

# How to Build the Dementia Friendly Music Player

## Wood Model with Built-in Speakers (not Recommended for Headphone Use)

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I was inspired to design this by the documentary [Alive Inside](#) which shows the profound joy felt by some with dementia when listening to their favorite music.

My Dad could no longer operate the home stereo. But he could operate this music player because it operates like a familiar two-knob radio. The vintage style fit with his old intact memories – for most people with dementia, the old memories are the strong memories.

It's easier than you think to make one. Everything I did is open source. This document contains all the information you need. You can order the parts online, including the cut & engraved wood. It's a good family project – kids do well with this. It's also a project that friends would love to help you with.

<b>Parts cost</b>	~\$170 + tax + shipping (~\$95 if more make 10+ at a time, see <a href="#">Appendix 1</a> )
<b>Music cost</b>	Minimal as you should use the recipient's existing music collection
<b>Build time</b>	Can be done in an afternoon, once you have the parts & music
<b>Parts source</b>	All parts can be mail ordered, links below
<b>Soldering?</b>	No
<b>Woodworking?</b>	No
<b>Laser cutter needed?</b>	No, you can mail order the pre-cut pieces for the wood case
<b>With a friend?</b>	Good idea, especially if your friend has the basic tools required
<b>Beverage?</b>	I recommend a hoppy IPA while you are assembling



## No warranty

USE THESE DEMENTIA FRIENDLY MUSIC PLAYER PLANS AND SYSTEM AT YOUR OWN RISK. THE DEMENTIA FRIENDLY MUSIC PLAYER PLANS ARE PROVIDED AS IS WITHOUT WARRANTY OF ANY KIND EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE PLANS AND SYSTEM IS WITH YOU. SHOULD THE PLANS OR SYSTEM PROVE DEFECTIVE, YOU ASSUME THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION. IN NO EVENT WILL ANY PARTY BE LIABLE TO YOU FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PLANS OR SYSTEM.

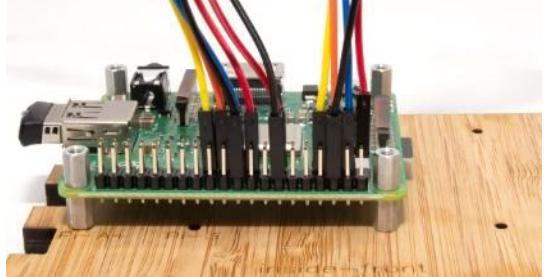
## Acknowledgements

People were very generous with their time, and I really enjoyed the experience. This is certainly an incomplete list: Alex & Mike & others at [Ada's](#), the super smart staff at [Metrix](#), neighbor Randy, [Stephen Christopher Phillips](#), [Bob Rathbone](#), [Stephen Rusk](#), [Graham Hill](#), support at [Ponoko](#), [Florian Festi](#), and my son.

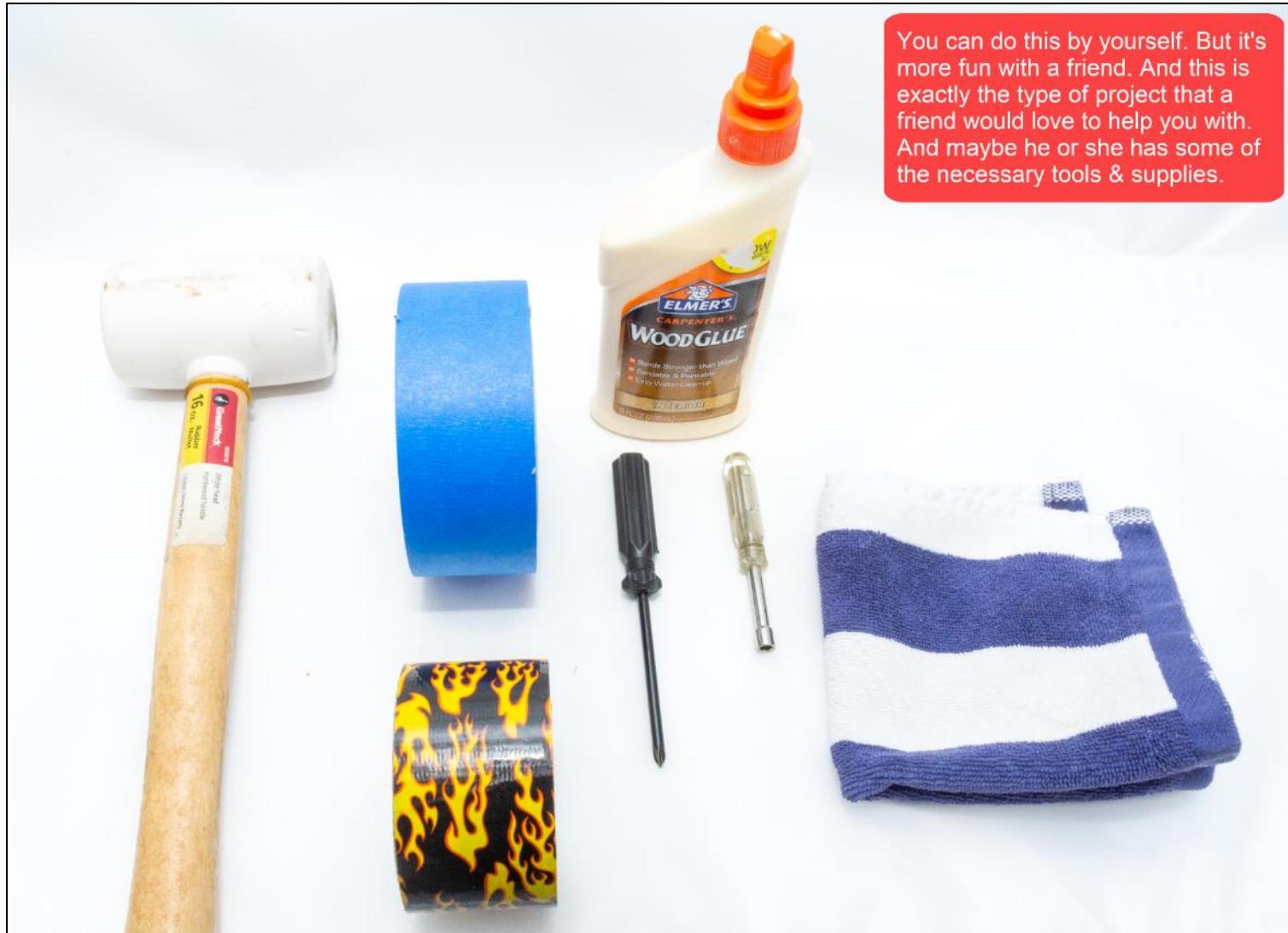
## How it works



## Preview of the steps

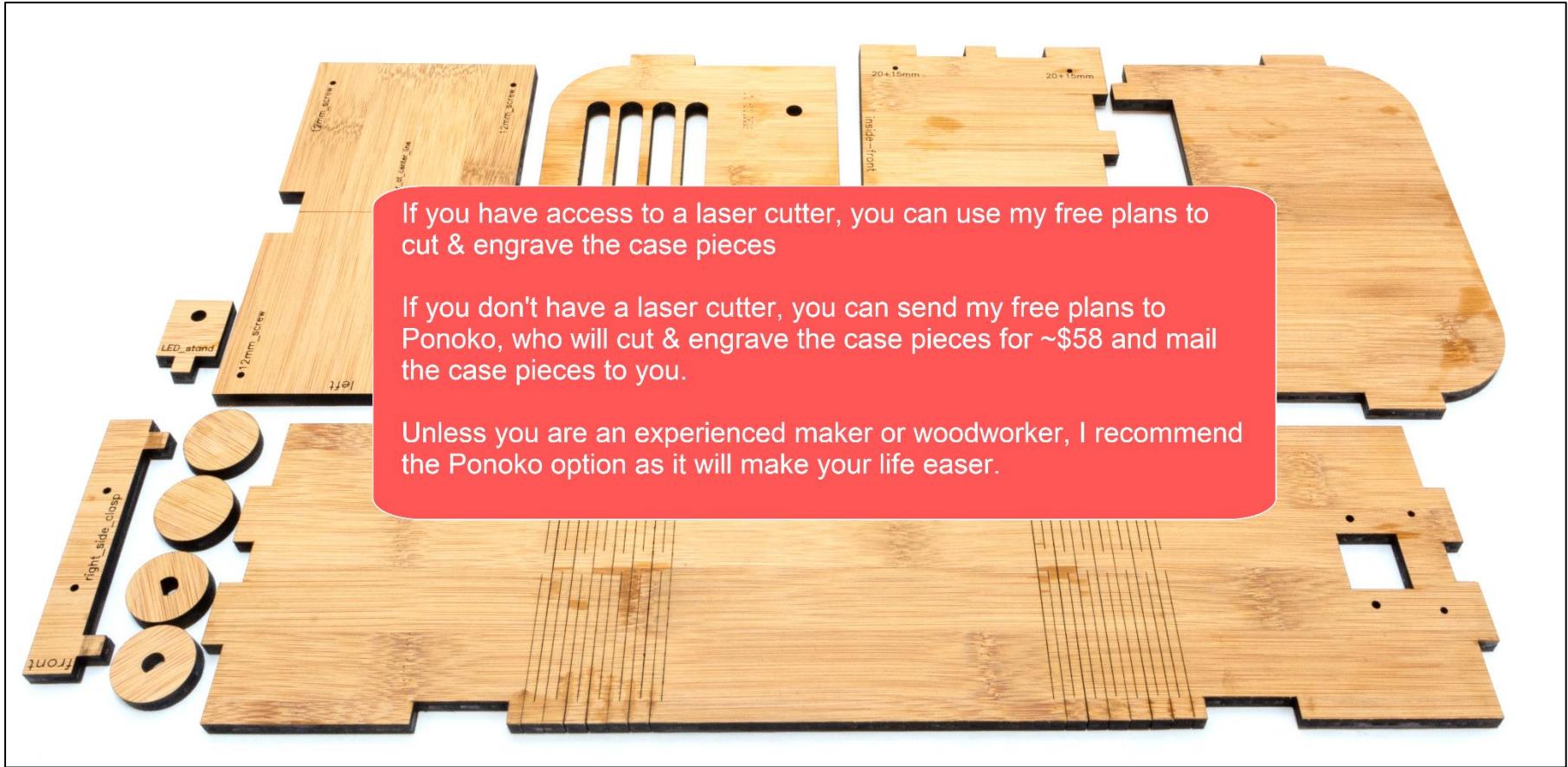
<p>STEP 1: Order or make the case</p> 	<p>STEP 2: Order parts</p> 	<p>STEP 2: Assemble music</p> 
<p>STEP 4: Flash the micro SD card</p> 	<p>STEP 5: Add the Pi</p> 	<p>STEP 6: Wire it</p> 
<p>STEP 7: Test it</p> 	<p>STEP 8: Glue it</p> 	<p>STEP 9: Enjoy!</p> 

## STEP 1: Find a friend to do this with



You can do this by yourself. But it's more fun with a friend. And this is exactly the type of project that a friend would love to help you with. And maybe he or she has some of the necessary tools & supplies.

## STEP 2: Decide about making vs. ordering the case



Ponoko is a company that laser cuts wood and sends you the precisely cut pieces. You don't need to use Ponoko – you are welcome to download my case design files from [github](#) and go to your local maker space and use the laser cutter there. Or buy yourself a laser cutter (if you do, will you be my friend?). In other words, Ponoko is convenient but not necessary. I have no affiliation with them, other than being a happy customer. Unless you are an experienced maker or woodworker, I recommend ordering the case – it will make the build process much easier.

## STEP 3: Get the case file

1. Go to [https://github.com/rosswesleyporter/dqmusicbox/tree/master/case/laser\\_cut/wood\\_speakers\\_only](https://github.com/rosswesleyporter/dqmusicbox/tree/master/case/laser_cut/wood_speakers_only)

2. Get the file you want:

If you are using LightBurn software & 5.2mm cherry MDF wood like my friends at Seattle Makers

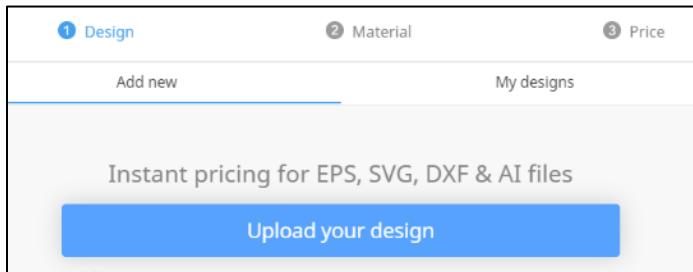
This is probably the file you are looking for - send to Ponoko

- [DementiaFriendlyMusicPlayer\\_5point2mm.svg](#)
- [DementiaFriendlyMusicPlayer\\_5point2mm.xlsx](#)
- [DementiaFriendlyMusicPlayer\\_5point2mm\\_BlackC...](#)
- [DementiaFriendlyMusicPlayer\\_6point7mm.xlsx](#)
- [DementiaFriendlyMusicPlayer\\_6point7mm\\_BlackC...](#)
- [DementiaFriendlyMusicPlayer\\_6point7mm\\_Ponoko...](#)

3. Right-click on the desired file, choose “Save link as...”

# STEP 4: Order the case

1. Go to <https://www.ponoko.com/>
2. Login (create an account if you haven't already)
3. Choose "Upload your design" and upload the file that you downloaded just above

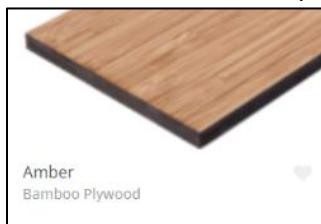


4. Set the design colors as per below:



5. Choose "Confirm design size & colors"

6. Choose "Amber Bamboo Plywood"



7. Choose thickness = 6.7mm and then "Confirm material"

**Amber Bamboo Plywood**

Thicknesses available:

<input type="radio"/> 0.9mm thick	\$37.38
<input type="radio"/> 1.8mm thick	\$40.20
<input type="radio"/> 2.7mm thick	\$42.13
<input checked="" type="radio"/> 6.7mm thick	\$57.56

**Confirm material**

8. Make sure that everything looks as expected especially the check that the horizontal bar above SONGS is colored in

Design
Material
Price

DementiaFriendlyMusicPlayer\_6point7mm\_Ponoko\_52.svg  
381.7mm x 373mm

Amber Bamboo Plywood  
6.7mm

Quantity  1      Price USD **\$57.56**

5      \$40.61      Save 29%  
 10     \$37.65      Save 35%  
 50     \$31.18      Save 46%  
 100    \$28.95      Save 50%  
 500    \$23.77      Save 59%  
 1,000   \$20.44      Save 64%  
 5,000   \$17.66      Save 69%

\$9 setup per order for human powered stuff

Submit pricing feedback (get 20% off)

**Add to Cart**

Your order qualifies for free shipping.

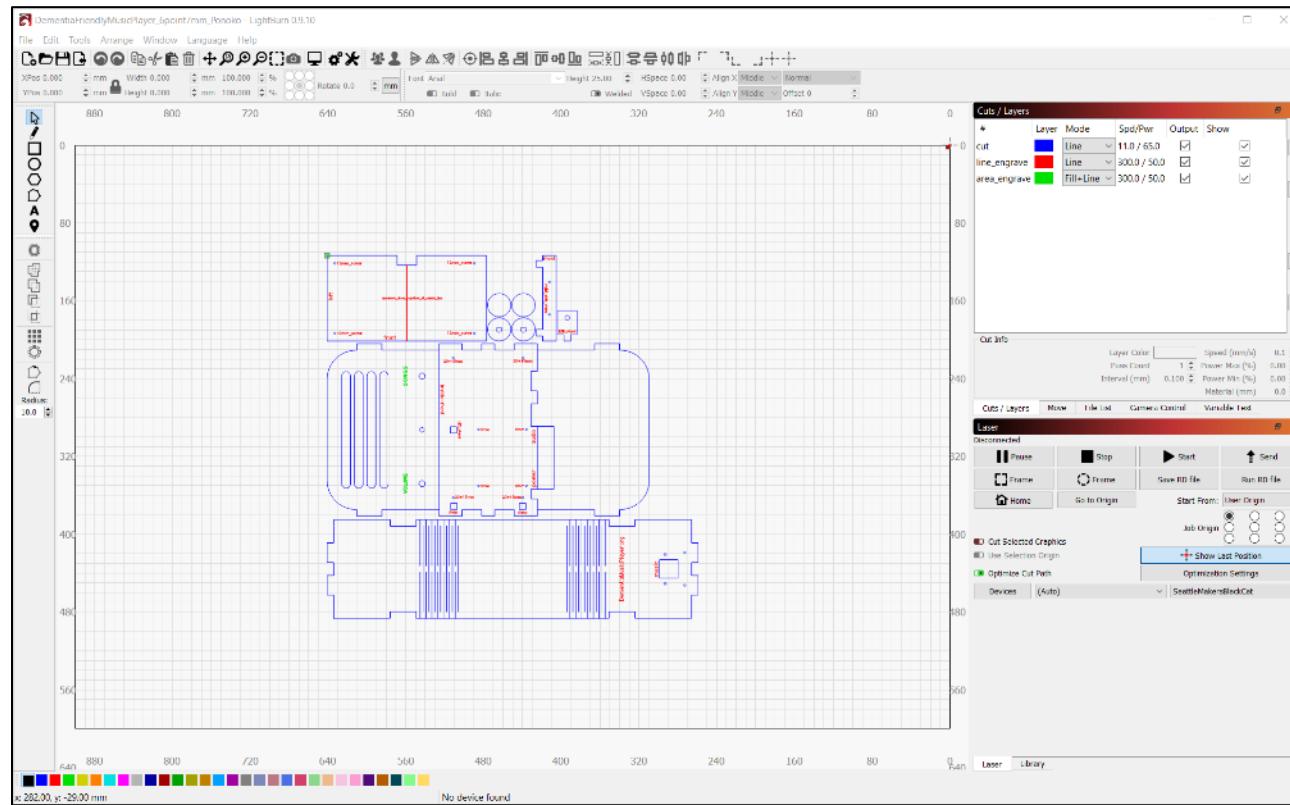
9. Click "Add to Cart"

# STEP 5: Make the case (if you didn't order it)

If you want to make the case rather than order the case:

1. Get the file that you want from [https://github.com/rosswesleyporter/dqmusicbox/tree/master/case/laser\\_cut/wood\\_speakers\\_only](https://github.com/rosswesleyporter/dqmusicbox/tree/master/case/laser_cut/wood_speakers_only)
2. If you like, you can customize the case
3. Cut on your laser cutter or go to a makerspace and use a laser cutter there

If you are curious, this is what a design file looks like (showing the .lbrn Lightburn file):



# STEP 6: Order the parts

If you plan to make 10+ units, see [Appendix 1](#) rather than the table below.



Item	Supplier	Cost	Notes & alternatives
Case	Ponoko	\$57.92	See instructions above
<a href="#">Raspberry Pi 4 Model B - 2GB RAM</a>	AdaFruit	\$35.00	Or buy Amazon B07TD42S27 (Pi 4). Or buy a Pi 3B+ and the appropriate power supply (not the Pi 4 power supply below).
<a href="#">Premium Female/Female Jumper Wires - 40 x 6"</a>	AdaFruit	\$3.95	Or buy Amazon B07GCY6CH7
<a href="#">Official Raspberry Pi 4 Power Supply 5.1V 3A with USB C</a>	AdaFruit	\$7.95	Or buy Amazon B07TYQRXTK
<a href="#">Panel Mount USB Cable - A Male to A Female</a>	AdaFruit	\$3.95	Or buy Amazon B0718XQPGB. Amazon B07C87FYLY *may* work, but you'll also need to buy M3 screws.
<a href="#">M2.5 standoffs (spacing screws)</a>	Amazon	\$10.99	Or buy Amazon B075K3QBMX
<a href="#">M2.5 screws 12mm M2.5-0.45</a>	Amazon	\$5.74	You can probably also buy these at a good hardware store for less
<a href="#">Speaker cloth (brown, large piece)</a>	Amazon	\$9.99	Or buy Amazon B01HMBKNSS (black, large cloth)
<a href="#">Speakers</a>	Amazon	\$7.99	Or buy Amazon B01KC7WGQQ
<a href="#">Micro SD card</a>	Amazon	\$3.99	Any 16GB or larger micro SD card is fine
<a href="#">USB flash drive</a>	Amazon	\$5.90	Or buy Amazon B07MDXBT87
<a href="#">KY-016 indicator LED</a>	Amazon	\$6.99	Or buy Amazon B07KJYR8K1
<a href="#">KY-040 rotary encoders (knobs)</a>	Amazon	\$7.99	Or buy Amazon B06XQTHDRR
<a href="#">Sticky back velcro strips</a>	Amazon	\$2.17	Or buy Amazon B0035GZCHC
<b>TOTAL</b>		<b>\$170.52</b>	+ tax + shipping

## STEP 7: Get wood finish product (optional)

Optional. Bamboo is quite nice unfinished. But you can give it a golden look and a bit of protection.

You only need one. If you don't have any wood finishes, you probably have a friend who does.



Easiest. Done in minutes. But needs re-application from time to time. Baby oil can also work if the main ingredient is mineral oil.

Fast. ~15 minutes of work spread across two hours.

Easy. One coat is enough, but best to let it dry overnight. Any linseed oil is fine, except raw linseed oil.

## STEP 8: Gather tools & supplies



## STEP 19: Get a computer with an SD card slot



You'll need a PC or Mac or Linux computer with an SD card slot. If you don't have one, you probably have a friend who does.

## STEP 10: Apply a wood finish (optional)

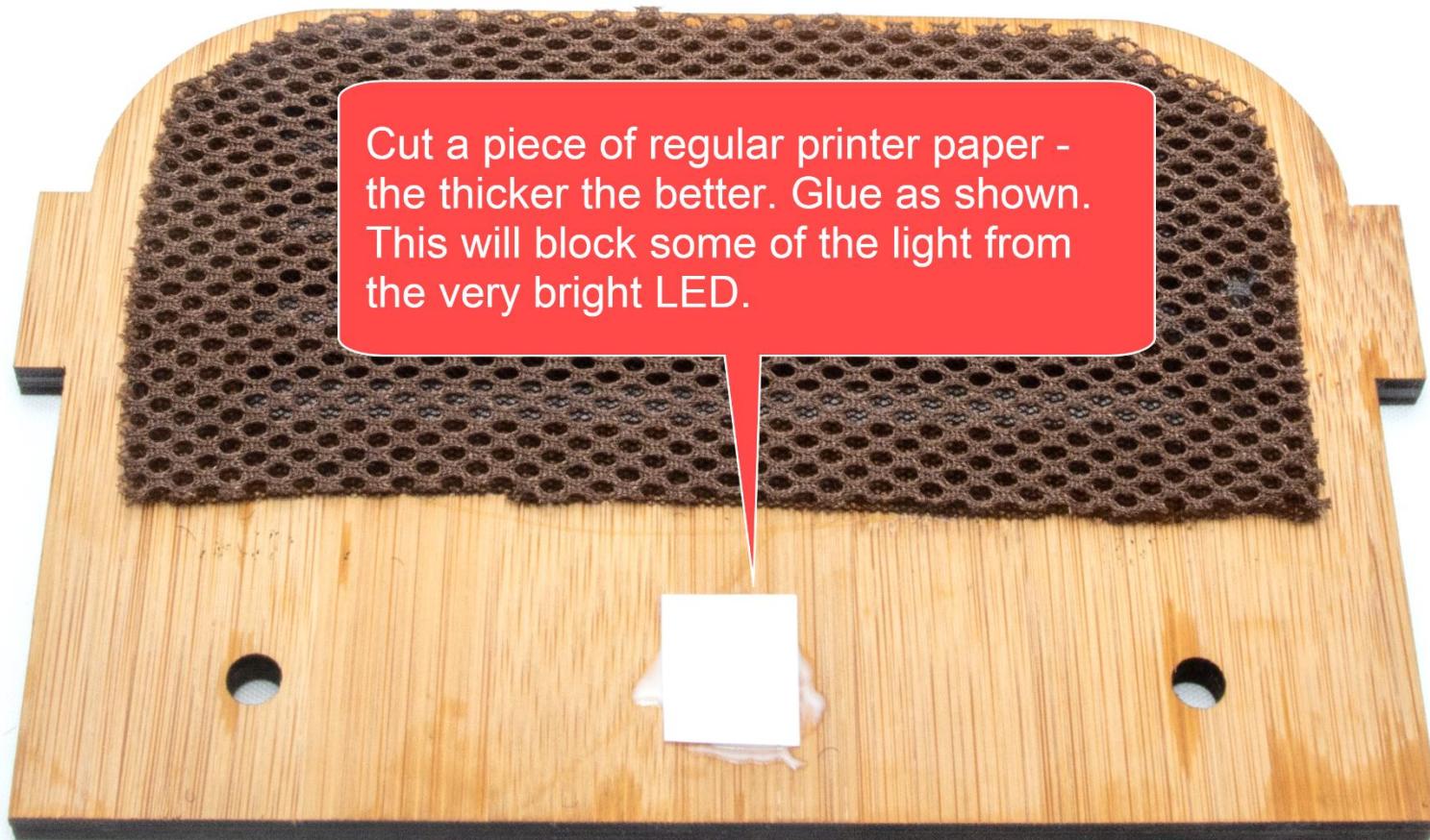


If you choose to use spray lacquer, see this [short video from Woodworking for Mere Mortals](#). The method shown is much faster than the instructions on the spray bottle. It takes about 15 minutes of work spread across two hours.

## STEP 11: Cut & glue speaker fabric



## STEP 12: Cut & tape paper to inside of LED hole



# STEP 13: Assemble the personalized collection of music

## Choosing the music – go for familiar favorites

This is the most important step. The personalized (familiar) music is the fundamental magic. You don't need much music, perhaps 6-10 albums. But only familiar favorites. In my case, my Mom mailed me my Dad's favorite CDs. It will take two weeks for the parts above to arrive, so you have time to do this well. Though it is easy to change the set of music later.

## Put the music on the USB memory stick

Organize the digitized music into folders on the USB memory stick, one folder per album. MP3, iTunes, and FLAC files are supported i.e. files with extensions .mp3, .m4a, .flac. In the end, you should have a set of folders that looks something like this:

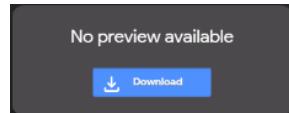
Name	Date modified	Type
A_Beethoven9	10/24/2015 6:25 PM	File folder
B_Eli_Porter_-_Eli_Porter	10/24/2015 6:25 PM	File folder
C_Mozart_-_Overtures	10/24/2015 6:25 PM	File folder
D_Tchaikovsky_-_Concerto for Violin i...	10/24/2015 6:25 PM	File folder
E_Vivaldi_Telemann_Bach_Mercadante...	10/24/2015 6:25 PM	File folder
F_Samuel Barber_-_Barber; Adagio for ...	10/24/2015 6:26 PM	File folder
G_James Galway_-_Serenade	10/24/2015 6:26 PM	File folder
H_Giacomo Puccini_-_Madama Butter...	10/24/2015 6:26 PM	File folder
I_Giacomo Puccini_-_Madama Butterfl...	10/24/2015 6:26 PM	File folder
J_Giacomo Puccini_-_Madama Butterfl...	10/24/2015 6:26 PM	File folder
K_Leontyne Price_-_Arias	10/24/2015 6:26 PM	File folder

# STEP 14: Copy software to the micro-SD memory card

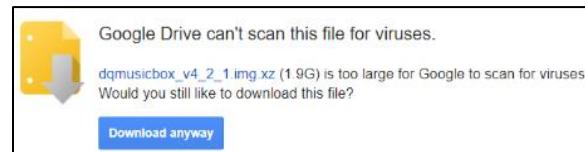
I prepared a disk image for you. It has all the required software. Your job is to download this disk image and then write it to the micro-SD card. The steps:

1. Install [Balena Etcher](#) on your PC or Mac or Linux computer. [Win32 Disk Imager](#) also works.

2. Download the [Dementia Friendly Music Player disk image](#).



3. Confirm download – “Download anyway”



4. Put the micro-SD memory card & adapter into the SD reader/writer in your computer.

5. Start Balena Etcher, instruct it to write the image file to the SD card:



6. Wait for the writing to complete, ~10 minutes. This would be a good time to make a sandwich.

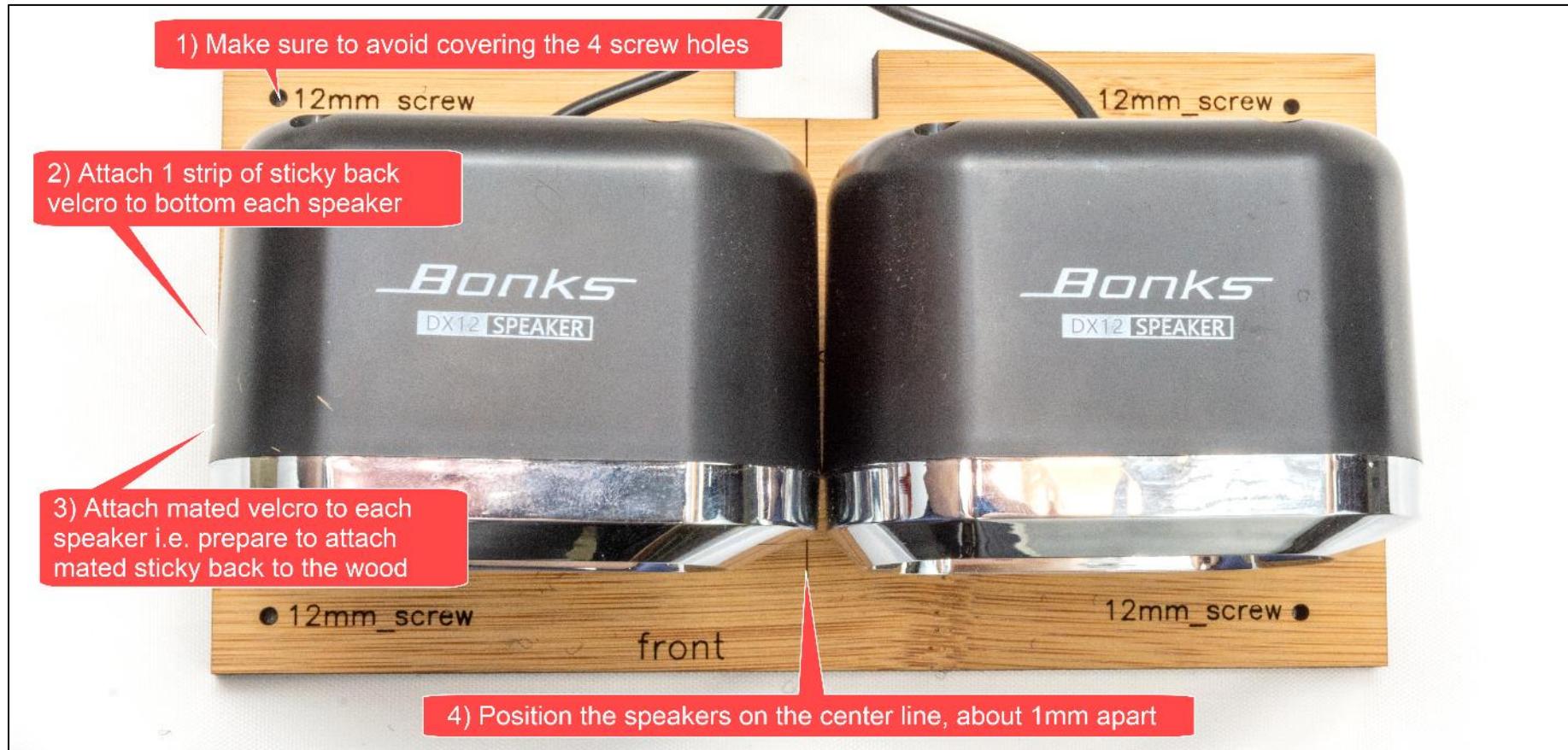
## STEP 15: Insert the clasp piece



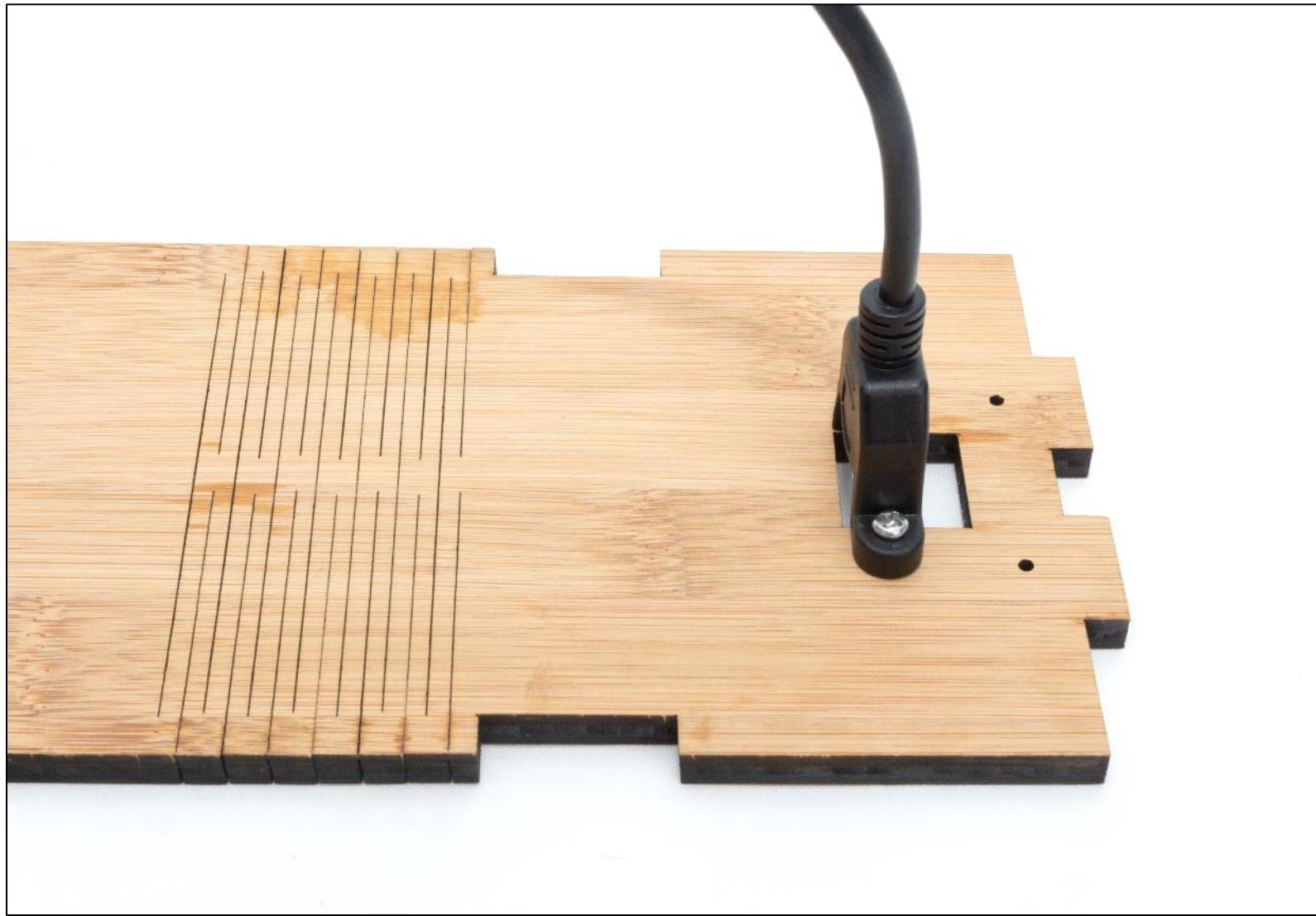
## STEP 16: Insert the LED stand



## STEP 17: Velcro speakers to the shelf



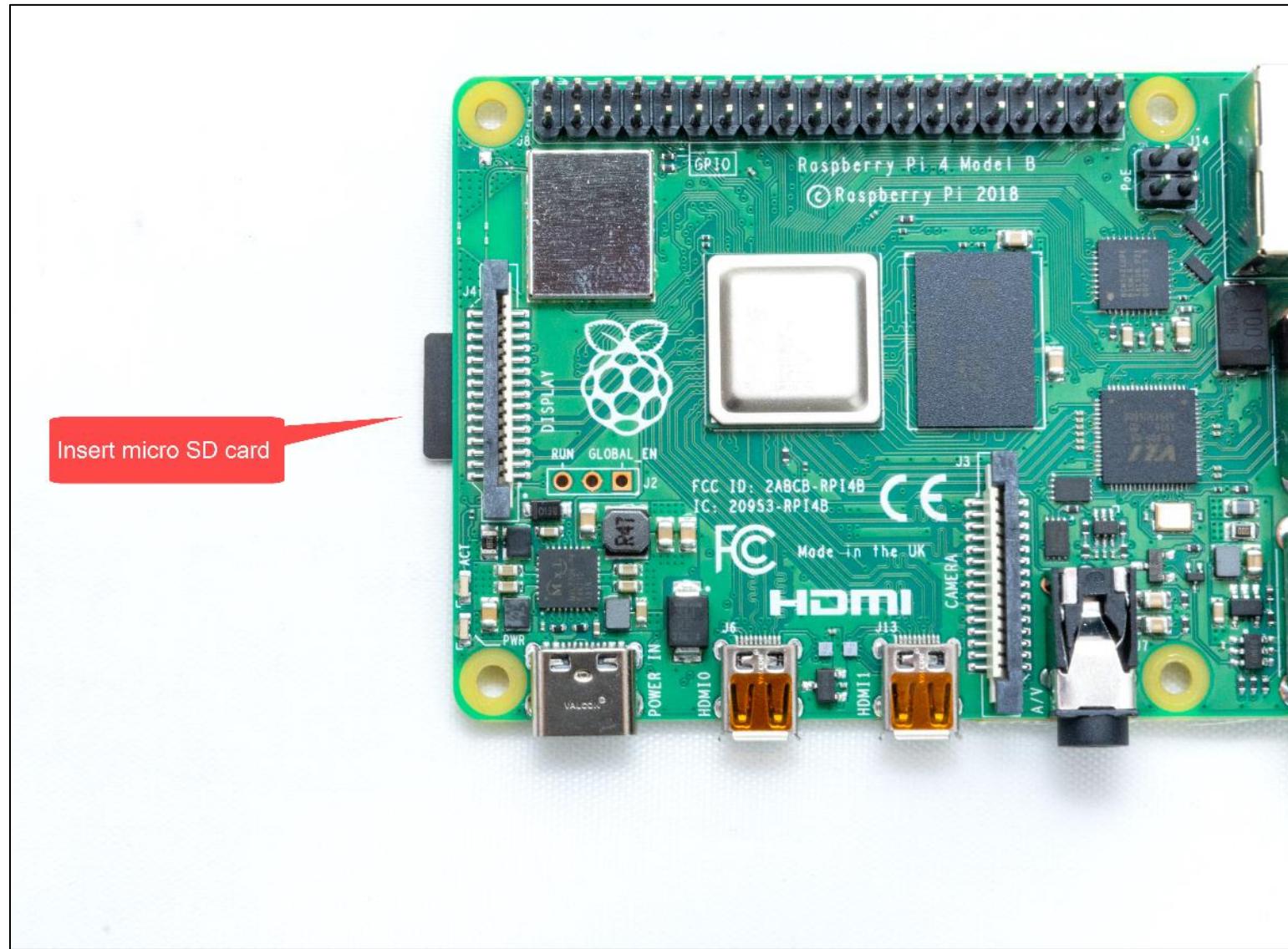
## STEP 18: Attach the USB panel



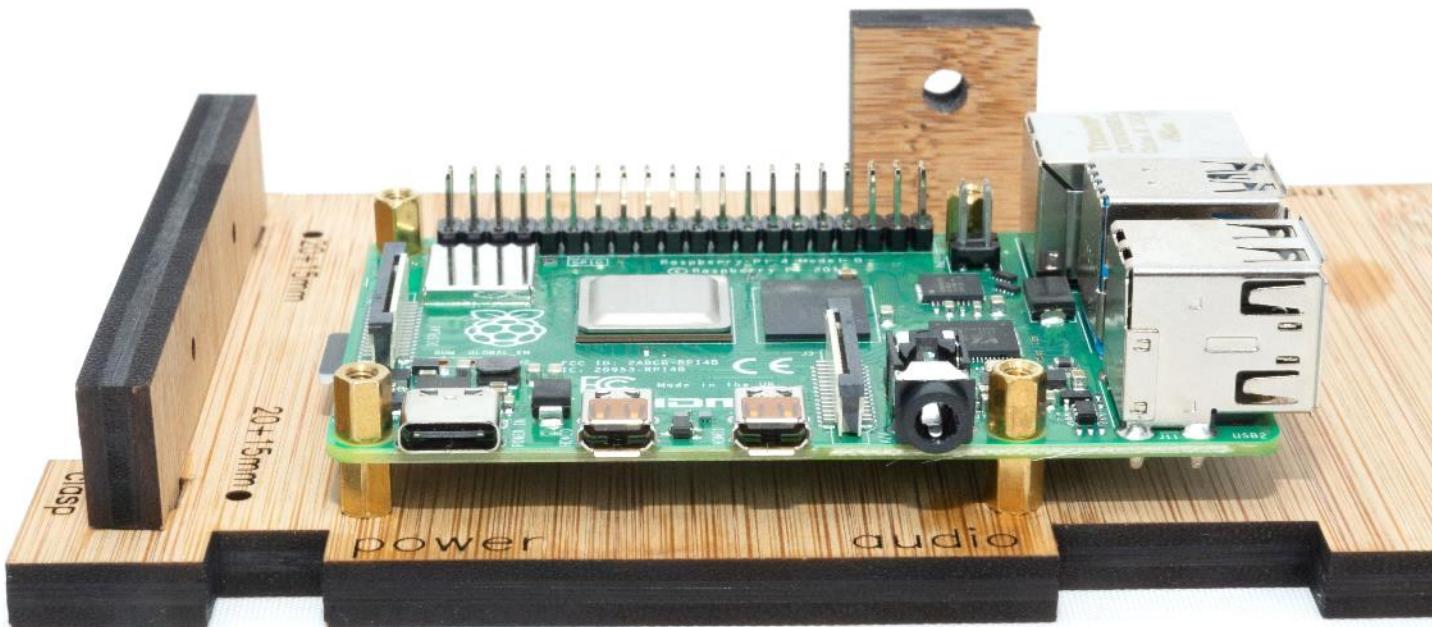
## STEP 19: Insert USB drive



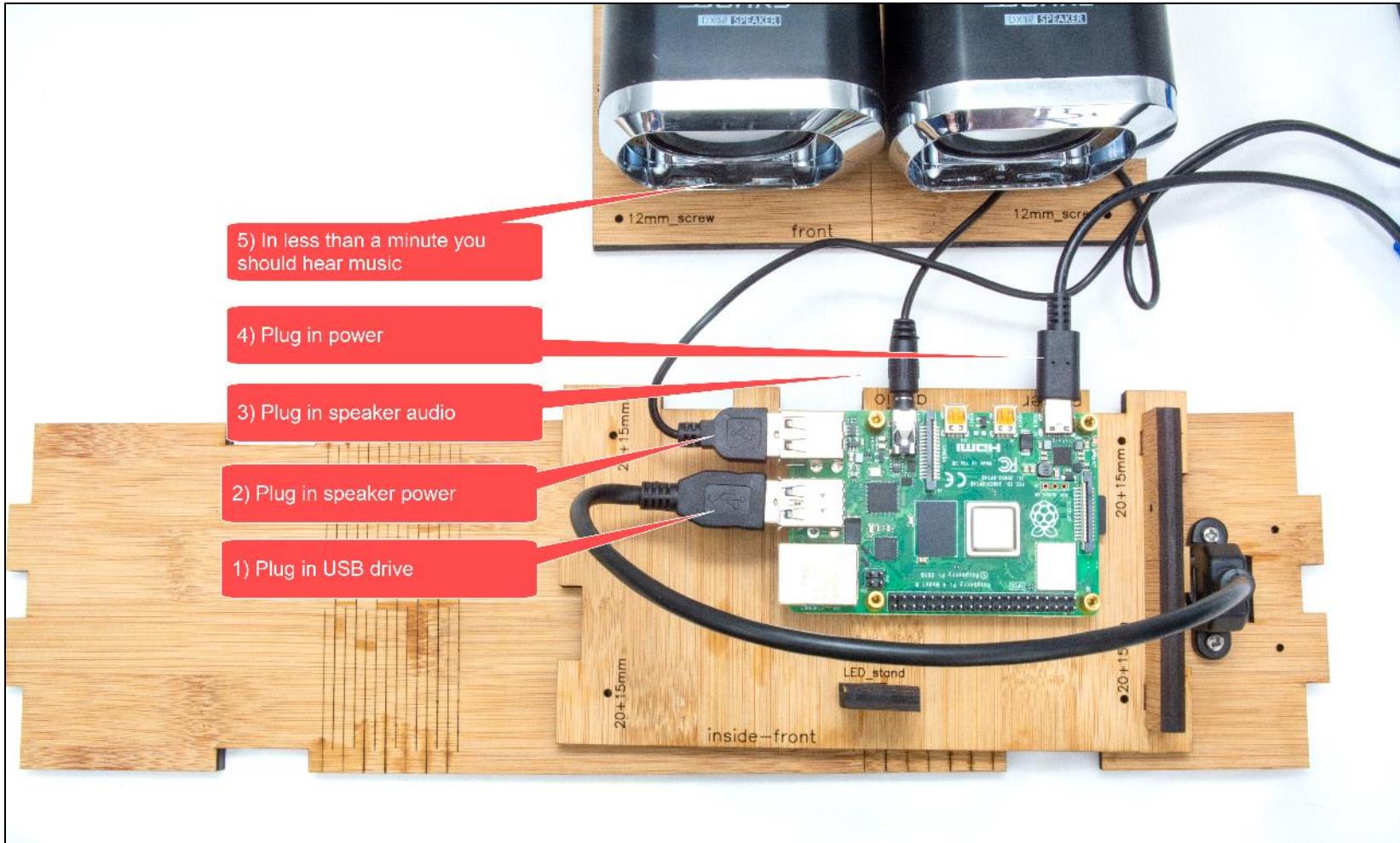
## STEP 20: Insert micro SD card



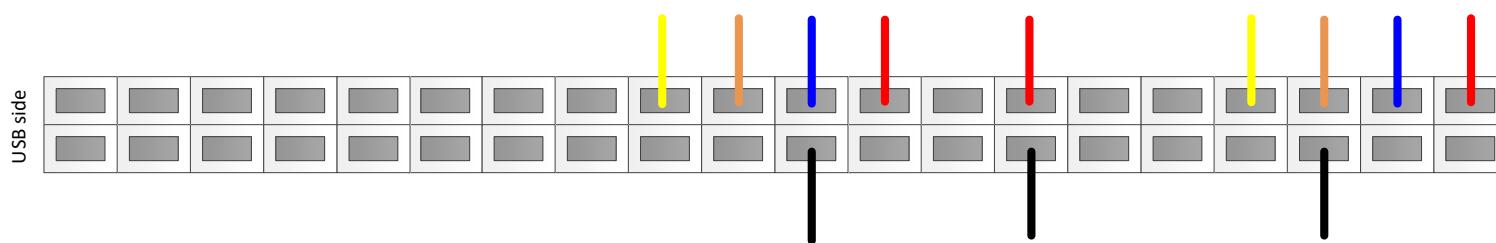
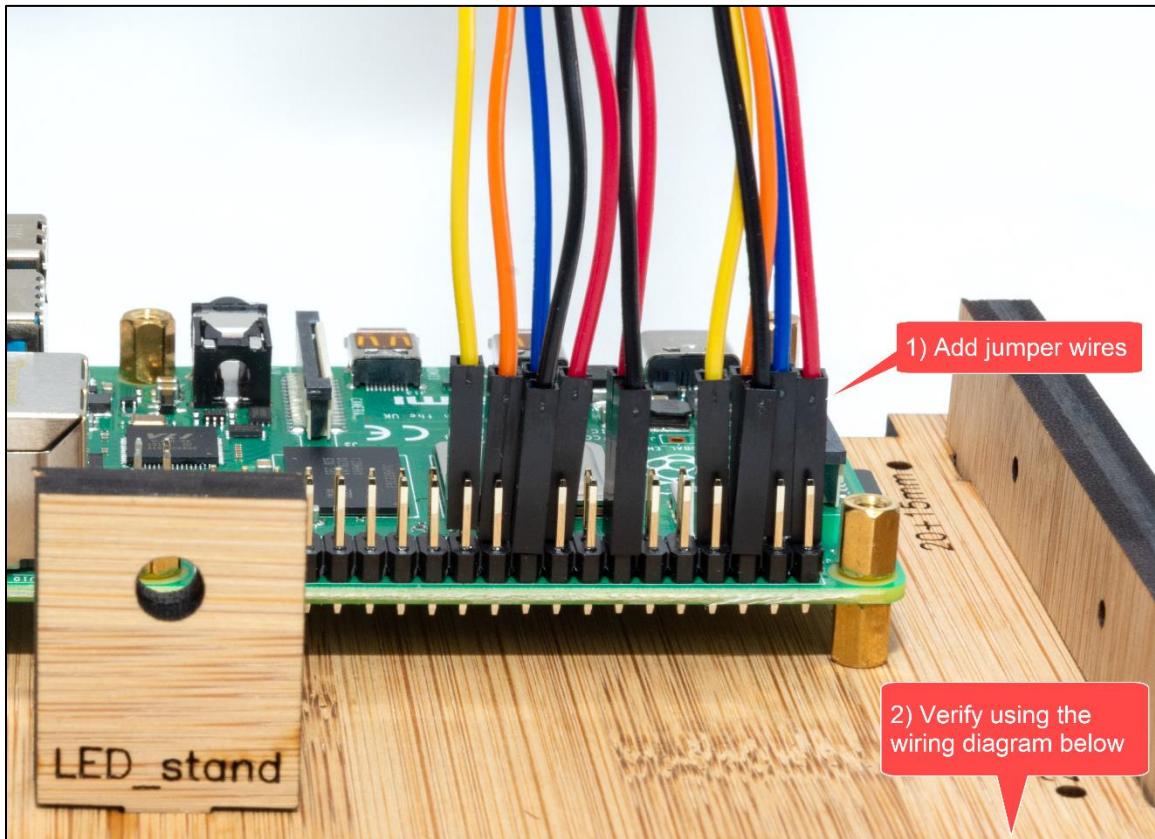
## STEP 21: Mount the Pi



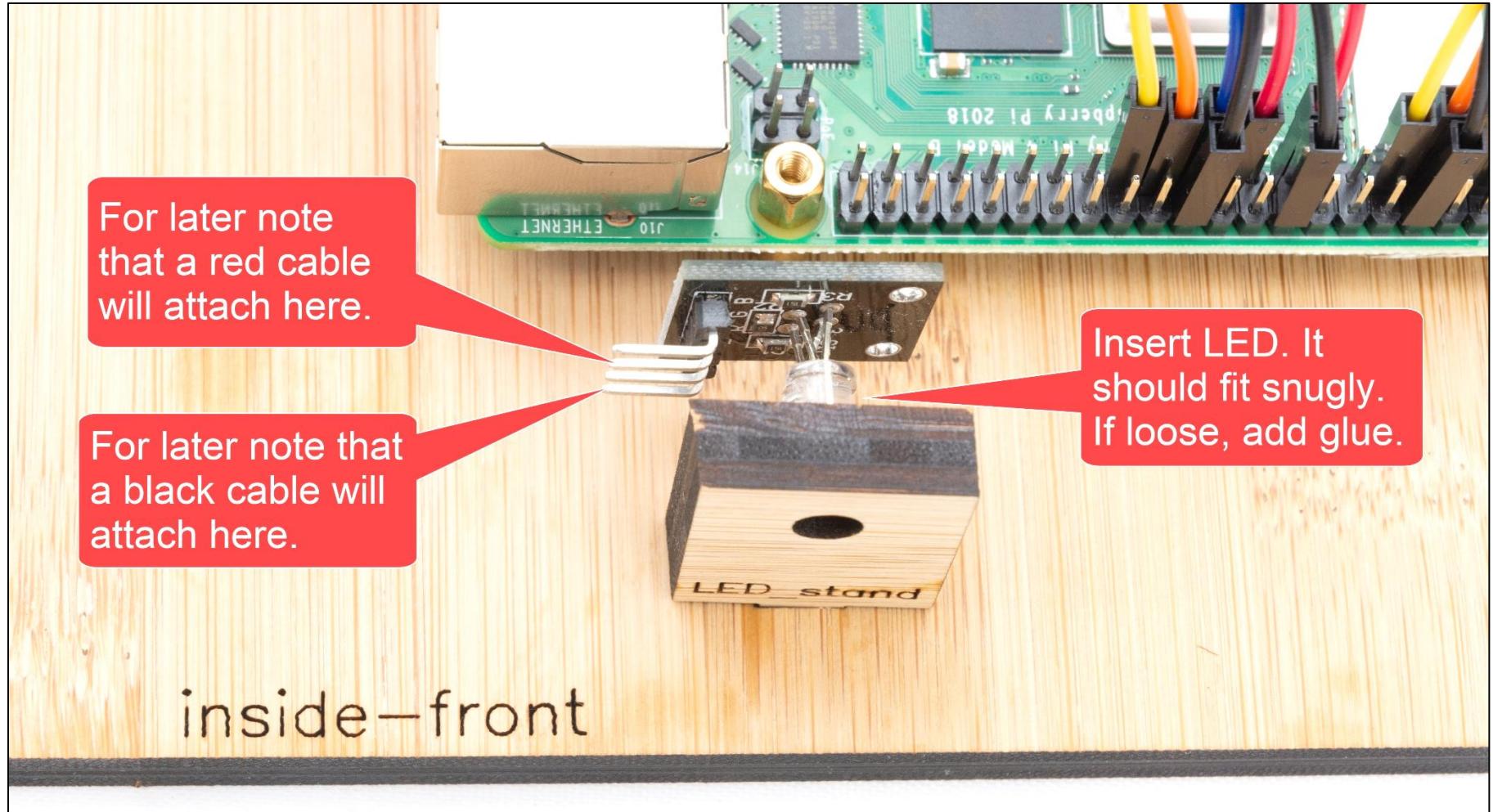
## STEP 22: Test it



## STEP 23: Wire it



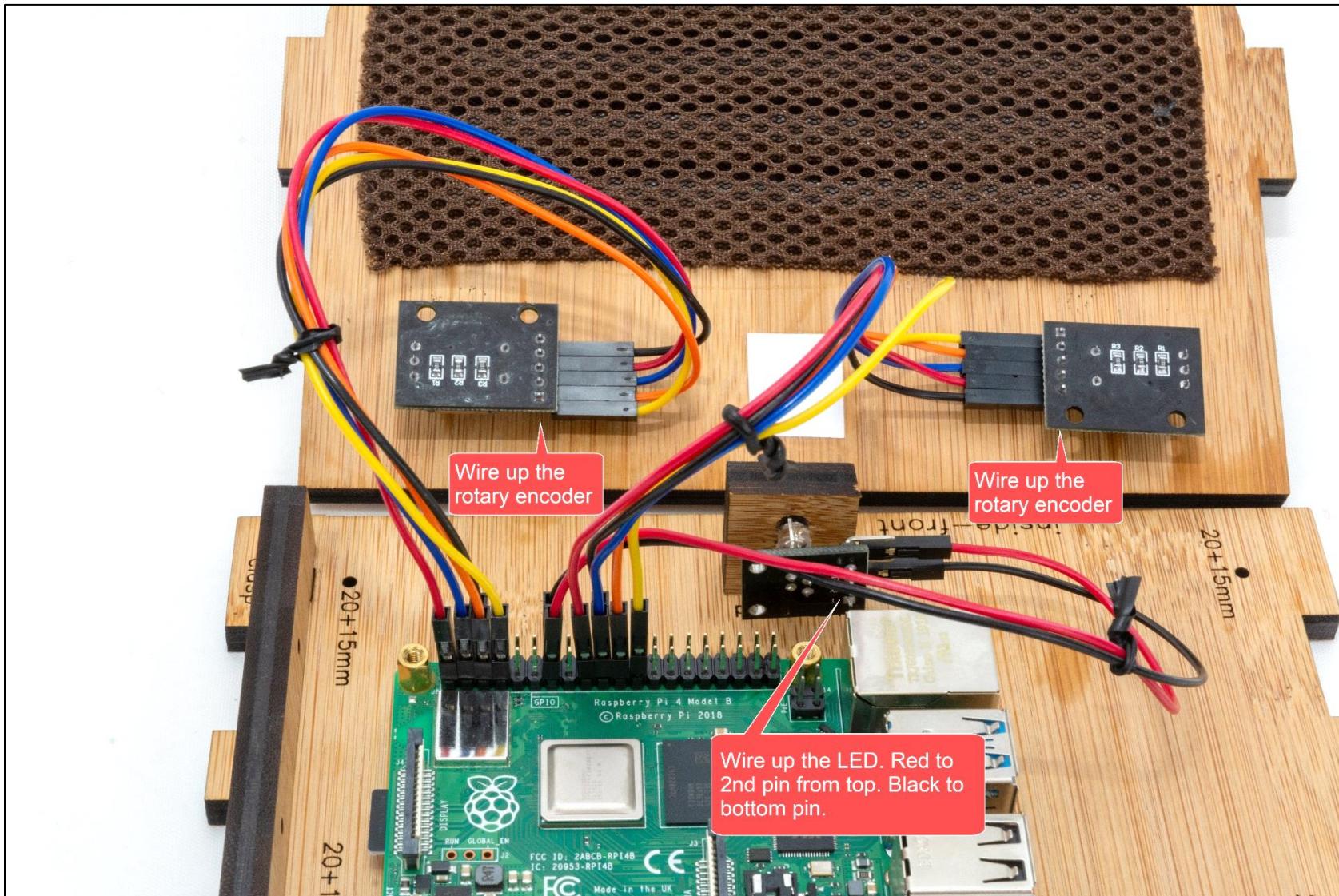
## STEP 24: Add LED



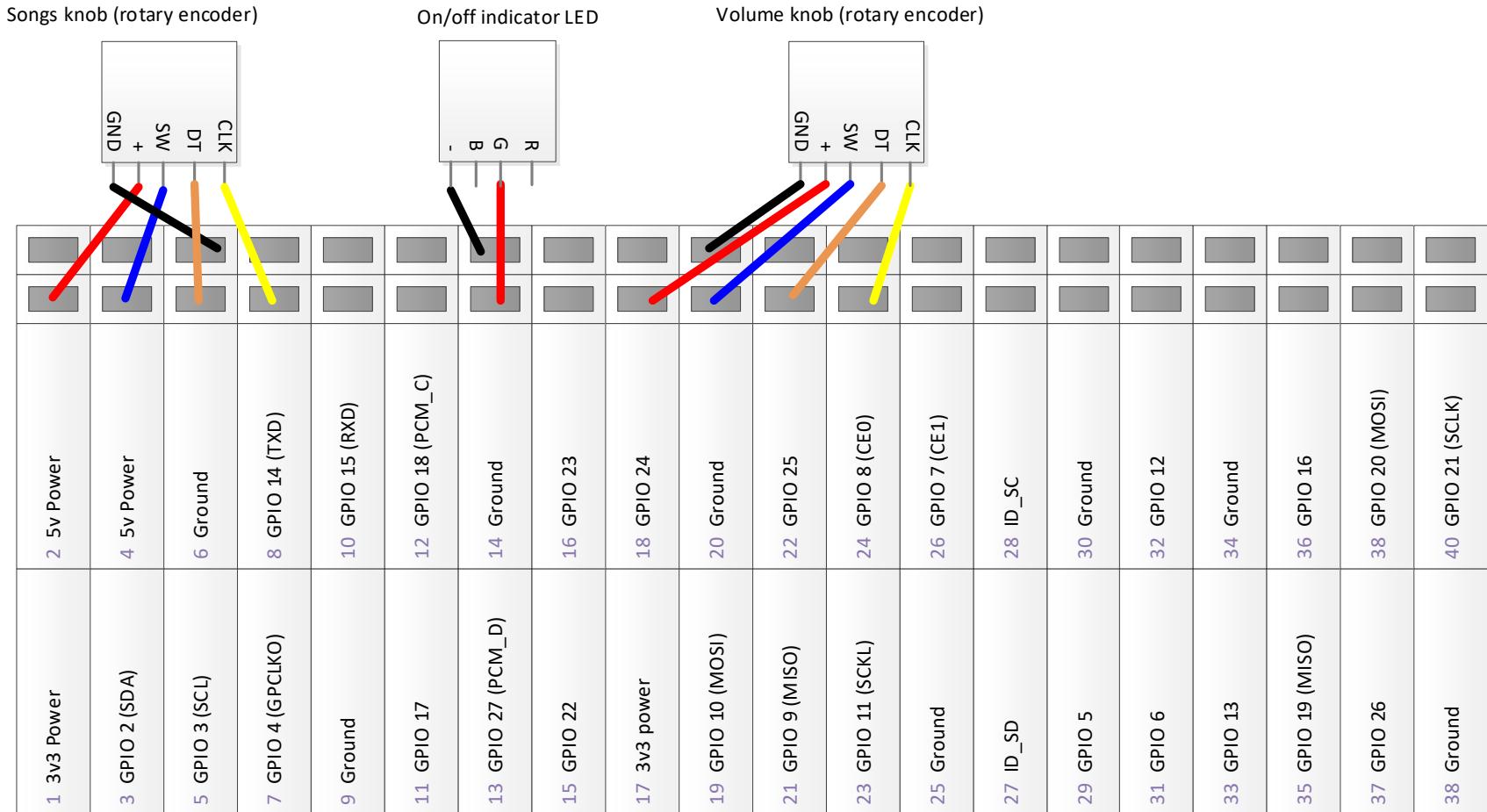
## STEP 25: Mount rotary encoders



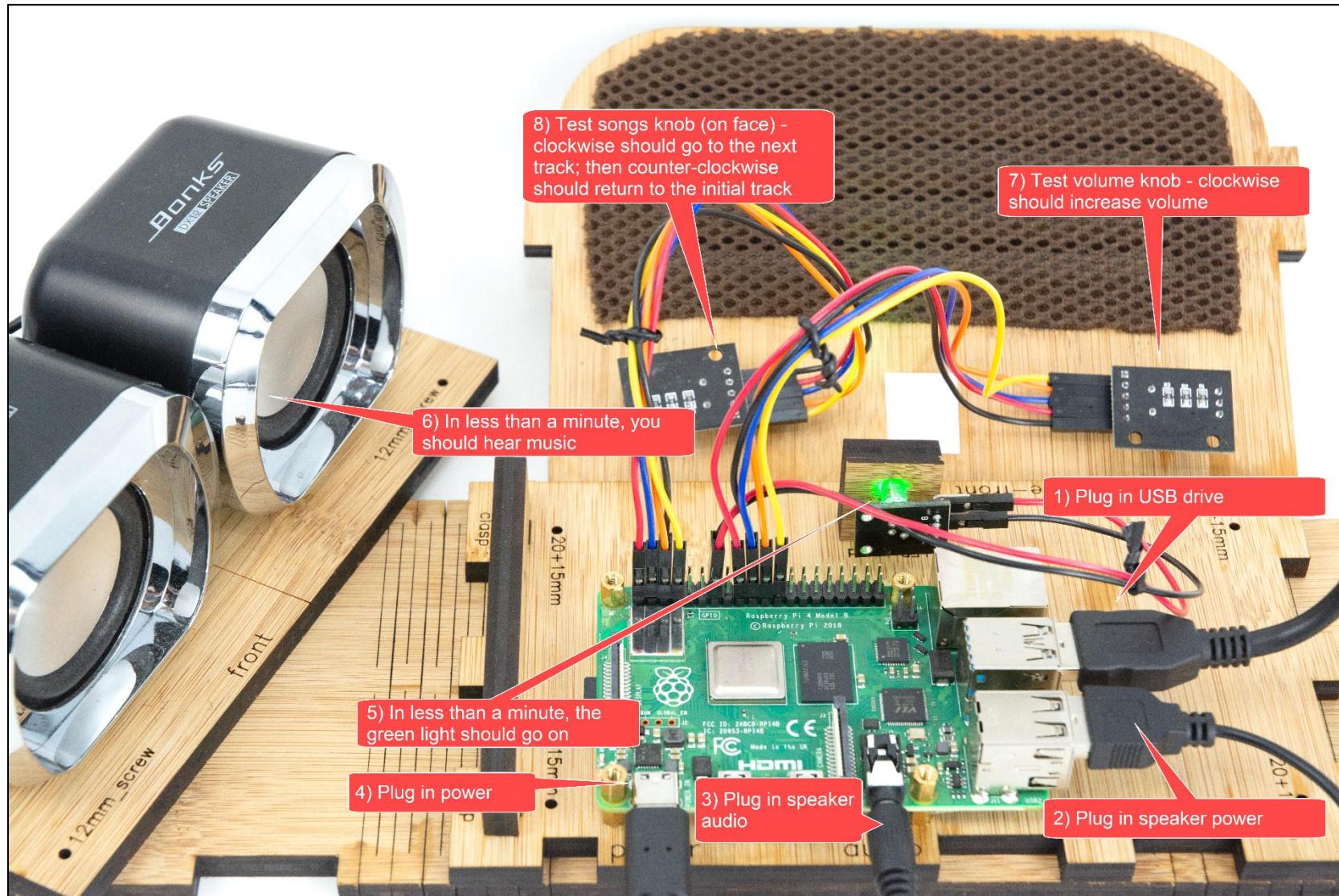
## STEP 26: Wire up components



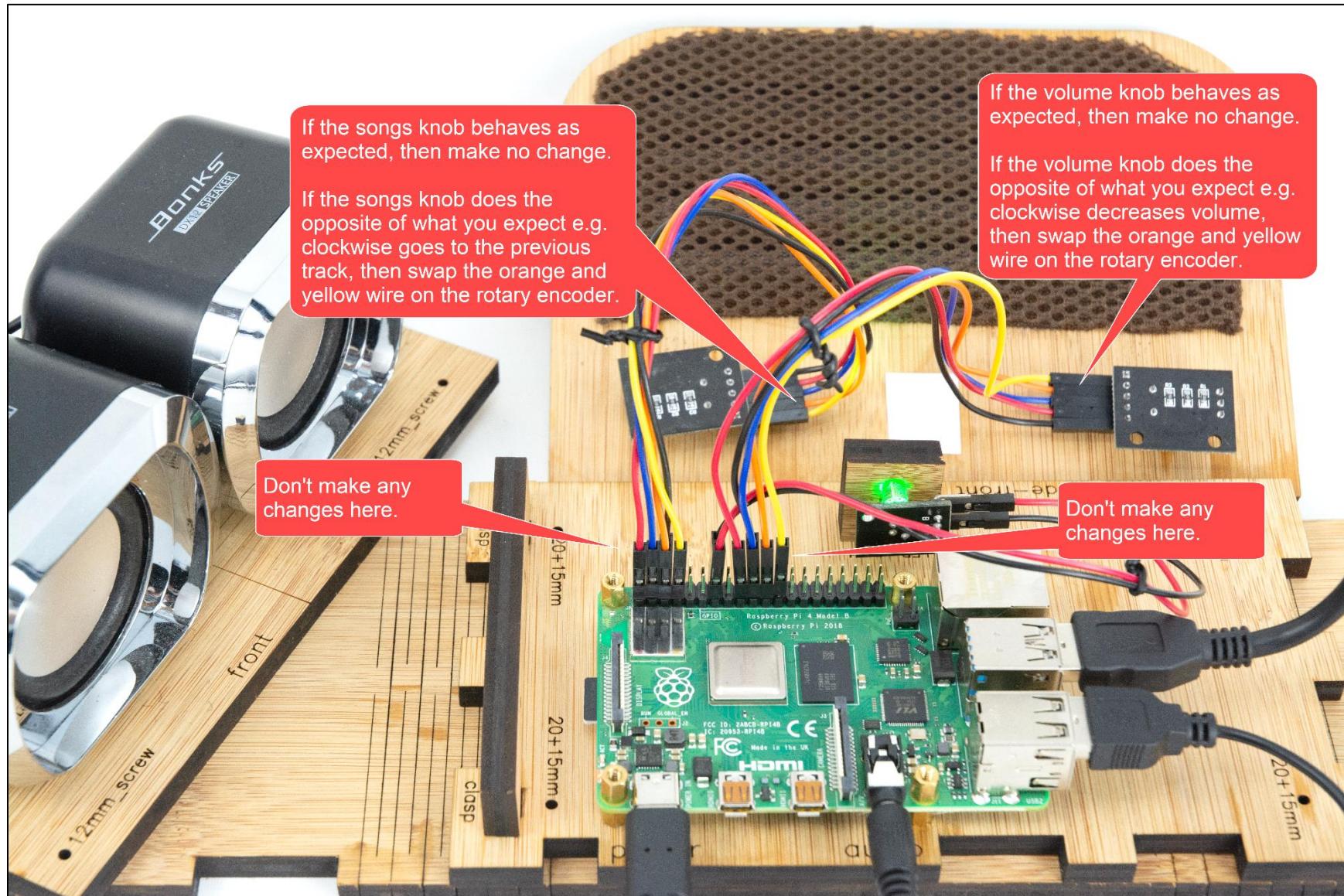
## STEP 27: Verify wiring



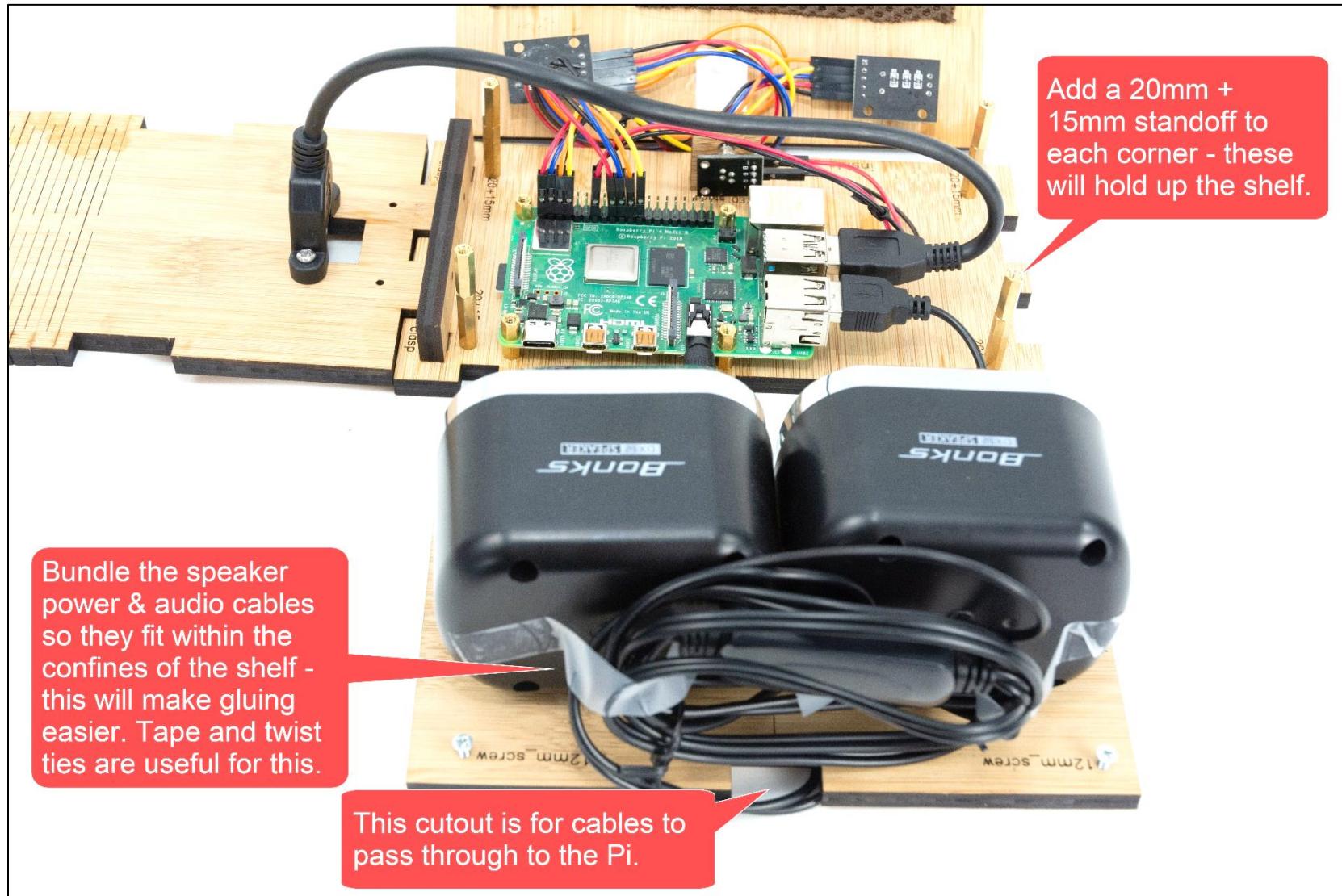
## STEP 28: Test it again



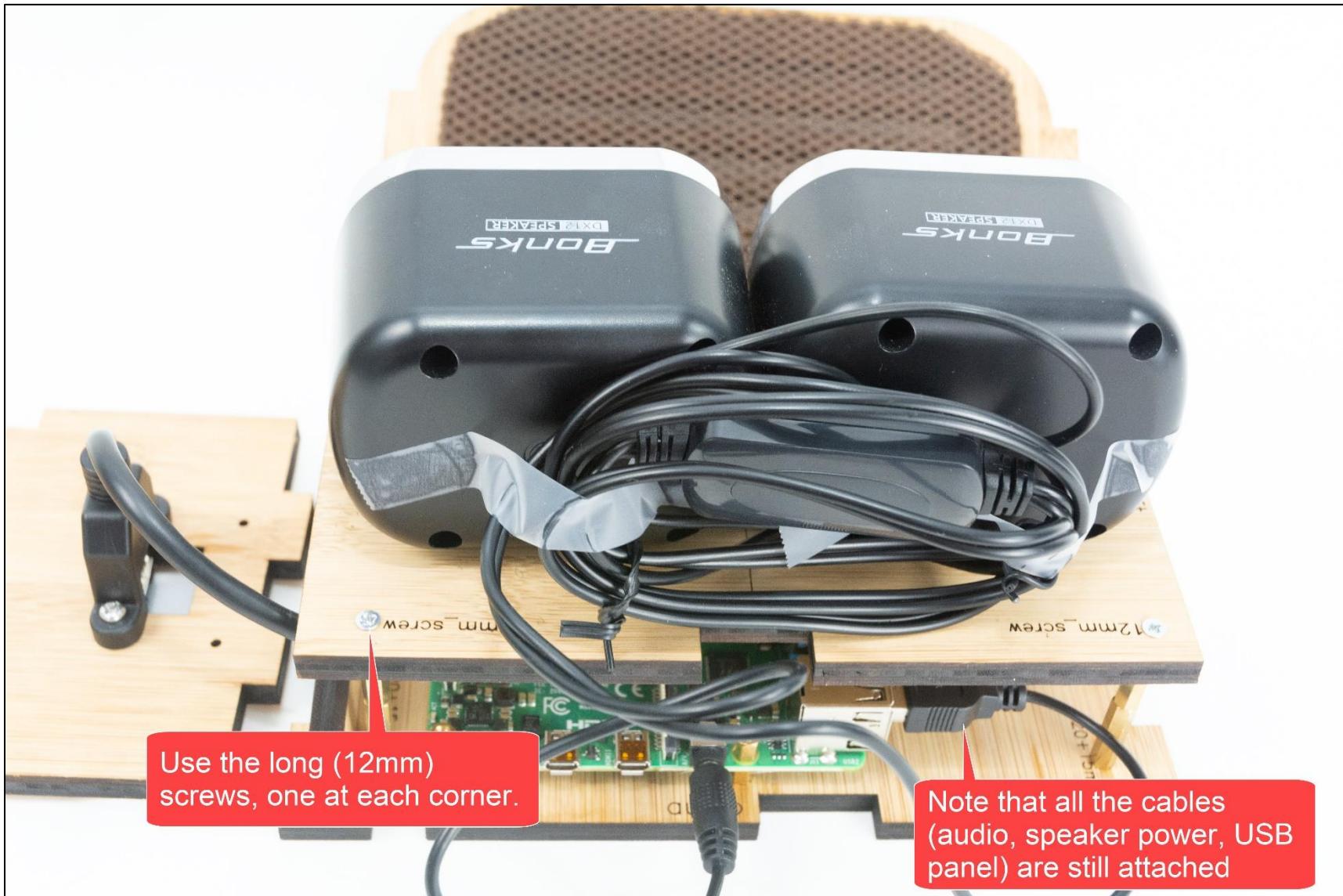
## STEP 29: Adjust the knob wiring (if necessary)



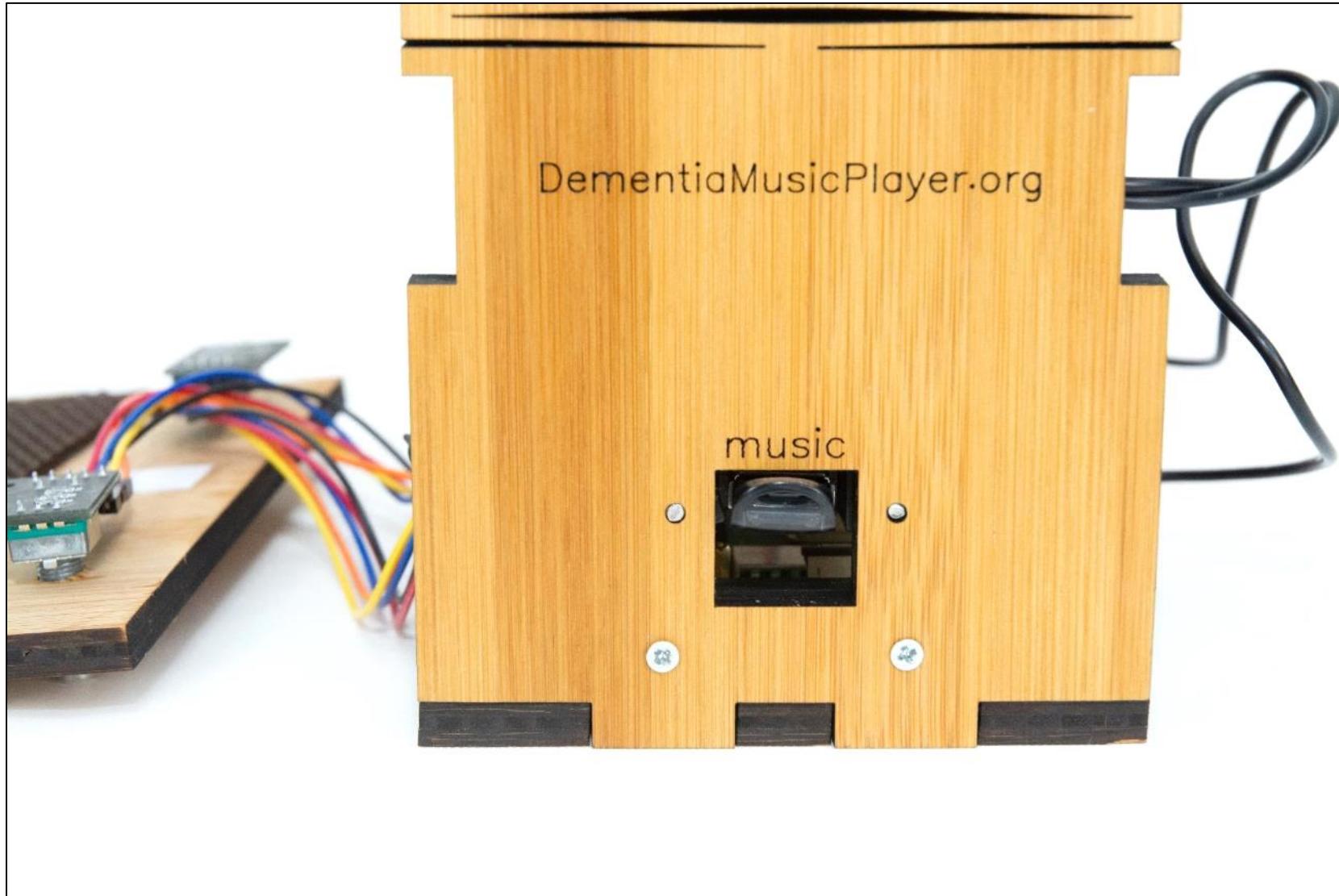
## STEP 30: Bundle speaker wires, add standoffs



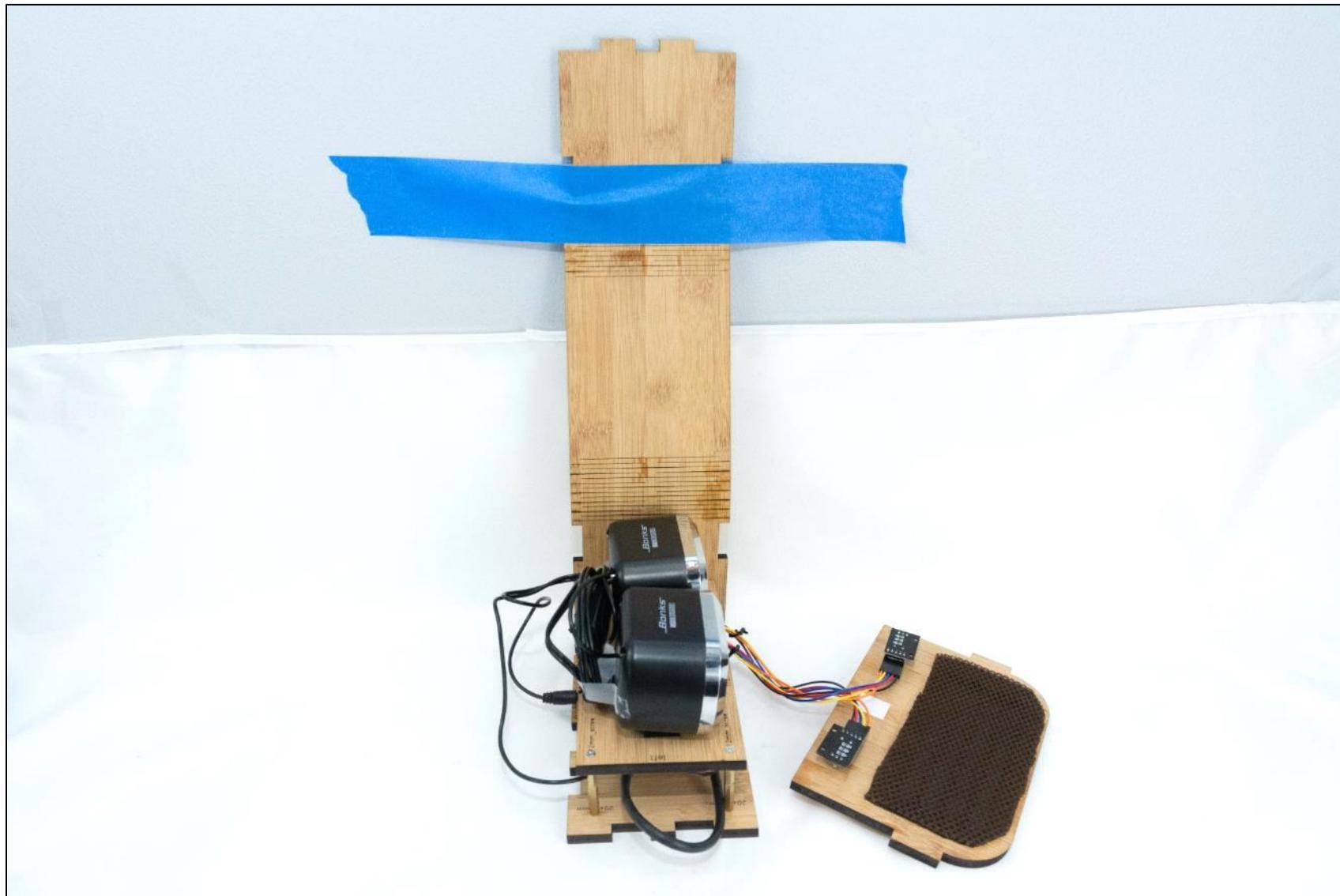
## STEP 31: Add the shelf



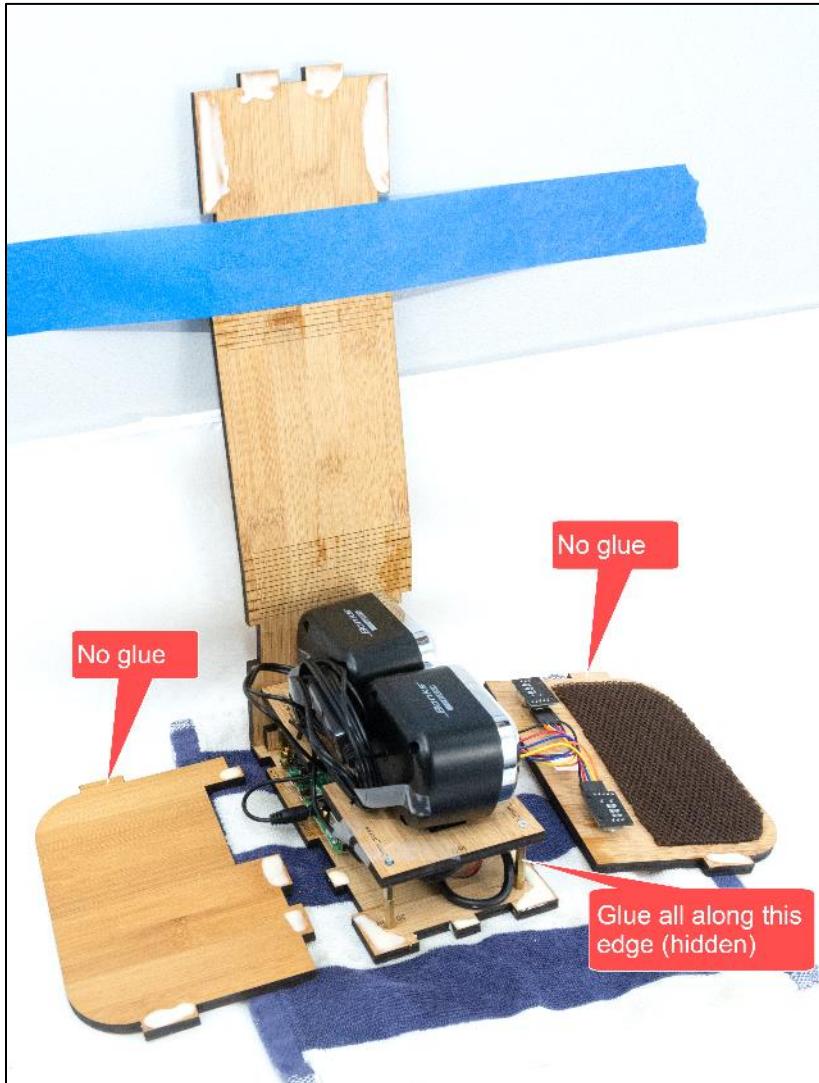
## STEP 32: Attach at the clasp (screws)



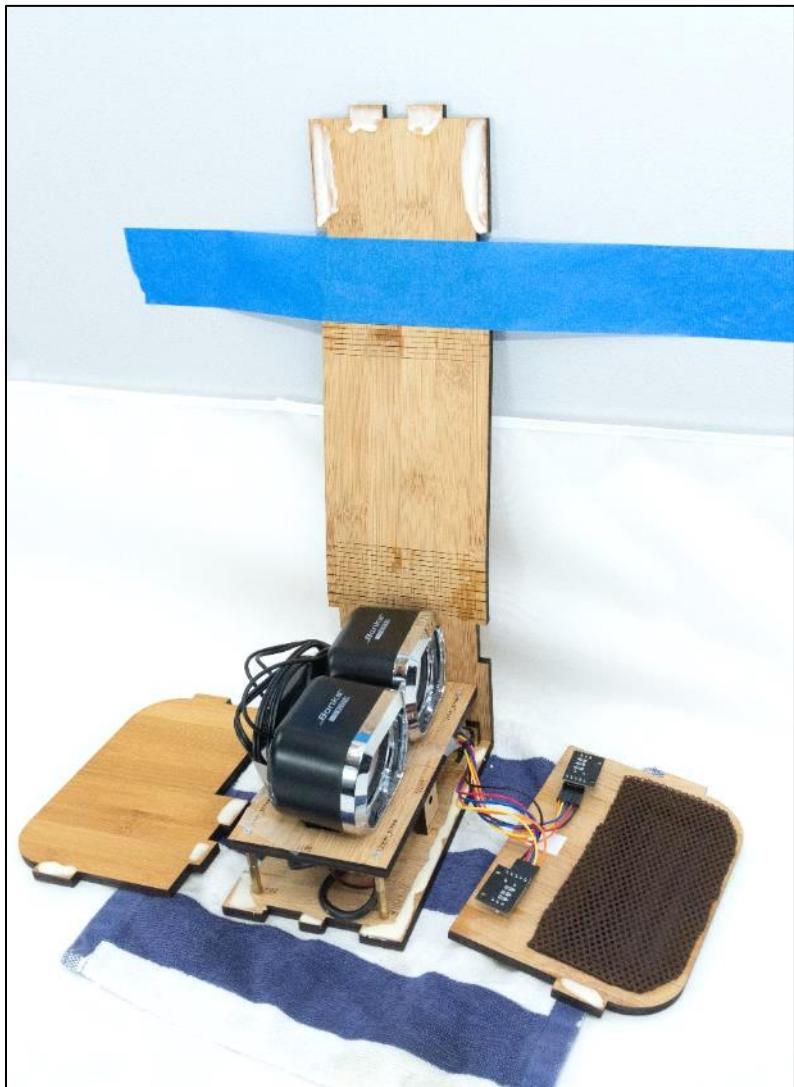
## STEP 33: Tape to wall (makes next steps easier)



## STEP 34: Add glue



## STEP 35: Verify glue



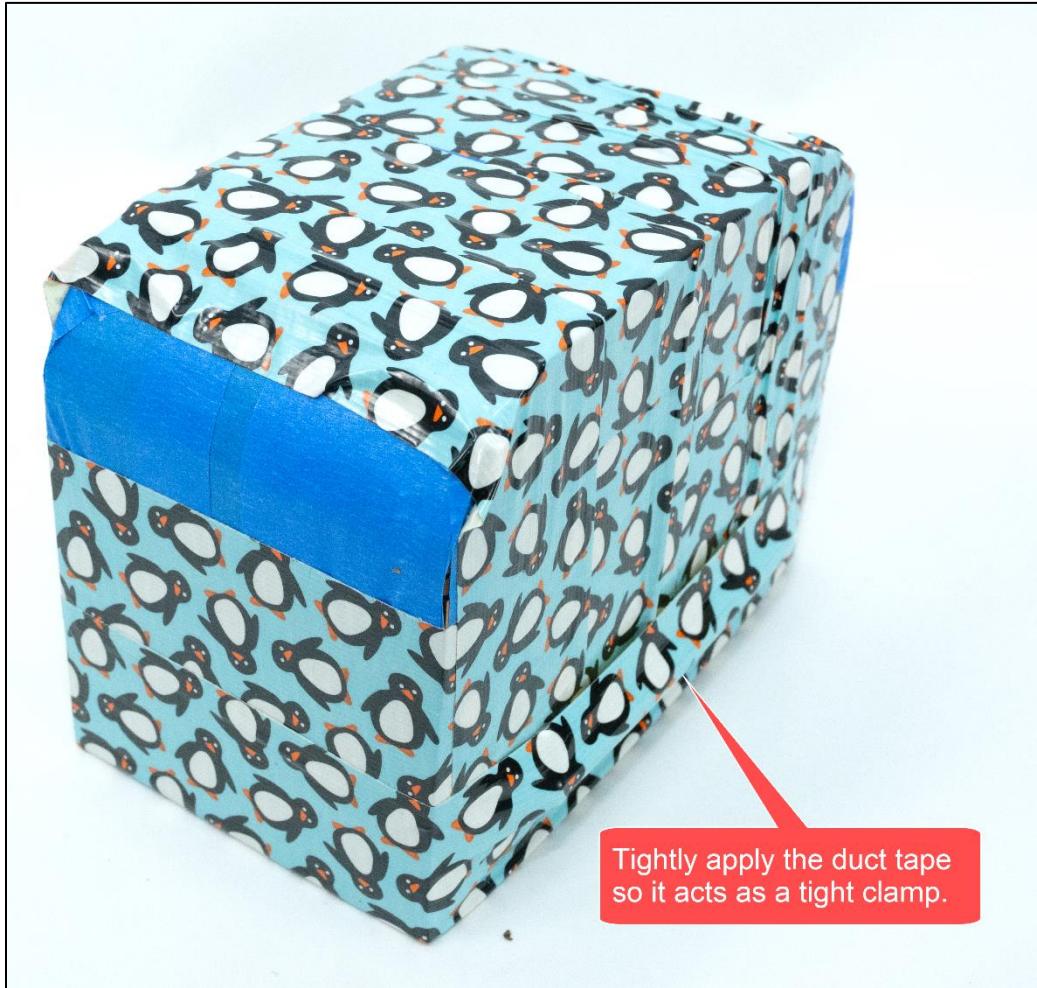
## STEP 36: Put the pieces together



## STEP 37: Clamp it lightly – painter's tape



## STEP 38: Clamp it tightly – duct tape



## STEP 39: Glue the knobs



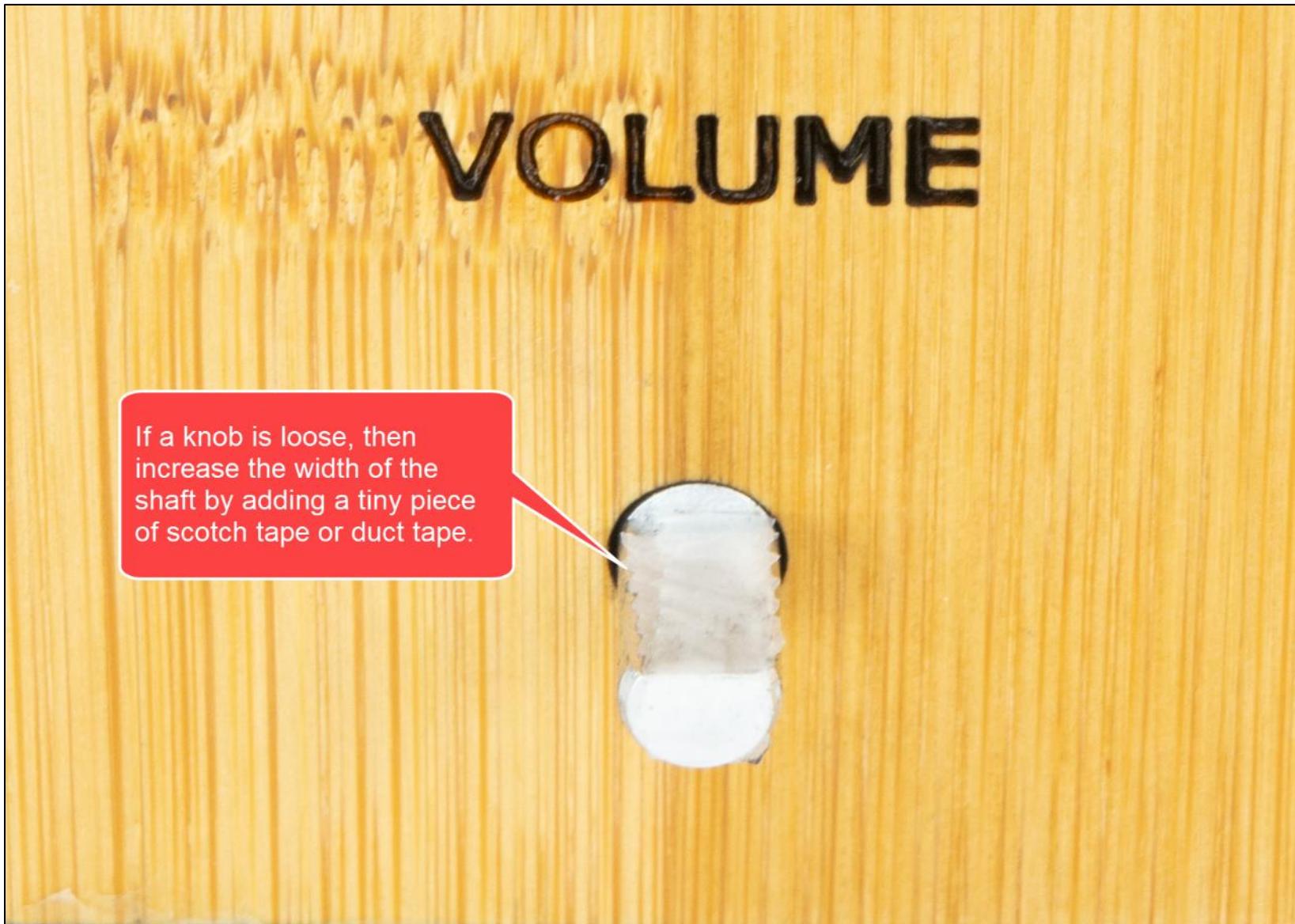
## STEP 40: Let the glue dry



## STEP 41: Remove the tape



## STEP 42: Adjust the knobs (if necessary)



## STEP 43: Tape instructions

Print this page and tape the instructions in the box below to the bottom of your new Dementia Friendly Music Player:

### To create personalized music

#### Organize the music on your computer

- A\_Beethoven\_9th
- B\_AndrewsSisters\_Hits
- C\_GlennMiller\_Hits

One folder per album. Use MP3 files, must have .mp3 file extension. Or iTunes files (.m4a). Or FLAC files (.flac). Optionally, use folder names prefixes to specify the play order e.g. A\_, B\_

#### Copy the music to the USB thumb drive



1. Unplug the Dementia Friendly Music Player.
2. Remove the USB thumb drive and place in your computer.
3. Copy music files from your computer to the USB thumb drive.
4. Put the USB thumb drive back in.
5. Plug in your Dementia Friendly Music Player.

## STEP 44: Done!

Congratulations! You should have a fully functional Dementia Friendly Music Player.

## Appendix 1: Building 10+ at a time

Assumptions:

- You want to build 10 or more units at a time
- You are planning this far enough in advance (6 weeks or more) that you can order some of the parts directly from China
- Two ways to make the case – laser cut it yourself or order with a quantity discount from Ponoko
- If you order in quantity 10+ from Ponoko, you get a ~40% discount; as of this writing (22 March 2020) Ponoko is still open, despite COVID19
- If you are planning to laser cut the case yourself, or in conjunction with a maker space, I suggest using 5.2mm cherry MDF wood
  - Looks great, is commonly available, laser cuts well
  - Ideally apply some wood finish (see above)
  - At my supplier, a 4'x8' sheet is \$55, and you can make as many as 12 cases from it
  - For the cost estimate below, I'm assuming 15 minutes of laser time at \$1 per minute
  - For laser cutting, be sure to use the matching 5.2mm file from [github](#)
  - You'll need the rubber feet (see below) as the 6mm shaft of the standoffs will protrude slightly from the bottom of the case

# units to make		10					
Item	Supplier	Quan	Each	Total	Per unit	Notes	
Wood case	Maker space	10	\$21.50	\$215.00	\$21.50	Or order 10+ from Ponoko for @\$37.89	
<a href="#">Raspberry Pi 4 Model B - 2GB RAM</a>	AdaFruit	10	\$35.00	\$350.00	\$35.00		
<a href="#">Official Raspberry Pi Power Supply 5.1V 3A with USB C - 1.5 meter long</a>	AdaFruit	10	\$7.95	\$79.50	\$7.95		
<a href="#">Panel Mount USB Cable - A Male to A Female</a>	AdaFruit	10	\$3.95	\$39.50	\$3.95		
<a href="#">Female-female jumper wires 30cm</a>	Ali Express	10	\$0.86	\$8.60	\$0.86		
<a href="#">M2.5x6mm + 6mm standoffs (50 pieces)</a>	Ali Express	1	\$2.43	\$2.43	\$0.24		
<a href="#">M2.5x15mm + 6mm standoffs (50 pieces)</a>	Ali Express	1	\$3.49	\$3.49	\$0.35		
<a href="#">M2.5x20mm + 6mm standoffs (50 pieces)</a>	Ali Express	1	\$4.04	\$4.04	\$0.40		
<a href="#">M2.5 screws 12mm M2.5-0.45 (100 pieces)</a>	Amazon	1	\$5.74	\$5.74	\$0.57		
<a href="#">Speaker cloth (large cloth)</a>	Amazon	1	\$9.99	\$9.99	\$1.00		
<a href="#">Speakers</a>	Amazon	10	\$7.99	\$79.90	\$7.99		
<a href="#">Micro SD card</a>	Amazon	10	\$3.99	\$39.90	\$3.99		
<a href="#">USB flash drive</a>	Amazon	10	\$5.90	\$59.00	\$5.90		
<a href="#">KY-040 rotary encoders (knobs)</a>	Ali Express	20	\$0.55	\$11.00	\$1.10		
<a href="#">KY-016 indicator LED (10 pieces)</a>	Ali Express	1	\$1.86	\$1.86	\$0.19		
<a href="#">Sticky back velcro strips</a>	Amazon	10	\$2.17	\$21.70	\$2.17		
<a href="#">Sticky back rubber feet (100 pieces)</a>	Ali Express	1	\$1.09	\$1.09	\$0.11	Only needed for wood < 6mm thick	
<b>TOTAL</b>					<b>\$93.27</b>	+ tax + shipping	

## Appendix 2: Change log

v1, November 2015	Original release for this speaker centric model
v2, September 2016	<ul style="list-style-type: none"> <li>Changed music storage from a micro-SD memory card to a conventional USB memory stick.</li> <li>Changed the base Operating System from full Raspbian to <a href="#">DietPi</a> – much smaller, so faster to boot, and less to go wrong.</li> </ul>
v3, January 2017	<ul style="list-style-type: none"> <li>Changed from USB audio to Pi built-in audio, including a firmware update for excellent audio quality.</li> </ul>
v4, May 2017	<ul style="list-style-type: none"> <li>Switched to bamboo for durability and use of standoffs.</li> <li>Switched to Pi A+ to lower cost.</li> <li>Made USB thumb drive externally accessible, to make it easier for the caregiver to organize music.</li> </ul>
v4.01, 25 June 2017	<ul style="list-style-type: none"> <li>Minor edits.</li> </ul>
v4.01_1, 20 July 2017	<ul style="list-style-type: none"> <li>Minor edits.</li> </ul>
v4.01_2, 11 August 2017	<ul style="list-style-type: none"> <li>Added links for ordering parts in the UK.</li> <li>Added detailed instructions for write protecting a micro-SD card.</li> </ul>
v4.01_3, 12 August 2017	<ul style="list-style-type: none"> <li>Minor edits</li> </ul>
v4.01_4, 12 August 2017	<ul style="list-style-type: none"> <li>Minor edits</li> </ul>
v4.01_5, 14 October 2017	<ul style="list-style-type: none"> <li>Edited text and updated photographs to reflect the change from an HDD-style LED to a KY-016 LED module.</li> </ul>
v4.01_6, 26 February 2018	<ul style="list-style-type: none"> <li>Updated the links for purchasing the parts. No changes to the parts themselves, just the links.</li> <li>Minor change to the instructions, noting how the build can be accomplished in one sitting, if desired.</li> </ul>
v4.1, 7 April 2018	<ul style="list-style-type: none"> <li>Reflects that the software has been updated to support the new Raspberry Pi 3 B+. No new software features.</li> </ul>
v4.1_1, 23 April 2018	<ul style="list-style-type: none"> <li>Updated to reflect the new bamboo case design.</li> </ul>
v4.1_2, 22 July 2018	<ul style="list-style-type: none"> <li>Updated for the new cherry wood version</li> </ul>
27 Jan 2019	<ul style="list-style-type: none"> <li>Updated to note support for the Raspberry Pi 3A+.</li> </ul>
v4.2, 1 March 2019	<ul style="list-style-type: none"> <li>Switched to pmount for USB drive auto mounting.</li> </ul>
v4.2, 7 April 2018	<ul style="list-style-type: none"> <li>Removed instructions for write protecting the SD card – rarely used and may cause certain rare problems</li> </ul>
v4.2, 26 October 2019	<ul style="list-style-type: none"> <li>Updated the parts list</li> <li>Updated Ponoko instructions</li> </ul>
v4.2, 28 October 2019	<ul style="list-style-type: none"> <li>Updated Ponoko instructions</li> </ul>
v4.2.1, 30 October 2019	<ul style="list-style-type: none"> <li>Changed link to the new v4.2.1 of the software image</li> <li>Noted support for Pi 4</li> <li>Updated Ponoko instructions to match Ponoko's updated user interface</li> </ul>
v4.2.1, 19 December 2019	<ul style="list-style-type: none"> <li>Minor update – naming conventions</li> </ul>
v4.2.1, 22 December 2019	<ul style="list-style-type: none"> <li>Updated to reflect the change from cherry to bamboo e.g. updated almost all of the photos.</li> <li>Added new steps to the instructions, particularly mid-point tests and troubleshooting.</li> </ul>
v4.2.1, 15 March 2020	<ul style="list-style-type: none"> <li>Updated to reflect the new speaker centric model</li> </ul>
v4.2.1, 15 March 2020	<ul style="list-style-type: none"> <li>Edited for clarity</li> </ul>
v4.2.1, 13 April 2020	<ul style="list-style-type: none"> <li>Edited for clarity</li> </ul>

