Perception, 2010, volume 39, pages 869 – 871

doi:10.1068/p3907ed

Guest editorial essay

In-memoriam note. This editorial was written in response to an invitation from Richard Gregory, the founding editor of the journal, to respond to his penultimate editorial with the controversial idea of a relative stagnation in the arts relative to the sciences. It is with deep sadness and great difficulty that I find myself revising it in response to his comments just before his unexpected demise on May 17th. He was such an overarching figure that the gap that his death leaves in the fabric of our lives is almost inexpressible.

Art versus science

Our founding editor has thrown out a challenge with his analysis of some controversial views (2010, *Perception* **39** 143 – 144) on the relationships between art and science (or the arts and the sciences—in plural), and their relative rates of progression. Clearly, science in general has made enormous strides in the past century, with many non-existent fields springing into being and rapidly becoming established so that they seem to have always been part of the landscape. Art, too, is viewed by many as a continual stream of novelty, with styles, conceptual approaches, and 'schools' replacing each other in rapid profusion. Each discipline is valued by our society, yet one (science) is viewed as remote and inaccessible, the other (art) as widely appreciated with immediate appeal. In this sense, the two disciplines lie at opposite poles of the cultural spectrum, the sciences being valued for their utility but generally consigned to obscurity while the arts are the occasion for highly publicised exhibitions and immediate experience by large sectors of the population. Yet their development has seen a continued intertwining of the two fields throughout recorded history. Pythagoras, one of the founders of natural philosophy (science) and of the spherical concept of the Earth, was also deeply involved in the understanding of music. Renaissance artists such as Leonardo da Vinci and Piero della Francesca made significant contributions to the science and mathematics of their day, as well as being pre-eminent painters. Brook Taylor in the 18th century, who 'wrote the book' on fully elaborated perspective geometry, was both a painter and the mathematician who introduced the Taylor Series that is the primary tool for calculations in physics, such as those of quantum mechanics. This intertwining continues today, with art being so broadly defined that it incorporates many kinds of science, from anatomical preservation to genetic modifications to mathematical explorations in topology to elaboration of large-scale geological formations to the optical sculptures of Anish Kapoor that so exercised our founding editor (2010, *Perception* **39** 143). Conversely, science has been brought to bear to illuminate many aspects of art history, from carbon dating to X-ray spectroscopy of *pentimenti* below the surface of paintings to perceptual analysis of depth cues, and so on.

It could be argued, however, that both art and continuing ('same-store') sciences are better characterised by the Kuhnian concept of paradigm shifts than by an exponential level of growth of knowledge. In the science of vision, for example, the paradigm of the 1970s was spatial-frequency analysis. Nothing that had been measured with points and lines counted any more; it was only if characterised in terms of spatial-frequency components that it was considered scientifically valid. The next 'revolution' was a shift to Gabor patches in the psychophysics of the 1980s. (I'm using simplistic decade markers here for the sake of brevity.) Now the full-field grating of the 1970s was suspect and it was only the local probe of the Gabor patch that had the requisite scientific

rigor. As a stimulus paradigm, Gabor patches remain a primary choice (although in my particular view they are still employed with too many cycles and should be further reduced for full rigor), but functional MRI became the experimental paradigm in the 1990s, providing millions of measures throughout the brain, rather than the few previously available to psychophysical and human electrophysiological paradigms. The recent trend has been to find fMRI too slow and to focus on whole-head EEG and MEG paradigms to measure the processing of elaborate naturalistic stimuli. The trend of the 2010s may be heading towards aspects of the global organization of the truly perceptual level of processing, perhaps coming close to the fulfillment of the original aims of the journal.

Are these transitions true advances, in the sense that the previous 'knowledge' is discarded, or are they effectively Kuhnian paradigm shifts, where the current paradigm is treading the same ground in different shoes? Despite a significant tendency to return to basic perceptual phenomena and measure them over again as each new paradigm is introduced, much of the understanding from each paradigm is retained as the next takes over, although the limitations that were not apparent in the first flush of enthusiasm are soberly taken into account. We still believe that there is a spatial-frequency channel structure, for example, although local to each region, not operative over the whole of the visual field. But this form of analysis is now relegated to the first level of cortical processing, rather than being regarded as a potential explanation for the full global perceptual organization. As illustrated by this example, the ultimate goal of science is to gain understanding of the underlying 'causes' of the phenomena that surround us. The physicist may tell us that fundamental knowledge is limited by an uncertainty principle, but, until we reach that limit, understanding the mechanism is the undeniable goal of scientific enquiry.

Not so the arts. It almost seems that understanding is the 'snake-bite' of the arts, the toxin to be avoided at all costs! Most works of art seem to overlay a conglomeration of features and motifs, with the specific goal of transcending understanding. If we understand the effect too clearly—the symmetry, the spatial layout, the emotion depicted, the social relations—it ceases to be interesting as a work of art. It is the deeper mystery, the interplay of the ineluctable, that makes a piece into a work of art. If I may be permitted the wordplay, it is the work that we have to work through that makes a work of art 'work'. Indeed, it may be the very unresolvability of the perceptual and conceptual issues set up by an artwork that marks it for greatness. If we can put our finger on what the artist has done, we tend to see it as a simple device or trick. If, however, it keeps tantalizing us with the mystery of its effect, we keep coming back for more, both individually and as an art market. This is not to say that works of art are not based on scientific principles, and that they may not be susceptible to scientific analysis when appropriately formulated, but it does suggest that such analysis should not be expected to be straightforward and that it may be challenging to get at all the aspects that make an artwork compelling.

With this analysis in mind, we may consider the core point of the previous editorial, which is the suggestion that art has progressed little over the centuries. I found this a surprising statement, although it could be seen as defensible up to about 1850 for the visual arts. Before that time, painting and sculpture could be seen as progressive attempts to recapture the greatness of Greek, and sometimes other Middle Eastern, arts. The Roman was a frank replication of the Greek; Byzantine was an Eastern form of the Roman; Medieval was a degenerate form of the Byzantine; Renaissance was a return to the Greek model; and so on. In the same way, Greek and Roman precursors can be found in Dutch interior art, baroque, rococo, Palladian classical revival, and even 19th-century Romanticism.

Nevertheless, it is a strong statement to say that there is no progress in these schools (or paradigms) of art. At the very least consider that the art of perspective was rudimentary according to both the surviving writings and the pictorial evidence of the Greek and Roman periods. Although there seems to have been a good understanding of the concept of central convergence, there is no evidence that the more versatile aspects of multi-point perspective, which were brought to a high level both in the Renaissance and subsequently, had been achieved in classical times. Similarly, the stylistic breakthroughs of the late 19th and 20th centuries, encompassing impressionistic, abstract, and conceptual art, go well beyond anything we know from the Classical era. Again, music may be considered to have been recapitulating classical styles up to about the 17th century, but clearly transcended them in both scale and emotional depth by the 18th and 19th centuries, spanning from Bach to Wagner. From there, the 20th century has continually tested tonal, rhythmic, and emotional boundaries with strident new forms as diverse as 12-tone and 'gangsta rap'. Considering this wealth of diversity in both visual and auditory art forms, there has certainly been a continual and accelerating level of innovation in both major forms fields.

The issue, then, is the distinction between innovation and progress. Is innovation progress *per se*? Or could innovation be just spinning the wheels to head off in different directions without really progressing anywhere? The burden of the Kuhnian concept of paradigm shifts is that they are simply changes in the fashionable way of looking at things without meaningful advances in the field as a whole. In this respect, it is reminiscent of true Darwinism, which is a continual adaptation to a changing fitness landscape without a value judgment whether fitter is better. Most of us have difficulty avoiding the notion that evolution is progress, that humans are a qualitative advance over blue-green algae. Darwinian utilitarianism says: no, we are just a biological adaptation to a different environmental landscape, and the complexity that we prize is just another adaptive strategy. My view is that there is a loophole in this Spartan logic: that, for social species, the members of the species become a key component of their mutually adaptive environment. Evolution then becomes a self-referential process subject to positive feedback breakouts that are no longer simply constrained by adaptation. Art may be viewed as the manifestation of such a breakout, a non-utilitarian activity whose progress or lack of progress may be evaluated by other-than-utilitarian criteria. Although full elaboration of this concept is beyond the scope of the present editorial, it offers an expansive approach to the assessment of progress in all fields of human endeavor.

Christopher W Tyler
Smith-Kettlewell Eye Research Institute, 2318 Filmore Street, San Francisco, CA 94115, USA;
e-mail: cwt@ski.org