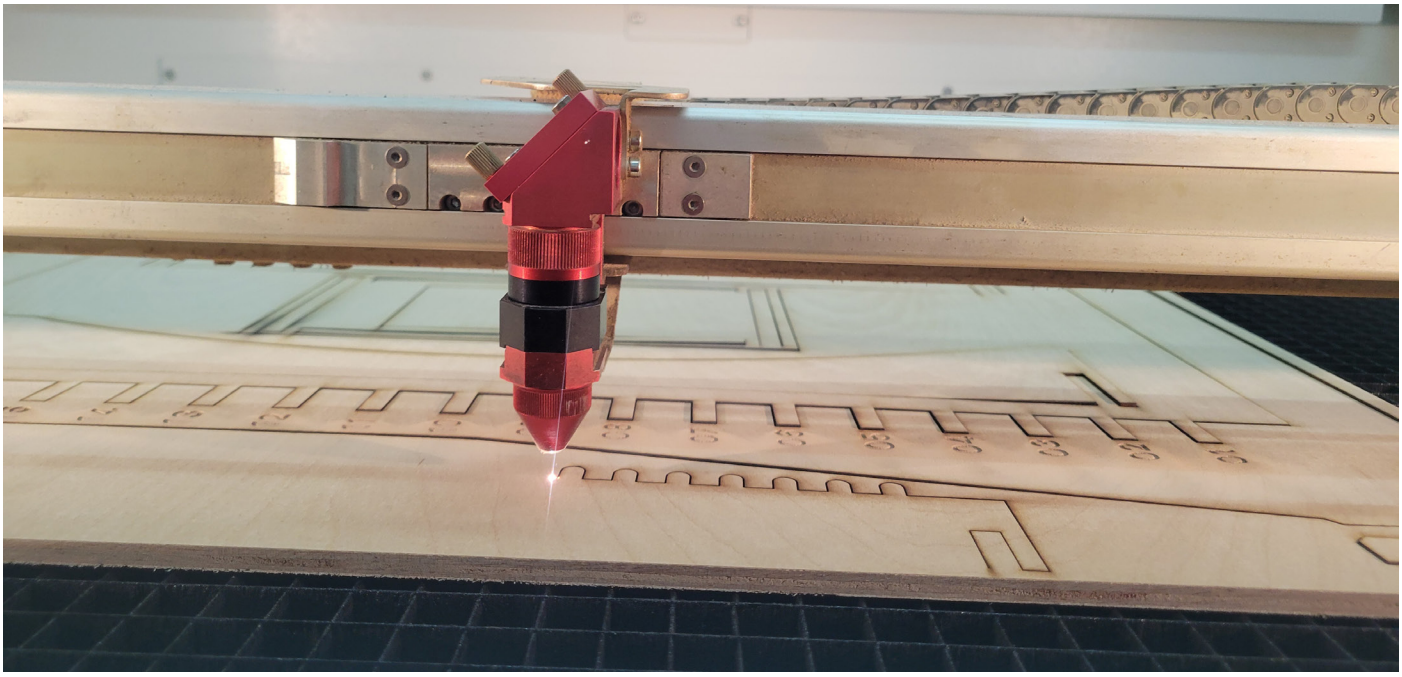


Nimble Animation Stand Design and Prototype Report

by Erik Asia

Usual industry-generated under-the-camera animation setups, making use of an animation stand, are large, expensive, and unable to be easily transferred from one location to another. Self-made animation stands, commonly consisting of lumber, hardware, and pre-made shelving units are DIY solutions to make the setup more accessible, but these are usually still fairly bulky and rigid in utility, commonly having a fixed configuration and unable to be easily disassembled or altered. The design and prototyping of the proposed multi-plane animation stand is to be easily replicated, easy-to-use for artists from non-animation backgrounds, and is portable and suitable for outdoor use and travel.

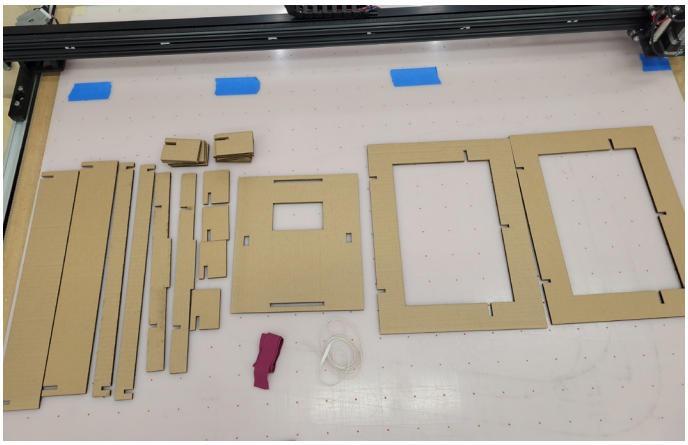
An initial meeting was held where the gaps of the existing DIY methods for constructing a self-made multiplane animation stand as well as project design considerations were identified. The stand is to be used with smartphone cameras and small DSLR cameras in mind. It is to be consisting of three to five layers for planes. To address the objective of the stand being easily replicated, it was proposed for it to be entirely digitally fabricated through laser cutting plywood. This was to provide users access to the open source vector files and material requirements that are of standard sizes in hardware and art stores. This would also provide sufficient constraints in construction of the stand to allow for modularity that would aid in making it portable and easy to assemble.

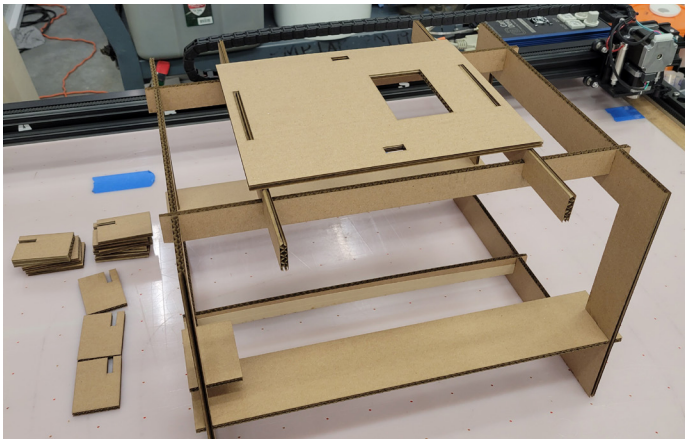
PROTOTYPE 1:
TESTING THE GENERAL MECHANISM

A cardboard prototype was made using ¼ in corrugated cardboard. This was to visualize and materialize the general form of the stand being developed. This consisted of a frame, structural braces, and one beam for a glass plane to be placed on top of.

The prototype was assessed in a meeting with the group and feedback was given. The beams that were supposed to hold the glass planes were too broad and minimized the work area available at the center of the setup. The center structural brace was also in the way for overall camera viewing angle from above. To heighten stability and to not disrupt the view of the camera in the work area, it was advised to put individual beams on the corners of the frame.

The phone holder was also too broad and could be reduced in scale. There was an emphasis on sleekness and minimizing unnecessary parts to reduce bulkiness and potential weight when carrying it from one location to another. With this, a survey of phone sizes, focusing on the camera modules, were briefly conducted to get a sense of general measurements needed for the phone holder in the stand.





PROTOTYPE 2:
DESIGNING TO SCALE

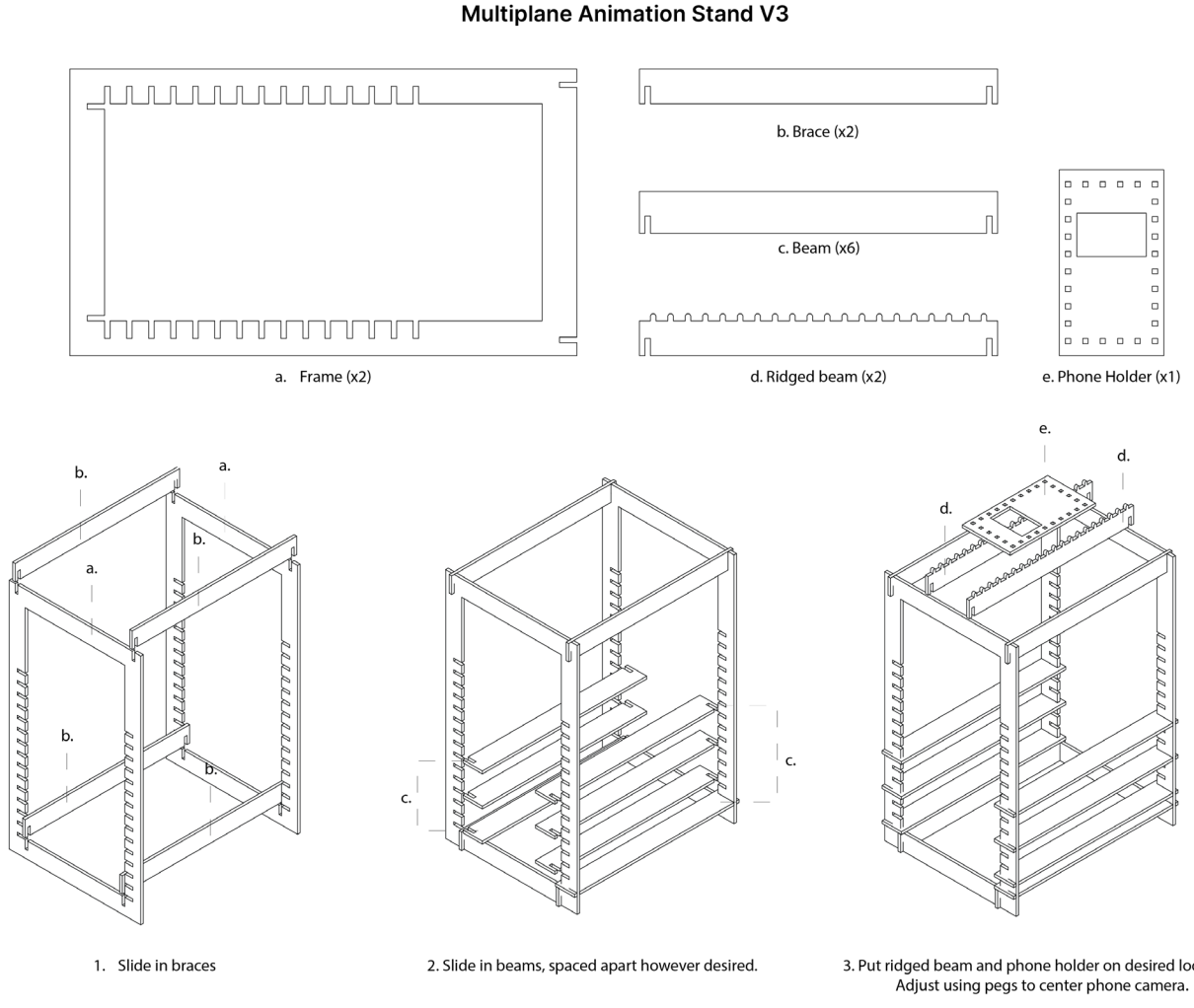
A second iteration was made still using cardboard, this time to scale with three layers where glass planes may be placed to use the stand. The phone holder was greatly reduced in size, catering to most phone sizes. An additional feature of being able to rotate the phone holder either in portrait or landscape modes was also added in order to switch orientation of shooting modes. Structural support braces were added at the corners of the bottom of the frame, and removed on top to minimize parts as the structure was to be kept in place by the beams as well.

Upon evaluation, the decision to remove the top braces resulted in stability issues. It was greatly encouraged for further iterations to have support braces on corners both on top and bottom of the frame. The flushed insertion of the beam to the frame was also a bit short to support potential glass planes to be laid on top of it. Certain measurements were marked to reduce the length of the beams in accordance with the 16:9 aspect ratio of shooting. It was also recommended to have an option of height manipulation for the beams holding the glass planes to allow for flexibility of shooting distance to subject.

PROTOTYPE 3:
DESIGNING FOR TESTING

The third iteration was finally laser cut using ¼ in plywood. It had mostly retained a lot of the structural components of the second iteration. A set of fifteen 1 in slots for the beams were added to have versatility and flexibility in height adjustments of layers. Support braces were also added on the top corners. The phone holder was perforated with slots that affixed in the redesigned connecting beam to the frame, this time having ridges that fit the slots on the holder. The flexibility of the pattern allows for different orientations, both portrait and landscape. It is the first prototype for user testing.

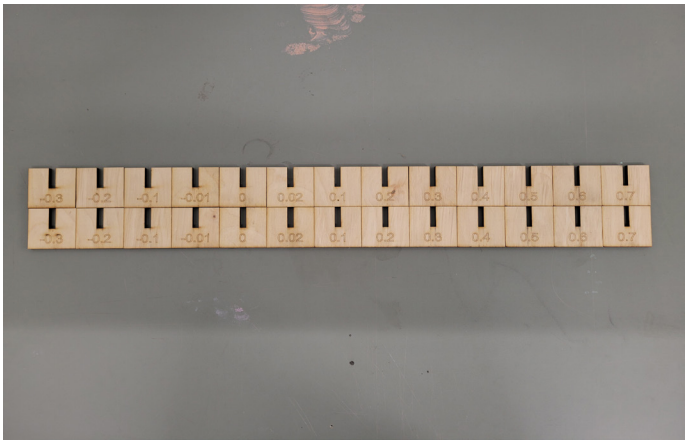
Feedback from using the stand consisted of difficulty in fitting beams from one frame to the next without any form of indicator to acknowledge the beam is leveled. Due to the similarity in braces and beams, it was also difficult to ascertain which parts are which with no visible differentiation. Fitting of the phone holder was also too rigid because of the precision required to fit the ridged beam onto the slots on the holder. This made transferring from peg to peg challenging and time consuming. However, the greatest concern in using the stand was its constant swaying and stability issues. This would be in relation to the sleek profile and loose tolerance of the joineries.

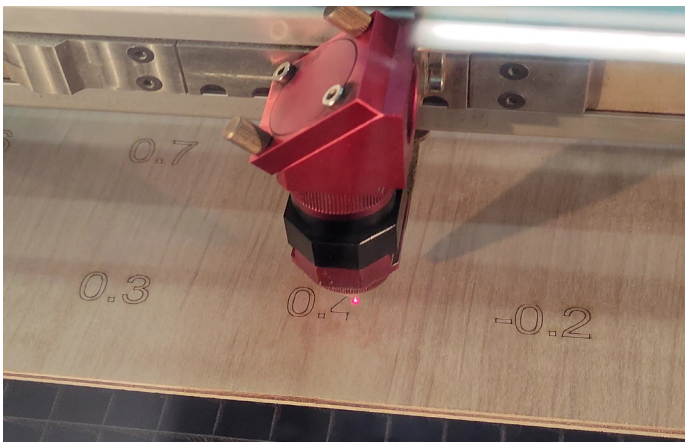


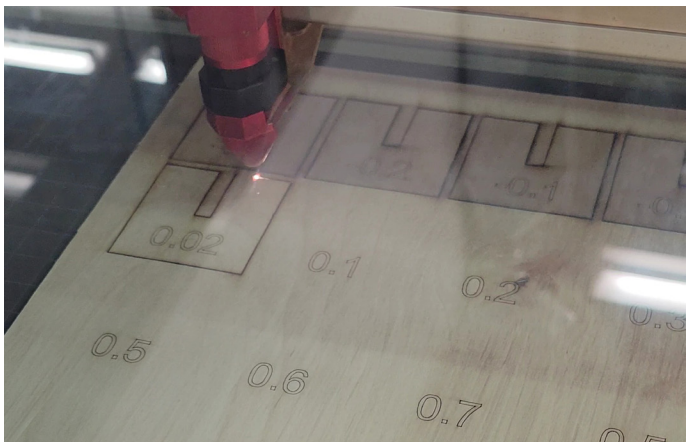
TOLERANCE TEST

Due to the main issue of the stand being too wobbly, a tolerance test was made for the fitting of the joineries. This was conducted with the assumption that with more material friction between parts, it would hold more rigidly and prevent loose spaces in between joineries. With this, a series of offsets were made in increments from -0.3 mm, -0.2 mm, -0.1 mm, 0 mm, 0.02 mm, 0.1 mm, 0.2 mm, 0.3 mm, 0.4 mm, 0.5 mm, 0.6 mm, and 0.7 mm.

The testing resulted in the use of a 0.6 mm tolerance for both parts to achieve a snug fit. However, upon testing in the actual prototype form, it was found that the tolerance was tight enough to hold the overall parts together without much wobble, however, it was too tight to disassemble. Thus, further testing was conducted and a combination of one part being 0.5 mm and the other being 0.6 mm tolerance was found to be best for a rigid snug fit for both assembly and disassembly.

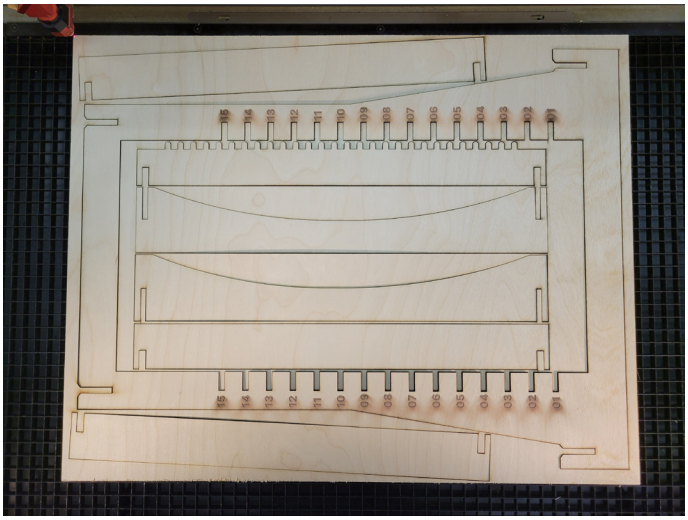


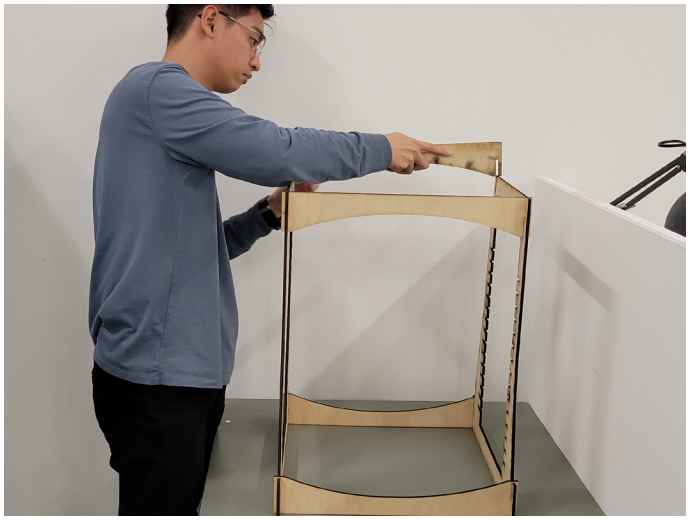


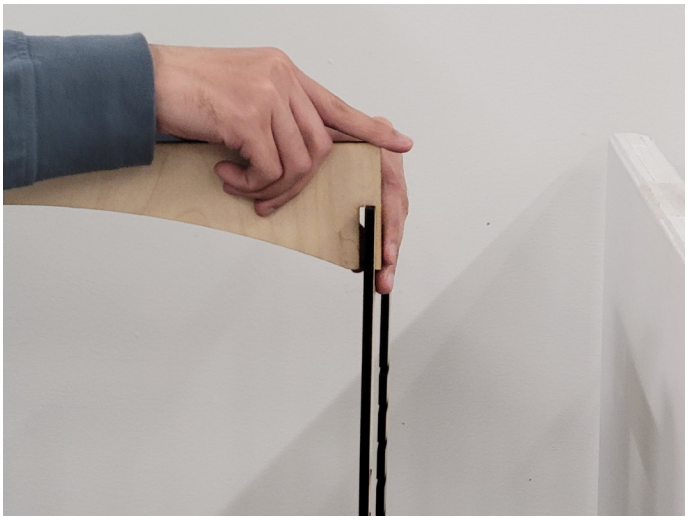


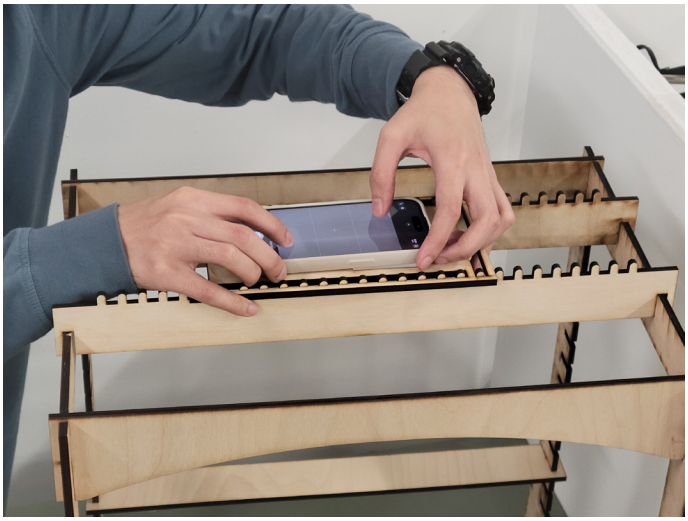
PROTOTYPE 4:
DESIGNING FROM USER FEEDBACK

The fourth prototype focused on enhancing stability of the previous iteration. It was laser cut using ¼ in plywood same as the previous. In this iteration, a wider base was made by tapering the frame. The structural braces were also curved to denote whether it was for the top or bottom as well as to differentiate them from the beams, which were remarked to be very confusing from the previous prototype. To enhance the user experience of affixing beams, numbered markings for each increment 1-15 were engraved to identify whether the beams are leveled on both sides of the frames.









PROTOTYPE 4:
DESIGNING FROM USER FEEDBACK

The phone holder was revised to have slits instead of a pattern of slots so putting it on and pulling it off the ridged beams would be easier and faster. The tolerance of the joineries, thanks to the tolerance test previously conducted, held strongly with the overall assembly being rigid enough to avoid wobbling while still being able to be disassembled without parts breaking off. To aid this disassembly even further, joints were chamfered to loosen the openings as well as the structural braces were designed with small flat surfaces where fingers may rest on that aids in pulling said braces off.