

# Hoist the Colors

## Pattern Interaction

by Lesli Kathman

A few years ago, when giving a presentation on horse color, I used the term “pattern hierarchy” to describe what happened when a horse inherited two or more patterns. Often the genetic instructions from one pattern conflict with those of a second pattern. For instance, the gene for the frame pattern dictates that the horse should have dark legs, while tobiano calls for white on all four legs. In that situation, would the legs be white, dark or some combination of both? Pattern hierarchy seemed to be a good term for the rules that governed which instructions took precedence.

In presenting things this way, I was trying to dispel the idea that white patterns simply layered one on top of another. It is easy enough for an artist, especially an artist working in most traditional mediums, to approach white patterns in this way. It is often how patterns are painted, with white added over the top of the body color. I felt it was important that artists understand that while patterns can layer in this way, their relationships were not strictly additive. Sometimes the genetic instructions not to add white in a given area had priority. An extreme, mostly-white sabino that inherited the frame gene might have a completely dark topline, because the prohibition against white on the topline was stronger.

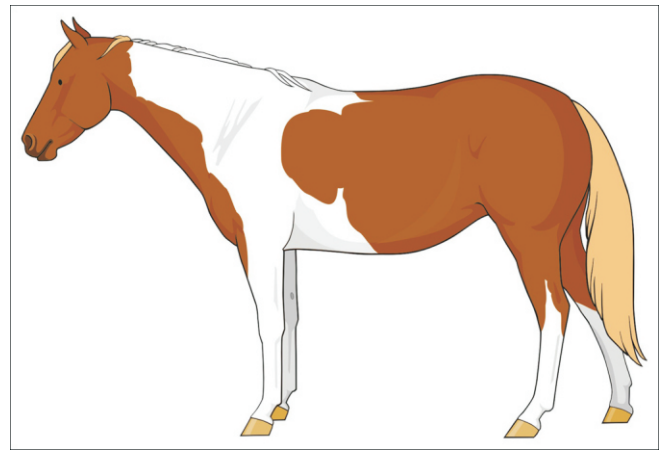
But my own observations tell me, and recent genetic studies certainly confirm, that the situation is a bit more complex. What I called pattern hierarchy might more accurately be called pattern interaction. It is true that sometimes that interaction boils down to a simple hierarchy; the white leg rule for tobianos pretty much overrules any instructions about leg color from the other patterns. But sometimes one set does not take precedence, and instead the instructions for one pattern are subtly altered by another. In the next few columns, I'd like to expand on this idea. But for this, the first one, I'd like to use a common example of how pattern interaction can work.

### **Tobiano and Sabino**

Of the various pattern combinations, tobiano paired with sabino is probably among the most common. In fact, it

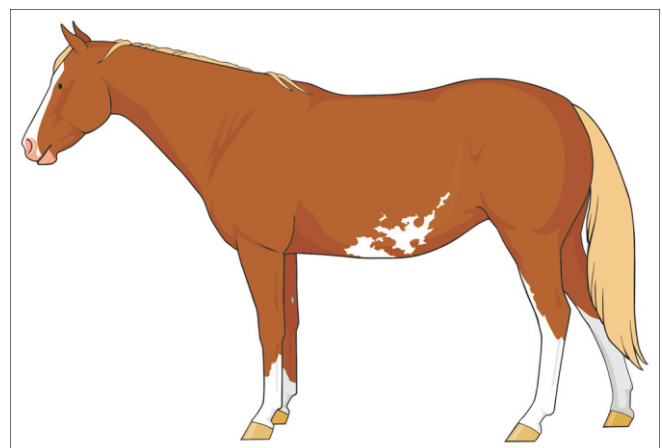
can be pretty difficult to find tobianos who are not also carrying some form of sabino. Most light breeds, and almost all New World breeds, carry sabino to some degree. It is therefore easy to study the I interaction of the two patterns because there are so many examples.

*Tobiano:* This horse is a pretty good example of what tobiano looks like when no other patterns are present.



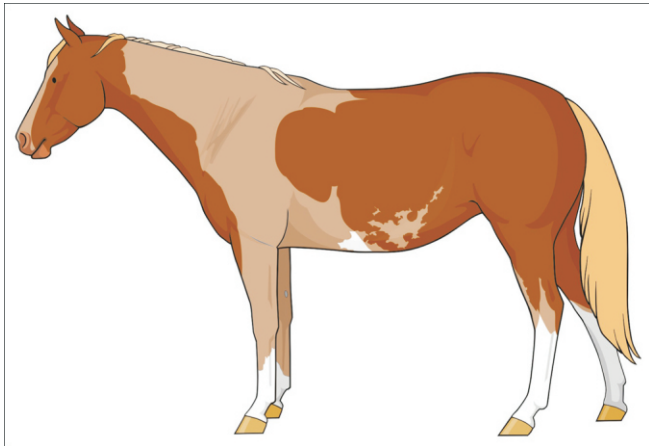
The face and chest are dark, as are the hindquarters. The edges are smooth, and while they do not form perfect circles, they do suggest large, rounded shapes. Notice also that there is no visible face white. Tobiano alone does not add white to the face, so without one of the patterns that does, the face will be solid or nearly so.

*Sabino:* This horse shows a fairly common form of the sabino pattern, also without another pattern present.

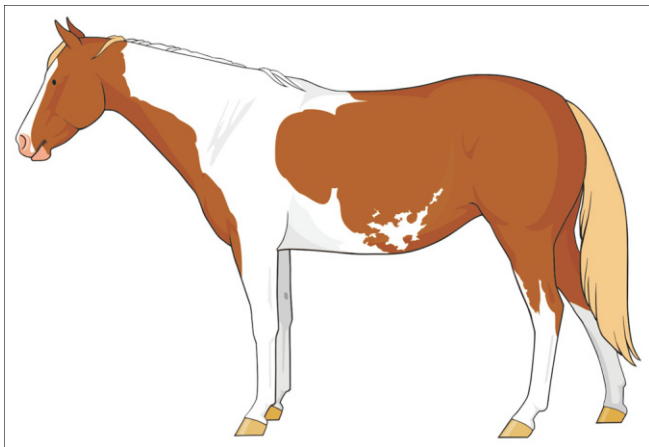


Unlike tobiano, which has a pretty consistent look in its pure form, sabino has a wide range of expression. Nonetheless, the blaze extending over the lips and chin, white on the belly, stockings that rise in the front of the leg and ragged edges are all typical for sabino.

Here is a partial overlay of the two patterns.



Which, painted one on the top of the other, would result in a horse that looked like this.



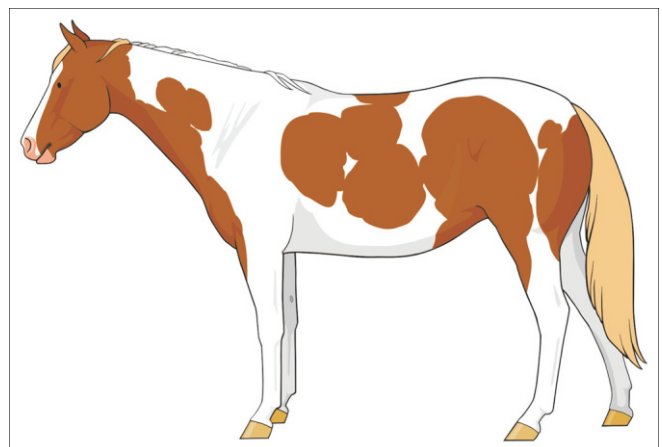
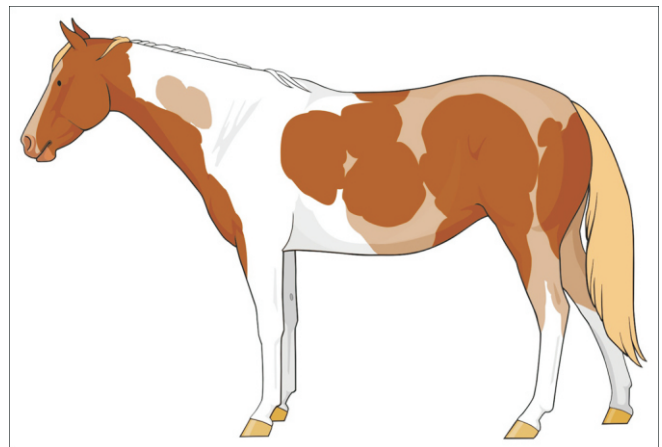
Notice the conflicting instructions for the white on the closest hind leg. The tobiano pattern has white travelling up the broad side of the upper leg, as is more typical for that pattern. Sabino, meanwhile, has the white moving up the front edge of the leg.

If patterns behaved as simple overlays, this is how a combination of these two patterns should look. And if patterns had a simple hierarchical relationship – if accurately portraying combinations was just about resolving conflicting instructions - all we would need to know is which version of that leg white might “win out”. Should we paint the white to the front, or to the side?

The problem with this approach is that it assumes the two patterns remain discreet, separate from one another. What actually happens is that sabino will subtly alter the original tobiano pattern. Tobiano is still going to predominate, of course. In the simpler, hierarchical view of pattern combinations, tobiano can be considered “king”. Whatever else is inherited, horses with the tobiano gene almost always retain a strong suggestion of the pattern. But the effect of the sabino gene will be visible.

### The Sabino Influence – Spot Frequency

Here is one version of how the two patterns might interact.



Here the sabino pattern has added white to the face, but has also broken the original tobiano pattern into smaller pieces. The pattern still retains a great deal of tobiano character with the rounded spots, but there are more of them and they are smaller.

This type of interaction is visible on this horse.



Sabino has taken the areas of the tobiano pattern that should be dark, and made them both smaller and more numerous. Sabino often influences other patterns in this way. Appaloosas with the sabino gene also show smaller, denser spotting than appaloosas without it.

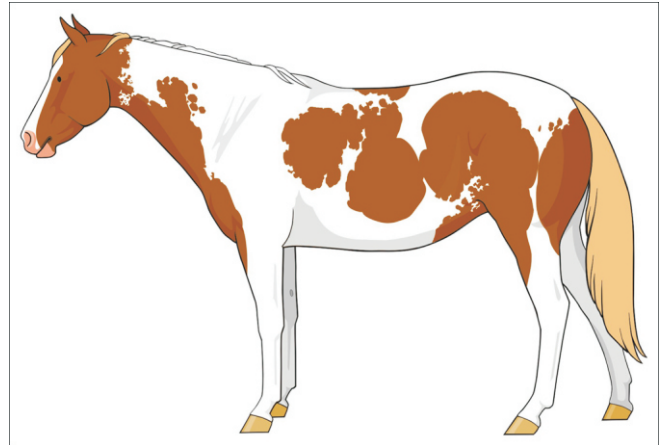


Reducing size and increasing frequency of spotting is probably the most consistent feature of sabino influence. To get a better sense of this, assemble a set of tobiano Paint Horse references, and group them into two piles – horses with face white, and horses with nothing more than a small star or snip. Comparing the two groups, the patterns with the sabino influence should appear more complex, with the dark areas more broken up than those without it. (Obviously there are other patterns that put white on the face, but for that breed the numbers are in your favor that most face-marked horses carry some form of sabino.)

### **The Sabino Influence – Lacing the Edges**

The other thing that sabino tends to do when paired with another pattern is lace the edges of the existing pattern.

Here is how that might look.



The tobiano pattern is still plainly visible, but the edges have become ragged and irregular. Looking carefully, it's obvious that this isn't an overlay of a loud sabino pattern because the irregular areas are concentrated along the edge of what would be a tobiano pattern, instead of the areas associated with sabino.

Here is a horse with this type of sabino influence.



Notice that while he does have lacey markings along the girth – something you could expect on a sabino – the primary direction is upward toward the withers, following the line his tobiano pattern might take. Meanwhile, there is almost no white under that front armpit or along the belly, which would be the most likely place to look for white on a purely sabino horse. So the sabino instruction to “add lacey white” has been redirected to follow the pattern edges laid out by the tobiano gene.

This is something not only seen when sabino is paired with tobiano, but other patterns as well. This horse is most likely carrying sabino and frame.



The softened, roany look to the marking on her side is very typical of sabino, yet all four legs are unmarked. Although not as obvious in this picture, the marking did not extend under the belly either. The appearance is that of a purely frame pattern with just the outline altered.

### Polygenic Traits

The type of influence sabino has on a tobiano pattern (or any other pattern, for that matter) varies a lot from individual to individual. Sometimes the only clue will be the white on the face, or perhaps a slightly more complex distribution of dark patches. In other cases, there can be enough breaking apart and roaning of the original pattern that it can be hard to see that tobiano is present. Even on the same horse, areas can display different effects to different degrees.

Here is another sabino-tobiano where the pattern edges vary a great deal from one part of the horse to the next.



The dark areas on his face and neck have a scalloped quality to them, as if the edges were made by numerous ovals layered over one another.



In contrast, the hindquarters have a smaller-scale, lacey edge. Even within this area, parts of the pattern have pronounced haloing, while other areas are not mapped at all.



Looking at these two pictures side-by-side, it's hard to imagine they come from the same horse. And yet they not only appear on the same side of one horse, we attribute them to the same pattern – sabino.

One of the things that contributes to this broad range of expression is that what we think of a one pattern – 'sabino' – is actually a group of genes. This explains why sabinos vary more than any other pinto; the term is actually a catch-all for what may be many pattern genes. Researchers have not yet found the key to this particular puzzle. At the moment there are two identified genes ("Sabino 1" and "Dominant White") that result in horses that look sabino; they result in strikingly similar horses, as a matter of fact. Yet the two genes aren't even in the same location. What's more, very few visually sabino

horses test as having either of those genes. It is likely then that there are many genes involved. This is why sabino-tobianos can look so different from one another. Still, the end result of the combination of the two patterns comes down to 1) the breaking down of the dark areas into smaller pieces and 2) the disruption of the edges (either lacing, roaning, scalloping, ragging or some combination thereof).

### **Why This Matters**

So why would an artist need to know such obscure genetic information? The answer is that we painters tend

to like the more “broken” versions of the tobiano pattern. The more complex patterns created by combining two or more patterns are often more visually interesting. Knowing just how the different patterns interact gives an artist more options not only in pursuit of interesting patterns, but also when trying to direct the eye towards (or away from!) aspects of the underlying sculpture, all without losing the impression of realism.