Science made easy

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Anti-elitism activists have been laughing for years about the true reason why the swedish director Ingmar Bergman, on the way to the height of his fame, has so generously used the colour red in his film *Cries and Whispers*[1]. Instead of stating the *official* reason that red was meant to depict the colour of the soul, he was heard saying in all simplicity that he just happened to view red as a very nice colour.

It is true that sometimes we attribute art works, meanings of the deepest nature, when in true reality, they moved in certain directions by no reason at all or for prosaic ones. But it is also true that the realization of the real importance of many art works, sometimes owes a lot more to the critics reflexion and conceptual development, than to the artist's primal intention.

When Jackson Pollock, the American painter started dripping paint all over the canvas in curved harmonic lines, surely in search of a new aesthetic dimension (a new style later known as *abstract expressionism*) and became the greatest living painter in the USA, it was observers and critics who found and discussed the obvious similitude between his paintings and newly geometric forms with singular mathematic properties (i.e. *fractals*) already being studied in physics and mathematics' departments of the most advanced universities in the world. Since fractals (and chaos theory) can be used to construct models of irregular patterns ubiquitously found in nature, can the public appeal for Pollock's paintings (i.e. the subconsciously pleasing of fractal representations) provide a clue to the existence of some mechanism of brain perception for the mostly unseen but real and profound structure of the natural landscape? If this is proved true, then even in scientific terms, Pollock's work has served us well.

Having doubts? Consider caricatures. We're all too familiar with their exaggerated physical traits and imagine those deviations from reality are there to make us laugh. However, evidence suggests that for the brain, an exaggeration of the singular characteristics of a subject makes his/her identification easier than looking at a recent photo![2] Whether based on trial and error or some past unattributed and unexplained insight, this technique of representation is being passed along generations of artists as nothing more than a technical gesture taught by experienced masters when in true reality it is the appropriation of a fundamental brain property only recently studied by experimental science[4].

Now then a question arises: can medicine learn something about its own craft by studying what goes on in the arts? If Borges's words are true it may well be possible: *"…intelligence has little to do with poetry. Poetry springs from something deeper; it's beyond intelligence. It may not even be linked with wisdom… it has a nature of its own"*[3].

"Nature as no-one has seen it before"[5]

Cézanne is the perfect example of an artist painting in the interface between science and art and getting away with it, I mean developing not just a new style but a deeper understanding of nature's structural truths. Not an easy task as his life would all too well illustrate.

Despite judging as interesting some pictorial innovations that many around him, namely the *impressionists*, seemed happy to pursuit, deep inside Cézanne always knew they hardly made up for a revolution in nature's representation, and most of all, understanding. But no revelation concerning nature's intrinsic properties, the main focus of Cézanne's attention, would ever be produced by those quite inconsequent efforts.

As a painter, Cézanne arose in a world of new ideas and for someone trying to create something *"no-one has ever seen before"*, conceptualizing his vision

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through the lens of those ideas seemed an obvious choice. New concepts like *"to understand is to find the relations between things"* and *"it's easier to explain nature by analysing the space between its constituents"* were particularly suitable to embrace due to the innovative forms of representation they could produce. Sensing these new ideas could lead to nothing less than universal truths, Cézanne dreamed of creating a new classicism. And by applying a new experimental attitude, he did just so.

According to the great art critic Meyer Schapiro, Cezanne managed to find a *"profound expression…without recourse to a guiding religion or myth, or any explicit social aims"*[4], but the critic never asserts an alternative source for the artist's inspired persistence. However, I beg for your contempt while I make a claim for *structure*. The structure of the natural motif. And as you may agree, structure is science.

Contrary to what one might think, Cézanne's starting concept was nothing radically new. Just an attempt to conquest balance, albeit with a completeness never tried before. Intuition guided his research so that form, space, colour and rhythm became fully integrated in a continuum of balance that speaks volumes in truthfulness and insight. And when he had to completely reconstruct the entire visual appearance to obtain a balanced picture, he managed to produce credible paintings perfectly *findable* in nature, but that really were nothing more than a reading of the forces at play in an ensemble of volumes, proportions and colours. Proof that his perception of structure was presiding over his aesthetic options.

Cezanne was determined to get away from the classic view from a window, wich was something everybody expected from a painting, until the day photography came along and started to do just that. Therefore, instead of valuing the *positive space*, eg the central motif, and letting the space around it (the negative space) recede into shade and darkness, Cézanne started to award the negative space an importance never attributed before. And the result was a flattened, less deep pictorial plane, as a consequence of moving forward the background (something very much helped by the use of bright colours). Confronted with these innovations, the public slowly forgot about central motifs and started to look for the interactions between things, the mass-effect of forms, the contours and the importance of vicinity. What the paintings were showing now was a new set of perceived laws that although being there all along, could not be depicted before because no-one knew how to do it. The amazing complexity of nature was now on show, something that needed Cézanne to exchange what the eyes were used to see by what the mind is used to feel in front of the natural motif. A dynamic structural truth was emerging, to wich he added a final step: an impression of movement and incertitude making nature appear not only from different points of view in space, but also from different points of view in time. By this, the first *structurally complex* paintings were born, encompassing nature s omnipresent variability (years before the *complexity* concepts started to be discussed in scientific academy). To look with the mind instead of the eyes was his legacy and this instantly became the proper way to see. In art of course but, and this may surprise you, also in science.[6]

Metaphors for the lab

The proof that Cézanne touched deep rooted realities, including several primal truths about nature, lies in the huge influence he has had upon his contemporaries. Picasso referred to him as his only master and cubism owes a lot to Cézanne's discoveries. This is the reason why he is known as the *father of Modernism*. Furthermore, his real influence in society has probably run much deeper, given the fact that some of his new concepts, while being seminal in giving birth to different artistic styles, but can also be seen as conceptual metaphors supporting new lines of investigation in science.

Extracting metaphors from artistic work is, for many, the only reason why science comes to art and given the bulk of innovative ideas Cézanne introduced, I believe that at least some informed scientists may have reflected them in their work. In fact structure concepts, laws of interaction and variability are too good to dispose of when you re desperately in need of developing new ideas, as science has been for the most part of its recent history.

Would you not agree that the mutual influence between an organism (or a cell, or a molecule) and its surroundings (in time and space) that is the hallmark of epigenetics, was a very well made point by Cezanne when he understood the exchange between any object and the elements around it, being it a plane, a line, a shadow or a colour? Or how else can we view Cézanne's reconstruction of the scenes in the canvas, based on his readings of the forces at play, as anything other than the first attempts to reconstruct

reality, that culminated in the modern *in silico* models (for computer simulation) that allow nowadays the study of very complex biological realities? Or yet, weren't the attemps of Cézanne at showing different time frames in the same canvas, the expression of a variability so ubiquously found in nature that it is now considered the new *normal* of the biological world?

Metaphors may indeed guide the way we reason about complex matters and the conclusions we draw from those as Thibodeau, among others, has found. In fact when thinking about crime as a virus, eradication of poverty and improved education were the proposed solutions, while conceiving it as a monster, saw the jailing of criminals and the enforcement of more severe laws, come out as more appropriate measures to take[7]. Everywhere we look we see metaphors we can use to perfect our understanding. When we consider the use of hyaluronic acid injections, like Roque et al did in their paper[8], how shall we look at the knees they treated? Are knees being afflicted by the action of a low-grade synovitis or badly perfused knees by overpressure in their circulatory system? Is cartilage being destroyed or cartilage being unable to recover? By choosing between these two sides you can find yourself miles and miles apart. Fortunately, using a good although complex surrogate of the joint health-pain- the authors were able to conclude that, as far as hyaluronic acid is concerned, the sooner we treat, the better. And this conclusion has rarely before been made as convincingly as now.

Although scientific research is attaining new heights of productivity, I'm sure you will agree that the development of a conceptual framework to integrate such a multitude of new findings has had difficulty in keeping pace. Could this exchange between disciplines and the judicious use of metaphors help to do the trick? Michelle Borkin seems to think so since in her TED Talk about astronomers and doctors, she urged everyone to read books and journals from different disciplines *"cause you really never know where your next great idea is coming from"*[9].

In loving memory of ***Julia Ferreira, MD***

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