A Robot's Guide to:

Bondo

by Steven Meissner
SoloRoboto Industries

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Foreword

Who am I?

My name is Steven Meissner, and I am the artist behind *SoloRoboto Industries*. I've been making things for as long as I can remember, but I've been building props since 2007. In 2009 I made my first piece for a client, and prop-making has been my full time career since 2012. Like you, I'm largely self-taught – every new project is a learning experience that leads to new and better skills, techniques, and methods. And just like you, I LOVE making things.

What is this book?

Everything you're about to read is based on my own personal experience as a professional prop maker, and should be treated as advice, not a set of rules to live by. I've worked hard to put this advice together for you in an accessible, easy-to-read way that makes sense. So please – don't copy it, upload/file share it, or reprint it without my permission. Thank you for buying it!

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Chapter 1 Introduction

What exactly is "bondo"?

Bondo is awesome! It fills holes, imperfections, and dings, can be used to smooth and shape surfaces, and can even be full-on sculpted!

Bondo is actually a brand name for what is more generally called "Body Filler." Body filler was designed for use in auto-body repair, but has a TON of other uses, especially when it comes to making props and costumes.

What does it do?

Body filler is great at MODIFYING things, and especially great at FILLING things. Scratches, dents, holes, concave surfaces. It sticks pretty well to paint primer, scuffed metal, itself, and most things with a rough surface. It carves and sands to an incredible level of detail – it'll shine like glass with enough patience. It evens out surfaces, creates new ones, smoothes textures, and makes rigid shapes. It's great for finishing a surface, especially on something that's going to be molded or that doesn't need to be lightweight.

What doesn't it do?

Body filler isn't great for making things FROM. It's heavy. It's fairly brittle. It doesn't flex well. It doesn't stick well to many plastics, or to anything that has a tendency to flex or bend. It doesn't play well with foam – it will dissolve many kinds. It's smelly, and potentially toxic (always wear a respirator!). Even with the shortcuts I'll show you here, it takes time and patience to make it smooth.

How Does Body Filler Work?

There's some pretty cool science behind body filler, but here's the main thing:

> **It comes in 2 parts – a Filler, and a Hardener. Mix the two together, and the Filler eventually gets hard.**

That's the most fundamental thing. Everything else is just details, although that's where things get interesting!

Details...?

As body filler cures, it gets hot – the more body filler, the greater the heat. Additional heat (and/or sunlight) makes it cure faster. This means that larger batches of body filler actually cure faster than small ones. This is one of many reasons it's smart to work in small batches (at least until you get comfortable). You don't want to mix up a big pile of body filler only to trash half of it because it kicked off before you were done with it!

Useful Terms

Cure – This is the term for what a substance like body filler does. It's more accurate than "harden." Once the two parts are mixed, they begin a chemical reaction. We call this process *curing*, and a fully reacted mixture is said to be *cured*. Why not just say "hard?" Because not all mixtures get hard! Lots of resins and urethanes stay soft or flexible, so hardness doesn't apply. We just use the same term for everything that reacts!

Kick / Kick Off – This is the phrase we use to describe the start of a chemical reaction. When a two part substance like body filler gets mixed, there's a grace period where nothing happens – it stays just as gooey as before the Hardener was added. But there comes a point where the physical properties start to change – the point where we say it has started to kick or kick off. Once a substance kicks, there's no stopping it until it's fully cured.

Chapter 2 Supplies

So you've got the basic idea of what body filler does, doesn't do, and how it works, and you're ready to start actually working! What sorts of tools and supplies are you going to want? Glad you asked!

Materials

Body Filler

Body filler comes in many varieties. The easiest to find is the classic: ***3M's Bondo***. You can get this at basically any hardware store in the United States, or online. This is your starting point. If you've never used body filler before, or if you burn through it by the gallon, this is your go-to stuff.

Other brands, like ***Evercoat***, offer smoother application, fewer air bubbles, and friendlier working times, but at a higher price.

Spot Putty

Sometimes you'll find little pinholes or scratches that body filler is too thick to fill. This is where ***3M Bondo Glazing & Spot Putty*** shines. It's a one-part putty that air dries. It can only be applied about 1/16" thick per layer, but it's softer and sands easier than any body filler. If you're using *Bondo*, you will almost certainly want some *Spot Putty* around.

Tools

Mixing Board

The next thing you need is a place to mix Filler with Hardener. This can be almost anything – scraps of old cardboard or plastic; disposable cups; plastic food container lids; even magazines (these actually work quite well, especially the glossy covers – cured body filler tends to pop right off).

There are a few options that stand out (like these ***Mixing Boards from 3M*** designed specifically for this purpose!), but whatever you choose, you want to be able to move it around easily. I use a scrap of old silicone left over from molding. I personally use a Silicone Pad (see sidebar).

Robot Tip

Some of the best tools are those you make yourself! A perfect example is a silicone mixing pad.

Silicone Pad – When mixing silicone for mold making, there's often a little bit of material left over that doesn't go in the mold. Once that rubber cures it makes for a fantastic mixing board! It's flexible, durable, and everything cleans off easily. I keep a couple of these around for mixing body filler, epoxy glue, and other materials.

Mixing Sticks

You're also going to have to get your Filler out of the can, onto your mixing board, and then mix it with your Hardener, or none of this is going to work (NEVER mix Hardener directly into the can of Filler, you'll ruin the entire can!). Thus the necessity of sticks. For mixing.

You can use ***Paint Sticks***, ***Popsicle Sticks***, ***Coffee Stir Sticks***, ***Plastic Utensils*** (I like spoons), or literally anything else capable of pushing putty around – scraps, cardboard, nails, big chunks of old body filler, whatever! Just remember to keep any Hardener or bits of cured body filler out of the uncured Filler – you don't want to spoil a whole can of Filler by accident!

Spreaders

You also need a way to start shaping Filler into the form you want. Spreaders do just that – they spread body filler (crazy, right?).

Playing Cards are far and away my favorite weapon when working with body filler. Since I'm rarely using body filler to make perfectly flat, square surfaces, the flexibility of playing cards makes them the perfect tool. They can be bent and curved to wrap around or into whatever shape you need. They can be cut into any shape or angle to get into corners or create interesting patterns in your filler. If you want more rigid spreaders, simply glue 2 or more cards together.

When you do want nice, square surfaces, or just the barest bit of curve, you can't go wrong with standard ***Plastic Spreaders*** or the much more durable ***Metal Spreaders*** made specifically for body work.

Those, plus a standard ***Putty Knife*** or two, will cover you for most situations.

Robot Tip

Playing Cards – Since they're wax-coated, they can be held in place on top of body filler to create a smooth surface, and popped off once it cures. Need to make a quick wall to add filler against? Tape some cards in the way, the filler won't stick and you can remove them when you're ready.

Putty Knife – I personally consider a good putty knife an integral part of any prop-making arsenal. I always have a couple these on-hand in different sizes.

Rasps and Files

Most of these are going to be useful primarily for shaping your body filler once it's fully cured, and you're going to want a variety of shapes and sizes. ***Surform Files*** / ***Multiraps***, however, are worth mentioning specifically. They are hands-down the most useful shaping tool for working with body filler that you can possibly own. If you only buy one thing for body filler work, make it one of these. I'll explain why these are so awesome later, in ***Chapter 3 Technique***.

Sandpaper

Typically paper covered in sand, this comes in abrasive "grits" ranging from 60 to 2500. The higher the number, the finer the abrasive, and the smoother the surface. ***60-80 grit*** is good for rough shapes; ***120-150 grit*** for refining shapes; ***220-320 grit*** for finish sanding and paint preparation. When working with body filler directly, you don't need to worry about anything over 220 grit.

Safety Gear

Respirator

Body filler is toxic; both the fumes it makes before it cures and the dust it kicks up when you shape it can damage your lungs and respiratory system. I like this ***3M Half Face Respirator***, paired with ***60926 Multi Gas Cartridges*** to ensure proper safety when working with this stuff. Whatever you use, the most important thing is to make sure it fits.

Rubber Gloves

Body Filler is sticky stuff, especially before it cures. You will get it on your hands at some point, no matter how careful you are. Wearing ***Nitrile Gloves*** protects you from absorbing any dangerous chemicals through your skin. Plus, they keep your hands clean so you don't have to scrub the body filler off later.

Chapter 3 Technique

You know what body filler is, how it works, and you've got your supplies. Now it's time to start using the stuff! The basic method is simple:

> **Put on more body filler than you need, then sand it down to where you want it.**

It's nearly impossible to build body filler UP until it's perfect; it's far easier to sand it DOWN until it's smooth. The tricks lie in not using too much filler, and how you apply it.

Mixing Body Filler

Every can of body filler comes with instructions on what the correct ratio of Hardener to Filler is. That's always the best place to start! Most cans of body filler also come with enough Hardener to get you through the whole can – usually one tube of Hardener per can of Filler.

Estimate how much Filler you need for the surface you're working on. Remember, it's better to put on too little than to put on too much – it takes a LOT less work to add more body filler later than it does to sand it off. Remember also that the more Filler you use, the faster it kicks, giving you even less time to get things right.

Robot Tip

Hardener is always a different color than Filler. This makes it easy to see when things are mixed properly. It also means that once you find a ratio of Hardener to Filler that you like, you can just mix to that color every time!

For big batches, I dispense the Hardener ACROSS the pile of Filler – it makes it easier to mix. For small batches, I dispense the Hardener NEXT TO the Filler – small doses of Hardener don't stick to Filler very well, but they stick to the mixing board fine.

Using a CLEAN mixing stick, scoop as much Filler as you think you'll need onto your Mixing Board.

Next, squeeze an appropriate amount of Hardener onto your Mixing Board as well.

Using a mixing stick, mix the Filler with the Hardener until everything is a uniform color. Scrape the Mixing Board while mixing to ensure there's no unmixed Filler.

Applying Body Filler

Now that your Body Filler is mixed, it's time to start spreading it! Keep in mind that once you start mixing Filler and Hardener, there is a finite amount of time before it starts to get hard and you can't spread it any more.

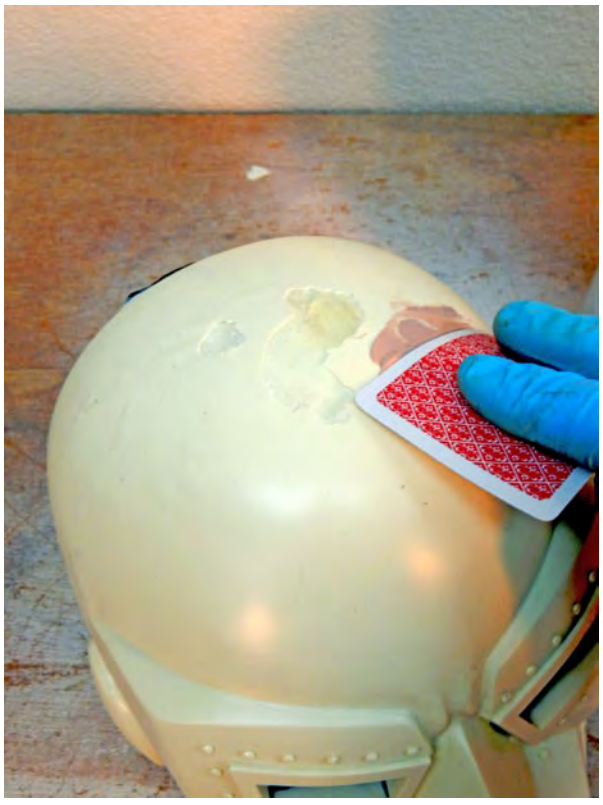
When applying body filler it's always best to work in small batches, or layers. It might seem like adding many small layers is more work than one big one, but it's isn't. It's MUCH EASIER to work in multiple layers than to try and do it all at once. And it takes a LOT LESS work to add more layers than to grind down big ones.

Robot Tip

Spreaders – Fit the Spreader to your desired surface. Need a very flat surface? Pick a Spreader with hard, clean edges. Need a curved surface? Pick a Spreader that will bend to the shape you want. Filling holes or gouges? Pick a Spreader that is stiff enough to push Filler into the gaps.

Always try to make your top layer smooth. Every ridge, bump, and extra chunk will need to be ground down once the body filler is hard. The fewer lumps you leave, the less work you have to do!

Using your Mixing Stick or Spreader of choice, move some body filler onto your project.



Then start spreading it to the shape you want. DON'T RUSH. The key is to work quickly and with focus, but not make a mess.

While you need to apply enough body filler that it can be sanded down, this does NOT mean you should go crazy! The goal is to get as close to perfect as possible, without going under. That's why it's much better to work in small batches.

Body Filler Stages

As body filler cures, it goes through several stages.

Frosting → Peanut Butter → Sand → Cheese → Hard

It starts out gooey, like frosting. This is usually the easiest to work with.

As it cures, body filler will start to heat up and get more stiff, moving from a smooth, frosting-like consistency to a slightly stiff, peanut butter-like one. It's still possible to shape it at this stage, though it's less sticky and pliable.

Next it will start to harden and become grainy, like damp sand or hard, crumbly cheese. Once this happens, you have to STOP. It's unusable at this point, and anything you do will just create more work later.

Finally, it will start to get truly hard. It will pass from a hard cheese-like state, to a fully cured, almost plaster-like final stage. The cheese-like stage is the most important of all.

Chapter 4 Shaping

When body filler reaches the cheese-like stage is when it's easiest to shape. This is the part most people never learn about, and the one that will save you the most time and energy!

Shaping Between Layers

Following this process (and repeading as necessary) ensures you never have to grind down huge chunks of body filler, re-fill ugly air pockets, or work up a sweat just to get a basic shape done. Plus, you'll be 90% of the way done before you even pick up a piece of sandpaper!

A ***Surform File*** will save you TONS of time and effort here.

Glide your file or rasp over the body filler, and the high points and ridges will quickly disappear.

Robot Tip

As you grind down the high points of your body filler, it will become clear where you need to add more. Any spot that has NOT been touched by your tools is a low spot, and will need more filler!

As the body filler cures and gets harder, each pass of your tools will require more effort. The more shaping you can do at this stage, the easier your life will be!

Once you've taken off as much body filler as you can without making new low spots, STOP! It's time to mix up some more body filler and add a new layer.

Cleaning Your Tools

This is also the stage at which you want to clean your tools and Mixing Sticks.

A putty knife or razor blade will easily shave the majority of the mostly-cured body filler off, and a few more quick passes to clean off any remainder will leave your tools ready for the next round of mixing and applying.

Robot Tip

Keeping your tools clean during the cheese-stage requires far less effort than cleaning them off once body filler is fully cured. Plus, if you are diligent with cleaning your tools between passes, you can easily reuse the same mixing sticks a dozen times or more!

Sanding and Final Shaping

You may need to repeat the shaping process quite a few times. Sometimes your plan will change as you add and remove body filler – that's OK! Eventually you'll have a shape you're happy with. When you do, it's time to start sanding.

Start with your Surform Files and heavy rasps, taking off the biggest high points, just like you did before.

I like to use FLAT files to make CONVEX curves, and ROUND files to make CONCAVE curves.

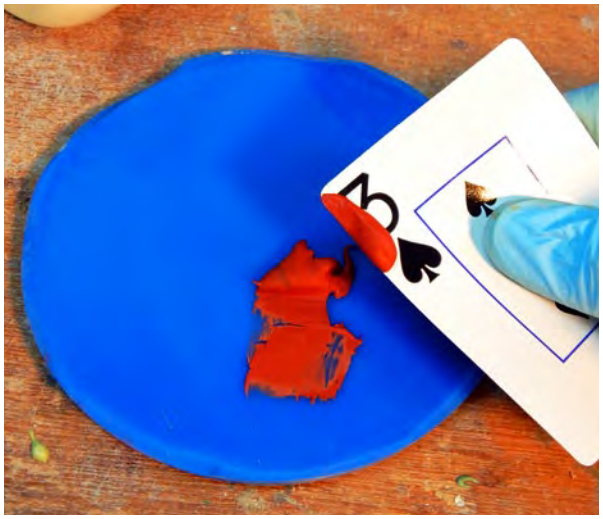
Robot Tip

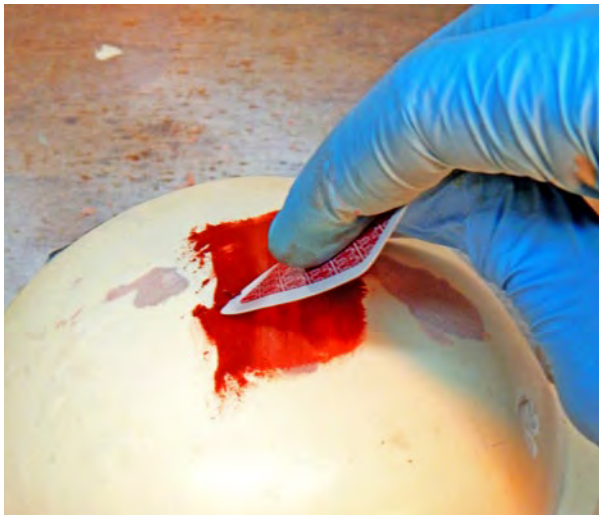
Body filler that is still soft will quickly clog raps and files.

A *File-Cleaner* will clear them out, but it's usually faster to let the body filler get past the cheese-state before using fine-grit tools. When your tools make dust, and not grainy chunks, then the body filler is easiest to sand.

Once your basic shape is done, AND the body filler is fully hard, move on to smoother files and rough sandpaper. The goal is to gradually refine your shape. Start with very low grit (60 or 80), and work your way up. I progress from 80, to 120, to 220. You should be done shaping before you move on to 220 grit sandpaper – 220 is for making your surface smooth.

At this point, you might find some pinholes from air bubbles, or some remaining scratches you don't want to sand out. This is where ***Spot Putty*** comes in handy.





Skim a very thin layer of Spot Putty over the problems using a Spreader.

Let it dry (it will change from dark red to a lighter, ashy color when it's dry), and sand it smooth using 120 or 220 grit sandpaper.

If you sand things too much, and want to bring an area back up again, no problem! Just dust the area off and add some more body filler!

Final Thoughts

When your body filler is smooth, you're free to move on to the next stage of your project, whatever it might be!

If you found this guide helpful (and I hope you did!), then you'll want to pick up my next book, ***A Robot's Guide to Sanding***, when it comes out! Also keep your eyes peeled for future ***Robot's Guide*** books, where I'll provide even more tips and tricks!

And please feel free to send my any feedback you might have – people like you are the reason I'm able to make cool things for a living.

THANK YOU!