Why free will is beyond physics

Philip Ball argues that "free will" is not ruled out by physics – because it doesn't stem from physics in the first place

Free will worries many physicists. It looks impossible to reconcile with a belief in deterministic physics, according to which events unfold as forces influence the trajectories of particles. In his new book *Until the End of Time*, the US theoretical physicist Brian Greene says that our choices only *seem* free because "we do not witness nature's laws acting in their most fundamental guise; our senses do not reveal the operation of nature's laws in the world of particles". In his view, we might feel that we could have done otherwise in a particular situation, but, short of some unknown psychic force that can intervene in particle motions, physics says otherwise.

Greene, like many others who take this view, is upbeat about it: free will is a perfectly valid fiction when we're telling the "higher-level story" of human behaviour. You can't change anything that will happen, but you should merrily go on thinking and doing "as if" you can with all the attendant moral implications. Maybe this picture works for you; maybe it doesn't. But in this view, you have no say about that either.

But is free will really undermined by the determinism of physical law? I think such arguments are not even wrong; they are simply misconceived. They don't recognize how cause and effect work, and by attempting to claim too much jurisdiction for fundamental physics they are not really scientific but metaphysical.

Hubristic and absurd

In the late 4th century BCE, the Greek writer Epicurus tried to reconcile our apparent freedom to act with Democritus's idea that the world is composed of atoms moving according to immutable laws. Epicurus supposed that predestiny is avoided because these particles sometimes execute a random change in motion – a "swerve". If that doesn't sound convincing now, modern arguments that try to save free will with physics are hardly any better. Classical chaos makes prediction of the future practically impossible, but it is still deterministic. And while quantum events are not deterministic – as far as we can currently tell – their apparently fundamental randomness can't deliver willed action.

If the claim that we never truly make choices is correct, then psychology, sociology and all studies of human behaviour are verging on pseudoscience. Efforts to understand our conduct would be null and void because the real reasons lie in the Big Bang. Neuropsychology would be nothing more than the enumeration of correlations: this action tends to happen at the same time as this pattern of brain activity, but there is no causal relation. Game theory is meaningless as no player is choosing their action *because* of particular rules, preferences or circumstances of the game. These "sciences" would be no better than studies of the paranormal: wild-goose chases after illusory phenomena. History becomes merely a matter of inventing irrelevant stories about why certain events happened.

Wrong way If physics can disprove free will, then it must override everything else too, even evolution.

Perhaps that is the bitter truth. Why should we sacrifice physics just to save the face of other disciplines? But let's consider the alternatives. Understanding decisions and behaviour through psychology allows us to form hypotheses and test them empirically. Some of these look as though they're right: we can reliably predict what might make people change their behaviour, say. If, however, physics demolishes free will, this is just a peculiar coincidence. Forget all the "as if" gloss: reducing all behaviour to deterministic physics unfolding from the Big Bang offers us no genuine behavioural science at all, as it denies choice and puts nothing in its place that can help us understand and anticipate what we see in the world.

Surely, then, we have to choose one or the other? No, we can have both. It's simply a matter of recognizing distinct domains of knowledge – of accepting that at certain levels of reductionism, some explanatory power vanishes while some is newly acquired. It is not because of the sheer overwhelming complexity of the calculations that we don't attempt to use quantum chromodynamics to analyse the works of Dickens. It is because this would apply a theory beyond its applicable domain, so the attempt would fail. Greene presents the matter as a hierarchy of "nested stories", each level supplying the underlying explanation of the next. But that's the wrong image. To regard every form of human enquiry, from evolutionary theory to literary criticism, as a kind of renormalized physics is as hubristic as it is absurd.

"Chimpogenic" physics

The sceptical physicist might then ask: so where does this "free will" come from that enables events to turn out differently than they might have? In response, we should turn the question around: what exactly *caused* events to turn out as they did? The underlying problem here is that the reducibility of phenomena – which is surely valid and well supported – is taken to imply a reducibility of cause. But that doesn't follow at all. What "caused" the existence of chimpanzees? If we truly believe causes are reducible, we must ultimately say: conditions in the Big Bang. But it's not just that a "cause" worthy of the name would be hard to discern there; it is fundamentally absent.

To account for chimps, we need to consider the historical specifics of how the environment plus random genetic mutations steered the course of evolution. In a chimp, matter has been shaped by evolutionary principles – we might justifiably call them "forces" – that are causally autonomous, even though they arise from more fine-grained phenomena. To complain that such "forces" cannot magically direct the blind interactions between particles is to fundamentally misconstrue what causation means. The evolutionary explanation for chimps is not a higher-level explanation of an underlying "chimpogenic" physics – it is the proper explanation.

There is good reason to believe that causation can flow from the top down in complex systems – work by Erik Hoel of Tufts University in Massachusetts and others has shown as much. The condensed-matter physicist and Nobel laureate Philip Anderson anticipated such notions in his 1972 essay "More is different" (*Science* **177** 393). "The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe," he wrote. "The behaviour of large and complex aggregates of elementary particles, it turns out, is not to be understood in terms of a simple extrapolation of

the properties of a few particles. Instead, at each level of complexity entirely new properties appear, and the understanding of the new behaviours requires research which I think is as fundamental in its nature as any other." Perhaps this is easier to accept for those working in condensed matter than in high-energy and "fundamental" physics.

Free will, then, is not a putative physical phenomenon on which microphysics can pronounce – it is a psychological and neurological phenomenon. In truth, "free" is a deeply problematic term, and "will" is scarcely better – so neuroscientists and cognitive scientists often prefer to talk about volitional decision-making. Decisions are things that happen at the level of neural networks and they are made using the coarse-grained information available to sensory receptors and neurons. It makes no sense to regard them as interventions in particle interactions.

If we recognize, as we should, that the origins of volitional decision-making lie in evolutionary biology, we must accept that the entire mode of its operation – the way in which brains imbued with innate tendencies and learned information process low-resolution stimuli – doesn't share an epistemic language with Newtonian and quantum mechanics. To talk about causation in science at all demands that we seek causes commensurate with the phenomena: that's simply good science and good epistemology.

Free will is not a putative physical phenomenon on which microphysics can pronounce

Long-standing disputes about free will and physical law, with their philosophical jargon of compatibilism and libertarianism, have not really advanced our understanding of the problem of determinism since Pierre-Simon Laplace supposed in the early 19th century that he could predict the entire future from total microscopic knowledge of the present. But this rather sterile debate can be and at last is being replaced with a "neuroscience of free will" that examines how brains, with their particular architectures and dispositions, arrive at decisions on the basis of past and present experience. That's the way to pose worthwhile, testable questions about choice and behaviour.

Those who say that free will, and attendant moral responsibility, don't exist but we should go on acting as if they do rather prove that their position is empty because it neither illuminates nor changes anything about how we do and should behave. The worry that free will *must* be salvaged somehow from physical determinism because otherwise responsibility for our actions will vanish is then revealed to be groundless. Moral responsibility is not a physical principle but a construct of human psychology and society. It expresses the view that we must strive to choose some behaviours and reject others. Some find that harder than others. Some can be encouraged to do so, perhaps by social sanctions. This is what we see in the world. To say that it only looks that way is to add nothing significant.

To claim that reality is not what you think it is, but that this can never be proved, is to speak metaphysically. Immanuel Kant was doing so when he postulated the *Ding-an-sich* – the "thing in itself" – that we can never access through our senses. It can be fun and stimulating to debate such things, but it is not science.

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