



The scientific sublime

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[Robert P Crease](#) identifies a physics experiment that philosophers would dub “sublime”



[Vast and intricate](#)

“This chocolate chilli mango tiramisu is simply sublime!”

Fascinating, the contrast between the colloquial and technical meanings of terms. In everyday language, we apply the word “sublime” to things like clothes, music and food that are particularly awesome, deep or yummy. In physics and philosophy, however, the word has technical and precise meanings that stick closer to its etymology, which combines the Latin sub (close to or under) and *limen* (a threshold).

Physicists use sublime to indicate a phase transition from solid to gas that bypasses the liquid state and is triggered by an endothermic process just below the critical-point threshold. Philosophers, meanwhile, use the word to describe the agitation and disorientation you feel when confronted with something incomprehensible and overwhelming. Here, the threshold is between the limited human mind and the limitless, natural world.

For philosophers, then, the sublime is not synonymous with beautiful, and the two terms are in some ways opposites. While the beautiful is calming, integrates mind and nature, and is generated by the formal properties of the beautiful object, the sublime is arousing and formless.

So are there any instances in physics that can give rise to the philosophical experience of “sublime”? Last summer I attended a series of lectures given in Italy by [Edward Casey](#) – a colleague of mine at Stony Brook University – that convinced me that at least one experiment perfectly fits the bill.

Mind and nature

Philosophers have mulled over the sublime for centuries. In his 1756 treatise *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful*, the Irish statesman and philosopher Edmund Burke wrote that terror is the “principle of the sublime”. Encountering overwhelming things such as hurricanes and volcanoes, for instance, disrupts our usual ways of coping with the world. But when such terror is placed at a safe distance – as in, say, a painting – we can feel its power without personal danger, producing a special kind of pleasure that makes us feel more vibrant and alive. It was this experience of fear-tinged pleasure that Burke dubbed “the sublime”.

In his *Critique of Judgment* (1790), the German philosopher Immanuel Kant analysed the concept somewhat differently, and described two kinds of sublime. One, the mathematical sublime, is inspired by experiences of things that are so vast and intricate (such as St

Peter's Basilica in Rome or the starry universe) that our imaginations cannot size them up by turning them into intuitions. Another, the dynamical sublime, consists of experiences of things of such stupifyingly overwhelming power (such as ocean storms) that we feel helpless to resist them.

Like Burke, Kant thought that when such disturbing encounters are put at a safe distance – as in art – they can generate a special kind of pleasure. Unlike Burke, Kant thought that the key to the sublime was the mental act of confronting something to which we realize our imaginations and power are utterly mismatched. Such an experience, Kant thought, reveals to us something liberating – the independence of our minds from nature – kindling in us a deep and humbling respect both for the implacable, law-governed natural world and for the freedom and transcendence that humans have with respect to it.

Casey's lectures examined these two influential accounts of the sublime, as well as others, but gave the subject a twist. He is a philosophical "phenomenologist", which means he is less interested in analysing concepts, such as the sublime, by taking for granted seemingly obvious analytic tools – especially those that come in neat pairs like mind/nature. The problem with these tools is that they often tempt us to squeeze an experience into conventional categories rather than to respect its nuances.

Instead, Casey began by trying to carefully describe the experience itself. That experience, he argues, reveals that the sublime is neither so much about a threatening object (as per Burke) nor about our special feelings in response (Kant). Instead, it is more like an aura that permeates an entire landscape, turning it into something we encounter differently from ordinary space and time. That encounter, he continues, can be inspired not only by terror, but also by other kinds of experiences of phenomena in which we perceive both nature and the way we perceive it as intimately knitttogether.

The critical point

Casey left me convinced that the double-slit experiment with electrons, which results in a visual pattern of spots indicating that these particles are spatially unpindownable, is an exemplary case of the sublime.

First, the experiment is (as per Burke) of a startling natural phenomenon; it reveals electrons behaving in extraordinary ways. Second, it shows (as per Kant) something that we cannot size up with our imagination and understanding even after almost a century of quantum mechanics. As Werner Heisenberg said, subatomic behaviour is unintuitable in ordinary space and time, while Niels Bohr remarked that those who are not shocked by quantum mechanics do not understand it. Finally, it is something (as per Casey) that we experience as not on one side or the other of the mind–nature threshold, but as the product of both. The double-slit experiment (and quantum mechanics, which provides its theoretical script), after all, is a human creation, even as it shows something shockingly indigestible to human imaginations and understanding.

There may be deeper illustrations of the non-classical character of quantum mechanics – the Stern–Gerlach experiment or demonstrations of the violation of Bell's inequality – but the double-slit experiment is the most perceptually accessible and dramatic. As Richard Feynman remarked in his *Lectures on Physics*, it puts on clear display the mystery of quantum mechanics. Forget St Peter's Basilica, hurricanes, volcanoes, hurricanes and tiramisu – if asked to name something truly sublime in the deep technical philosophical sense, I'd choose the double slit.

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1 comment

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Sublimely sublime

I enjoyed that essay thanks, and for many years would have agreed fairly strongly. However, speaking as a non-physicist and non-philosopher I recently have become at least less awestruck by the double-slit and related non-deterministic quantum phenomena. It struck me that * maths being a branch of physics rather than vice versa (a view that I have defended successfully, but Fermat-like, lack the space for here; anyone interested can email me at jonrichfield@gmail.com) and depending on information for its fundamental operation or expression, and * information being a quantifiable physical entity, and * physics being causal in nature (though not deterministic, a different concept) that nothing, no single thing, in physics (and therefore in nature) can be exactly specified, neither digitally nor otherwise, because that would require infinite information, for which the observable universe has too little scope. Now, if the outcome of an event cannot be exactly predicted, either by us or "by nature", the irreducible degree of uncertainty must necessarily be expressed by effects at the least very like the events we see in the uncertainty of outcomes, in randomness and relative probabilities. Randomness in this sense is *not* the effect of our ignorance of causes, but of the *absence* (or insufficiency) of established causes; the outcome is no more real before it happens, than alternative possibilities in proportion to their relative probabilities. Note that one implication if this makes sense, is that it has relevance to the concept of the "arrow of time". Whether this reduces the sense of sublimity I cannot say, but it seems to me more comprehensible than either dead/alive cats or single electrons passing through both slits.

Edited by Jon Richfield on Oct 27, 2017 8:24 AM.