solder lugs to pins 6-8. Pins are connected to the audio adapters in line with one another i.e. pins 1 and 6 are attached properly to the same audio adapter (with 1 positive and 6 ground); pins 2 and 7 are attached to the same audio adapter properly (with 2 positive and 7 ground); and pins 3 and 8 are attached properly to the same audio adapter (with 3 positive and 8 ground).

2.1 PREPARING THE WIRES AND ADAPTERS

1. Unscrew one of the audio adapters and remove its clear plastic insulation. Slide the adapter onto pins 1 and 6, making sure that the side that screws into the adapter is facing away from the d-sub connector.
2. After the adapter is slid on, slide the clear plastic insulation onto the two wires.
3. Repeat these steps for pins 2 and 7 for the second audio adapter, and pins 3 and 8 for the third audio adapter.



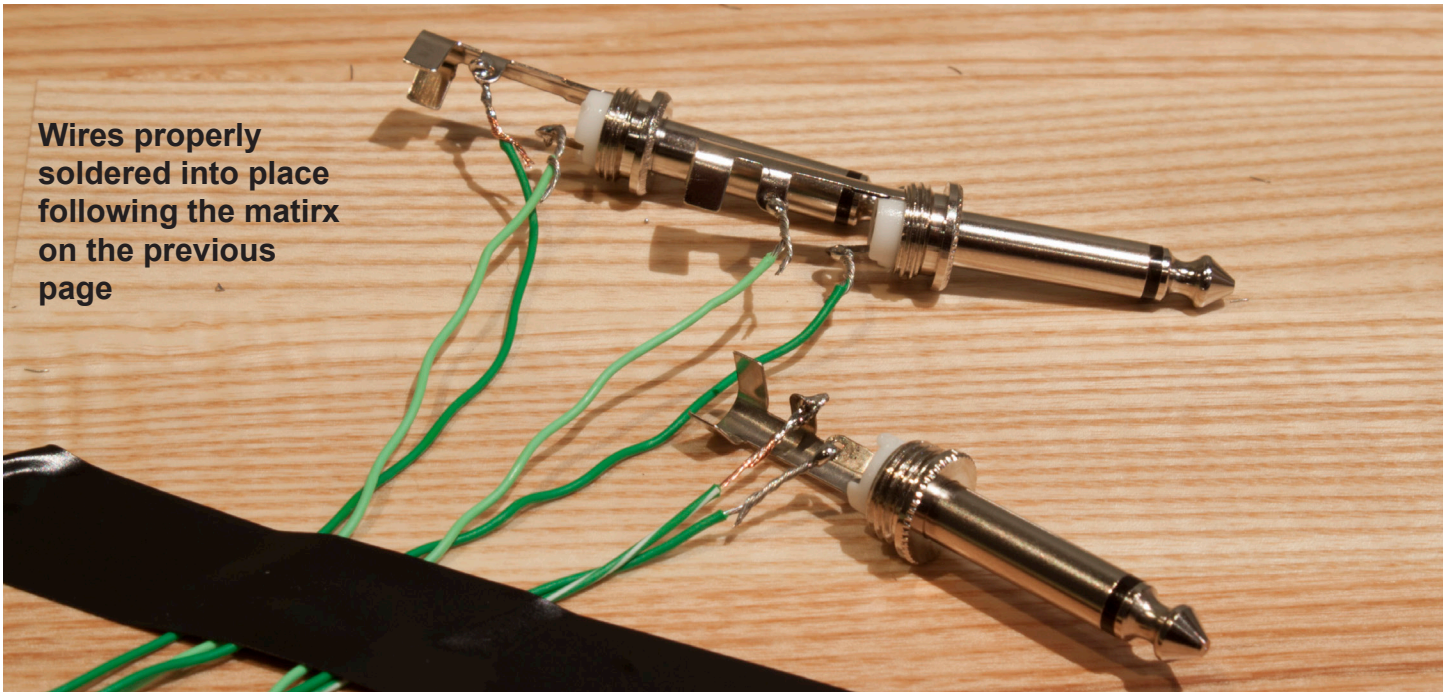
2.2 SOLDERING THE AUDIO ADAPTERS

1. Once the cylindrical base and insulating plastic is in place, solder the wires onto their proper solder lugs of the audio adapters following this table:

	ADAPTER ONE	ADAPTER TWO	ADAPTER THREE
POSITIVE SOLDER LUG	PIN 1	PIN 2	PIN 3
NEGATIVE SOLDER LUG	PIN 6	PIN 7	PIN 8

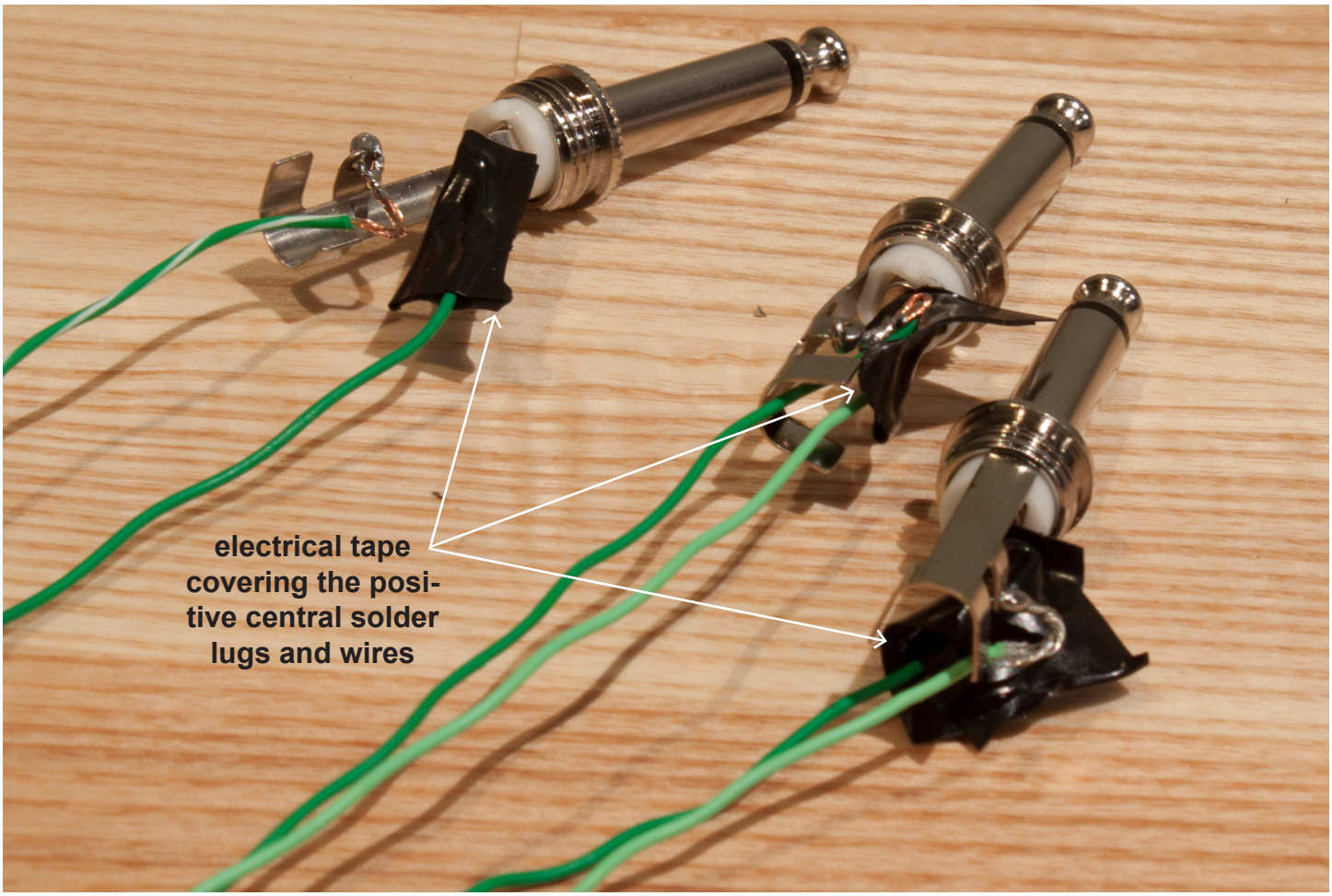
2. Once the wires have been properly connected to their solder lugs by inserting them into the small holes and twisting the wire around itself, tape all 6 wires to the table to hold them into place.
3. Solder the wires into their proper place, following the same soldering instructions as above.

NOTE: be mindful of how the wires are bend out of the solder lugs as you solder them. You don't want them to be at a harsh angle that would make the reapplication of the insulating plasitc and the cylindrical bases difficult.



2.3 ADDING INSULATING TAPE TO THE POSITIVE SOLDER LUGS

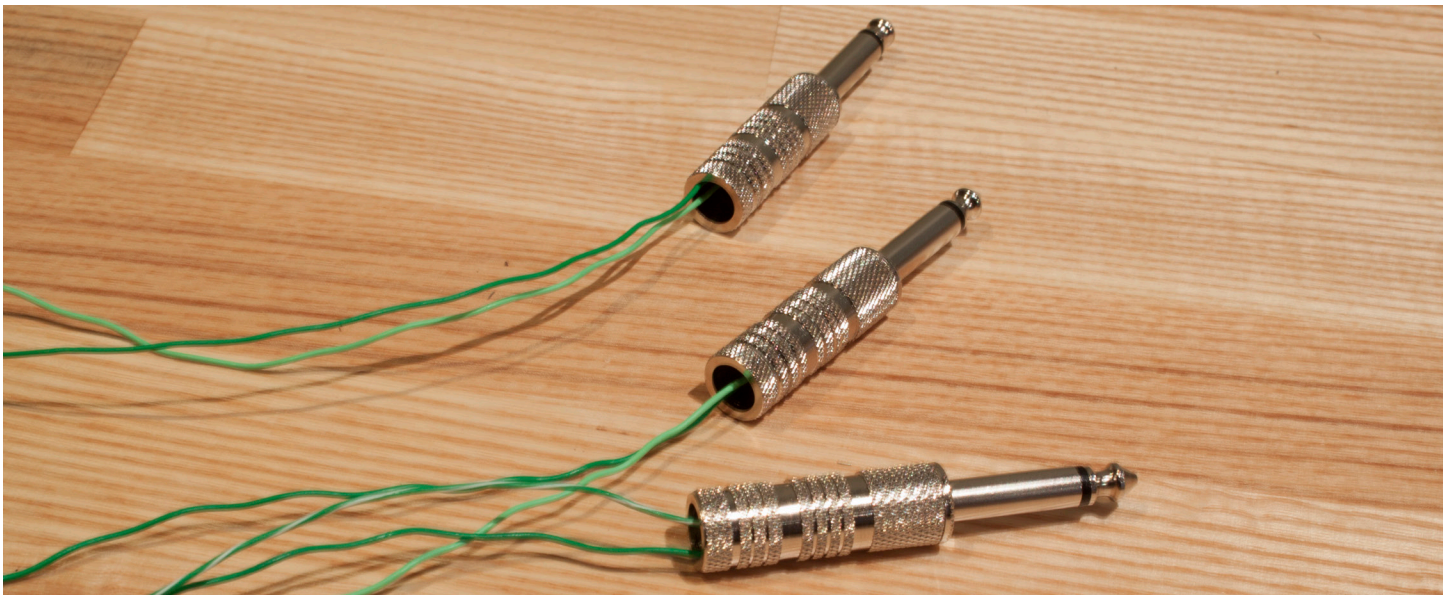
1. To make sure that the positive and negative wires don't touch, use a piec eof electrical tape to cover the positive wire and its solder lug completey for all three audio adapters.



3 FINISHING UP

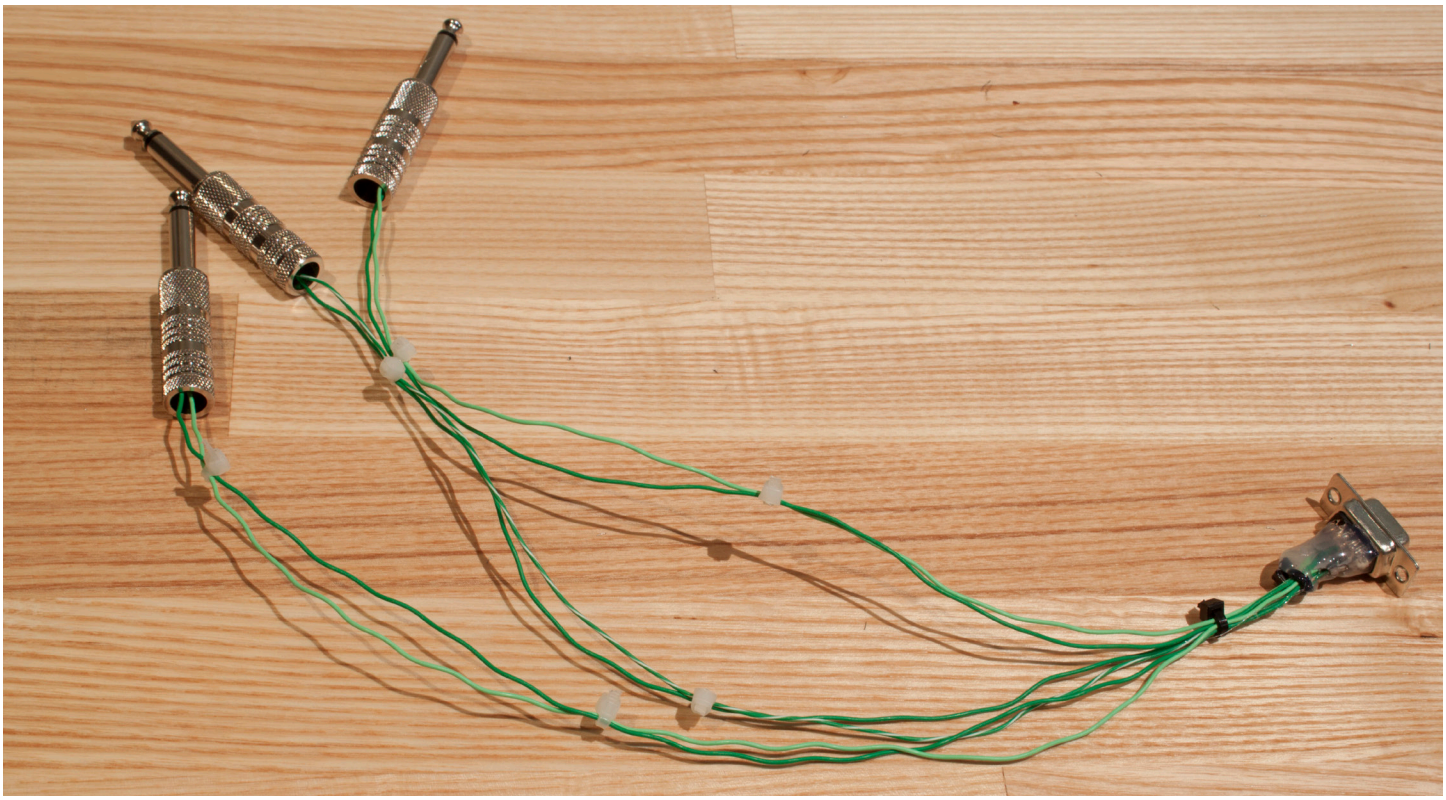
3.1 PUTTING THE INSULATING PLASTIC AND CYLINDRICAL BASES BACK

1. For each of the three DIY audio cables, place the insulating wire back over the solder lugs and their wires. This may be a little tricky as the solder may have made wires stiff, but they don't have to be perfect and you can force them into place as long as the positive and negative wires aren't making contact.
2. Rescrew the cylindrical bases into place, completing the DIY cables.



3.1 PUTTING THE INSULATING PLASTIC AND CYLINDRICAL BASES BACK

1. Apply a generous amount of glur from a hot glue gun to the solder terminals of the female d-sub connector to help hold everything into place.
2. Add 2-3 zip ties over all 6 wires near the d-sub connector, and the ad 2-3 zip tipes to the two-wire DIY cables to keep them separated but kept together.



Email questions/comments/suggestions to: jconno@saic.edu

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