

How the Other Side Thinks: What art and engineering can learn from each other

By Julio M. Ottino

Engineering produces stunningly beautiful objects – the Brooklyn Bridge, the Eiffel Tower, 1950s Ferraris, the Boeing 787, and many iconic products designed by Apple under Steve Jobs.

Like artists, engineers leave an aesthetic trail of ideas bifurcating and evolving through rough sketches, complex drawings, models, and mockups. Today we have photo-realistic computer renderings, virtual reality images, and 3D printed working prototypes.

We also see in scientific and engineering publications stunning images of objects and natural phenomena generated by an array of ever more powerful and deep probing scientific instruments, such as electron microscopes, X-rays, and so on. Many of these images are exquisitely beautiful and even artistic looking. In my earlier days doing fluid experiments with chaotic flows, I, along with others, produced myriad spectacularly artistic-looking images – interesting, beautiful, even inspirational images.

But is any of this art? No.

One does not stumble into a scientific discovery or into building an elegant machine any more than one stumbles into art. Intent matters. Without intent there is no art, and art is not the intent of science.

Science is about making the unrecognizable recognizable, turning the unfamiliar into familiar, and seeing a thread of unity behind dissimilar phenomena. While someone might enjoy the sight of milk gently mixing into coffee, a physicist might be able to extract how milk mixing into coffee contains the seeds of understanding of how regions can remain unmixed in oceans or why Jupiter's red spot persists. This is the essence of science: finding the simple picture that contains all pictures.

Art is the opposite. It is seeing something that one may have seen a hundred times before but in a different light, a new viewing that makes the familiar become unfamiliar. This is "bestrangement," as the Russian Formalists called it, or "perplexion." Sometimes described as the moment of awe, it is only the first step towards a critical engagement with art. Art is far from just the aesthetic concerns of shape, color, and composition -- it is about the why's and how's of a thing. And although it leaves the answers up to interpretation and questions unresolved, its utility is in bestowing upon the viewer the role of completing the work and inviting us to participate in a change of perception. It asks us to make distant and perhaps implausible connections that couldn't exist without a confrontation with the art itself.

Science and engineering are driven by purpose and ultimate objectives that can be simply encapsulated: Technology is about invention; science is about discovery. Art need not be driven by a purpose, at least not one that can be captured in a compact phrase. Objectives in art are as varied as artists: provoke, incite, irritate, challenge, reframe, shock, nauseate, reveal. Art exists essentially for its own sake, but it is not always self-referential. And it is most clearly not driven by beauty, though beauty can be an outcome. Some say art is about self-expression, a form of human response to the world, an attempt to capture something about it, to put a lens to some

thing, creature, or feature of reality, or conversely turn a mirror back on us. One could argue that herein lies its utility.

While the outcomes of art and science are fundamentally different, there are significant benefits to bringing more visual, more artistic thinking into science and engineering. But there is more: The value in the intersection resides *in enriching how the other side thinks*.

Can this interface work when actually put to the test? Can one put together artists and engineers with loosely defined objectives to find common ground and engage in projects as co-equals?

Yes, but this is something that must be curated, not forced. At Northwestern, we have tested the idea with self-selected groups and loose objectives. In classes that combined engineering students with students from the School of the Art Institute of Chicago and from Northwestern's Department of Art Theory and Practice, groups developed new ways of visualizing social inequities in Chicago transit, games to facilitate interaction with autistic individuals, and ways to explore the commonality between sounds of laughter and sadness. The most rewarding outcome, however, was the collision of thought processes among team members.

But it isn't easy to move beyond small, self-selected groups who are often eager to interact. One needs to overcome stereotypes. Both sides have a romantic, almost cartoonish, view of the other. Scientists equate art with creation, beauty and inspiration, and sometimes with struggle; artists equate science and engineering with cold, methodical logic and a singular moment of inspiration when a great discovery is made. Engineers equate art with paintings, photographs, and sculptures, and leave out conceptual art, installations, and much more. Artists equate engineering with technology and not with the human factors and passions that animate it.

But it is precisely in the similarities and opposites where interesting things happen. Iñigo Manglano-Ovalle, a colleague artist and MacArthur Fellow, has been engaging the sciences through discrete collaborations throughout his career. He has had collaborations with geneticists, meteorologists, iceberg hydrologists, and experimental systems engineers. Among artists at Northwestern, he emblemizes the bridging of the interface with engineering. His work has the power of putting things in a new and sometimes unrecognizable light. The collision of his art with engineering projects has resulted in upside-down modernist architecture, subjecting Brancusi's iconic Bird in Space at Mach 10 speeds, and large-scale rapid-prototyped iceberg stations.

His work is proof that ultimately, scientists and artists can connect through the need to *make* things, rather than *talk* about things. At a high level of abstraction and production the differences between artists, scientists, and engineers blur. They all rely on a singular need, craving or obsessiveness, and an ability to enjoy the process of creation for its own sake.