

BowLab Kit Assembly and User Guide

A complete manual for building and using the BowLab 3D-Printed Bow

V4.5.0 August 2025



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Introduction:

A letter from Gary:

Hey, it's great to see you! Whether you are an educator, maker, musician, tinker, or student, it is wonderful to get a chance to chat with you about this project. I started BowLab back in 2024 after working with a master bowmaker in NYC for a few months and got to really understand a lot of the issues in the classical music world, with access to a music education being one of the largest.

Although we focus so much on promoting music education through the traditional path of fundraising, this idea really does not take into account the actual barrier for most families and is not really scalable. Nearly 300 million children are living off of 2.15 dollars a day. Today, at a minimum, an instrument and bow would cost around \$50, making starting out completely unfeasible for so many people around the world.

Starting out was just too expensive.

I still remember the tremendous investments my parents also had to make to buy me my first viola at age 9. I still vividly see my nine-year old self so incredibly excited as I began my musical journey then which has gotten me so, so far. I learned life skills, became an artist, and honestly, just a better citizen of the world.

So now, as a musician but also as a tinker, through first-principles thinking, I wondered if it would be possible to cut down cost while preserving quality. I saw many wonderful programs like the Recycled Orchestra of Cateura, Hova Labs, and others that were pioneering the next 3-D printed or synthetic instruments, which had substantially expanded access to music education for many.

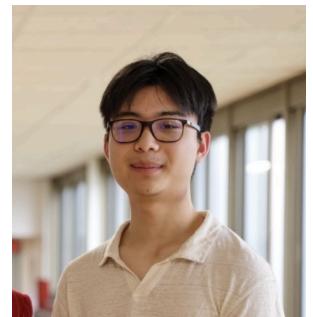
Yet, I noticed that almost all of them were playing on the typical student bow which had not gone through any innovation. At that time, almost no one was working in this field as well. I realized that if I could manage to get the cost of this down, even by a couple dollars, so many more would be able to begin their music journeys.

With a passion to innovate and explore, I set off on my journey. I researched old bow techniques, worked with master bowmakers at the top of the industry, and spent hours trying, failing, readjusting.

Now, I am happy to present BowLab's V4.5, a pioneering first step in using innovation to expand music education for all. Granted, there are limitations here and there and the process for assembly is not as smooth as I would like, but this is a great first step in the right direction.

Once again I thank you for reading and taking a look at this project.

Cheers to greater music education access for all,



Mission:

BowLab exists to reinvent the overlooked violin bow by making it affordable, printable, and open source so that every student everywhere can access the tools to play.

Audience:

To tinkers, aspiring musicians, students, educators, and more...

Safety Disclaimer: *Not intended as a commercial instrument. Prototype use only.*

Bill of Materials (BOM):

3D Printed Parts (Download Links on Website):

1. STL File: Bow Segment 1 (2x) (Female Connector)
2. STL File: Bow Segment 2 (1x) (Frog Connector)
3. STL File: Bow Segment 3 (1x) (Long Male Connector)
4. STL File: Bow Segment 4 (2x) (Short Male Connector)
5. STL File: Bow Truss (1x) STL File: Bow Tip (1x)
6. STL File: Bow Frog (1x)

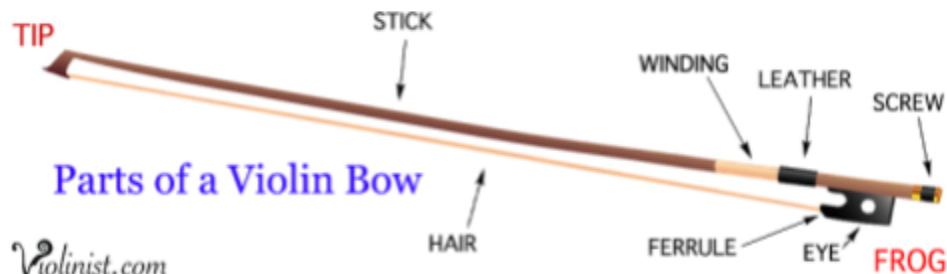
Hardware:

1. Eleven 4D 1-½ inch x 0.072in finishing nails
2. Nylon String Bundle
3. Small Bundle of Horse Hair (or fishing line)
4. Two Makeshift Plugs
5. Thick flexible metal wire

Tools:

1. Thin pliers (for removing support structures)
2. Hammer (for nailing in the connector pieces)
3. Adhesive or tape (optional; for securing the counter weight at the end)
4. Chisel or jigsaw (optional; for creating the wooden plugs) You could also use plastic for the plugs as well.
5. Super Glue (optional; for securing the plugs tightly to the tip and frog)

Terminology for Bows:



Source: <https://www.violinist.com/blog/laurie/202310/29787/>



Printing Instructions:

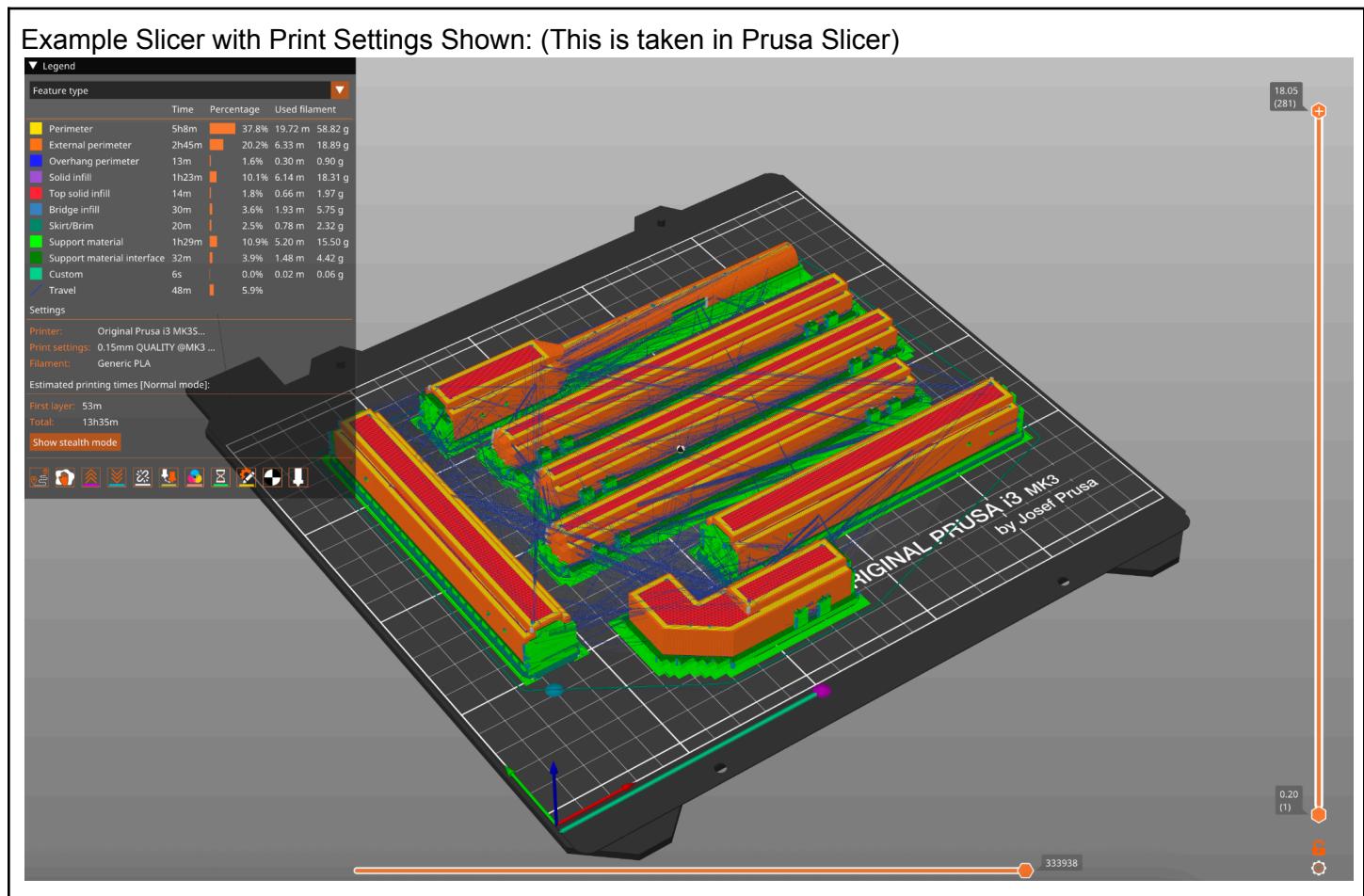
Slicer Settings:

For Bow Segments 1,3,4; Bow Truss; and Bow Tip, do **4 perimeter layers with 0% infill**.

For Bow Segment 2 and the Bow Frog, do **4 perimeter layers with ~50% infill**.

I used a PRUSA MK3S but as always, adjust accordingly based on how your printer operates.

Please ensure that the ‘Supports’ setting is turned on to ‘Everywhere’. Otherwise, a few sections may sag and/or collapse.



Step-By-Step Assembly:

Materials List:

Here are all the materials you will need.

3D Printed Parts (Download Links on Website):

7. STL File: Bow Segment 1 (2x) (Female Connector)
8. STL File: Bow Segment 2 (1x) (Frog Connector)
9. STL File: Bow Segment 3 (1x) (Long Male Connector)
10. STL File: Bow Segment 4 (2x) (Short Male Connector)
11. STL File: Bow Truss (1x) STL File: Bow Tip (1x)
12. STL File: Bow Frog (1x)

Hardware:

6. Eleven 4D 1½ inch x 0.072in finishing nails
7. Nylon String Bundle
8. Small Bundle of Horse Hair
9. Two Makeshift Wooden Plugs
10. Thick flexible metal wire

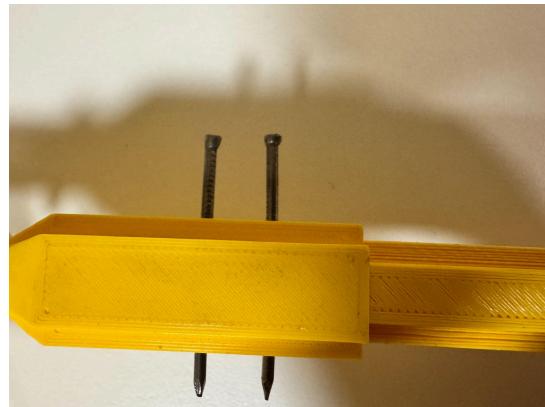
Build Instructions:

3-D Print Frame Assembly:

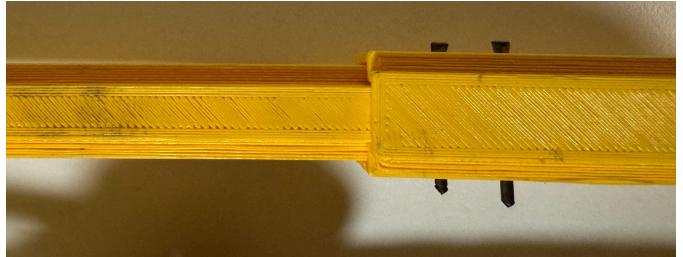
**A note on removing support structure: Pieces are designed within 0.3mm tolerances. Ensure all support material is removed prior to assembly so that all the pieces fit together properly.*

Step 1: Attach Bow Segment 2 (frog connector) to Bow Segment 4 (short male connector) by nailing in two of the finishing nails into the holes. Ensure that the holes between the two pieces line up before hammering the nails in. (Do not nail the nail all the way through. If you do this, the sharp end will interfere with the hair.)

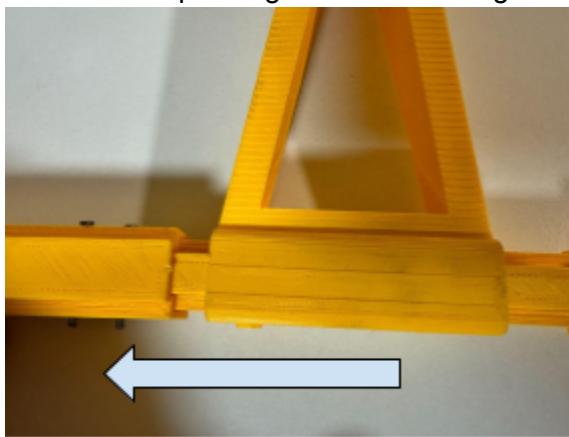
Reference figure to the right.



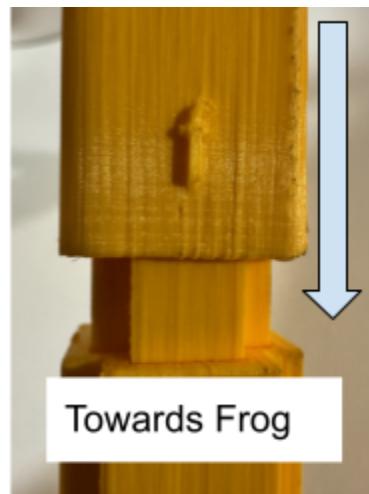
Step 2: Connect Bow Segment 1 (a female connector) to the end of Bow Segment 4 (the short male connector) and hammer in the nails by following the same procedure as in Step 1.



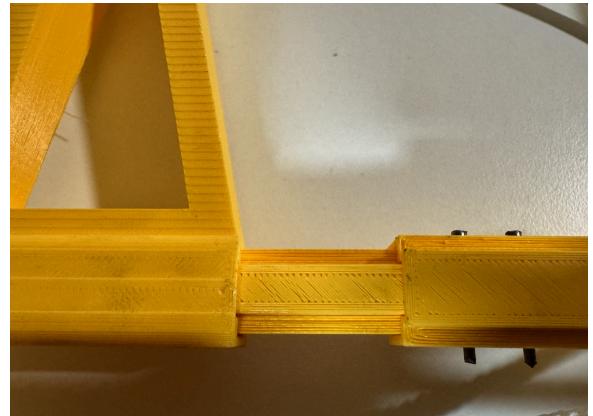
Step 3: Slide the Bow Truss down the short male connector until it hits the end. Make sure that the side labeled "F" is pointing towards the Frog connector.



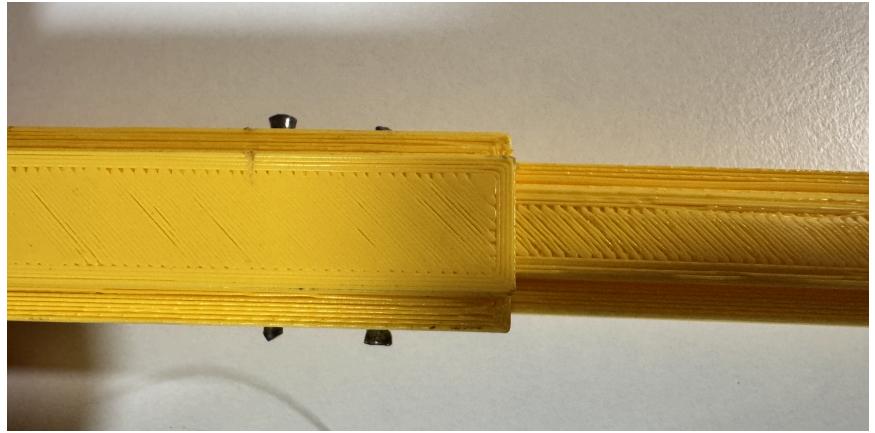
Towards Frog



Step 4: Connect another female connector (Bow Segment 1) to the other end of Bow Segment 4 and fit the nails in accordingly.



Step 5: Connect a long male connector (Bow Segment 3) to the end of the female connector (Bow Segment 1) and fit the nails in accordingly.



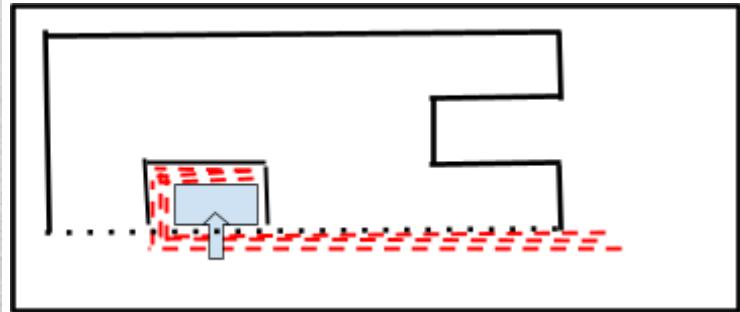
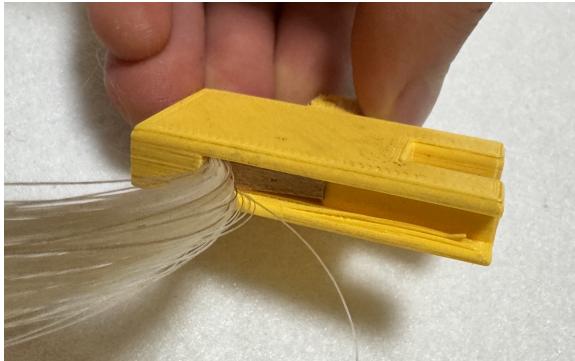
Step 6: Attach the Bow Tip to the end of Bow Segment 3 (the long male connector) and fit the nails in accordingly.



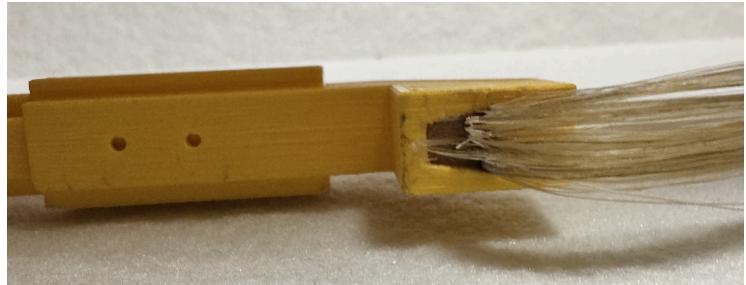
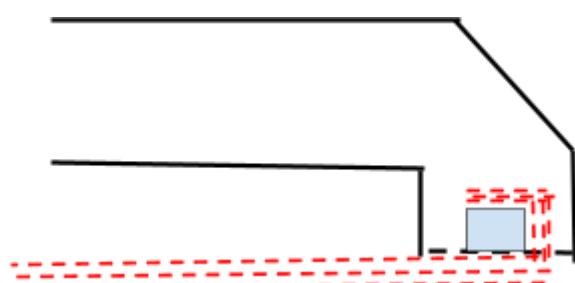
Hair Device Assembly:

Step 1: Get the material that you want to use to create the plugs. As you notice, there are holes located at the tip and the frog. To fit the hair into the tip and frog, we must create loose plugs that essentially friction fit the hair into place so we can tension out the hair.

Step 1A: The Frog. First, create the friction fit plug using a chisel and/or jigsaw with either some scrap hardwood material or plastic. Insert the hair (optional - stick with super glue), then insert the plug. Wrap the hair around the plug as shown in the diagram on the bottom right.

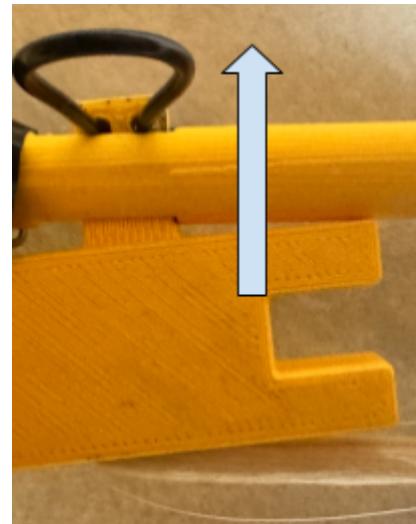


Step 1B: The Tip. Same idea here.



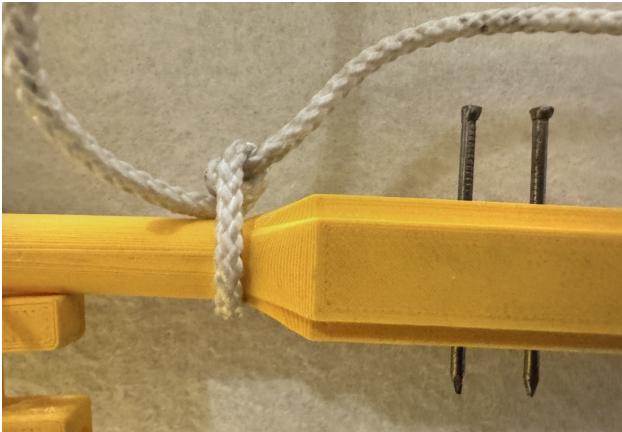
Step 2: Connect the Frog into the Frog Connector (Bow Segment 2) and attach it temporarily using some filament, or nail.

The stick should begin to bend in the opposite direction and the bow hair should feel taut (but not too taut). If it is too loose, cut the hair by a small amount and try again.

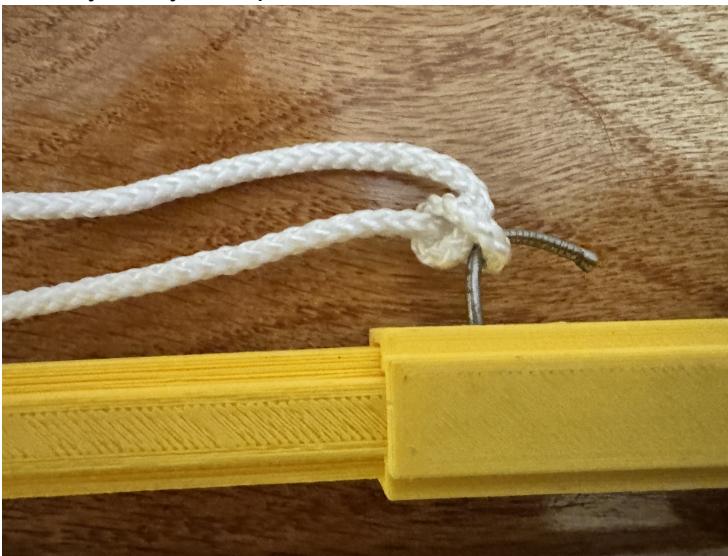


Tensioning Device Assembly:

Step 1: Tie a knot on one end of the stick around the area of the frog connector (Bow segment 2).



Step 2: Bend one of the nails at the tip to around 120 degrees to create somewhat of a hook. Tie the other end of your nylon rope on this end.



Setup and Adjustments:

Tension Adjustments:

To adjust the tension properly, use your hands to roughly estimate the length required to keep the bow tension taut. In order to be an effective bow, the curve of the bow must be concave up slightly as seen in all traditional bows.

Tie the nylon rope to the desired length and gently wrap the rope so that it goes over the indentation that is located on top of the bow truss feature.

Note: the truss is purposely offset to mitigate issues with torsional forces.

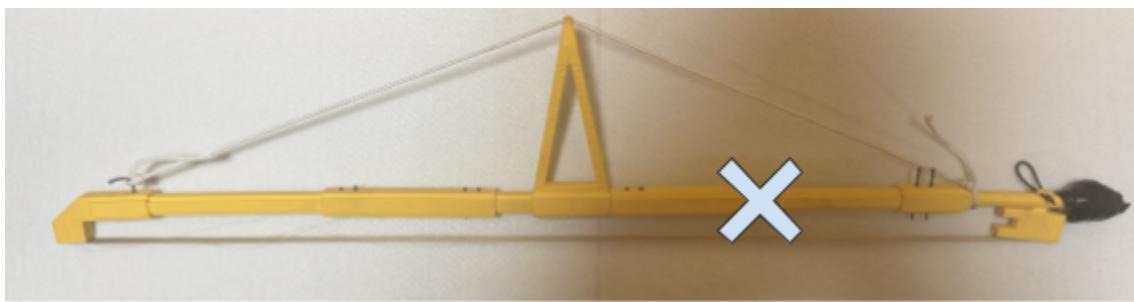


Counterweight Adjustments:

Use the heavy metal wire to wrap around the bottom end of the frog to adjust the weight balance of the bow.

Ideally, the bow's balance point should be around the lower 1/3rd as seen in the reference diagram below.

Optionally, wrap the counterweight with tape or adhesive to secure it to the bow.



Balance point should be around the x.



Proper Bow Hold:

To properly hold the bow, examine the diagram below. The fingers should be as loose as possible and the wrist should be flexible. Make sure to rosin the bow thoroughly.



To play properly on the instrument, ensure that the bow is parallel to the bridge of the instrument and move the arm parallel.

Contact Information:

For feedback, comments, questions, or concerns, feel free to reach out:

Email: ghan_personal@outlook.com

Linkedin: <https://www.linkedin.com/in/gary--han/>

