Watching Paint Dry

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"Vulgar and inactive minds confound familiarity with knowledge .... The scientist, who is not content with superficial views, harasses himself with fruitless curiosity; and still, as he inquires more, perceives only that he knows less..."

So wrote the English man of letters, Samuel Johnson, nearly three centuries ago. Like the scientist, the minds of children are eternally and sometimes infernally curious about everything - the familiar is after all, still not yet so!

Alas, with time we all fall into the same trap, numbed by the mundane, searching for the sublime.

But if we look at history and learn from it, in science, in art, indeed just about everywhere, we have also been inspired by the mundane. This is particularly true in the everyday world as we experience it; if we took the time to look carefully, hear patiently and touch gently we find that Nature is not only shy, but in her living designs often subtler than we might even imagine.

Somewhat reversing the trend towards reductionism, over the last few decades there has been a growing appreciation of the richness and variety of phenomena that arise from relatively few and fairly simple causes in the natural world. There is mystery and magic in the mundane. And what is more—it can be experienced, every day, everywhere by everyone. It is also a gentle reminder that science can be an engaging and enriching cultural, and ultimately human activity, not always a means to an end.

Could there be anything more boring than watching paint dry? Try it! Paints start out runny, more or less depending on the base and pigment type. But it eventually dries out, and more often than out, does what you want it to. How? Well, the solvent just evaporates, you say, and that is that. But how does the solvent evaporate? And where? And when does the liquid paint become a solid? How come it is smooth to touch? These are the questions of a child, yet they are far from childish.

Paints are mixtures of a solid pigment which can be granular or stringy in a liquid solvent, and what the artists of the Lascaux cave paintings knew evolved through the ages via a combination of serendipity and design to the very sophisticated product it is today. It cannot dry too quickly, or it will crack—the specific pattern of cracking (known as "craquelere") is a feature now used to analyze the different "styles" of the masters of the Renaissance., in terms of materials used. Furthermore, when controlled, mud-crack patterns can be used purposefully, for example to channel fluid, create optical effects, and even guide cells to create tissues.

Drying too slowly will either leave paint-free holes or form patchy blobs of wet paint covered by a skin. As the paint dries further, the skin wrinkles up, just as a grape shrivels into a raisin—not a desired effect on the average wall, but perhaps when controlled could tune the transparency and hue of your painted window. If it is not smooth at very small scales, so that even light will pass through unimpeded, a new property arises—the wet sticky paint becomes self-cleaning when it dries, even better than Teflon. This is simply because only things smaller than the bumps can stick to them—think of how junk gets stuck in cracks! What of an isolated drop of paint? Or coffee, milk, or even the remains of the salted snow?

Everyone has observed that dried drops of coffee leave rings behind, as do milk, salty water and the sweat beads on spectacles. Why? At the simplest level, water can leave much more easily along the edges, and does, pulling the coffee along, which of course is left stranded as the water evaporates at the edge. If the drop can be levitated (no, we don't need help from Yogis or Gurus) and dries quickly, some paint particles (jargon: colloids) find themselves crowded together at the interface, forming a skin and shielding the rest. You can imagine that this has the makings of some clever tricks for engineering tricks for parceling, protection and delivery; perhaps you will not be surprised to know that Nature (insects in particular) has already discovered and exploited some of these a few hundred millennia before us.

And what of the process of drying? Surprising as it may sound, here is where the dragons lie. The transition from a liquid to a solid remains poorly understood, lying as it does at the interface literally, between physics and chemistry, arts, crafts and technology. How quickly all this happens determines everything—does the stuff freeze? or jam? or does it creep along forever? So much in the drying of paint—a dash of this, a drop of that, and a little bit of cooking. The ingredients and basic causes are simple—the results are not, and neither are the implications that run the entire gamut of science and engineering, with origins in art and artisanship. Does that not border on the sublime?

An innate curiosity defines humans and our search for what, where and who we are. Directed outwards, the same insatiable hunger to understand what is, and create what never was, drives our species to measure, to abstract, to create. Start now, not in a lab, but in the familiar world around you. What sets the color, shape and gentle falling patterns of leaves as they leave their trees, the sounds and shapes of raindrops on your windows, the waves behind barges on the Charles, the colors of the sky at dusk, the rotting snow on the pavement, the blooming of a flower, the power of a storm? As you peel away each layer of understanding, you will find a new layer of questions that draw you in, with glimpses of a solution, and hints of the deeper patterns. And soon, you will be part of the greatest adventure there is—forever uncertain, yet forever fruitful!