

Stop Motion Puppet Construction 1st Edition

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Contents:

- 1.0 Introduction
- 2.0 Equipment
- 3.0 Material Review
- 4.0 Armature/Puppet Design
- 5.0 Character design/Sculpture
- 6.0 Foam Latex and mold-making
- 7.0 Puppet examples (to be added)
- 8.0 Informative books on Puppet-making. (to be added)
- 9.0 Conclusion

1.0 Introduction:

This document is basically a distillation of our knowledge and experiences of designing and constructing stop motion puppets. We have been making puppets now for several years in a variety of ways with different materials and the one rule of stop-motion puppet construction, if you pardon the cliché, is that there are no rules. There isn't a right or wrong way to do things, and you learn something new each time you make a puppet. The making of a good puppet is an art in itself and a most rewarding aspect of stop-motion. This beginner guide will run through basic armature and puppet design and construction through to more complex puppets and processes. We have included several photos of finished puppets using different techniques and also some shots of puppets under construction.

2.0 Equipment: Some equipment normally used in making different puppets

Stanley/Hobby Knife - Rolling pin
Soldering Iron - Hot Glue gun
Vice - Screwdrivers

Wood saw - Metal working files (small variety)
Sunbeam mix-master - Digital weighing balance (.1 decimal)
Needle nose pliers - Good sharp pair of fabric only scissors
Paint Brushes - Sculpting tools
Pins Electric drill
Small hacksaw - Kitchen Oven
Airbrush - Duct tape
Belt sander - Foam latex injection gun
Allen key - Vise grip pliers
Metal taps oven thermometer, and a room thermometer
Hair dryer - Double boiler or meat grinder (for mixing clays)
Assorted bowls and spatulas - disposable brushes, lots of empty plastic containers

S3.0 Material Review: Some materials I use to build, or help build puppets from

Plasticene A colored clay used in making clay stop-motion puppets (Claymation) Many different brands made using varying processes, well known brands used by professionals include Van Aken (Vinton Studios), Harbutts (Aardman).



Pottery Clay Common pottery clay can be used in bedding down sculpts for mold casting. Bruce Bickford uses common clay mixed with paint pigments and vegetable oil for claymation instead of plasticene.

Klean Klay An oil based sculpting clay that does not dry out when exposed to air, excellent for making molds for that reason. Available in the US, Canada and Australia, not sure where else.

Polymer clays

eg. Sculpey, Super Sculpey, Sculpey III Sculpey Flex, Fimo

Polymer clays which are thermosetting plastics which go hard when baked in the oven. Sculpey is a good general purpose clay which is white, Sculpey III is colored and has a large color range. Super Sculpey when baked has a more ceramic finish, while Sculpey Flex is still flexible after baking and can be used as puppet hands etc.

Fiberglass resin and glass matting Can be used for a variety of different uses in making puppets from armature components to puppet body parts. Also can be used to make the jacket mold of a silicon mold.

Epoxy putty A two part putty that cures in about 10 minutes and is extremely strong. It can be drilled , filed , sawed after curing. Takes on the appearance of stone. Another name is Propoxy, also called metal epoxy It often contains metal filings.. I use this almost exclusively now in wire armature construction.

Aluminum sculpting wire 1.5mm & 3mm Wire used in making puppet armatures. 3mm diameter length is good for legs and torso sections while the 1.5mm diameter length is good for arms. Tip* take several lengths of 1.5mm wire and fix one end in a vice and fix the other end into the chuck of a drill. While keeping a tension on the wire use the drill to wind the wire together. The finished wire is stronger but resistant to breakage and can twist for neck and wrist sections. There are more than two sizes available, we use very tiny wire (1/32") for hands and fingers, and have used 1/4" for waists. It depends on the size and bulk of the puppet. remember to compensate for the bulk of the foam, it creates a great deal of resistance on the wire. your armature should be a little too stiff before the foam goes on. You can also use solder wire for fingers but it can break.

Aluminum Sculpting mesh Comes in different mesh sizes, like armature wire, this mesh can be used in armature construction to add strength to clay shapes. It may be wrapped around a wire limb to give something for the clay to key on to. Very fine mesh can also be used for backing hats, scarves, clothing, and other props that need to animate yet remain soft at the same time.



Mineral Oil/Linseed Oil Used sparingly and applied with a soft stiff brush, it smooths out small imperfections in your sculpt to give that smooth (Winton) look. Baby oil also works for this, is more widely available and far less expensive.

Mineral Turpentine Also used for smoothing clay sculpts and in particular Sculpey. A common solvent for cleaning paint brushes, or thinning enamel paints etc. If you can use a regular household paint thinner, do. It's much less toxic. never use too much of these on your clay, the surface will get very mushy.

Clear food cling wrap Use to cover opened clay to prevent dust and fabric fibres sticking to clay

also cover sculpt with wrap when not in use. Pour melted clay onto wrap to cool.

Baby wipes Use to keep hands clean while sculpting or animating particularly when changing colors, nothing is more frustrating when the wrong color is accidentally smudged onto to your nice clean sculpt.

Epoxy adhesive (5 min. variety) Fast setting glued which is great for any general purpose use where a strong bond is required. Used in Armature construction because it glues metal to metal. This is the only glue which can be used on styrofoam.

Balsa wood glue As the name suggests, for gluing Balsa wood.

Balsa wood (different sizes) A lightweight fine grain wood used to make armature parts etc. Thinner stock can be cut with a hobby knife.

Styrofoam Also used for house insulation, not the pebbly white type but the hard solid colored ones. Can be cut, carved with a hobby knife, rasped, sanded (wear dust mask, dust is toxic). Used to block out a puppet to give hard places to grasp for animation, when the rest of the puppet is going to be blocked out in upholstery foam. not suitable for foam latex, it cannot be baked, it melts. we also make lots of set pieces out of this, it's light, cheap, and takes paint well. may only be glued with residential styrofoam caulking, or 5-min clear epoxy. all other glues melt the foam.

Aluminum stock Blocks of aluminum are available at metal supermarkets. It's soft enough to drill in a drill press, cut on a band saw, and grind with a belt sander. Use it for hip and chest blocks in a wire armature puppet. Drill holes for the wires to go in, then holes on the surface for set screws. Surface holes are tapped to create threads for the set screws. You can also drill a hole in the middle of the block and thread it to create a place to mount a flying rig. Use aluminum blocks for foot blocks and you can drill and tap a hole for a tie-down.

PVA glue A glue for wood and paper can be watered down and brushed onto fabric to stiffen it. It dries transparent, but shiny.

Acrylic and Enamel paints Acrylic paints are used for many things, water soluble, but will eventually wreck your paintbrush as dried paint accumulates on the brush. Acrylic paint is mixed with Pros-aide latex adhesive 50/50 for painting foam latex puppets. This is tricky, you need to add some water and never let the brush even start to dry out. You'll go through 2 or 3 brushes to paint a puppet but the bond is excellent. if your puppets are sticky after painting, brushing them with a bit of corn starch/corn flour ,baby powder or talc will take the stickiness away. rub excess flour off with your fingers. Don't use regular flour!

Enamel paints give better metallic colors and are very good for painting glass beads for eyes. Tip* place eye bead on the end of a toothpick and place toothpick in a drill chuck, then paint the pupil while the drill is rotating. This will produce a nice perfect circle dot for the pupil.

Bolts and wing-nuts Various lengths of bolts and wing-nuts can be used for tie-downs and also as clamps for foam latex molds. With molds it is a good idea to also use large washers to prevent too much stress being placed on the mold.

Glass or plastic or wooden beads Perfect for eyes as a pin can be placed in the hole while animating to move the eye. Try to get the brilliant white beads for eyes. Wooden beads may be glued with epoxy to wire armatures to make a spot to grasp the puppet. For example, on the upper arm, it will prevent the arm from bending above the elbow and will give you a firmer spot to hold for animation so you don't crush the foam.

Silicone rubber A condensation cured rubber polymer. Used more and more in puppet construction instead of traditional foam latex. Commonly used to make molds, is flexible and very heat resistant up to 200 oC after curing. Known for its ability to very accurately capture even the tiniest surface details of a sculpt. Expensive. There are hundreds of different types, so you'll need to find a reputable supplier who can help you decide the best type for your application, whether it be a puppet or a mold.

Foam Latex. The traditional medium for making stop-motion puppets and still widely used today. Based on natural latex rubber it is a tricky multi-component system that will take a few attempts to get the hang of making. Is rather expensive. The two most common brands are Burman & GM foam. I have used both and prefer GM. GM foam comes with excellent instructions and a great website as well as a toll-free number to call their support staff if you get stuck.

Brushing Latex Used to mix with acrylic paints for flexible paint, can also be used with cotton fibers in the buildup method of puppet making eg. Skeletons in Ray Harryhausen's "Jason & The Argonauts". I have used brushing latex for foam latex after I ran out of latex base and it worked fine, but it depends on the quality of the brushing latex. I also use brushing latex to fix up tears and holes in foam latex puppets.

Icy-pole sticks/wooden coffee stir sticks General mixing uses, and also as a palette knife when applying thickened silicone rubbers

Sand paper Comes in various grades from rough to smooth. Used for many things eg. Cleaning up Balsa wood or fiberglass components.

Two part epoxy resin There are many different epoxy resins on the market with different setting times and colors and strength. I use a 5 min fast setting resin for making armature components and props. It even comes in a double syringe type contraption so you never have to worry about getting the right amounts.

Rare Earth Magnets Strong magnets used as tie-downs during animation. Will not work on aluminum! you'll need to have steel in the foot of your puppet.

Aluminum foil Many general purpose uses for props and puppets. Can be used to bulk up parts of the puppets so less foam can be used. also works well under steel epoxy.

Casting plaster (eg. Ultracal 30) There are also other types of casting plaster but this is the most widely used when making foam latex molds. It is cheap and sets very strong. I suggest using fiberglass, Burlap or sisal fibers as reinforcing to prevent breakage. Molds need to be thoroughly dried in the oven before use on latex or it will cause leaking in the foam when heat cured.

Upholstery foam A yellowish stiff foam used to stuff out your sofa. Available at some fabric stores. A little goes a long way since you don't need much to build up a puppet. Used for bulking out a puppet when you're not going to be casting it in latex. This type of puppet requires no special tools or equipment, it can be done in your home. Just layer on the upholstery foam, using fabric glue or contact cement to glue it to the armature. Then trim it with scissors till it's the shape you want. The puppet can then be dressed in fabric or leather. This type of puppet cannot be painted. Heads and hands should be made of sculpey or some other substance.

Magic sculpt Available at taxidermy shops. This is a cheap two-part epoxy type sculpting compound. It cures slowly so you can work with it for a while, and it sets very hard. The proportion of hardener and resin may be adjusted if you want it to set a bit faster, but it generally takes 2 - 4

hours to set up. It's a bit sticky to work with and takes practice but the next day you can sand and drill it. It works great for heads. Use some water and your fingers to smooth it out before it cures. Totally non-toxic.

Fabric/leather Used to dress a puppet. If you are shooting on a digital camera, the fabric needs to be tested under camera to make sure it doesn't "ring" (cause interference and buzzing in the picture). Use fabric with a small grain. knitted fabric is better than woven fabric since it will stretch around thin arms and legs and round tummies, and it doesn't fray as badly. Fabric may be sewn or glued into place, but sewing looks better and stitches can be removed if you make a mistake or want to get inside your puppet for a repair or to attach a rig. Details like pockets and trim are glued on with contact cement or an industrial shoe repair type cement. Use lots of ventilation or you'll get dizzy quickly. Leather may be sewn or glued and can be stretched and molded around the shape of your puppet. Don't make the clothes too loose or they will pop during the animation. You can stuff loose bits with cotton balls so they don't move on you during a shot.

4.0 Armature/Puppet Design:



This is the most important part of making a Stop-motion puppet. Bad planning and design of your puppet at this stage will result in a difficult puppet to animate and bad animation. Especially for the beginner if your puppet is poorly designed then you may be put off from Stop-motion altogether as being too hard so I can't stress this aspect of the construction more.

The Story board is where you work out all the actions your puppet will need to do, walking, Jumping, talking, flying? Any action that the puppet is going to perform that could impact its design should be taken into consideration for example if the puppet is going to fly then you will need to have some place to attach wires or rigs. If the puppet is going to talk, then you need to figure out how you will do the lip sync etc.

Armatures are the skeleton of the puppet. They support it and enable it to be animated effectively. An armature should be strong enough to support the puppet's weight but not to hinder its movement. The armature needs to be stiff enough to move and support the bulk of the foam and clothing on the puppet. Don't make the mistake of making a perfect armature only to have it sag when the puppet is foamed out. It's better to err on the side of too stiff until you get the hang of it.

Armatures are normally made of aluminum sculpture wire, in the case of simple armatures or intricately built ball & socket armatures that can be very precise and very expensive. Other materials can be used as long as the puppet will be able to be animated.

I have used both , and prefer the ball & socket machined armatures which realistically simulate human movement (assuming your puppet is humanoid). Wire armatures can be springy and you tend to have to bend the armature slightly more than you need, to allow for the spring back effect. Good aluminum sculpture wire is pretty "dead" and is the best choice for a beginner. However, the main point to make on this issue is that wire armatures are definitely workable, and the beginner should not worry about learning all the machining techniques employed in making ball & socket armatures but rather grab some wire and pliers and get stuck into it. The following photo is of a basic wire armature made with sculpture wire and epoxy putty.

How will my puppet stand up? This is really critical. If your puppet doesn't stand up well and secure you will be fighting a losing battle when animating and the end result will be disappointing.



There are several ways of securing your puppet. A simple way is with a pin through the foot into the floor of the set. This is okay if you have a clay puppet where the pin is easily covered and will do as long as the puppet doesn't move about a lot. Of course your set will have to be soft wood or styrofoam, or even foam core.

A Tie-down is a device to fasten a foot to the floor. It is usually attached to the puppet from underneath the set floor and is usually a bolt, but I have heard of wire also being used. If the puppet only has wire in its feet, a very thin strand of wire may be threaded through the foam or clay in the bottom of the foot, hooked over the wire inside, and back out through the bottom. you'll need two tiny holes in the set for the two wire ends, then twist the wire together under the set floor. This is good only if the puppet is staying in place for a while, it's too hard to do if the puppet is walking. The downside to tie downs is that you have to drill holes in the floor of your set and hide the holes afterwards. I will discuss different tie downs later during puppet examples.

Rare earth magnets are very good, especially if you don't want annoying holes in the set floor. These magnets are available through specialty shops. Magnets are used a lot in industry to remove ferric particles during processes and come in different sizes and strengths. The magnets should be strong enough to hold the puppet foot but not too strong as to hinder the animation. Also the puppet's foot needs to have steel in the foot or it won't be magnetized. The floor of the set will also need to have a thin sheet of steel so the magnet will stick to the underside of the set floor. Wallace in the Aardman film "The Wrong Trousers", is able to walk up a ventilation shaft and around to the inside of the shaft because of magnets.

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