## TROUBLESHOOTING

Over the past year, so many of you have been kind enough to write to me and ask for help with issues, instead of just tossing the book in the donation bin. To start troubleshooting, it helps to apply a rough version of the scientific method you learned in middle school. Isolate your variables and address each issue individually. There are seven main factors that affect the outcome:

## QUARK

Quark is rarely the main issue, but getting commercial quark, such as farmer's cheese, will eliminate this variable if you're having challenges.

## LIME

Lime is occasionally the source of issues. The easiest way to test this is to get a packet of Cal Mexicana to see if your lime is the issue. Keep every other variable the same and try the Cal Mexicana instead of your original lime.

## PIGMENT

Pigments tend to introduce the most variability between batches for an individual person. Make sure you have at least one iron oxide red – this is almost impossible to get wrong, so it will help you isolate if other factors are the issue.

## WATER

Tap water should always work fine, but if you're worried about your weird water, just get a bottle of cheap drinking water.

### TECHNIQUE

If the paint itself looks good, you might have just applied too thickly or quickly. Thick paint drawn out thinly on the wood should always work.

### SURFACE PREP

Consistent surface prep helps avoid mystery issues. Sand everything with a few passes of #120 grit like you're trying to remove a light pencil mark.

### TIME

If all else fails, try just giving each coat twice as much time waiting. You'll be able to speed up with experience.

Now let's look at common and uncommon issues that have popped up and how to resolve them.

### GRITTY PAINT

If your finished paint feels like high-grit sandpaper, don't worry. Certain pigments tend to bring out a little more mineral texture. The good news is it knocks down in seconds with a light burnishing. Just rub it with your burnisher of choice and it'll go from feeling like emery to smooth as ivory. Follow with a damp cloth to remove any chalky residue. You can also rely on your topcoat to soften the feel somewhat.

If you are running into very coarse grit in your paint, your lime may be the issue. Certain brands of lime may have overcooked or "dead-burned" particles, resulting in hard grit that will not rehydrate, no matter how long you soak it in water.

Another culprit is titanium white pigment. Titanium white

tends to have hard clumps, so it should be slaked and strained before adding to paint. Decanting the paint to a new jar after a short rest also helps.

If you get small clear pearls in your paint, this can be from the quark, especially after freezing. Filter them with a strainer and you're fine. In general, straining your paint is one way to address grit, but it's better to prevent grit beforehand than trying to filter it out.

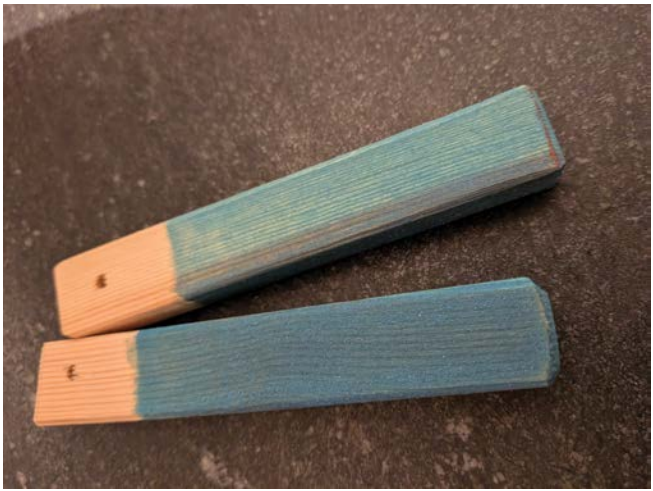
### LOW QUARK YIELD

If you consistently get less than 250 grams of homemade quark from 2 quarts of milk + 2/3 cup vinegar, move on to another brand of milk. If the milk explicitly says "ultra-pasteurized" on the label, avoid it.

Waiting more than 10 minutes can slightly help, but I find it's almost always the milk at fault. Also make sure your vinegar is at 5 percent acidity, which is standard for distilled white vinegar. Insufficient acidity reduces quark yield.

### LIME GETS HOT

Uh oh, that's not supposed to happen. Sounds like someone found quicklime. Or at least hydrated lime that wasn't fully slaked. Quicklime can slake in air, but it really accelerates on contact with water. Any temperature changes, even a single degree, indicate the exothermic reaction of calcium oxide-to-calcium hydroxide reaction is occurring. Be aware, true quicklime will give off massive amounts of heat on contact with water, so slaking at home is not advised. If it's supposed to be calcium hydroxide and only gives off a little heat, you can try slaking in water for a few days, but you would be best to find a new source of lime.



*Isolate each variable and test your options. India blue is a weak pigment; adding closer to 40 grams of pigment helps speed up opacity, but this still needs another coat.*

### PAINT GETS HOT

That's probably the lime issue mentioned above unless your iron oxide pigment is sold next to the camo gloves at Fleet Farm. If you're blending too long, this can also warm the paint up. Don't do that.

### PAINT TOO THICK

You want thick paint, but you shouldn't be spreading peanut butter. If you're getting carpal tunnel syndrome from painting, thin with water. Don't go too thin – it's easy to add water, but it's tough to take out.

If your paint keeps thickening over time despite frequent

thinning, it could be a delayed absorption of water by your lime. Calcitic lime, such as Cal Mexicana, is especially prone to this. Try soaking your lime for a few hours beforehand. The same goes for absorbent natural pigments such as ochre.

The size of your container also has an effect – a gallon ice cream pail has a high amount of paint-to-air surface area for the paint to dry before even being applied.

If your paint is going completely solid within minutes, this could be from blending for too long. Air whipped into the paint speeds up curing time, which results in your paint going solid. Reduce your blend time to short pulses. You're not trying to drown a pearl diver.

### PAINT TOO THIN

If you made a batch of watery paint, it's going to be annoying to use. You will need many coats and will be frustrated. One option is to let it rest for several hours or overnight in the fridge. You'll get at least some thickening over time. But sometimes it's better to just cut your losses and make a new batch of paint or make a second batch extra thick and combine the two.

### FIRST COAT LOOKS BAD

Really? Just bad? It's supposed to look terrible. Keep going with coats at an appropriate pace until it looks not bad. Then go with one more to reach good. Enough coats of paint will eventually give solid coverage.

### PAINT FLAKING OFF

The most common cause of paint flaking off a few hours after drying is that the bond has failed from too much water, causing

wet lift. Synthetic pigments are especially prone to this. There's not much you can do to repair it; the bond failed. You'll need to sand back down to bare wood.

To prevent this, slow down with your coats, and if you are using a synthetic color that needs more coats, consider doing it in two-half batches: three to four coats the first day, and the remaining coats the second day.

If it is flaking off only in very specific places, this could be more caused by surface prep. Old finish, dried glue or burnished wood are all difficult to bond to. Locally sand back to bare wood and follow up with a few spot coats to correct or just call it character and ignore.

### PAINT CRACKING

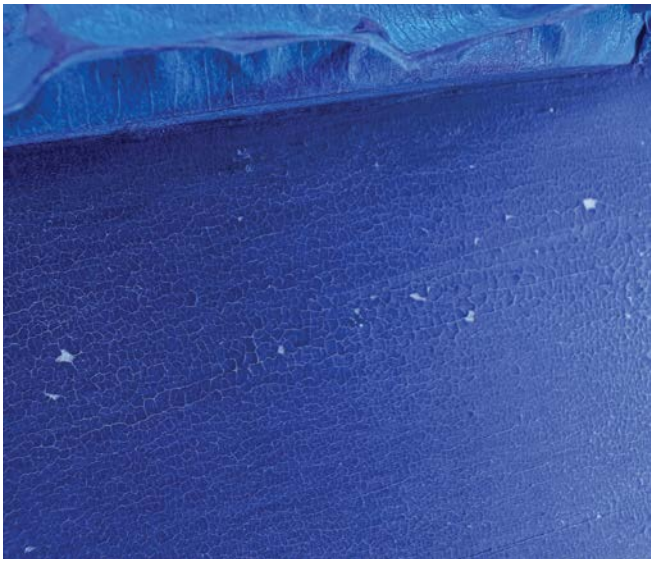
If your paint went on beautifully smooth, but develops cracks like a dried mud puddle, you're looking at "crazing." Crazing happens when paint is applied too thickly (in terms of volume, not consistency) or dries too quickly. High temps and low humidity can contribute to this, but most often the cause is too much paint on the wood. It can also happen if the next coat is applied before the last coat has fully dried.

The bond itself isn't necessarily failing, but the hairline cracks can be unsightly up close. You can sand lightly and cover with another coat. Or just live with it.

To prevent crazing, avoid the temptation to apply too much paint or to move on the next coat too soon. You will find this hard – painting is actually fun and you will want to keep at it.



*The first coat always looks questionable. Do not go into a panic spiral.*



*Significant crazing, together with wet lift flaking, caused by paint with a hydrophobic pigment being applied before previous coat fully dried. Photo by Jonathon Hammack.*

## WOOD TURNS DARK BROWN

Oh, yeah, it'll do that sometimes. The pH of the paint can react with the tannins in certain woods, causing a rapid darkening similar to ammonia fuming. Additionally, iron-based pigments may also react with the tannins in oak and other woods, causing an ebonizing reaction.

The good news/bad news is that this interesting effect usually only affects the first coat. Once we're working paint on paint in subsequent coats, the reactions are covered up. Or you can use

this effect to your advantage and use this faux-mmonia fuming as your intended finished look.

This also makes the paint much darker, so if you tested spruce but are painting oak, it will look much different. After the first few coats, you're working paint on paint, so the differences will even out. This means a mixed-species project should not be an issue.

### LOOKS DIFFERENT THAN TEST BOARD

Using the same species of wood for test boards and your furniture avoids surprises like tannin reactions. Surface prep can occasionally also be an issue – make sure the test boards get similar treatment to the project. And make sure the paint really is the same – same thickness, same batch, well-stirred, etc. If it's a new batch of paint, a new test board is a good idea, even if the pigment ratios are the same.

### PAINT NOT COVERING

Every pigment has different characteristics. Natural green earths and synthetic blues often have very translucent first coats. You may get four to five coats while still having very poor coloring power. Keep going. It will snap into place eventually. Full opaque coverage will appear rather suddenly with sufficient coats. This is also why a test board is so important – you do not want to learn this on a chest you made at 1 a.m.

To avoid weak coverage from light blue pigments, I find it's much easier to lighten a dark blue pigment with a titanium white tint. Instead of transparent base plus transparent blue, you've got opaque white and a stronger blue. This gives strong coverage from the titanium white, while achieving the light blue result.



*The lime in the milk paint base will instantly darken oak and other woods with tannins. You can apply an unpigmented paint to "fume" these woods without any noxious odors.*

If your normally strong pigment, like a natural red, looks weak after multiple coats, you may have thinned your paint too much. Or double-check your scale for calibration errors.

### PAINT COVERS TOO MUCH

If you want a translucent wash effect but your rich iron oxide is giving "one and done" coverage, you can reduce the total amount of pigment in the paint. This is more effective than thinning the paint with water. You can also start with a priming coat of paint base with zero pigment in it to help seal up the grain and enable more consistent absorption of pigment in the second coat.

### BLEND DOESN'T CHANGE COLOR

Certain pigments have much stronger coloring power and will overwhelm other pigments in the mix. Red plus blue sometimes stays fairly red. Especially past the ~30 gram saturation point, the color will be "stuck." You can't just keep adding blue to try to correct it.

This is where it helps to mix separate colors in smaller batches then combine slowly, instead of oversaturating the main paint. You might end up with a little leftover of one color, but better this than a murky mess.

### TINTED PAINT TURNS WHITE WITH BRUSHSTROKE

Titanium white is a strong pigment. It also has a fun trick, where you add it to a colorful paint and you don't notice much change. So, you keep going and add a few more grams. Then when you go to brush it on, the paint is basically white with a hint of your original color. The white was hiding until you forced it out with the brush.

To prevent this, mix up a small amount of white paint and mix it into your main color, instead of mixing only the white pigment directly into the main color. This should cause the paint to change color more reliably as you mix.

### COLOR SHIFTS WHILE APPLYING

A blend of pigments is a suspension of particles of different densities. So, what starts as slate green may shift toward olive as your dense blues settle and everything shifts toward yellow-green.

Keep stirring to prevent. This may be necessary every few minutes. Stir by hand or with a milk frother. Do not re-blend

each time. Thin paint is also more susceptible to pigment settling because it does not hold the pigment as well.

### COLOR CHANGES RAPIDLY

If your paint immediately starts fading or changing colors, you most likely have a non-lime-compatible pigment. Milori blue (Prussian blue) is a common example. You can save the guilty pigment for making oil paint.

### COLOR CHANGES WITH TOPCOAT

This should be expected to some degree with any topcoat. Sometimes it is very minor, while other times it is more pronounced. A test board reduces surprises. The effect also usually softens as the topcoat dries. Certain blue-green pigment blends are especially prone to a green shift with a topcoat. Cheating them with extra blue-blue in the original paint mix can help to compensate.

### COLOR CHANGES BETWEEN BATCHES

It's nearly impossible to get absolutely dead-on color matches between batches. But if you use a sub-gram sensitive scale, a fine hand and take good notes, you should get to the point where the human eye can't tell the difference between where one batch ended and another starts.

If you are getting significant inconsistencies, check your scale. Digital scales are vulnerable to damage and going out of alignment. Weighing water is a good way to check the calibration, as 1 milliliter equals 1 gram.

### TEDIOUS TO APPLY MULTIPLE COATS

No, it's not. You're taking this too seriously. Move quickly and easily. Listen to something entertaining and let your mind wander. Any mistakes can be covered with the next coat. Split bigger projects into half batches over two days.

### EDGES CHIPPING

Nothing sticks to a sharp edge. And your paint may cure into Easter egg cement, but you can still chip cement with a frying pan. Break those edges thoroughly with sandpaper beforehand. The wider the chamfer, the easier for paint to hold. Or, for long-term durability, preempt the tribulations of life by planing away a light chamfer after painting. This bare wood bumper does a good job of taking the worst of the corner impacts.



*This table has seen rough years at the ice rink, but it's never looked better. Thanks to a bare wood chamfer, the chip carving with skates had minimal effect. The light haze is commercial hard wax finish failing after excessive standing water and/or Glühwein exposure. The paint beneath remains well bonded.*