

The King of Protein Glues

Arguing the case for reversibility and easy application, *Bill Ratcliffe* discusses the value of fish glue

There is a glue for every material and every occasion. One type is often referred to as 'traditional' but I consider it better to class them as 'protein' adhesives. These glues are hide bone and skin glues which are collagen based, collagen being a protein contained in animal skins and bones. Here I write by narrowing the focus the protein adhesive, fish glue, and some comparisons with hide glue.

The earliest evidence of the making and use of 'hide glue' is in ancient Egypt, where stone carvings depict their preparation and use as early as 1500BC. The prime period for protein glue use in furniture making was between 1750 and WWII. Post-war, saw modern PVAs and aliphatic glues gain popularity.

As a conservator & restorer, I am often governed on my choice of materials and/or techniques by considering reversibility. Any professional restorer should be the same, but I do not use fish glue only for that reason. The glue is excellent and easy to use, and I argue that 'makers' should consider the restorability of the items we make. Surely, we want our items to be well made, made to last and not to make them hard to restore with a built-in shelf life.

I often see what I consider as over-engineered projects, made with non-reversible adhesives, items containing hidden fixings then covered with timber or veneers. Hidden fixings have their place when appropriate as do waterproof adhesives for exterior items. Take some of the principles, skills and materials from conservation and apply them to your making, and have the two words reversibility and appropriateness in mind. Sometimes in an age of image and social media, we can all put aesthetics over practicality. Build in reversibility to make your product easier to restore.

Synthetic adhesives and baby bottles

There are many issues linked with synthetic glues, making them unattractive to furniture makers. Often these issues are ignored in favour of the perceived convenience of other products. One of the most overlooked issues is that lack of reversibility. Most makers today do not consider the problems that synthetic glues will create in the future. Most furniture



gets damaged in its life and needs to be repairable to survive. Synthetic glues cure by catalytic conversion and are irreversible. This means that to take the furniture apart you may need destructive intervention and mechanical removal of all glue before repair. We will not discuss toxicity of some modern glues at this point.

Some readers may not be familiar with protein adhesives, their pros and cons. Some think of these glues as messy and smelly, and needing lots of preparation. They imagine the old cauldron double boilers and consider it not convenient in these days of immediacy. However, the truth is far from that.

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In my workshop I use a baby bottle warmer to either cook hide glue or to gently warm liquid fish glue. I use a domestic steam cleaner to reverse glue,

where appropriate. Both can be picked up second-hand very cheaply.

The Prince of Glues

The type of protein glue most people remember is the one with more aliases than the artist formerly known as Prince (the symbol, squiggle etc). The Prince of Glues is known as Scotch glue, pearl glue and animal glue, but I prefer to refer to it as hide glue. It is excellent, but it needs preparing in advance, has a limited shelf life once mixed and has a shorter open time than fish glue as it cools.

If hide glue is the prince of adhesives, fish is the Elvis. It is assumed that Elvis loved glue, singing: "I'm gonna stick like glue, because I'm stuck on you." I rest my case your honour.

The most obvious advantage of fish glue is that no preparation is required, and the shelf life is better and the open time when a glue typically remains liquid and workable is longer.

What about PVA types and other synthetic non-reversible glues? They give you an immediate fix, but with a touch of guilt that they can never be reversed. PVA



Bill also uses a ThermoTastic Drink Coaster (above), powered via USB from the back of a DAB radio. The weight of the bottle switches on the heat and is very gentle and hot enough to warm a pot of glue on even a cold day



Bill uses fish glue for his stick chair courses. In this case Ben (right) found a passion for woodworking, and doing a PhD in Theology. Philip (on the left, and a QM subscriber) has a five-acre woodland in Sussex and gave Bill a 'wild service' sapling, the species being relatively rare

or other modern glues may seem the quick convenient choice but are they the best choice? I see too often on TV 'restoration' programmes, the PVA comes out and is used in joints and under veneers, this is not appropriate. I say that partly tongue in cheek, many modern glues are excellent when selected for their appropriateness and not out of ignorance, particularly when 'restoring' items. Using adhesives is about having a selection of glues with different properties available and then choosing the most appropriate for the task.

There are modern versions of hide glues made by various companies but many of these have additives to keep them in a liquid state and fungicides to extend shelf life, by preventing mould. That said, the recipes for liquid fish glues remain secret and there will be similar additives for the same reasons. The only way to really know what is in your protein adhesive is to prepare the ingredients yourself. In conservation this is more appropriate and essential but as a maker just start off by considering any form of protein adhesive to make it reversible. In most cases these modern modified 'genuine' products also



A baby bottle warmer with fish glue full strength and diluted. The syringes are of assorted sizes. The pale blue is 0.7mm and used largely where access is limited, while the pink is 1.6mm, used when access is allowed and you can use a stronger mix

work out expensive by volume, when compared with preparing your own protein adhesives. Buy liquid fish glue or some hide glue in pearl form and mix it yourself.

Fish can be made less viscous with water added. At colder temperatures, winter workshop time, the glue becomes a more viscous gel and needs to be warmed. I would recommend warming before use all the time anyway as it helps with glue flow and adhesion.

You'll feel less stress during glue-up, and excess is easy to clean, even after it has dried it is reversible. It doesn't leave sealed shadow patches around joints which cause finishing problems later. Fish glue can even be diluted and used with a syringe to access joints or under veneers.

Once hide glue is cooked it has a limited lifespan, water can be added and it can be reheated, but this will gradually reduce its potency and it will start to become mouldy. Once mixed and cooked, you can refrigerate or freeze it in batches and heat when required. This can be kept cooled for months. However, fish glue in its liquid form can be stored in the workshop without an issue for months/years and heat when required. This can be kept cool for months. In comparison, fish glue in its liquid form can be stored in the workshop without an issue for months/years.

These protein glues can have open times easily extended with the application of heat, for example, a hot air gun carefully used. Hide glues starts to hold very quickly as it cools but fish glue can be open for an hour or more depending on conditions.

Wooden surfaces

In the 18th Century, workshop stoves and fires were used to pre-heat wooden surfaces to extend the opening times of



Using a steamer to reverse protein glue (above) and a charred tenon (left) on a 19th Century chair rail. All the tenons on this chair were burnt like this

hide glue. Later there were specific heated rooms for assembly. I restored a chair 10 years ago and the frame needed taking apart to then by re-glued. I found the tenons were all showing signs of a bit of overheating, in fact let's just say they were all burnt. I imagine the maker popping them on the stove and then getting distracted like me with the toast in the morning, or maybe that charred look was what he was aiming for?

When I reglued the chair frame, I can understand why as the angles involved and the timescales for clamping and adjusting were tight. The fact I was able to take it apart, make repairs and then reglue, with the same adhesive is testament to the glue. The chair now sits in the corner of my bedroom. I also made the paint finish, milk paint, not from a packet of powder, from a milk bottle and pigmented to the colour.

This was not intended to be an exhaustive academic study of protein glues, but hopefully it will make you

reconsider your adhesive options, think about restorability in the design process and this may spur you to do your own research. Making an informed glue selection should be no different than the choice of other materials or tools: what is best for the project, not what is easiest to get hold of or at hand. Liquid fish glue is a great entry material into the use of reversible protein glues.

Preparing and using protein glues is satisfying. You have control of your materials, and the glue will outlast most modern glues. The strength and longevity of protein adhesives are impressive when you consider so many pieces of furniture remain secure after centuries of robust use. Balance that with seeing more modern furniture with degraded PVA, which is only a few decades old or even less.

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Fish glue was used for the assembly of a dovetailed box when Nick Gibbs (left) visited Bill's workshop last year. Using a syringe (above) to fix a loose piece of veneer

The Fishy FAQs that Make Application Simpler

Bill Ratcliffe answers the most common worries about using fish glue and other hide options



In the UK you can buy Kremer fish glue (left) from art supplier Fitzpatrick, quoting it has a 10-year shelf life. A shelf of protein glue in Bil's workshop

What is the best way to apply fish glue? What do you use?

Apply it any way you want: brush, syringe, spatula, coffee stirrer and even your finger. The joy of the glue is its ease of use and ease of cleaning up.

What sort of cloth do you use to remove excess?

Use a damp cloth. Soaked in warm water but squeezed out so excess water does not run into the joint. You want to clean around the joint not weaken the adhesion inside it. Obviously not a fluffy linty cloth. Just a piece of lint-free cloth, old tea towels, old t-shirts, mutton cloth are just a few examples.

How do you judge how much to use?

Experience and trial and error, of course, but you judge it the same way as other glues, enough for coverage but not so much it is running everywhere. If no glue seeps out when clamped, then perhaps it was a touch light. If a lot comes out, then adjust for next time. As with all woodwork, a tight well-cut joint needs less glue than a joint with gaps.

How thin does the glue need to be for a syringe, and what sort of syringe do you use? I use a 10ml syringe with needles from 0.6mm to 2mm. The level of viscosity depends on the size of syringe needle and is common sense really. If the smallest diameter needle is used, then you will thin the glue and try it, if none comes out then thin it more to get the optimum mix. If a large diameter needle, it needs barely thinning.

Is it best to remove the excess damp or dry?

Either works but it is much easier to use a damp cloth as it negates the need to introduce a blade, and depending on your level of tool control, you may leave damage on the wooden surface. The advantage of this glue is that you can wipe it off and reverse it with damp cloth the next day as opposed to PVAs etc... so best to use a damp cloth. Protein glues will not leave an invisible shadow patch that will show up when surface finishing is carried out.

When you say a hot air gun carefully used can improve open time, what do you mean by carefully? Is that distance, heat or what? Carefully, as depending on the type of gun you have, you may scorch the wood. This again should be common sense to a woodworker as hot air guns are mainly used to strip and bubble paint. A gentle waft with the gun from a distance, changing the setting on the gun to prevent burning is ok. You can waft and then remove the heat source, then put a spare hand on the wood to see how warm it feels, then adjust heat setting and/or distance, and repeat.

This process would sometimes be needed with hide glue but the whole point of fish glue is the long open time, so it is exceedingly rare to have to do this, but the option is there.

In summary careful = distance and heat setting. Please not that if you are restoring, the joint is likely surrounded by polished surfaces so be even more careful than when making a new item.

How long does this glue need to be clamped?

Ideally clamp for 24 hours but I regularly remove clamps after 12 hours without any issues. Welsh stick chairs are assembled with fish glue on my five-day courses, and we glue up the end of day four, and on the morning of day five everything is ready to continue working.

Who makes fish glue? How much does it cost, and what is the best way to buy it? This depends in which country you live. Prices also change and vary across countries. The photo array shows Lee Valley USA, Titebond 'Genuine' Hide Glue and Conservation Resources U.K.

I use Conservation Resources so I can provide a current UK price. They do two sizes: 300g: £13.74 1kg: £31.74 This can be bought easily online from their website conservation-resources.co.uk/products/hi-tack-fish-glue?variant=31117028425797

Finally, does it smell fishy?

No, to me it smells pleasant and a bit sweet. I will post some videos and supplementary images on my Instagram account @cravenconservation over the next few weeks to demonstrate some of the uses of fish glue. These will be hash-tagged #quercusmagazine so please follow both.