
Science as Culture and the Science of Meaning

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Here I argue for widening the discourse about how science interacts with the rest of culture – for relaxing what are often portrayed as (and policed as) hard and sharp boundaries, and for recognizing that the questions we ask about ourselves and the world rarely align with the demarcations we draw between academic or intellectual disciplines. This process might begin by admitting questions about meaning into science itself.

Conflict or Consilience?

The sciences and the arts/humanities often look like rivals who want to get along but just keep rubbing each other up the wrong way. They are generally polite enough in public, but you should hear what they say about each other in private. Every now and then the rancour spills out, as it does in these remarks in 2002 by the biologist Lewis Wolpert:

Although science has had a strong influence on certain artists – in the efforts to imitate nature and thus to develop perspective or in the area of new technologies – art has contributed virtually nothing to science. Art does not explain, but it broadens our experience in ways that are not clearly understood. I value it in its own terms but it has nothing to do with understanding how the world works. To pretend that it does is to trivialise science and do nothing for art. We should stop pretending that the two disciplines are similar, and

instead rejoice in the very different ways that they enrich our culture.

Unlike the second law of thermodynamics, population genetics or quantum mechanics, which require much basic knowledge to appreciate properly, the response to a painting needs no prior training – though it can increase appreciation and pleasure... Science needs a much greater, and quite different, intellectual effort.

There is much to argue about here, but I think it's fair to say that at the root of comments like these is a sense that whatever claim to truth the humanities can make is subjective and contingent, whereas science speaks to what is objective and eternal. To some extent, one can see this as a battle for supremacy of intellectual authority. But Siân Ede, former arts director for the Gulbenkian Foundation, suggests that the rift here – the hoary old divide of the Two Cultures—goes deeper. She says

it derives from radical difference in two epistemological traditions concerned with the nature of knowledge itself. On the one hand is the view that there is an implicit reality out there waiting to be discovered, independent of the observer's mental state, as very many scientists maintain. On the other hand is the idea that reality is all or at least partly a construction of the human mind, phenomenologically and linguistically determined and therefore unfixed, and whether we are aware of it or not, viewed in accordance with the prevailing values and beliefs of particular times and places... many in the arts and humanities... are suspicious of any constituency that claims to be wholly right in finding the route to Truth and particularly can't agree to assess all human behaviour, perceptions and products outside any political and cultural context. *We must always assert the right to ask who makes the judgement and why.*

Observations like these are commonly regarded by scientists as, at best, secondary to the real nature of their task. Yes, they will say, of course individual scientists are products of their time, and

prone to the all-too-human foibles of ambition, vanity, self-delusion, and aggrandizement. If pressed, they will admit that even Charles Darwin's writings were marred by the racism habitual to nineteenth-century European thought. None of this, however, invalidates what endures: Newton's laws, the theory of natural selection, general relativity. For such scientists, their ultimate goal is to distil the pure spirit of eternal truths from the grimy residue of cultural, political and personal contingencies.

As Ede hints, there is a common belief that this can and should be done even for understanding human behaviour. Biologist E. O. Wilson was more inclined to find an accommodation – what he calls a consilience – between the sciences and the humanities, but in the end he felt that science must be the firm bedrock on which the latter disciplines build. He says that

until a better picture can be drawn of prehistory, and by that means the evolutionary steps that led to present-day human nature can be clarified, the humanities will remain rootless... The humanities have always been viewed as an ensemble of disciplines that explain “what it means to be human”... To achieve this goal will require a great deal more of the information available from scientific research than has been used by scholars of the humanities.

Underlying these tensions seems to be an assumption on the part of the sciences that the humanities are striving to ask and answer the same questions as they pose, but with inadequate tools. In art criticism, says Wilson, “due to the extreme subjectivity of the target, the insights easily slide across the surface and off target.” In avant-garde arts and criticism, he says,

It is not surprising that bizarre subcultures sprout abruptly and randomly [that] defy coherent explanation... Whether emanating from ordered or disordered minds, they give us glimpses, still disordered unfortunately, of the emotional checkpoints and decision centers of the subconscious mind.

But, he adds, “it is time for a deeper probe in a different setting, entered at a different angle, to a greater depth, and exploring a deeper causation”. In other words, time for science to bring order and rigour to this confusion!

The harsh but somewhat justified term of this sort of thing is *scientism*: a belief that scientific methods and techniques are the only routes to reliable knowledge, and that, if properly applied, there is no corner of human experience they cannot illuminate.

I am not proposing to resolve these conflicts. What I want instead to suggest is that, by insisting on them, we constrain science to be less than it can be, and less than it needs to be. We prevent it from speaking as widely, and certainly as wisely, as it can and should.

In his book *The Age of Wonder*, biographer and historian Richard Holmes offers a different view:

Perhaps most important, right now, is a changing appreciation of how scientists themselves fit into society as a whole, and the nature of the particular creativity they bring to it. We need to consider how they are increasingly vital to any culture of progressive knowledge, to the education of young people (and the not so young), and to our understanding of the planet and its future. For this, I believe science needs to be presented and explored in a new way... We need to understand how science is actually made; how scientists themselves think and feel and speculate... The old rigid debates and boundaries – science versus religion, science versus the arts, science versus traditional ethics – are no longer enough. We should be impatient with them. We need a wider, more generous, more imaginative perspective.

I agree with Holmes, and I want to talk about how we might find that perspective. I believe that it depends on recognizing that many of the questions that have been at the heart of human experience and culture since time immemorial do not neatly partition in ways that align with academic disciplines. Science adds to them new facets and new

implications, but not in the manner of a sage deigning to offer crumbs of wisdom; rather, the very practices of science are as much a part of the question as of the answers. In particular, science can, and should aim to, contribute significantly and meaningfully to questions about meaning and purpose, and how these are expressed in our cultures. Science will surely not supply anything like an *explanation* of these attributes, but it can deepen and enrich the discussion. Rather than seeking to emphasize how science is different from other intellectual pursuits, we can afford to celebrate their integration.

Towards an Integration of Science and Culture

When they speak to a broad audience, scientists often seem almost to revel in stripping away any illusion of subjectivity, purpose or meaning in their vision of the world, confronting us instead with the stark facts of reality. As physics Nobel laureate Steven Weinberg put it in 1977, “The more the universe seems comprehensible, the more it also seems pointless.” Cognitive scientist Steven Pinker sees it even more bleakly: “We are born into a pitiless universe”.

These statements seem to me to be making a category error. There is no more reason to suppose that “the universe” is the kind of thing that has a “point” or that might show “pity” than there is to think that it displays a sense of humour. We should stop telling people that science somehow removes any illusion of purpose or pity from the universe. To put it another way, the statements of Weinberg and Pinker are not, as I suspect they think, devoid of theology, but are predicated on it: only by asserting what they deem to be a religious or spiritual vision of the universe is there anything to be removed from it by science.

But no: it is in human existence that notions such as purpose and pity are to be located – or that their absence might be lamented. The real problem with Wolpert’s view is that it implicitly recognizes that the arts are a cultural activity but wishes to place science outside of culture. As he says,

Science is about understanding how the world works, there being only one correct explanation for any observed phenomenon. Unlike the arts it is a collective endeavour in which the individual is ultimately irrelevant – geniuses merely speed up discovery.

Let's pause here to notice two things. First, when it is suggested that we might no longer name institutions or awards after "great" scientists of the past who turn out to have feet of clay, such moves provoke extraordinary passions in scientists. The suggestion that the name of the geneticist and biometrician R. A. Fisher be removed from the Centre for Computational Biology at University College London on the grounds that he was a racist and eugenicist caused some of his former students and advocates to react with outrage. Others scoffed at the suggestion at Imperial College London that the name of Thomas Henry Huxley be removed from a building because he too promulgated a racist biological hierarchy, having written in 1865 that "no rational man, cognisant of the facts, believes that the average negro is the equal, still less the superior, of the average white man". I won't debate here whether or not these decisions were correct; the point is simply that individuals are evidently anything but irrelevant to many scientists, who hold them in great reverence.

These are, ironically, perhaps the same passions that tend to be aroused when historians of science suggest a contextualization of science that seems to demote it from a striving for pure and timeless knowledge into a socially negotiated and contingent process of consensus-seeking. The response is reminiscent too of the antipathy expressed by some scientists when philosophers point out that there may be more to (including more problems with) their unspoken predicates than they would prefer to allow – a view exemplified by Stephen Hawking's notorious (and ultimately meaningless) claim that "philosophy is dead".

Second, the idea asserted by Wolpert that science is "about understanding how the world works", while likely to be nodded through by many other scientists, would be rejected outright by many contemporary historians and philosophers of science. The idea that

science can be neatly distinguished from its applications – from technology, or more generally from the business of *making things* – is interesting as a fictitious rhetorical device still widely deployed by practitioners, but is objectively nonsensical.

All of this reveals an eagerness to fence off science from the rest of culture – from art, philosophy, history, sociology, politics, and anything that seems to threaten it with context or contingency. The image it seeks to preserve is very much a hierarchical one in which science happens in an elevated realm detached from the rest of culture, while supplying ideas and knowledge that trickle down *into* culture, perhaps in a somewhat debased form, where amongst other things it enables the grubby but useful business of producing technological applications. One sometimes senses a view that the fact that science must be done by humans is an unfortunate but necessary inconvenience, which the objective, passive voice of the scientific literature is designed explicitly to disguise or even to deny (and which – who knows? – we might see displaced one day in favour of hypothesis-generating AI). As Holmes says, the result is an insistence on boundaries and indeed conflicts: science versus the arts or humanities, or religion, or ethics, or the rest of culture. It is, in other words, the Two Cultures narrative, albeit here defended rather than lamented (and was it ever much more anyway than a demand from a chemist for Oxford classicists to learn more thermodynamics?).

One way to challenge these divisions is to seek for bridges, for points of contact. We end up then making well intentioned and noble-sounding claims along the lines that “Art and science (or religion and science) are asking the same questions from different perspectives”, or seeking points of thematic overlap between them.

There’s some rich material to be found here, for sure: to examine how, say, geometric thinking entered artistic expression in the Renaissance, or how religious faith created both a spur to and a focus for a rational inquiry into the universe during the Middle Ages.

But then we are apt to be faced with Wolpert's instrumentalist response: what does this gain us, and specifically what does science gain? "Although science has had a strong influence on certain artists", he asserts, "art has contributed virtually nothing to science." Bridge-building is, meanwhile, actively opposed by the historically illiterate "conflict thesis" which asserts that religion actively inhibited science for centuries: Keep it out!

I think there is a different way. In short, I think we should start from where we are, rather than to pretend we can attain some Platonic, objective perspective far removed from lived human experience.

First, we need to acknowledge a contingency about all of our knowledge and our explanations. As evolved beings adapted to a particular environment and lifestyle, our intuitions and our modes of sensing the world are inevitably contingent. The reason we struggle to understand quantum mechanics is that it will not fit into the classical metaphors we find ourselves using to talk about it. *We are* the at centre of *our* universe, and can hardly be otherwise. There's good reason to doubt the confidence with which most scientists seem to believe that intelligent extraterrestrials will formulate natural laws much as we do, for the physics that any agent comprehends depends on the sensory channels it uses to interact with the world beyond itself. As J. B. S. Haldane said, "The universe is not only queerer than we suppose, it is queerer than we can suppose."

But my real point is that I think it is harmful to present science as a distillation of pure natural laws free from any humanistic residue. That doesn't even fit with how science is practised in its own terms. The goals of understanding and of intervening and manipulating are far too intimately interwoven to permit any such separation. Many scientific questions, from the life sciences to physics, are motivated by applied questions: Why won't this device work? How can we cure this disease? How can we make this process more efficient? It's very striking how some of the cutting-edge ideas in quantum theory and thermodynamics stem from asking not "What is the world like?" but "What can we *do*?"

They present the world as an exchange of information between an agent and its environment. Meanwhile, it is no coincidence that the philosophy of science has traditionally been essentially a philosophy of physics, because it does not know quite what to do with the unique characteristics of living matter (of which, more below) and is wholly disconcerted by a science like chemistry that is primarily not about knowing but about making. (The philosophies of biology and chemistry, and indeed of engineering and other disciplines, are in rude health today, but a significant part of their goal remains to carve out an operational space that is not constrained by the expectations of a tradition dominated by a focus on mathematical physics.)

Among other things, this makes for a rather confused and often rather thin discourse about ethics in science and engineering. The common claim that scientific knowledge is value-free is essentially a way to duck the issue. Science *starts* with questions – but, as Ede asks, who chooses the questions? This is not simply a matter of finding ethical reasons not to do certain things or to ask certain questions, for there are ethical dilemmas about decisions *not* to do, *not* to ask. The simple fact is that, as moral agents, our choices, actions and investigations are apt to have moral consequences.

When I communicate about science, I find that the questions people wonder about don't make distinctions or draw boundaries between what is "inside" or "outside" of science. They don't worry about whether theirs is a "truly" scientific question or not. People want to know about what interests them, or perhaps worries them, or excites them. The idea that, say, the quantum-mechanical phenomenon of entanglement might permit mind-reading and thought-transference makes physicists roll their eyes (and let me be clear that quantum physics does *not*, as far as we know, permit such things), but those who ask such questions don't regard this as a "non-scientific question" – it's simply a possibility that fascinates them, and why would it not? It's merely the flipside of the coin to point out that a fascination with the idea of mind-uploading to machines – which some technologists think is feasible and even desirable – is not in the end a question of science

(which is currently silent on the matter, but the prospects are hardly encouraging) but is motivated by the enduring dream of immortality. Sometimes what scientists and technologists themselves think is a scientific question is not really that at all.

What I'm saying here is that the way we *think* – both individually and culturally, both as experts and lay people – is not neatly apportioned into the categories of “science” and “non-science”. It is conditioned by other criteria, which are ultimately rooted in phenomenological human experience. And this should be the basis on which we talk about the world we encounter.

Science is, of course, a very specialized activity, and necessarily so. It is immensely powerful for answering certain kinds of questions, and I do think it is rather unique in human inquiry in its ability to find reliable and quantifiable answers. There *is* something special about it – just as there are other kinds of specialness in the arts, in philosophy, and – I can't stress this enough – in the activities of human caring and child-rearing, in spiritual contemplation, in building just and resilient societies. There is a compelling case for treasuring, celebrating and defending science's special qualities, and for talking about and communicating what emerges from them for their own sake.

But I believe it will only elevate and benefit science to *integrate* it into these other aspects of culture rather than to ring-fence it from them. Take, for example, the literature on the cognition of music. It can be an arid affair. Swathes of it reports on laboratory experiments in which participants are tested on their ability to distinguish changes in synthetic note or rhythmic sequences, or in which the parts of the brain activated during the process of listening to music are listed in all their Latinate splendour. I put this with exaggerated bluntness; much of that work yields valuable insights, and the compromises it makes are necessary to achieving clear connections between cause and effect, free from extraneous influences. But the fact is that most musical experience is *saturated* with “extraneous influences”: our pre-existing mood, our past associations with the music, our response to the crowd of other

listeners, our reactions to the clothing and gestures, the fame and mystique, of the musicians, and so on. With some notable recent exceptions, studies in the cognition of music traditionally shied away from precisely the kinds of strong emotions that make music so important to the lives of so many – for where do you start to dissect those? I wrote my book *The Music Instinct* precisely because I was frustrated with how the popular literature on the intersection of music and science seemed so often to restrict itself either to the mathematical and physical aspects of acoustics and pitch, or to the mere naming of brain regions that are involved, almost as if they were incantations through which understanding and insight could be summoned. If we cannot connect scientific studies to the real traditions of composers and performers – and not just Mozart and Bach but also Mötörhead and Bacharach, not to mention ceilidh bands, Mongolian throat-singers, flamenco dancers and jazz musicians – then what in the end are we actually going to say about how music does its work in cultures and societies?

It is constantly surprising to me how science seems to imagine that it can mobilize popular culture as a communicative device while remaining aloof from the cultural currents into which it thereby dips. There is, for example, a tradition in discussing the science of structures known as metamaterials (which can manipulate light in non-conventional ways) of locating the research, for the purposes of public discourse, with reference to popular tales of invisibility such as those in the Harry Potter novels or Tolkien's magical Ring of Power. But such associations don't come for free. The moment you invoke them, you import many centuries of cultural associations and meanings. For the power of invisibility is no more neutral than is a technology that makes it possible (and which, it will surely surprise no one to hear, receives generous military funding). Since the legend of Gyges' ring, recounted by Plato in *The Republic*, invisibility has been seen as having the power to corrupt. Plato's point – that a ruler, or indeed any person, who could act with impunity because they are "unseen", is liable to become corrupted and to abuse the privilege – is arguably more relevant today than ever. It was certainly the theme that H. G. Wells explored in

The Invisible Man, which wore its debt to Plato on its sleeve. It seemed to me when I wrote my 2014 book *Invisible* that to write about invisibility from a scientific angle simply could not be attempted – not satisfactorily or perhaps even ethically – without speaking too about, for example, Shakespeare’s ghosts, fairy tales, stage illusionism and Victorian spiritualism. Are any of those topics “scientific”? I’m not even sure why the question should be relevant in this context. Rather, until we appreciate the wider cultural context, we cannot hope to have a meaningful grasp of what scientific work on “invisibility” *means*.

Far from, as some might fear, making science seem constrained by cultural contingency, such considerations reveal it as a genuinely creative process fueled by the richness of our cultural imaginations. As we explore and, crucially, reconfigure the world, we are able to leverage a collective storehouse of ideas, images, stories, and concepts, putting them into the service of becoming better at predicting outcomes of events and directing our own destinies. Science feeds into cultural tropes, archetypes and inspirations precisely because it already draws from them. It is more embedded than we often allow in the meanings we have already distilled from our experience of being alive in society with other minds.

A Science of Meaning

Meaning is at the crux of the matter here. I believe there is a synergy between the effort to frame science meaningfully and the work needed to create a science of meaning itself. Efforts – and they have been rather vigorous – to isolate scientific thought from considerations of meaning have, in contrast, hindered science itself as well as its admission to the wider cultural conversation.

I believe that the gulf that exists between the notion of meaning as an experienced aspect of human lives and societies, and our (lack of) scientific understanding of how it arises and what it implies, has real consequences. In the physical sciences, an insistence that meaning has no role in physical law supports a view of science as divorced from the

kinds of questions we ask to frame our existence. In the biological sciences, there has long been a fear that questions of purpose, value and meaning threaten to make biology a matter of metaphysics – or worse, to open a portal to advocates of intelligent design or other religiously motivated interpretations. There remains a kind of exceptionalism in biological thinking that supposes these notions of purpose and meaning to be uniquely human: constructs we impose on the world, not characteristics of the world itself. But where then, if we truly believe in the continuity inherent in Darwinian evolution, do these characteristics come from?

Information theory, meanwhile, was explicitly divorced from meaning when it was devised by Claude Shannon at Bell Telecommunications in the 1940s as a method for quantifying the fidelity of signal transmission. This was an important, necessary and useful simplification. But it meant that, when this informational perspective merged with the apparent existence of a “digital code” of DNA and genetics in the 1960s and 70s, no one knew how to reconcile it with the fact that evolution is a *generator* of meaning: a process through which some aspects of an organism’s environment are imbued with salience, valence, and value, while others are ignored. Organisms persist by virtue of being information filters and meaning-constructors. We loaded all these features into a “master molecule” (which is now revealed to be not that at all), because we did not know where else to put them.

As Wilson’s remarks indicate, the kind of meaning that we seek and explore in the humanities and the arts has, when acknowledged at all, been reduced to evolutionary imperatives of survival and procreation. In our technologies, meaning and purpose sit within the buried foundation of an ethical framework that is commonly regarded as an optional afterthought. Neither does justice to our true potential, and its attendant hazards. Despite Wilson’s dream of an over-arching “consilience” that brings all of that experience, from arts to religion, insider an umbrella of evolutionary imperatives, there seems little prospect right now that neuroscience or evolutionary biology is going

to deliver the final word on all that we create, value and nurture. That, indeed, was my conclusion in my attempts to understand the cognition of music: there is only so far that brain scans and psychological tests can take us. The very nature of mind, and especially of the human mind, as a faculty that relies on improvisation, imagination, and model-building, liberates us from the narrow constraints of evolutionary psychology. Culture has only widened that gap separating us from evolutionary imperatives. Minds, you might say, escape their original purpose, precisely because that's what they are "designed" to do. We owe it to ourselves to be constantly amazed by that. In my experience, the idea that we are the result of matter becoming able to know itself strikes many people as an odd way to regard human existence – but I don't see how it can be regarded otherwise.

Science today is becoming a little less reticent about these issues. There is a slow acceptance in biology that, rather than consigning words such as agency, function, goals and purpose to sanitizing quote marks, we need to recognize that they keep cropping up in the life sciences because they have some ontological validity: they are, like life itself, real attributes, if only we can find a way to define them adequately (which is not the same as defining them rigorously or narrowly). And precisely because they are not uniquely human attributes – because, in fact, they seem inherent to some extent in all living organisms – we can hope to say something meaningful about them from the point of view of biology and evolution.

What, then, do I suggest? That we try to develop a science of meaning, yes – although I have only the vaguest notion of where that might begin. But also that we talk about science with Richard Holmes' "more generous, more imaginative perspective." That we recognize how the questions we ask, and the issues we care about, intersect the rich seam of knowledge that is science, and are illuminated and enlivened by the lode it encounters there, but cannot be sated or exhaustively explained by it.

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