little red hiding good

Anyone who has applied an oil-based varnish to timber knows that it goes on as a, more or less, transparent amber liquid and stays that way throughout the drying process until the solid film is formed. Waterborne acrylic varnishes behave very differently however. These materials, both in the can and on application, are distinctly white milky liquids which, initially, obliterate significant amounts of the timber grain. On drying, this 'wet' opacity is lost and a clear film results.

The reason for this is straightforward* but the purpose of the example is to illustrate the differences between 'wet' and 'dry' hiding. This difference still exists when pigments are added to these varnishes to make paints. An oil-based, solventborne white enamel will behave in the same way the varnish does, that is, there will be little change to opacity during the drying process. This is pretty reassuring when one is painting as, if one's application looks pretty good in the wet state, one can be pretty sure that it will look fine when it dries.

An equivalent paint based on a waterborne system, however, contains the same 'temporary' hiding that our acrylic varnish has which, again, is lost on drying. This phenomenon (plus some almost inevitable flocculation of the white pigment) leads to a significant loss in hiding during the drying process. Application which seems to be satisfactory from a hiding perspective can disappoint when the job dries.

The same phenomenon affects colour depth between wet and dry. Again, with solventborne, oil-based enamels, what you see is, pretty much, what you get. With waterborne systems, however, that transient 'milkiness' present in the wet resin always makes the wet colour look paler than when the film dries fully.

There is an exception to the above and this is when paints are specifically designed to have air voids in the dried paint film. Air voids, just like the foam on a glass of D.B. Export Dry, can have an opacifying effect. Typically, air voids reduce the strength of the film so this strategy is mostly used in ceiling paints. As the air voids are full of water during the wet state, they do not contribute to any 'wet' hiding. However, as the film dries, water evaporates out of these voids and extra 'dry' hiding develops as air fills these voids. Any colour shade also 'lightens' during the drying of such paints.

This leads me, tenuously I'll admit, to the relative hiding power of colours.

Let us firstly look at the widespread notion that white paints, tinted to pale yellow shades, actually lose hiding power. We have investigated such propositions (complaints) thousands (well hundreds) of times and have never been able to confirm this. Our test is to apply paints, at a standard film thickness, over a black and white test card and measure any differences over the two areas. Although your scribe, bending over backwards with head almost touching floor, could argue a possible logic to the anecdotal stories, on balance they are probably best filed under 'Urban Legend'.

What is absolutely certain, however, is that certain coloured pigments have inherently lower hiding power than others. Lead chromates can produce brilliant shades of strong, bright yellow with hiding power as good as, or even better than, a good quality white. Lead chromate can be matched for shade by, for example, Hansa yellow. The obliteration, however, is abysmal. Apply it over a pure white background and the colour will look stunning – apply it over a black background and the colour will appear, well, black!

The hiding power of pigments is determined by two factors which influence how the pigments interact with light. The first of these factors is particle size, which can be manipulated by the pigment manufacturer but the second factor, refractive index, is absolutely inherent in the pigment and cannot be altered. If the refractive index of the pigment is close to that of the binder, light passes through it as if it were not there. Massively increasing the levels of such a pigment will have little effect on the hiding.

There is another property of pigments, which affects the depth and opacity of colour. This is tinting strength. Tinting strength means the amount that the pigment can be 'diluted' with other, high hiding pigments with little loss of their colour purity. Phthalocyanine blue is such a pigment which, while quite transparent in itself, can produce deep hues even in the presence of significant amounts of high hiding, titanium dioxide.

While the search for new brilliant, high opacity chromophores continues, it would be fair to paraphrase the old 'Speights' ad "She's a hard road finding the perfect colour pigment but!"

*Acrylic emulsions are suspensions of sub-micron, plastic particles suspended in water. The refractive index of the particle is higher than that of the water it is suspended in and hence interferes with light passing through it – appearing milky. As the water disappears via drying, the 'difference' then disappears and the acrylic achieves its own transparency.