ARCHITECTS MEMO
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urban legend
old painter tales or tricky physics?

Sporadically we get complaints from the field that a pale shade, tinted from white, has significantly poorer hiding power than expected. Every complaint has been faithfully investigated, even though we have never been able to find justification for the complaints.

The complaints always intrigue us because there is part of painting folklore which maintains that pale yellows and pinks always have poor hiding. Hard facts are ephemeral and we tended to greet the assertion with a disdainful "Yeah!" Nonetheless, the residual shrunken kernel of technical curiosity remaining in this hoary technical director couldn't quite dismiss this 'out of hand'.

You see, there is a possible rationale to this piece of inherited knowledge.

Titanium dioxide, which is the most important 'white' pigment, also has the highest known refractive index (R.I.) of any colourless material. Measured at 592nm wavelength light, it comes in at 2.73. Diamond is 2.42 and glass is around 1.5. For most materials the R.I. measured for purple/blue light differs only slightly from the R.I. measured for red light (the longest wavelength) – just sufficient dispersion to provide us with nice rainbows and prismatic effects.

Titanium dioxide is very different – the difference in R.I.s between purple/blue light and red light is massive. Imagine the spectrum produced by shining light through an equilateral glass prism. Change the material of the prism from glass to TiO2 and the spectrum is over five times broader!

You must surely, by now, be wondering where on earth I am going with this. The point that I am (rather clumsily) trying to make is that purple/blue light is exceptionally interactive with TiO2 and very efficient at being refracted out of a TiO2 pigmented film. Red light, on the other hand, with fewer interactions, is more likely to penetrate right through to the substrate and then be reflected back to the observer – giving the appearance of poor hiding.

So! The thought experiment now goes thus: if one reduces the amount of blue light by adding a red tinter (blue light absorbing), is the effect on hiding positive (by absorbing purple/blue wavelengths) or negative (by removing very efficient blue wave refraction)?

Very careful laboratory experiments seemed to indicate that we could induce a loss of hiding power by the incorporation of specific amounts and types of red and yellow tinters and increase the hiding by the addition of purple and blue ones.

So! Had we provided the scientific basis for the old wives tale? Well yeah/nah!

We decided to test our hypothesis and experimental evidence against what had happened in practice. We went back over 10 years of Customer Enquiry Forms to check which colours were involved in such complaints and our first surprise was that there were only 16 over the whole decade. We seem to have had an awful lot of 'noise' for such an infrequent problem!

The second surprise was that 75% of the complaints involved the colour 'Alabaster'. Clearly this was a route to pursue. However, all our testing showed that the tinter combination used to produce 'Alabaster' actually increased hiding power vs plain white! Our theories, then, seemed to be confined to laboratory 'oddities' rather than the real world.

Avid readers of these memos will vividly remember memo No. 107 – The Art of Coarse Painting Revisited – Yeah right! The heart of that memo dealt with the fantastic 'tool box' of additives available to the present-day paint chemist to 'dial in' precise rheology profiles for paint. The corollary to this advancement was the caution that precise control of application aids, be it bristle types or lengths used in brushes or nap lengths and fibre types used in rollers become much more critical.

The act of brushing results in the formation of 'valleys and ridges' in a paint film and 'pimples and dimples' in a rolled film. The film thickness (or lack of it) in the valleys and dimples gives a focus to the eye creating the impression of poor coverage. The 'ridges' and the 'pimples' are excessively thick and afford more hiding than is needed. Even out these discrepancies and coverage 'issues' disappear.

The other issue is that sometimes paint can be overspread resulting in lower film builds and subsequent poorer hiding. And why should Alabaster feature so highly? Probably because it is our most popular colour and therefore used the most!

The vast majority of painters know this stuff, which accounts for its low level of occurrence, but urban legends don't die easily. Hmmm; just let me have another think about this!