Nerdyharpa

Building instructions (4-rows)

Introduction

You are reading the manual for assembling your own Nyckelharpa, based on mostly lasercut and 3D printed parts. People have been referring to it as the 'Nerdyharpa' since before I even started designing it, so I didn't have to look far for inspiration when naming it. This is of course due to the tremendous (and, to me quite unexpected) success of the Nerdy Gurdy, which I designed based on similar technology and which has been embraced by thousands of musicians around the globe since we released it in 2017.

Being an engineer, more than anything else, I have spent a lot more time the last few years on learning to improve the design of instruments than on commercial or business considerations. Luckily, a huge community has grown up around the Nerdy Gurdy where people are advising us, helping each other build their own instruments, and a few great people have even teamed up with my wife Fay to help her supply kits to the world. Without this community the Nerdy Gurdy would never have reached the audience it has, and I probably would never have gotten around to designing the Nerdyharpa. I love you guys, and keep up the good work!

A special thanks goes out to the people who have tested the first Nerdyharpa's. Your feedback has been invaluable, and I hope that I have done your comments justice.

Jaap Brand
Enschede, the Netherlands
May 2023

Release notes v3.3:

- 4-rows, stronger machine heads, extra bracing
-

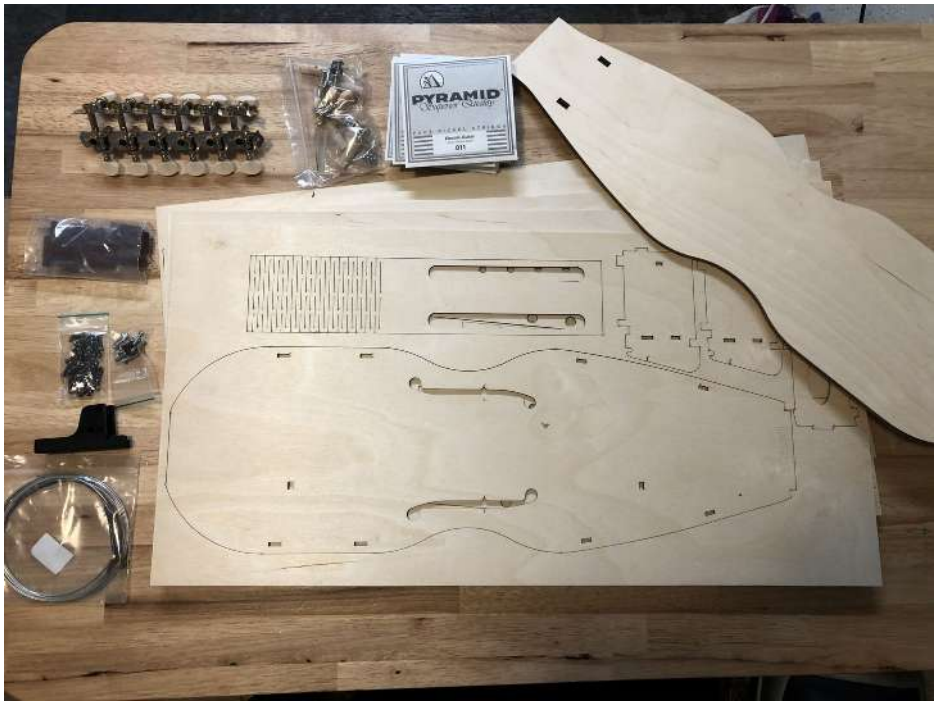
General directions

- The parts are glued together with regular wood glue (not included in the kit).
- Don't glue the bridge or any part that's adjustable.
- Make sure that all surfaces that touch are fully glued together. This prevents undesirable vibration when you're playing. Use plenty of glue, and wipe off any excess glue with a wet cloth.
- If you want to stain the wood: it is best to do this before gluing, with a water-based stain. Stain may not take well on area's that have seen glue. And glue may not take well on oil-based stain.
- When removing parts from the plate that are still attached, it's best to cut the attached points with a sharp knife or chisel, to avoid splintering.
- It's best to read through the whole sequence, before starting.
- If you do something wrong, it is possible to release wood glue by heating it to sufficient temperature (e.g. with hot air gun).
- Before gluing, it is wise to assemble the parts without glue, so that you're sure how they fit together. You can assemble most of the instrument without glue, to get an idea of how the parts go together.

Please note: If you live in a very hot and/or humid climate you may need to take extra care with the type of wood glue that you use. Some glues may not be able to keep the required strength

Parts Included in the kit

wood	sheet 3mm	3 x
	sheet 6 mm	3 x
	A strip of felt	1 x

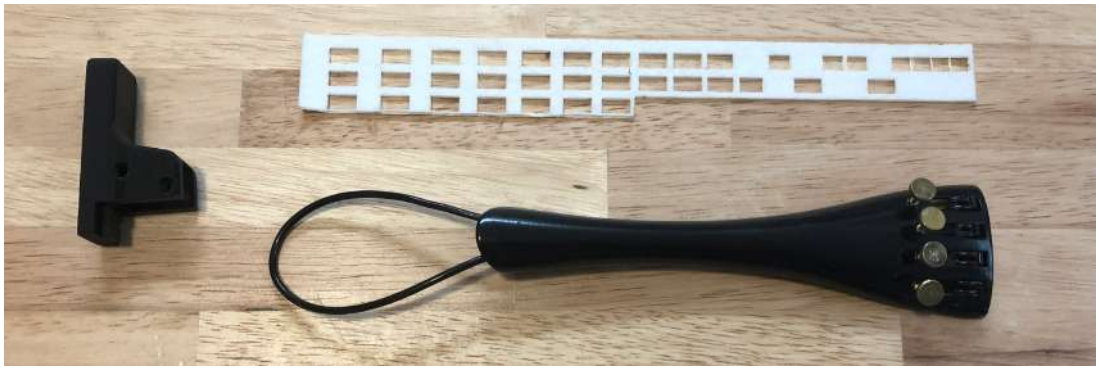


The full set

small tangents (17x) *middle tangents (13x)* *large tangents(10x)* *XL tangents (7x)*

M2,5x10 bolts (30x) *M2,5x25 bolts (17x)* *M3x12 bolts (7x)* *M3 nuts (7x)*

screw 2,5x13 (2x) *screw 3,5x17 (1x)* *strap pin (1x)*



tail extension piece *felt* *cello tail piece*

Steel (resonance) strings (12x) *Cello (melody) strings (4x)*

Machine heads for 12 strings (+ screws)

3d printed bridge *3d printed nut*

Machine heads for melody strings

Not included in kit

You will need the following materials to build your Nerdyharpa (not included in the kit):

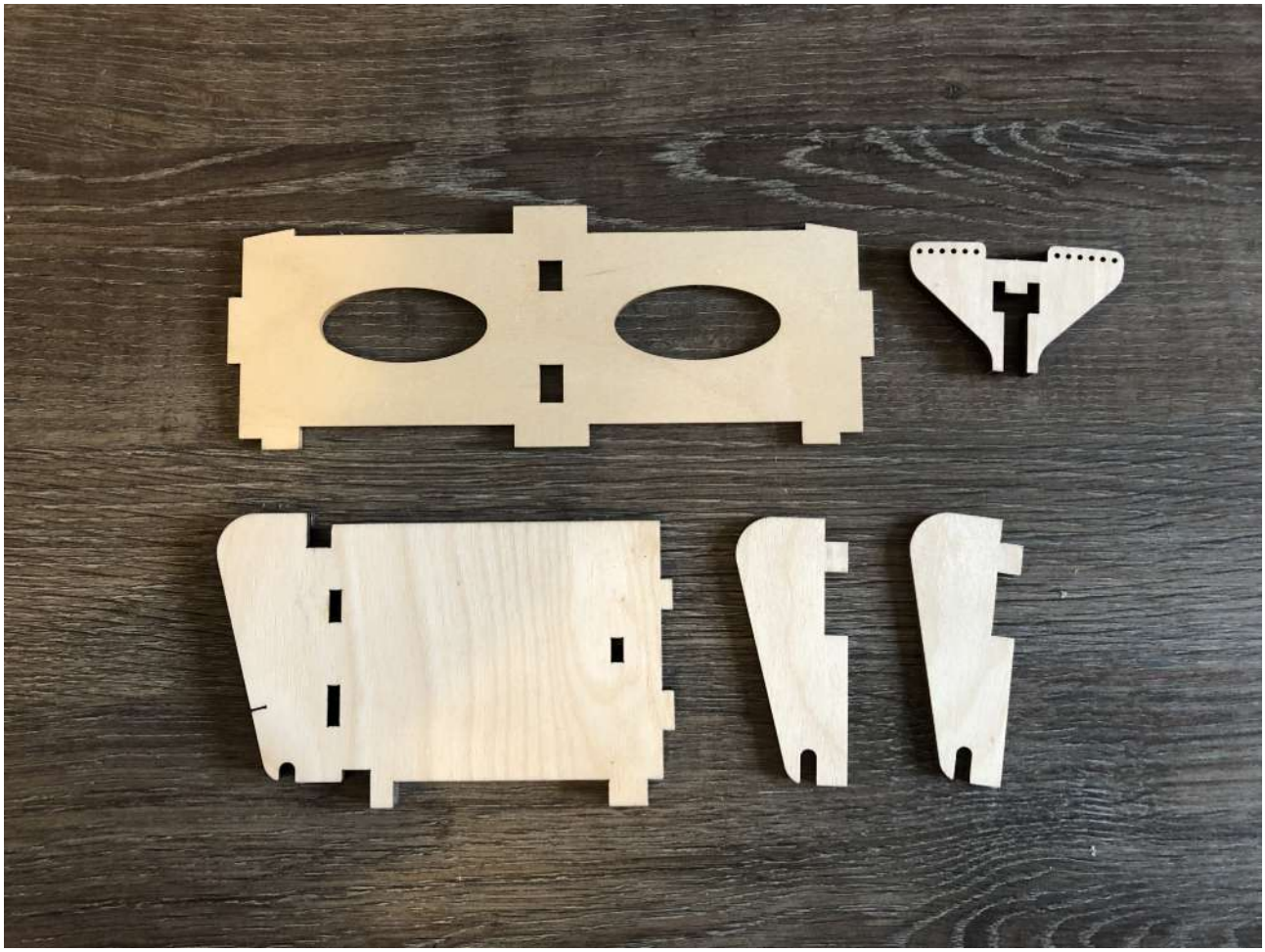
- Wood glue (Extra strong, preferably!)
- (retractable) knife
- Lots of glueing clamps
- Varnish (optional, but recommended)
- Sand paper
- Some tools (screw driver, plyers)
- Cable ties
- Some basic woodworking skill and patience :)

Apart from these you need some things to play it:

- A guitar strap (with cord).
- A bow (A 1/8 violin bow works nicely. When you get really good you'll want to experiment with other bows. I've been told that it's not uncommon for the bow to be more expensive than the instrument.)

Tail

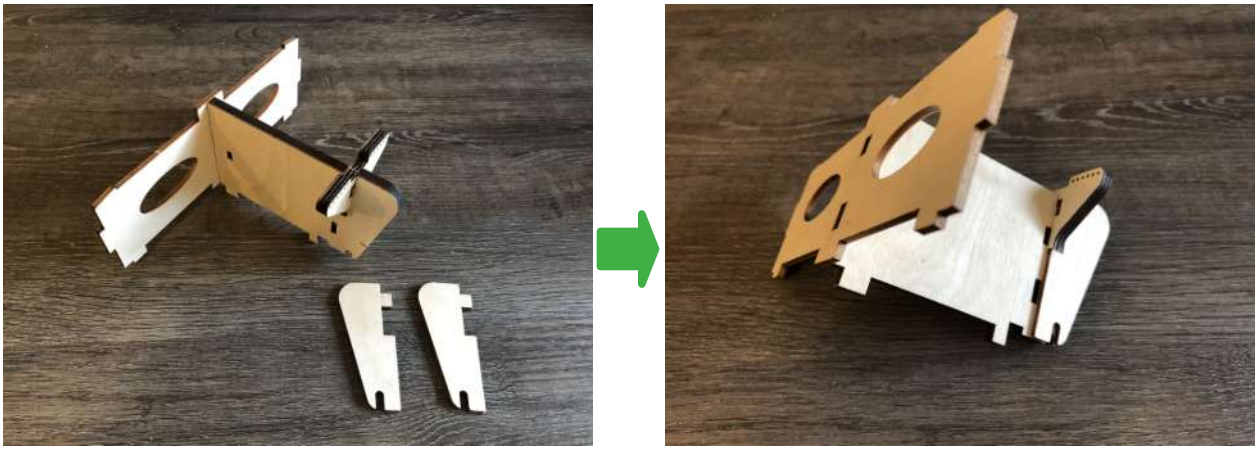
- Start by assembling the tail of the instrument



These are the parts that you need

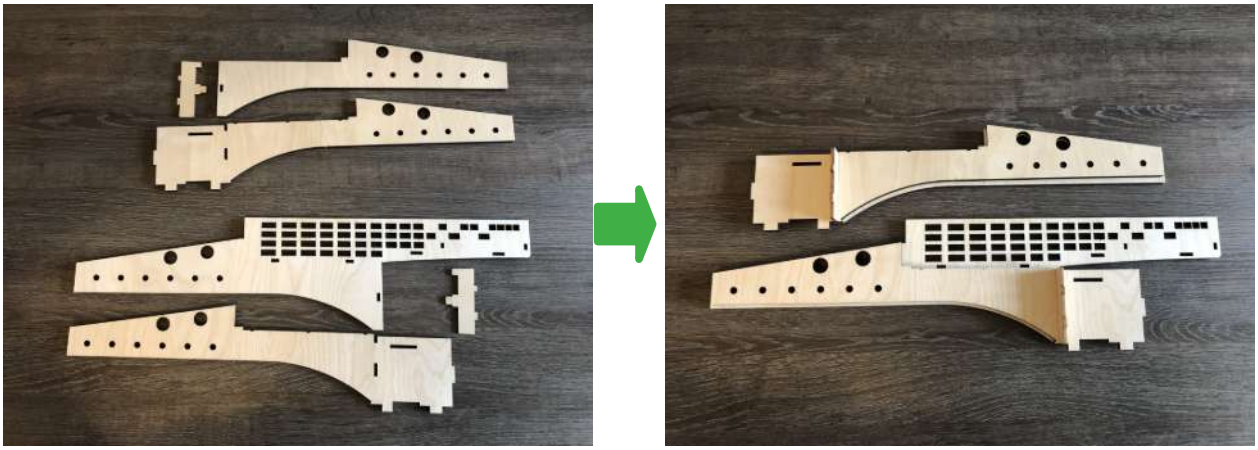
Add the cross-plate

Insert the 6mm plate from the top



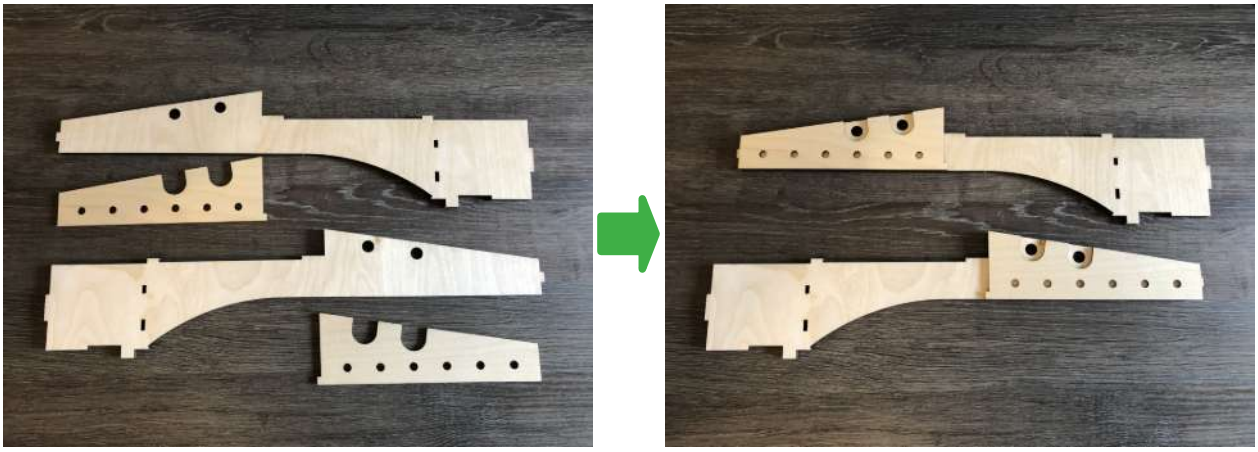
Insert the small plates from the rear

Combine the outer head plates with the 6 mm head plates

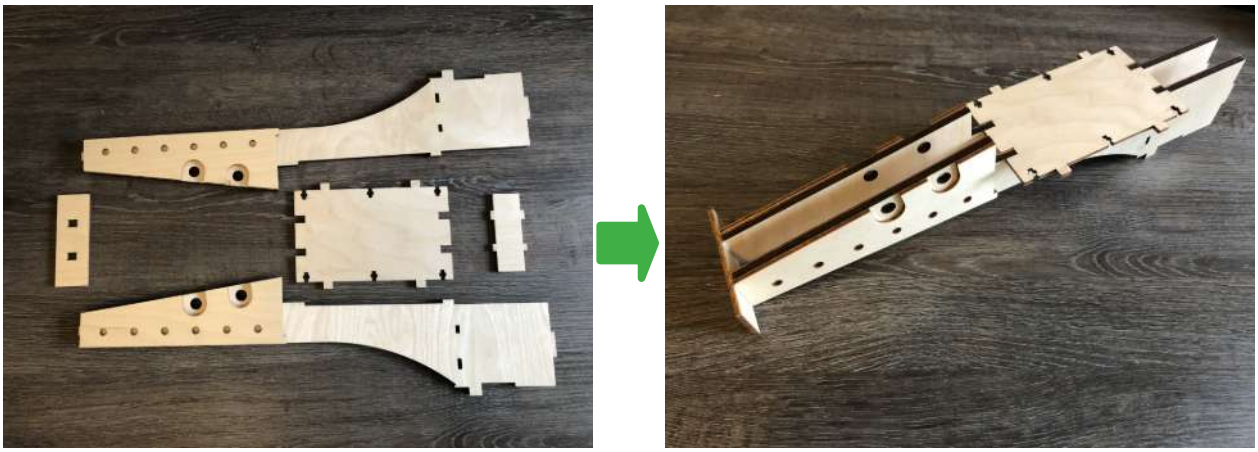


Again, insert the machine heads to make sure that the parts are lined up correctly

Add shorter head plates



Combine head plates



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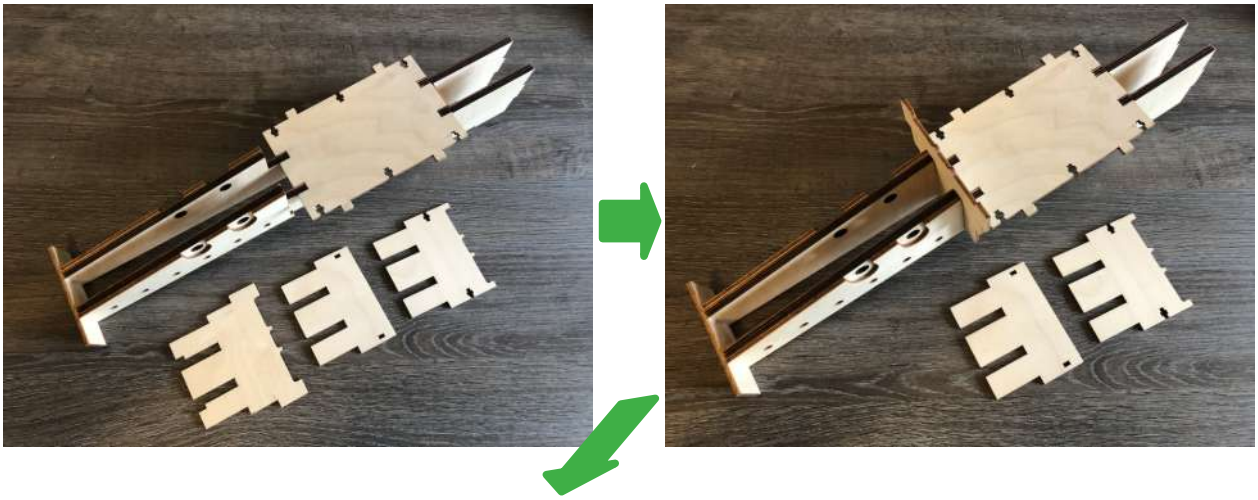
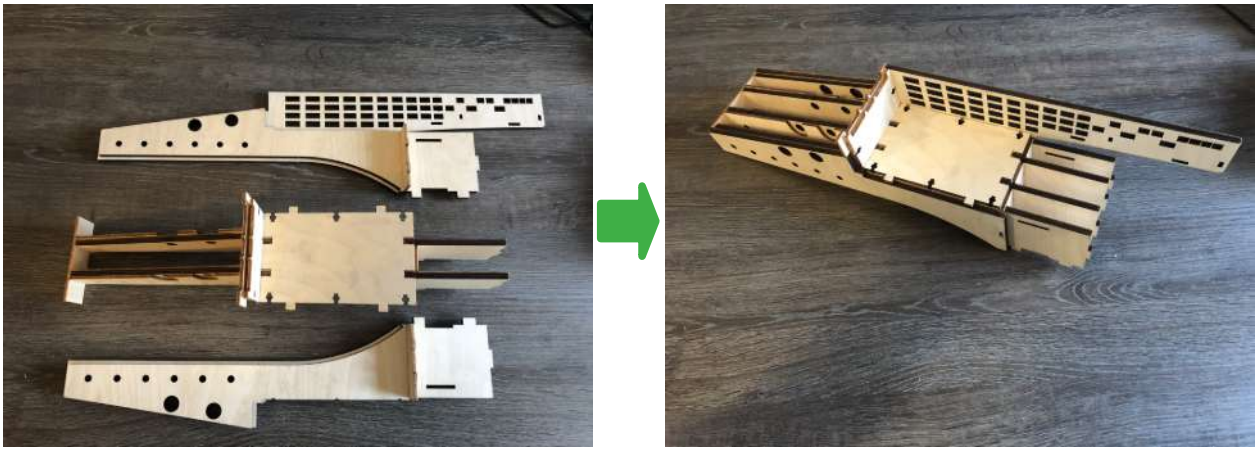
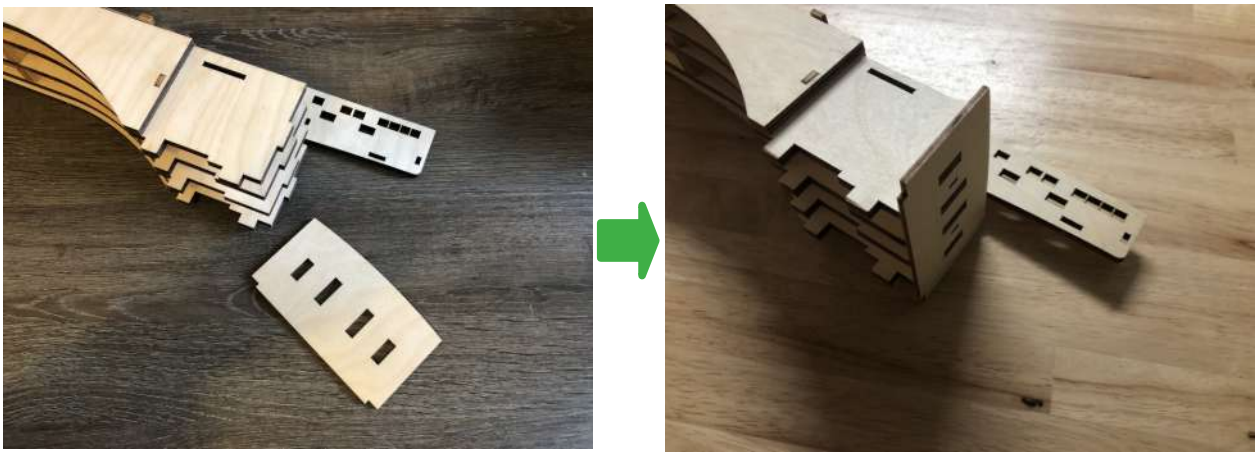
Add the bridge



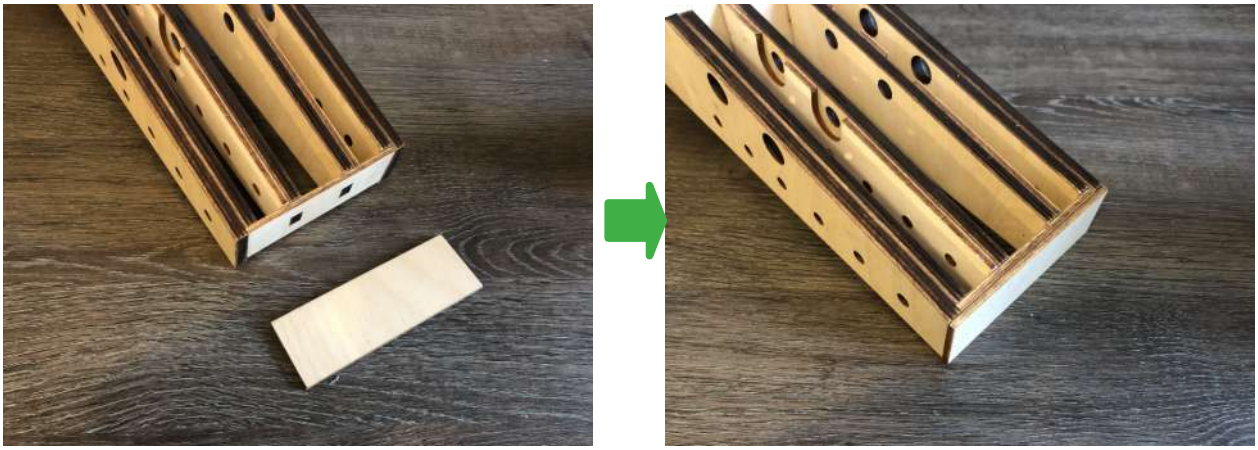
Make sure the parts are well aligned at the bottom

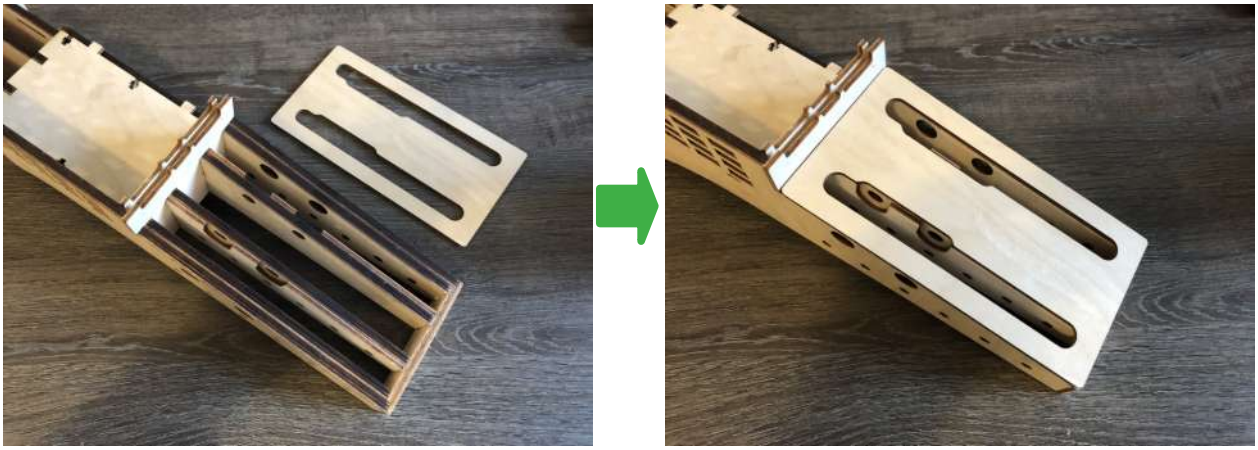
Combine the head pieces to form the head

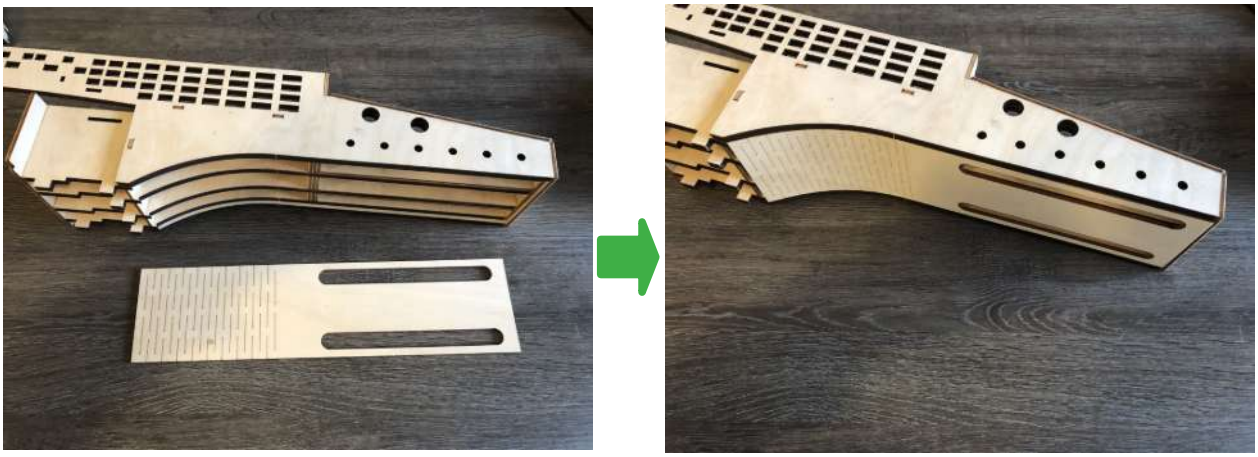




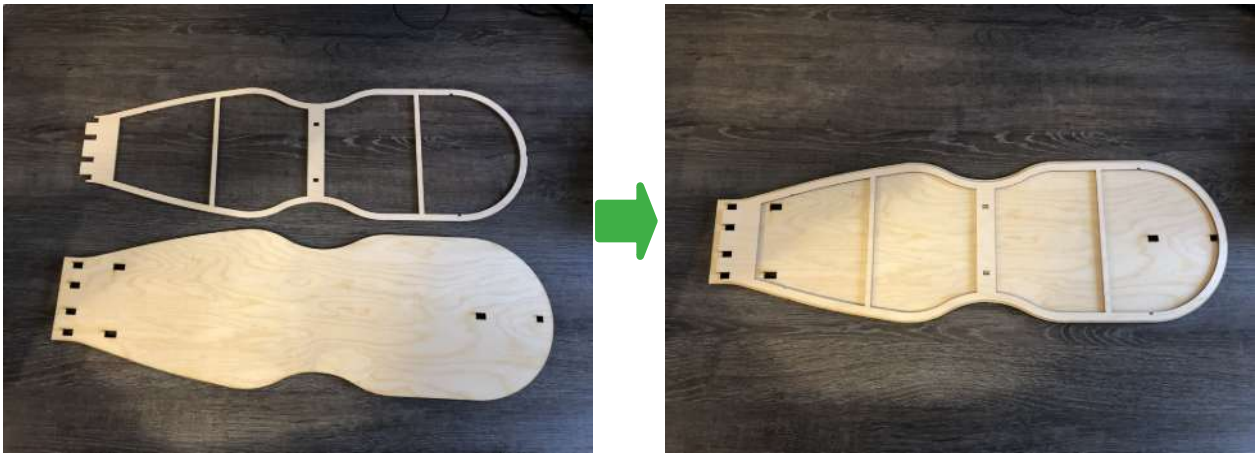
Add the remaning parts to complete the head







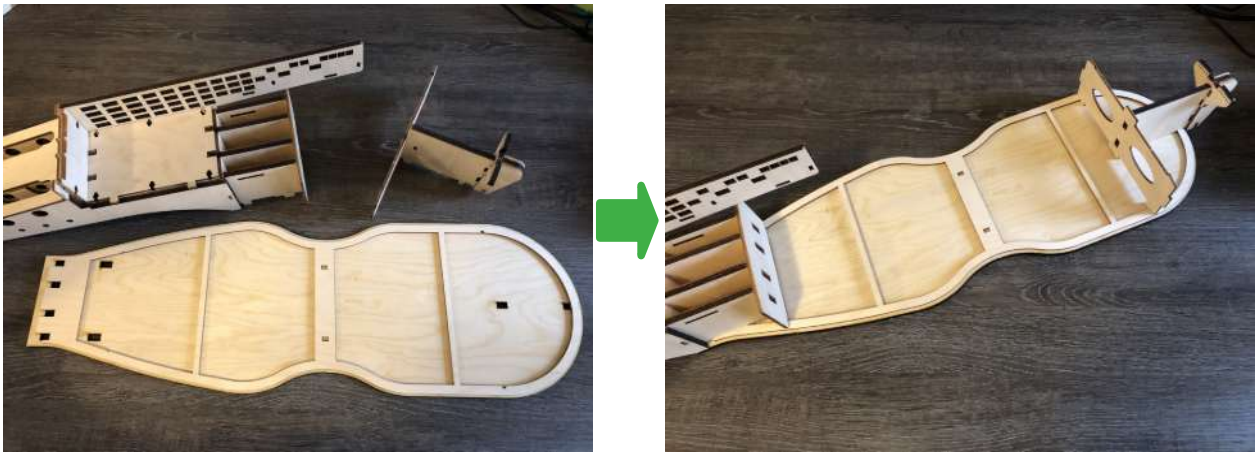
Attach the ridge to the bottom

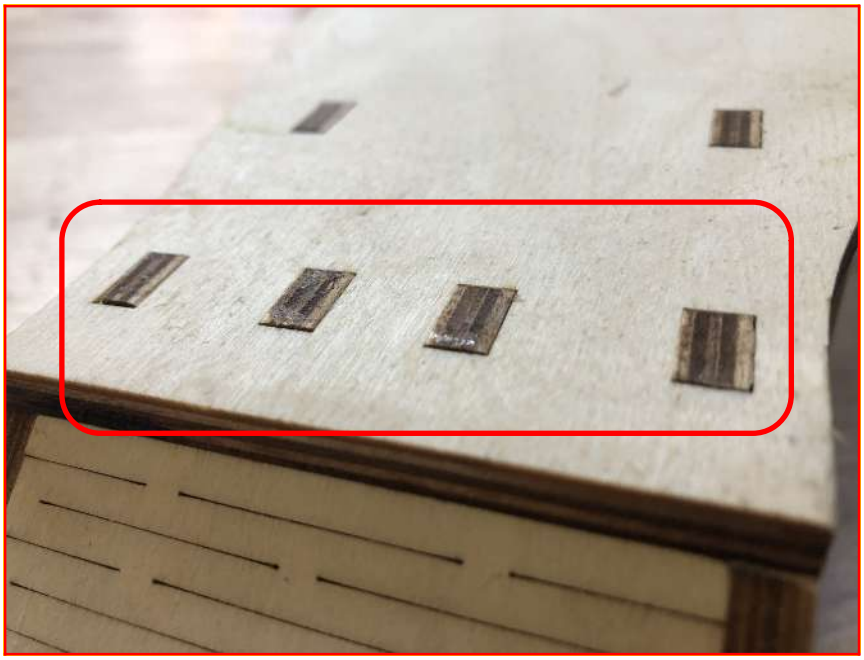


Use the neck and tail pieces to align the ridge unto the bottom plate. There should be an even spacing around the perimeter of the ridge. Make sure there is nu glue residue around the perimeter.

Combining the body

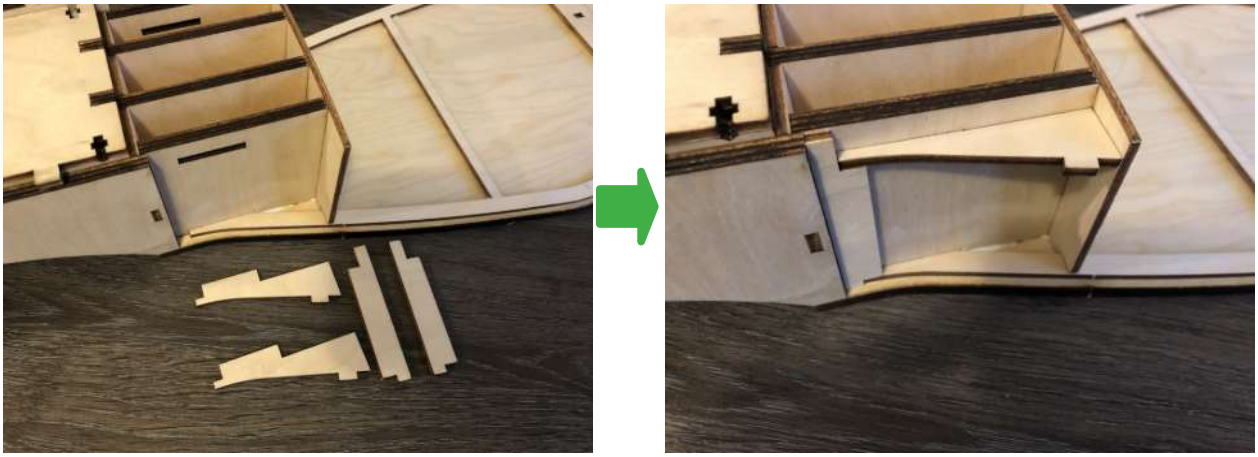
This step is important! The neck joint is heavily loaded, so you need to make sure the surfaces are touching, and everything is glued. File or sand the mating surfaces a bit, to make sure the surfaces are flat and clean. Use ample glue, to make sure it gets everywhere. But a thin layer of glue is stronger than a thick layer, so clamp everything well together after applying glue.

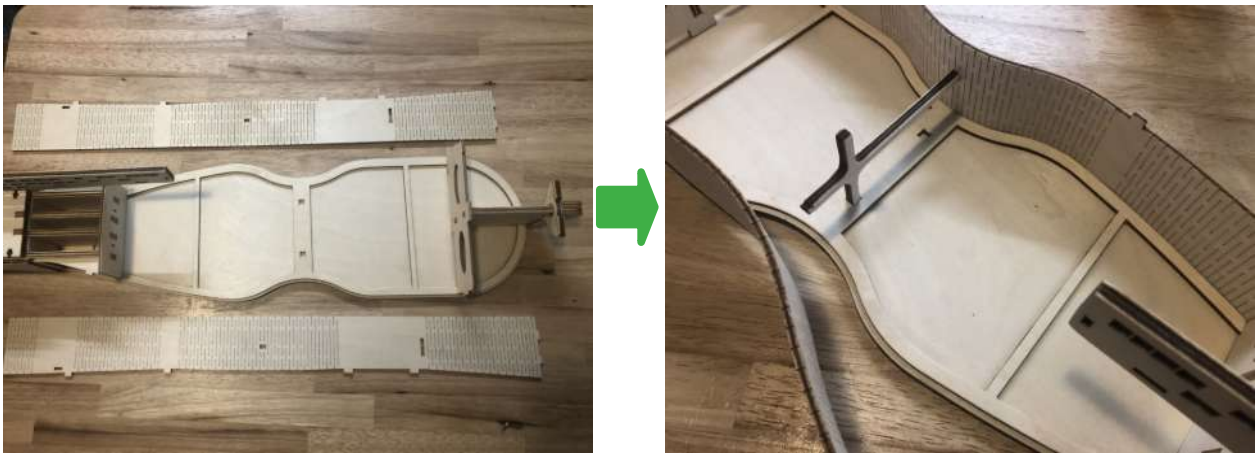




The tabs should stick through the bottom plate a bit, so you can sand-off the dark edge and so you can check that they are inserted all the way

Mounting the sides





Bending the top plate of the instrument

Before mounting the top, you will need to bend it. Bending a plywood plate is a matter of making it wet, putting a force on it, and then waiting. A good way to bend it in shape is by putting cable ties around the plate, and then adding spacers under the cable ties on one side. In one or two days you should have a nicely warped piece.

We'll take you through in steps:

1) Put tape on the edges of the plates, to minimize damage from the cable ties

2) Put cable ties around the plate and tighten them. Use wide cable ties for preference, and more = better.

3) Put some spacers under the cable ties on the INSIDE of the top plate (there is a marking)

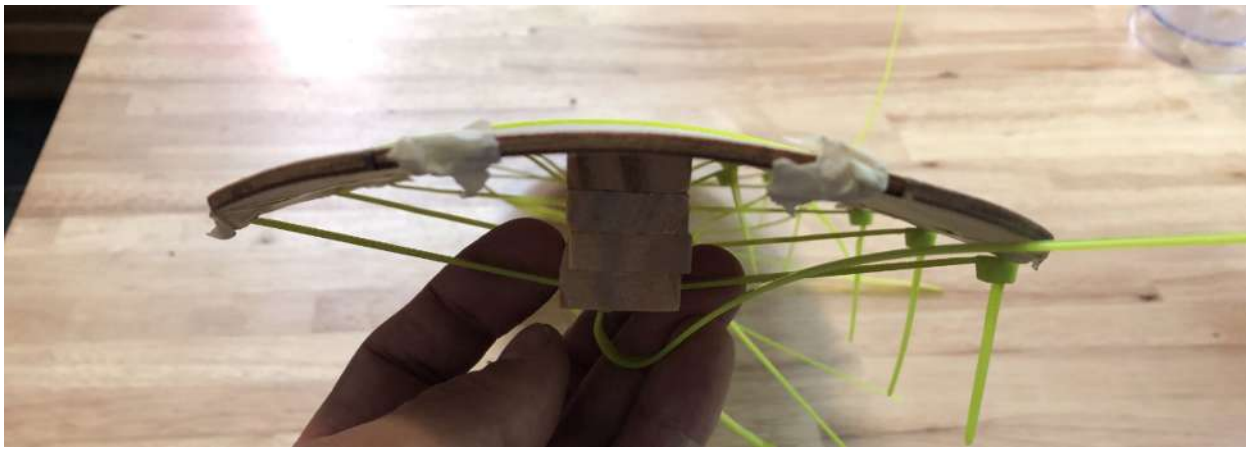
- You can basically use anything for this. I use a strip of wood, or just pieces of LEGO DUPLO and Kapla.

3) Make the wood nice and wet, using warm water. Allow it to soak for some time.

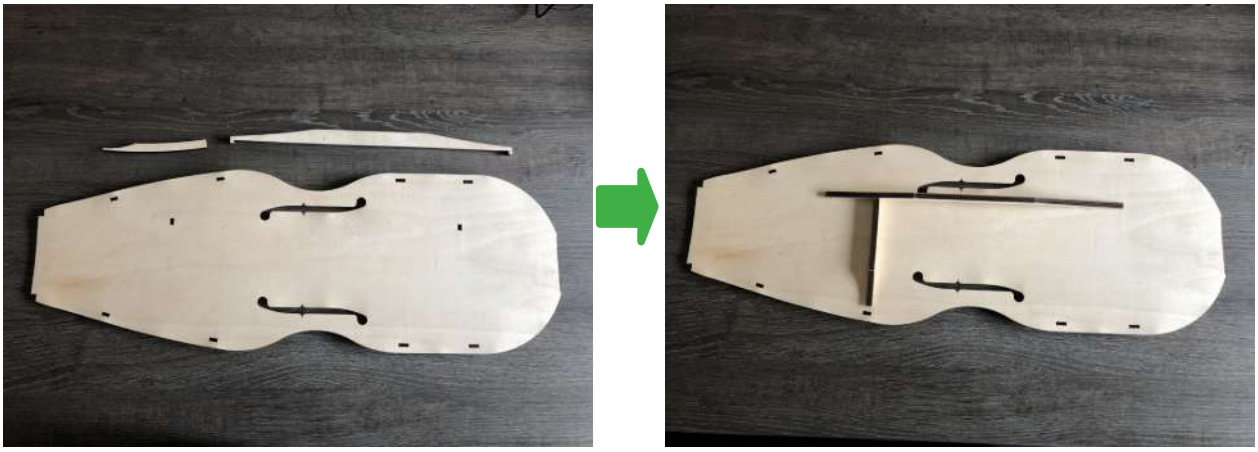
4) Add more spacers under the cable ties, as you feel the tension lessen

- As the wood gets softer, you'll notice that you can put more and more spacers under the cable ties.
- Re-soak the wood now and then.

5) Let the wood dry under tension. When you release the cable ties you should have a curved plate.



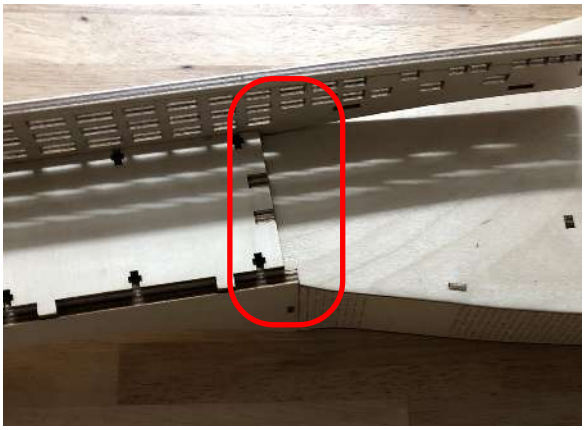
Mount the bass bars inside the top plate

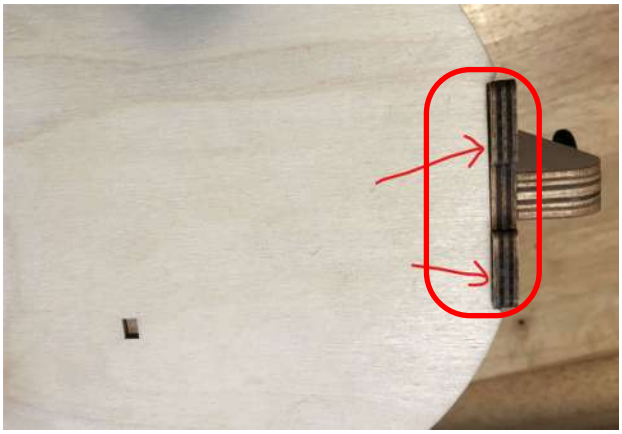


Mount the top plate

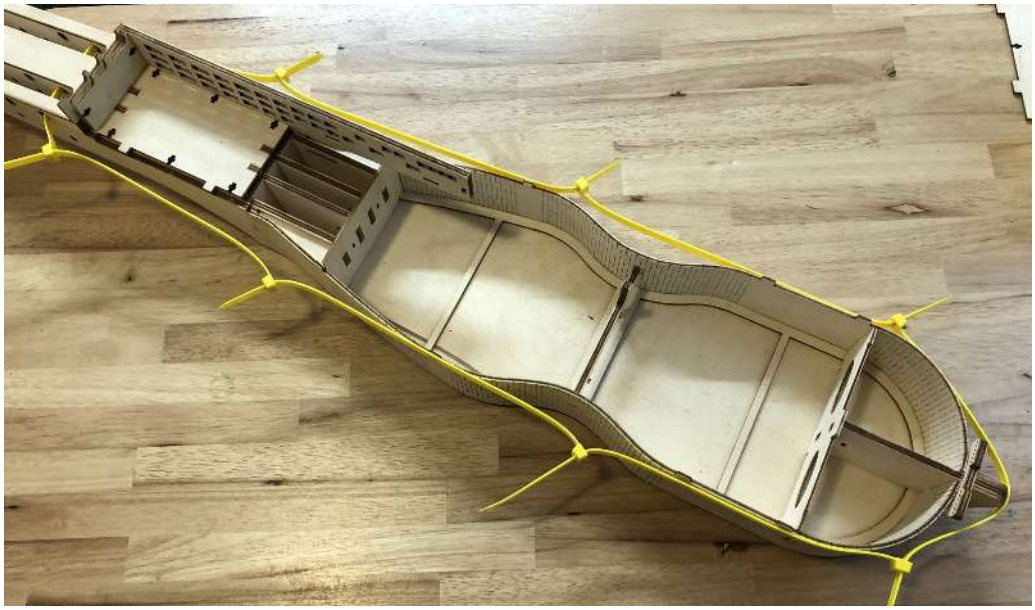
Next step is to mount the pre-curved top plate. It should be more-or-less in the correct curvature to fit it onto the prepared instrument. If not: you can go back to the previous step and soak and bend it another time. It is easiest to soak the to plate before attaching it, so that it is flexible (but dry the surface with a cloth).

This step is important again! The top plate needs to take up much of the stress off the strings, by keeping the head and the tail apart. To minimize warping when you tension the strings, you need to make sure that the top plate is touching at the front and back (pictures below).

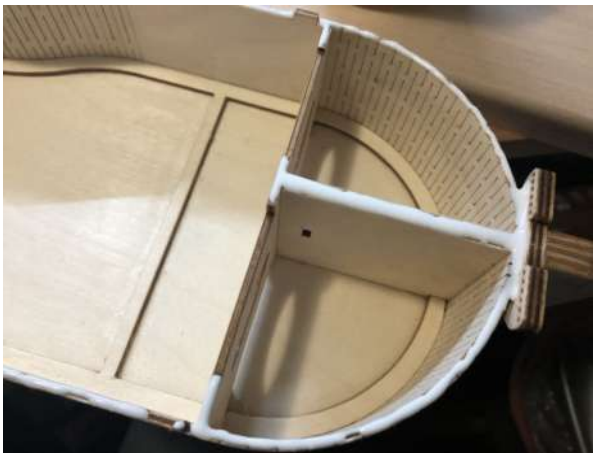


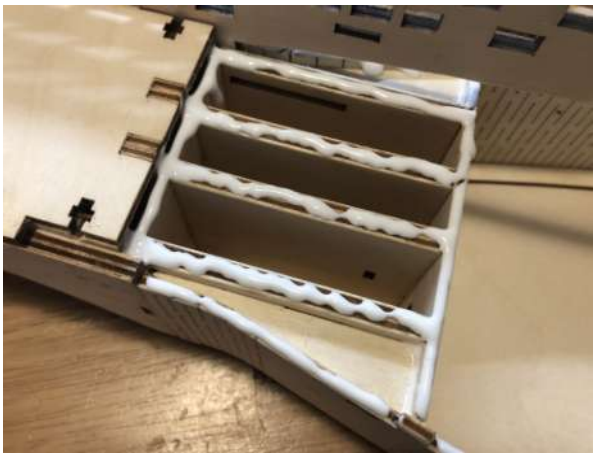


This can be done with a string of cable ties, or with a tie-down belt e.g. You can even put some strings or wire through the tail holes, and use the machine heads to pull the tail towards the head.



Preparing cable ties to pull the front and back together during gluing





Not all the inner parts will follow the profile of the top plate perfectly, so apply ample glue to make sure everything is attached.

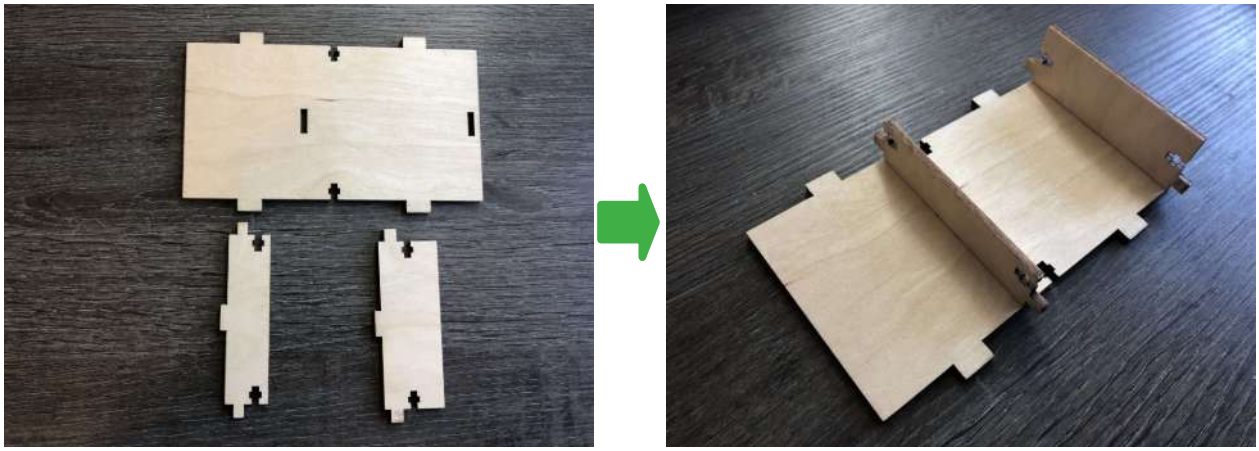
Finishing

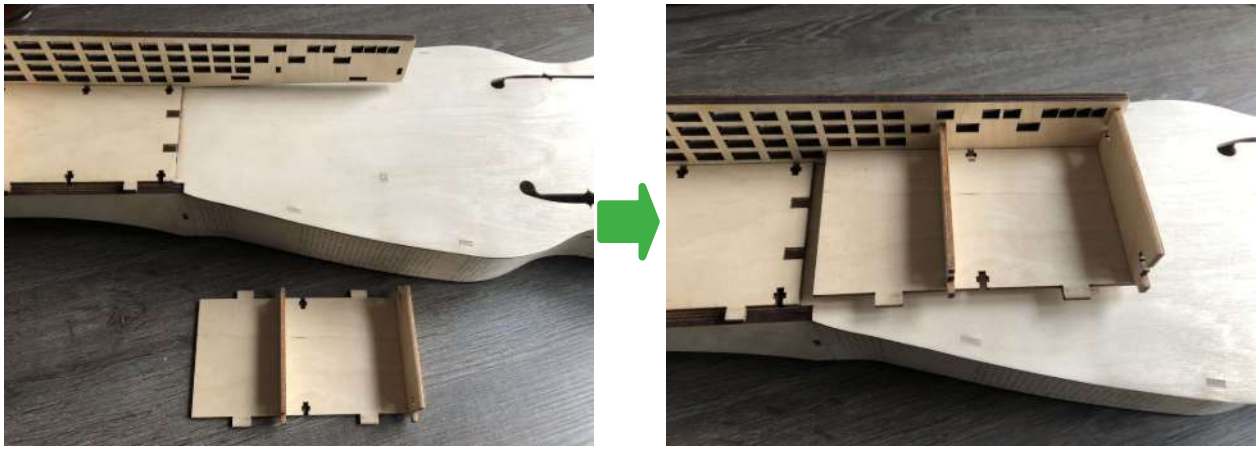
File and/or sand any places where you want to round the edges, particularly under the neck

Apply lacquer

You may want to lacquer or paint your parts at this point in the assembly.

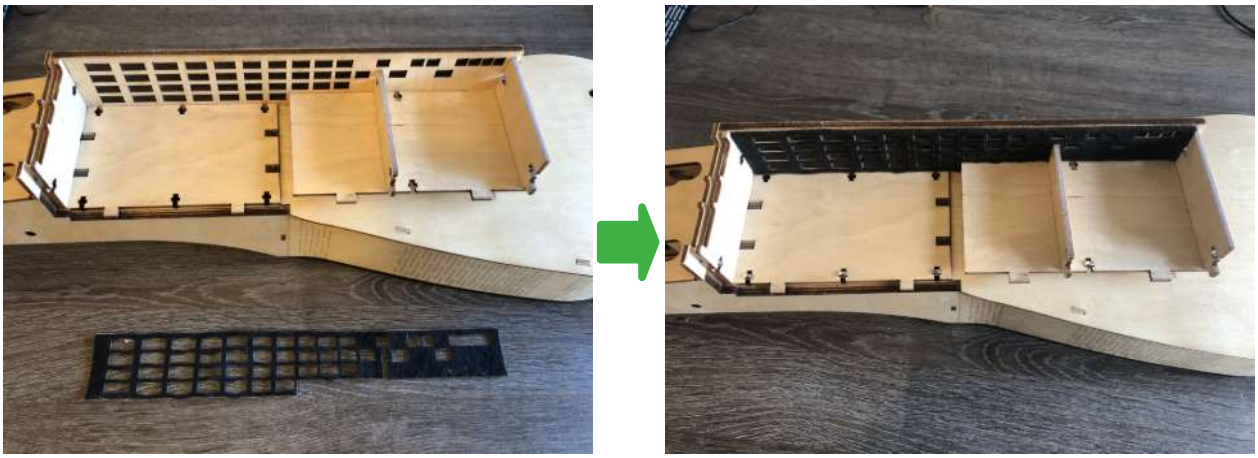
Final gluing steps





Note: is is much easier to lacquer or paint the instrument before you assemble these pieces!

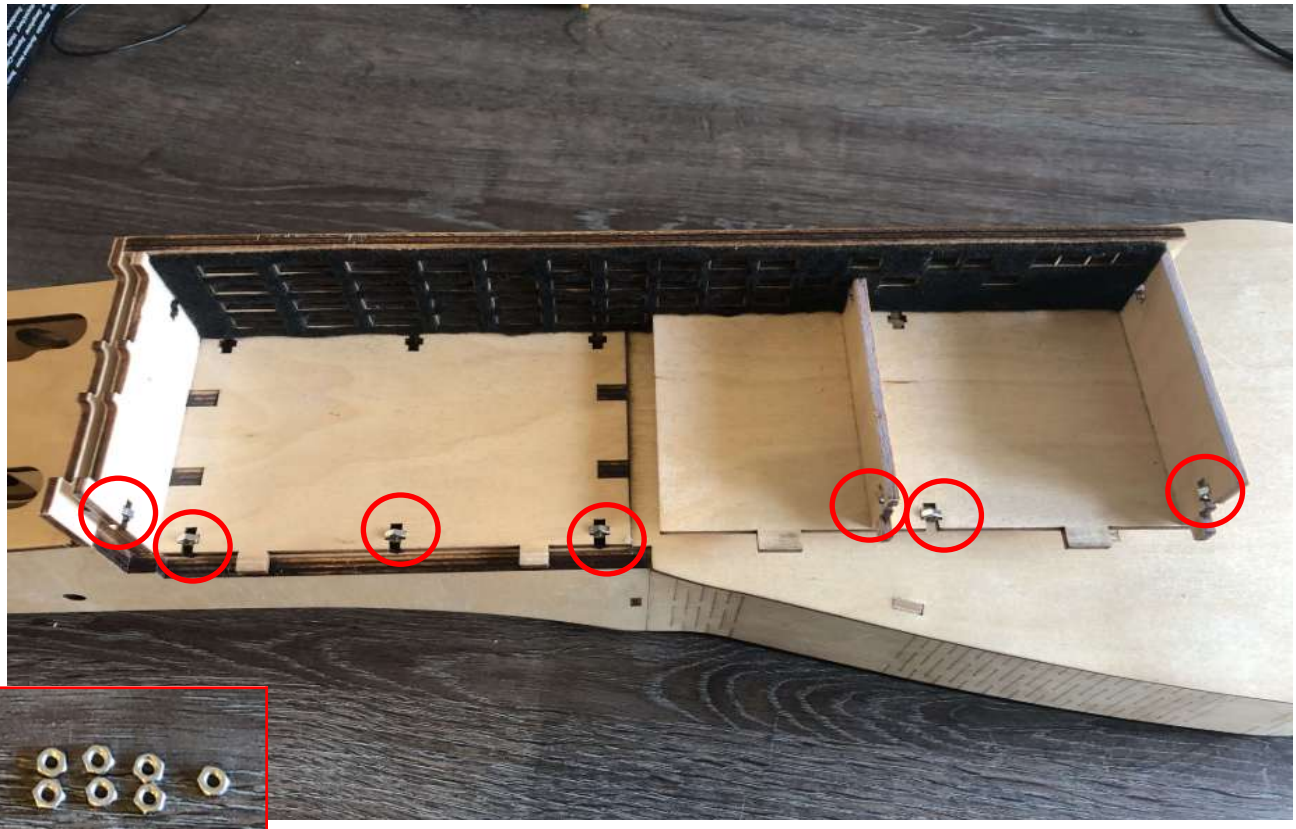
Adding Felt



Glue the felt on the inside (peel off the backing paper – it's self-adhesive). Use a bunch of keys to position the felt correctly, so that all the holes line up well.

~~Going~~ Adding nuts

Insert the seven M3 nuts into the slots. If the fitting is too loose, they may fall out when you turn the instrument. In that case it's easier to apply a bit of glue to keep them in place.

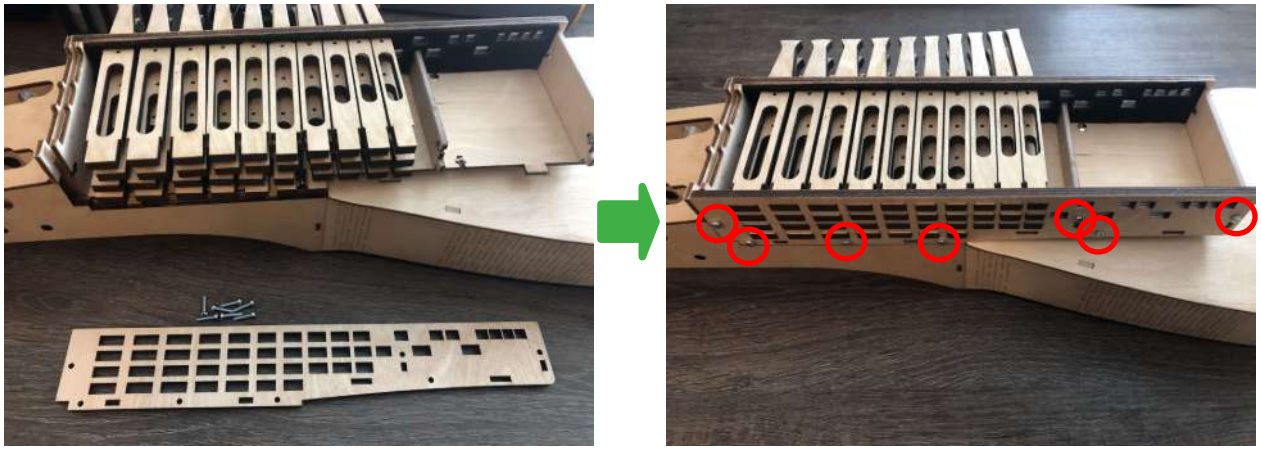


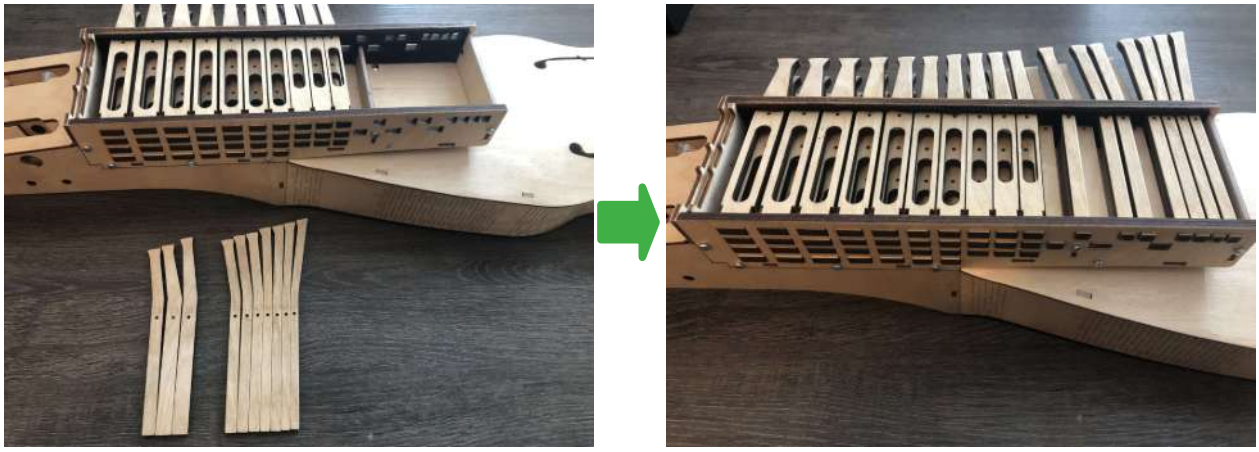
Preparing the keys

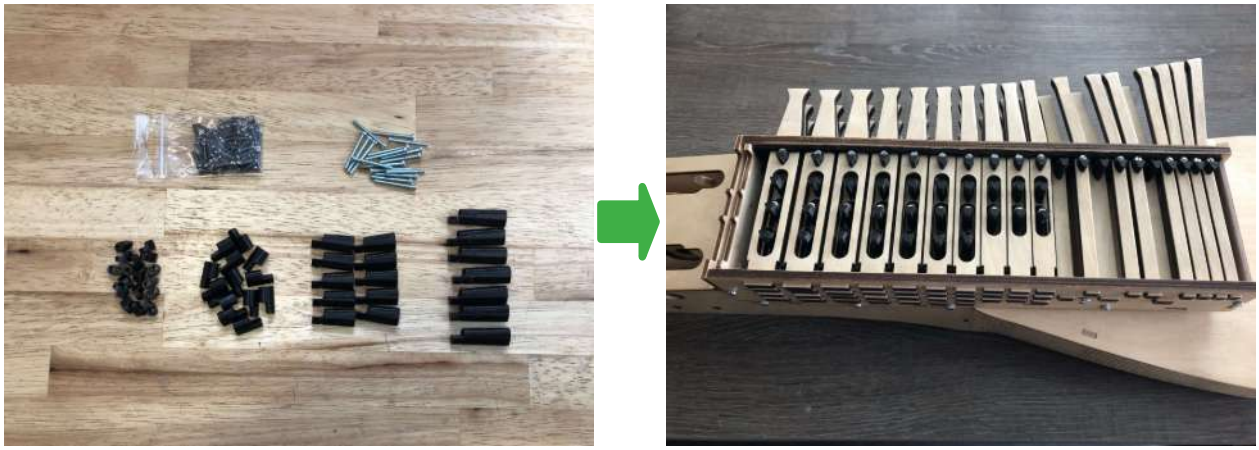
- You need to sand the keys, and remove any lacquer that may have spilled into the holes for the keys. The keys need to be able to fall through the holes by gravity.

Mounting the keys and tangents

- Only the first 10 columns of keys need to be inserted from the inside; the rest can be added after the keyboard has been closed







- You'll notice that the 17 large and XL tangents need to be fixed with the long M2.5 x 25 bolts.
- Mount the rest of the keys and the tangents. Note that there are three 'middle tangents' that go in the first row, where the keys are lower.

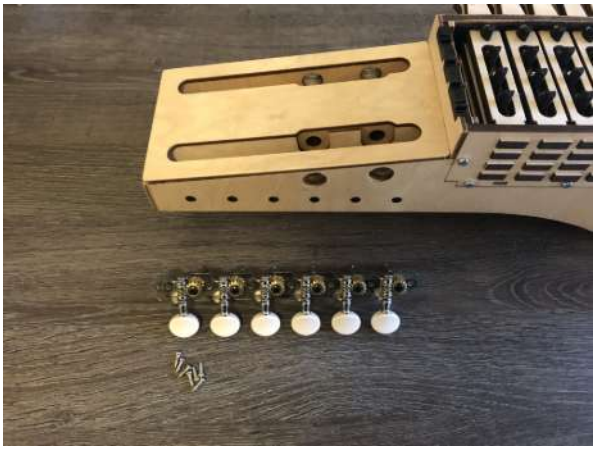
Nut

Mount the strap pin

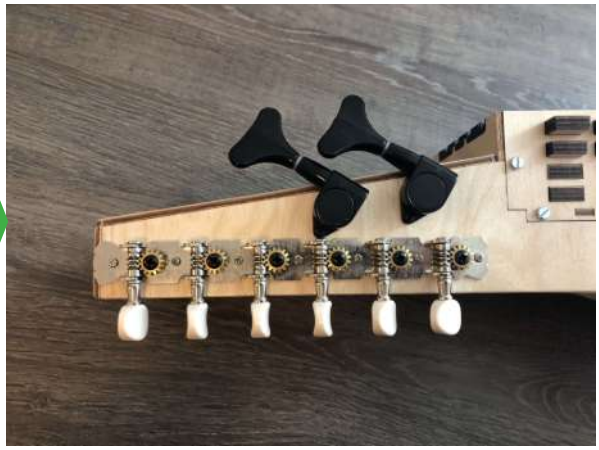
Mount the strap pin with the 3,5 x 17 screw (the thicker one).

Assembling the machine heads

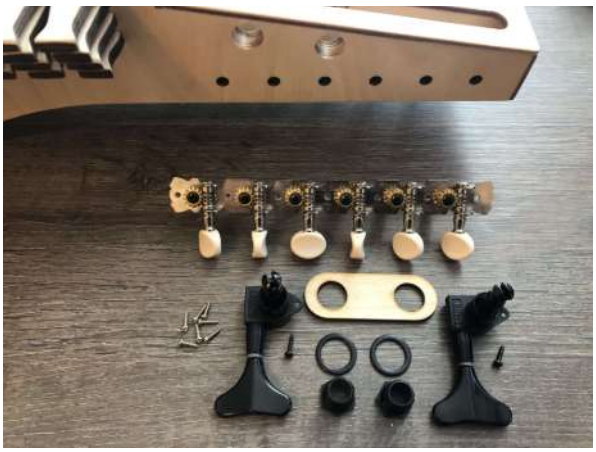
- Make sure that you have them the right way around, else they will turn in the wrong direction.
- Sometimes the small screws are hard to get in. It help to drill some 1 mm holes first.





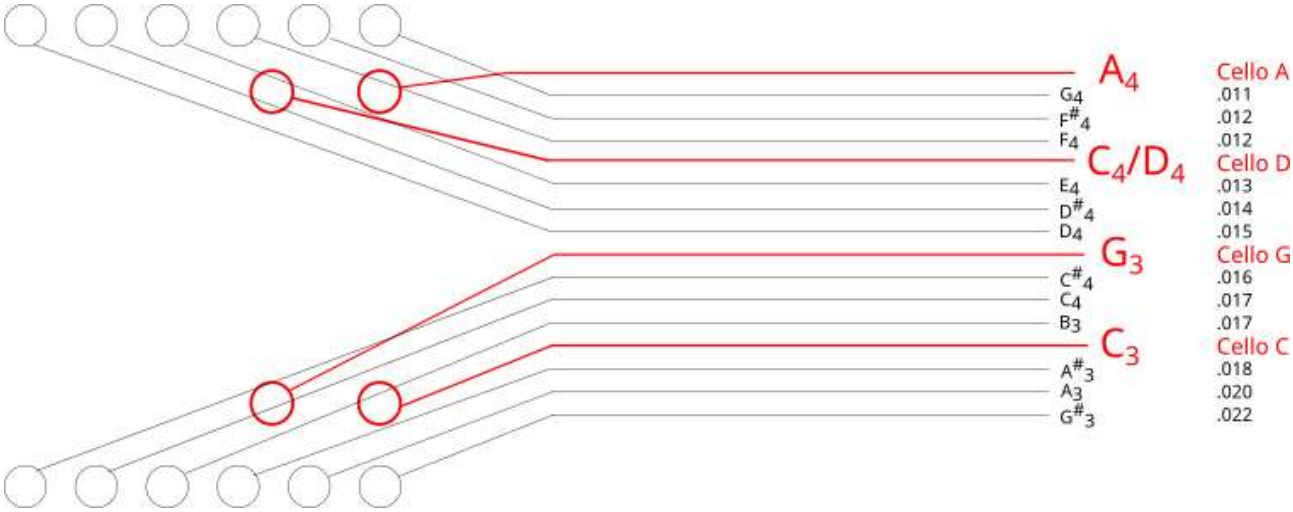



Same for the other side:



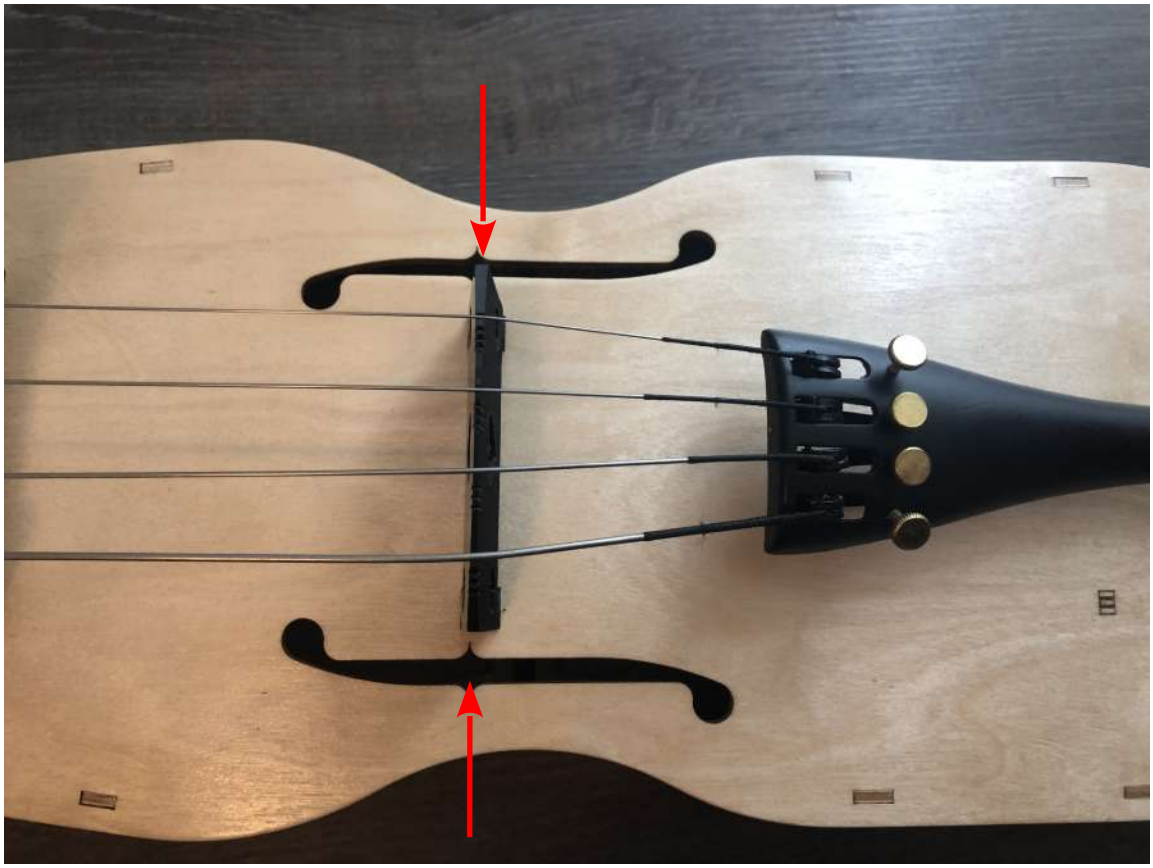

Adding strings and tuning

The strings are tuned as follows:



- Don’t try to tune the strings all the way immediately, but allow the instrument to settle for a bit. The first few days you will need to re-tune the instrument regularly, which is normal for all stringed instruments.
- The traditional Swedish tuning is C G C A. Outside of Sweden C G D A seems to be more common, which is the same as Cello and Viola and which is more suited to playing a broad range of music styles.
- Don’t use the entire length of the cello strings, but cut a bit off the end. You want the string to go a few times around the peg so that it is well secured. But if there are too many windings, it will take a long time for the pitch to settle.
- If your resonance strings touch a tangent, try adjusting the position of the bridge a bit. You can also shave a bit of material of the back of the tangents.

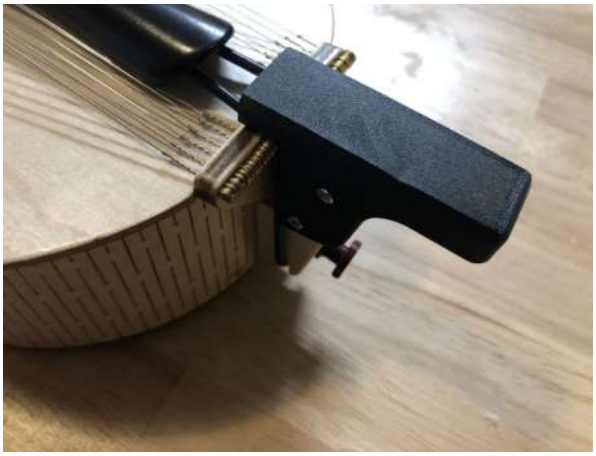
- You can remove the ‘fine tuners’ from the tail piece or leave them on as you prefer. Routing the resonance strings is a bit easier if you take them off.



The bridge should be in line with the cut-outs on the f-holes

The tail extension piece

We've added a piece to extend the tail of the instrument, because many players like it that way. The optimal geometry and length however seem to depend on playing technique, so you can see for yourself whether you want to assemble it, or not. You may even print your own alternative versions to tailor the instrument to your preferred playing technique.



The tail extension piece is fixed with the two small 2,5 x 13 screws

Mounting a strap

Playing the Nyckelharpa

We'll this is as far as we can help you. Now you need to learn to play the Nyckelharpa :). Fortunately there is lots of help to be found online.

Please let us know if there are steps you found challenging in the building plan, so we can keep improving the design and the instructions.

Jaap and Fay Brand
Dec. 2020