A simple system for holding mollusk shells and other small objects for photography

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Introduction

Some years ago, I created a set of special mounts to hold mollusk shells for photography. The aims were (a) to physically separate the shell from the background to make it easier to cut the resulting image out; (b) to allow better lighting of edges and (c) to allow the shell to sit in an exact orientation.[1] The limitations were that the new system could not use traditional modeling clay or any other adhesive medium and had to be made from easily available materials.

I developed two designs: one that uses a "tree" with metal prongs to hold the shells, and one that uses a vacuum. As they share same base and backgrounds, I will describe them both here. Both designs have been in constant use in our imaging center for many years and have proven durable and versatile.

These mounts are easily made in a basic workshop such as most museums have. It is useful but not essential to have a drill press and a rotary tool such as a Dremel®.

Development

The starting point for the design was the traditional "nail and block of wood" mount. This simple and easily-made setup generally works very well. A large nail or bolt is fixed vertically in a block of wood, with a piece of velvet or other material surrounding its base. A blob of modeling clay sits on the nail head and holds the specimen. If the nail is a snug but not tight fit in the block, it can be rotated to better align the specimen in the picture.

The main disadvantage of the nail-and-block mount is that it uses clay, which leaves a residue on the shell. Modeling clay, especially products intended for children, is made with non-toxic ingredients. Its liquid component was originally mineral oil, but nowadays vegetable oils are also common. Non-setting adhesive putties sold for putting up posters and notices also leave an oily residue and have a much stronger tack that can damage specimens.

In addition to the problem of deposits that over time can damage the shell surface, many shells have fragile surface features such as frills, spines and periostraca that can be damaged during attachment to and separation from clay. Finally, clay softens at room temperatures and heavier specimens can gradually deform it until they fall off.

For all these reasons, my new system would rely only on gravity or a vacuum for adhesion. It was important that the system be both scaleable for different sizes and adaptable to various shapes. It also had to be strong enough to support heavier objects like fossils and to withstand daily use. For effective support, a mount needs only three points of contact, but they should be rigid and spaced as far apart as possible. This system achieves that through the use of stiff metal.

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[1] For standard orientations, see "Standard views for imaging mollusk shells" https://ams.wildapricot.org/Imaging-Mollusk-Shells

1. Construction of the palm tree mount

A key element of this design, which I call the "Palm Tree Mount", is pairs of close-fitting brass pipes that create an inner "stem" and an outer "sleeve". These are widely sold at model shops, hardware stores and online. Suppliers in the USA include K&S Precision Metals™.[2]

Note: aluminum tubing, which is available in some of the same sizes, is also acceptable for stems but brass is more suitable for trees as it is stronger and harder. However, be aware that – like aluminum – brass work-hardens, which means it can only be bent a small number of times in the same spot before it cracks.

These are the five pairs of sizes I used (all diameters are outside):

Inner pipe (stem) diameter	Outer pipe (tree) diameter
1/8" (3.18 mm)	5/32" (3.97 mm)
7/32" (5.56 mm)	1/4" (6.5 mm)
5/16" (7.94 mm)	11/32" (8.73 mm)
15/32" (11.8 mm)	½" (12.7 mm)
5/8" (15.88 mm)	21/32" (16.66 mm)

Base and stem

Start with a block of wood or similar material such as plastic, approximately 3-4" (7.6 - 10.2 cm) square and 1½ - 2" (3.8-5.1 cm) thick. I used pieces of leftover plastic lumber from construction projects (Fig. 2).

Mark the center of one large face of the block. Drill a pilot hole with a small bit to roughly half the block's thickness, then finish the hole with a drill bit of the same diameter as the intended stem. It is recommended to test whether the drill bit is the right diameter by drilling a hole in a piece of scrap first. The stem should fit tightly into the hole; if it is loose, use a slightly smaller drill bit. If one is not available, however, wrap the stem with electrical tape until it is a tight fit in the hole, or glue it in with a hard glue such as epoxy.

Tip: to help with precise positioning of the mount while in use, I surfaced the base of the camera stand with black felt and attached four small furniture sliders to the underside of each base. This makes it easier to finely position the mounted specimen without disturbing its pose.

Trees

The precise size of the pipe pairs does not matter as long as one fits snugly over the other. The outer pipe is used to make the palm tree itself. Multiple trees can be made for the same base, with differing numbers of arms, overall diameter, arm angles and so on. Having a selection avoids having to bend a mount or force a specimen to sit in a particular orientation.

[2] www.ksmetals.com

The design is very scaleable; my smallest tree is 6 mm in diameter across the tips and the largest a bit over 60, though even larger ones could be made (Fig. 1). As shown in Fig. 8, the mount can hold shells far larger than its own diameter.

To make each tree, first decide how many arms you will make and how long they will be. I usually make either three or four arms, all of the same length or with one longer than the others. Add the length of the longest proposed arm to that of the stem, then start with a piece of outer pipe that is longer than the combined dimension.

Begin by marking three or four equidistant points on the end of the pipe. These will be the tips of the arms. Mark also a ring around the pipe at the point that will be their base (Fig. 3). Cut the spaces between the arms out using either a rotary tool such as a Dremel® or a fine craft saw (Fig. 4). With the arms cut, carefully bend them outwards using pliers (Fig. 5). When they are at the desired angle, bend the tips upwards to form a cradle. Clean up any sharp or rough edges and round off the tips with fine abrasive paper or a small file (Fig. 6). Trim the shaft to match the length of others in use (Fig. 7).

Finally, the tree can be painted flat black using any suitable paint. Brushing produces a smoother finish than spraying.

Background

Each mount can have multiple backgrounds, which are simply sheets of stiff card with a hole in the middle. To make a very light-absorbent black background, I glue open-cell rubber foam onto a piece of card (Fig. 13). This is sold in craft stores and online as “foam padding” or “Neoprene sponge foam rubber sheet”. The open-cell foam absorbs more light than, for example, black velvet or felt.

2. Construction of the vacuum mount

The vacuum mount is a good solution for very small specimens (down to as little as 1 mm diameter) or those of very thin construction that might be damaged in posing them on a regular mount. Instead of a palm tree, the stand is topped with a conical “chuck” with a shaped orifice through which the suction passes. Chucks can be shaped in different ways to support a variety of specimens.

Vacuum base

For the vacuum mount stem and pipe I use brass or aluminum tube of 15/32” (11.92 mm) diameter and for the chucks the corresponding brass tube of 1/2” (12.7 mm). Any similar pairing of tubes would work, but there is a relationship between pipe diameter and vacuum strength and this pair of sizes has worked well for us.

Starting with a palm-tree mount base made as above, drill a second hole at right angles through the side of the base until it intersects with the vertical pipe. Press a second pipe into this hole and blow through it to check that air flows freely up the stem (Fig. 2).

Chucks

The chucks are made using 18 mm (45/64") diameter round cake decorating nozzles (or "tips") with various hole sizes.[3] I attached them to short pieces of outer pipe using epoxy putty sold that is in home centers for plumbing and other repairs, but other hardening media such as car body filler, silicon caulk or even thick glue would also work.

For each chuck cut one piece of outer pipe 1" (25 mm) in length. Scuff the outside of this and the inside of the cake icing tip with sandpaper to ensure good adhesion (Fig. 9). Place the stem over the end of a piece of inner pipe to hold it, then insert it into the icing tip and pack thin rolled "sausages" of epoxy putty into the gap all round until it is filled or slightly built up (Fig. 10). With the inner pipe held in a vice, turning the chuck will show whether the icing tip is on straight and allow adjustment while the putty is still soft. The tip should be as straight as possible on the stem to give even lighting in the eventual images. Stand the chucks upright until the putty hardens (usually about an hour; overnight will give full hardness) and set aside for painting (Fig. 11).

Lightly scuff the finished chucks with fine sandpaper and paint them black or white.

Chuck variations

- "Hammock" chucks: cake icing tips are made of chrome plated brass, and the opening can be bent into different shapes. One very useful one is the "hammock". Obtain a tip with a hole of 3-4 mm diameter and gently squeeze the tip with a pair of pliers to make the hole into a long oval. Then use a rat-tail file to give the tip a curved profile and a banana-shaped hole (Fig. 12).

- Reduced vacuum or "star" chucks: decorating tips for making star shapes have a series of teeth around the opening. These allow air to bleed past, reducing the vacuum and spreading the contact over several points. They are thus useful for very fragile specimens such as dried seed bodies or insect wings (Fig. 12)

Note: Chuck tips require periodic repainting, as inevitable chips in the paint finish reveal the bright brass. A smoother finish than spray paint can be obtained using a fine sable brush. If all you have is spray paint, spray some paint into the lid of the can and then brush it onto the chuck tip.

Vacuum pump

I use a small laboratory vacuum pump but a small vacuum cleaner, like those used for cleaning cars, would work well too. Cheap diaphragm-type pumps are available at online retailers that can either move fluids or create a vacuum, depending on how the hose is connected.

The mount is connected to the pump by a length of rubber hose. It is wise to place a fine filter somewhere in the line in case a specimen or part of one gets sucked through the aperture. I use the very fine brass mesh from a regular kitchen faucet head.

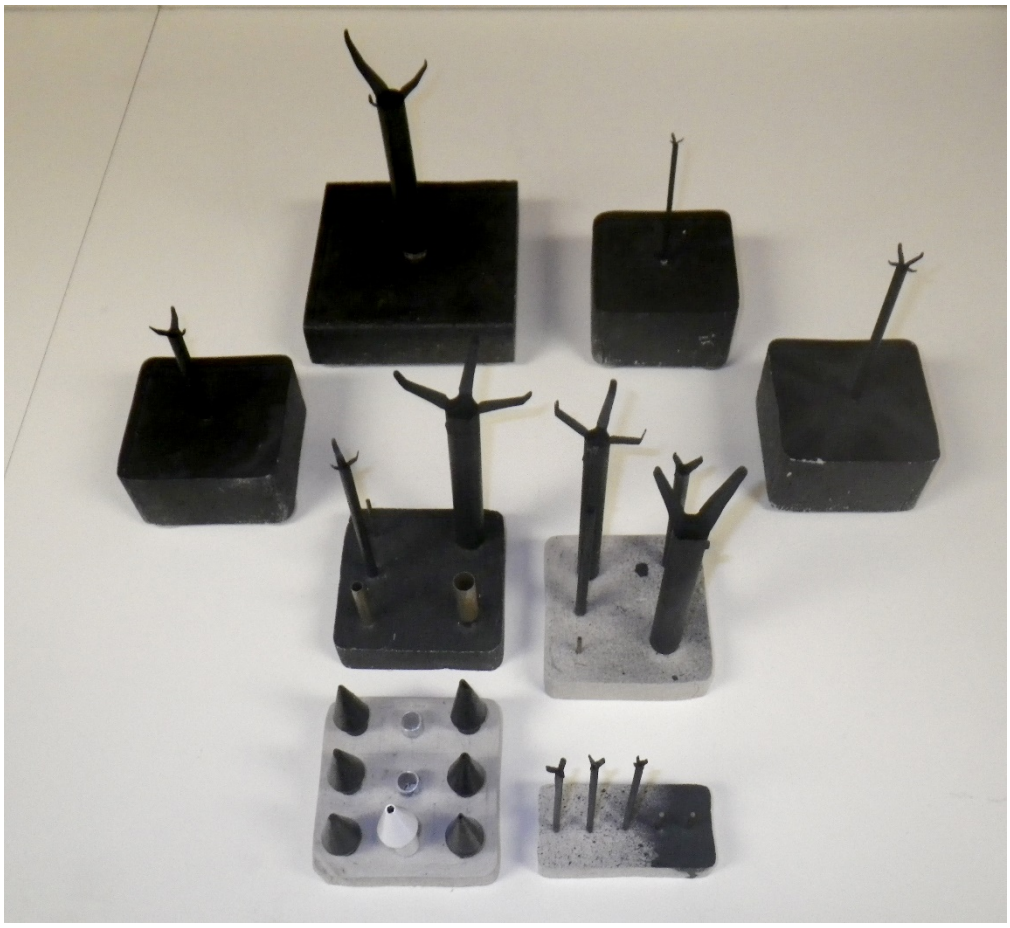
[3] A good selection to start would be *e. g*. Wilton™ #1, #4, #5 & #14. http://www.wilton.com/shop/tools/piping-bags-and-tips/piping-tips/

Field notes

- Mounting specimens on a post allows their sides to be better lit, either by angling the light sources or using fill-in mirrors, without making shadows on the background. This often avoids having to use a white background to get a clear image.
- A second block of wood can be made into a tree or chuck holder (Fig. 1). By keeping all but the mount currently in use in the holder, you can keep track of them and their condition. Storing them loose tends to scratch the paint off.
- As long as the mount is painted black, it does not matter that it is visible on either side of the shell unless it actually obscures it or casts a shadow. It is easy to cut the mount out when the image is worked up. It is far more important that the specimen be oriented correctly.

Fig. 1. Four mounts and a selection of trees, showing how widely the design can be scaled. At front left is a set of vacuum chucks, including a useful white one for dark-colored specimens.

The chuck and tree holders shown here, made from scrap, keep everything in order and reduce damage.



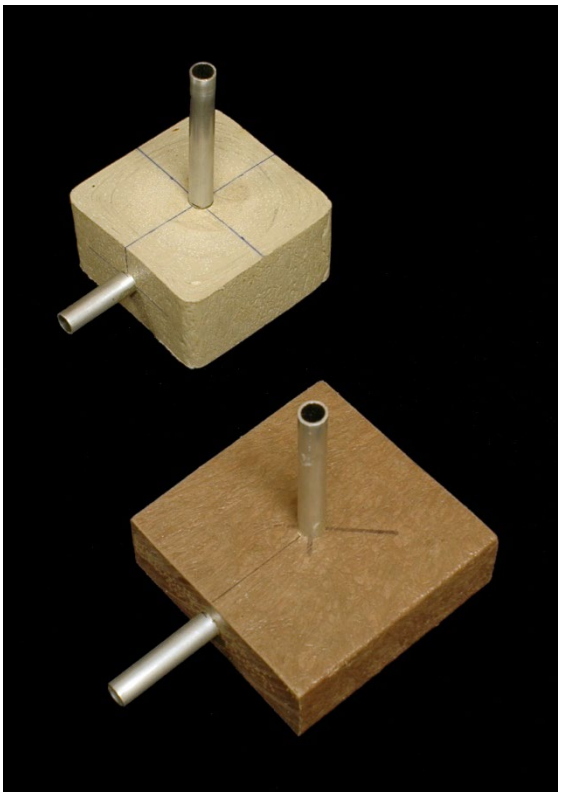


Fig. 2. Two bases, both with the optional vacuum pipe, made using plastic lumber and aluminum tube.

Fig. 3. Marking the outer pipe to cut the tree.

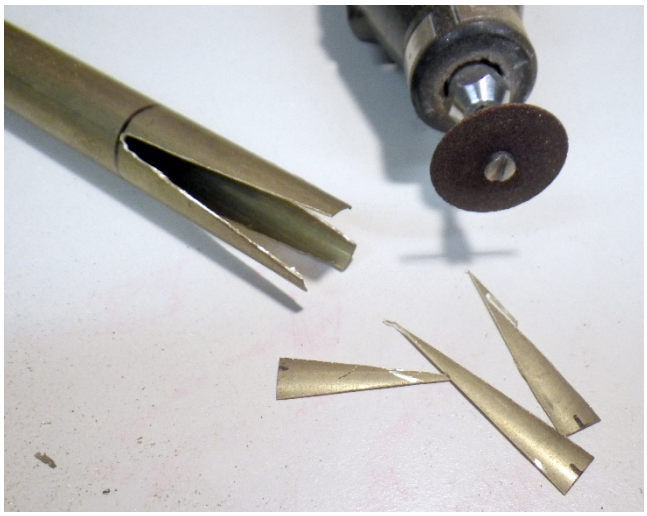


Fig. 4. Cutting the tree arms using a rotary tool.

Fig. 5. Bending the tree arms. This is best done with long-nosed pliers so that the bend occurs at the foot of each branch

Fig. 6. Tools for finishing the tree. The tips are bent upwards with pliers. Sharp edges are removed and the tips are rounded using small files or abrasive paper (here glued to pieces of wood).

Fig. 7. Trim the finished tree to match the length of others in use.

Fig. 8. The tree from figs. 1-7, showing its considerable supporting ability.

Fig. 9. The parts for a set of four vacuum chucks: cake icing nozzles and one-inch lengths of outer pipe.

Fig. 10. An assembled chuck, showing the joining of the components with (here) epoxy putty.

Fig. 11. The four chucks ready for painting.

Fig. 12. Hammock-type (top) and star-type chuck tips

Fig. 13. The vacuum mount in action. The scalebar is mounted on a chemistry stand.