Chance Regained: David Z. Albert's oeuvre revisited

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After Physics is a new collection of essays by the illustrious David Albert, and represents (I believe) his first panoramic look back at his own oeuvre. The book can be thought of as roughly comprised of two parts, the first of which revisits his landmark *Time and Chance* while the second directs itself to a rich set of issues in the interpretation of quantum mechanics.

Given the standing of the author, this volume doubtless represents compulsory reading for those invested in any of the debates that it touches on. Its natural analogue in this respect is the recent collection of essays by the other east-coast heavy-weight, Tim Maudlin's *The Metaphysics Within Physics*. I suspect, however, that approaching this book with that comparison in mind (as I did) is apt to invite disappointment. While Maudlin's book somehow managed to be all of expansive in ambition, inclusive in approach, and just a pleasure to read, this is not a pedagogical work in anything like the same sense and you will likely have to work for your money. For all its inevitable stylistic flair, the text is rather compressed and laborious to read, and it can be hard to differentiate what is merely a statement of Albert's point of view and what is intended as an argument. There is also a conspicuous lack of engagement with Albert's many esteemed critics, and as such it isn't obvious either how to place this work in the wider field nor what the value added to his extant body of work is. But that said, it is almost goes without saying that this volume *is* a very rich seam, and those more firmly grounded in the core philosophy of physics curriculum than I am will no doubt find it less taxing a read.

The early chapters revisit Albert's comprehensive vision for physics outlined in *Time and Chance,* which argued that the macroscopic phenomena we observe, including its temporal asymmetry, can be fully accounted for by fundamental physics. In particular, it claimed such phenomena may be accounted for by deterministic, time-symmetric fundamental laws supplemented by the posit that the early state of the universe was one of extremely low entropy, plus a uniform probability distribution over the microstates that realize this state – all understood in Humean-friendly terms. This perspective on the systematization of nature has by now (via the Coen brothers) become known as the *Mentaculus.* After summarizing the view outlined in this work, published first in 2000, he outlines how this vision offers a corrective to views on the autonomy of the special sciences, accounts for the existence of human memories, and does nothing less than ground the possibility of knowledge itself.

It will go without saying that the success of this programme would represent a philosophical achievement as grand as any imaginable: this is presumably why *Time and Chance* has garnered so much discussion since it burst onto the scene. Sadly, however, that commentary receives scant mention here, and certainly nothing that can **could** be called systematic. This strikes me as a wasted opportunity, and made me wonder what precisely the motivation for revisiting this material was. It also strikes me that during this period the general Humean metaphysic in which the Mentaculus is wrapped up has been confronted with a variety of new and significant challenges, and the absence of any discussion of these struck me as a lacuna once again. Perhaps, however, philosophers of science have in large part quietly resigned to the idea that no-one will be talked out of their pet stance on Humeanism, at least not before the heat death of the universe – a pessimism that I believe to be unwarranted but that is easy to understand nonetheless.

However, one area in which Albert does seem keen to reflect on the broader impact of his earlier work is in terms of its relationship to the special sciences. I have already noted that if the Mentaculus succeeds, then all of our worldly non-fundamental ontology – all of its structure and dynamics – can in principle be accounted for. But now Albert seems to want to go further and emphasize that the non-fundamental is not just *composed* or *determined* or *brought about* by the fundamental, but is in addition fully *explainable* in fundamentalist terms. While conceding that the philosophy of science literature is 'awash in famous objections to pictures like that', in Chapter 1 of the book he attempts to show how his vision of science can fend such objections off. One line of attack (on pages 13-14) is to call into question the idea that multiple realizability undermines the explanatory autonomy of fundamental physics, though it strikes me that here his example misfires and that there is nothing that poses any obvious threat to the 'famous objections' of Dennett and others. But much more threatening in this connection, it seems to me, is his argument against Kitcher's claim that many of the regularities that are successfully explained in the terms of the special sciences – such as the explanation of a preponderance of baby boys in the terms of natural selection – cannot be regarded as anything other than 'gigantic coincidences' when viewed from the purview of physics. I will not attempt to recapitulate either side of the argument here, but the big point embedded in Albert's argument seems to be that an essential appeal to higher-level ontology when providing explanations need not disqualify that explanation from being an explanation in the terms of fundamental physics. And while what notion of explanation Albert has in mind here has is never made explicit (nor precisely what he understands by 'coincidence'), it struck me that (a) if he is right about this, then it will be very important indeed, and (b) he could very well in fact *be* right. Here I should underline that I am no expert when it comes to explanation: for all I know someone has made this point before and this will just turn out to be old physics imperialism in new bottles. But I nevertheless feel confident in saying that anyone working on big-picture issues on explanation in science needs to have a policy on what Albert has to say here.

The second part of the book concerns an assortment of interwoven issues in the philosophy of quantum mechanics, structured around three central themes. Roughly speaking, these are the questions of how non-fundamental ontology, or at least the appearance of it, arises from fundamental ontology; what the arena in which quantum mechanics unfolds is, and what the implications of the failure of relativistic quantum mechanics to be *narratable* are. Overall, the metaphysical vision that emerges (to the extent that one does) is a neo-Lorentzian picture in which there exists a privileged frame of reference, and in which quantum physics is much more akin to classical physics than most of us are accustomed to thinking.

The material on how higher-level structure emerges from the fundamental is distributed across a couple of chapters: Chapter 6, 'Quantum Mechanics and Everyday Life', and Chapter 7, 'Primitive Ontology'. In these pages, Albert considers (among other things) how it is that three-dimensional appearances could emerge from the 3N dimensional space in which he takes the wavefunction to undulate. This project of getting the appearances of low-dimensional spacetime out of fundamental dynamics turns geometrodynamics on its head, and anyone with an interest in the emergence of spacetime would be well-advised to pay close heed to this chapter (regardless of their position on configuration-space realism). Be warned, however, that there are central assumptions regarding the dynamics made here whose naturalness one must simply take on trust. In this respect, Albert's discussion is a little less satisfying than Wallace's wonderfully hand-holding presentation of the emergence of classical ontology through decoherence in Chapter 2 of *The Emergent Multiverse*, and this was another point in which I found myself wishing that Albert had taken more trouble to put his work into contact with that of others engaged in comparable tasks. But it is easy to see that there is fruitful work to be done here, whoever it should be that steps up.

Chapter 7 takes issue with proponents of 'primitive ontology' approaches, such as GRW theory with a mass density, who insist *a priori* that fundamental ontology must exist in four-dimensional spacetime – memorably comparing this insistence with a defense of the caloric (pp. 156-7). Nevertheless, a good chunk of this chapter consists of a defense of GRW theory against Tim Maudlin's objection in terms of the 'problem of tails'. What Albert shows, assisted by a simple dynamical model, is that the low-density portions of the wavefunction that correspond to the tails behave nothing like familiar objects, and so cannot be reified given a functionalist understanding of non-fundamental stuff; moreover, their effects on that stuff are unimaginably tiny, and so can be ignored for all practical purposes.

While I'm not wholly convinced of the consistency of being a Humean about the fundamental and yet a functionalist about more provincial stuff, it was this material surrounding the relation of fundamental to non-fundamental ontologies that I found the most edifying of all the book. It strikes me that the discussions surrounding this issue in philosophy of physics today are of a sophistication unmatched in the history of the discipline – so carefully wrought that they make the 'mereological sums' and 'particles arranged tablewise' that are the proclivity of our less naturalistic

colleagues seem almost imbecilic by comparison. The elephant in the room here though is that the brunt of this discussion, as already mentioned, takes place against the background of configuration space realism. This is where most of the action has been in the metaphysics of quantum physics over the last two or three years, and what precipitated this discussion was (I believe) another work of Albert's hand, his 'Elementary Quantum Metaphysics'. If this view is right, then the world is fundamentally 3N dimensional, where N is the number of particles in the universe – a space which, needless to say, is 'mind-bogglingly high-dimensional' (p. 147). But as papers on this topic continue to churn out, what continues to astonish me is just how *flimsy* the justification for this radical proposal fundamentally is. Simply put, configuration space realism seems to be embraced by those who do so only to ensure that the wavefunction is not a 'shadowy and mysterious and traditionally quantum-mechanical sort of thing'; only in order that we not be 'saddled' with the 'old-fashioned and unwelcome quantum mechanical weirdness of non-separability' (p. 149). But is this sort of squeamishness over something perceived as 'weird' really sufficient grounds for positing, in all seriousness, 'a continuously infinite set of very high dimensional [fundamental] spaces parameterized by a single, absolute time' (p. 142)?

It seems to me not. Indeed, it seems deeply *incongruous* to me that respectable philosophers of physics are so sanguine about letting quasi-aesthetic predilections like this do so much ontological work. Surely we should hold ourselves to a higher standard in this regard than our analytic colleagues – or, if these sorts of appeals should turn out to be ineliminable, at least have something to say about their methodological standing that is vaguely empirically informed. But here there is no reflection, not so much as a momentary expression of regret, over the idea that at some point we may have no choice but to retreat to largely individual preferences regarding virtues to support our world view; there is nothing on what makes supervenience entitled to the status of a regulative principle; no guidance on how to proceed when one 'weirdness' conflicts with another. (On the configuration space realism approach, for example, had there been one extra particle then there would be another three dimensions to space. Isn't *that* pretty weird? Does it out-weird the idea that space is 3N dimensional in the first place? Or is judging it weird just to indulge anti-Humean intuitions according to which the basic laws of a world should be stable under small changes in initial conditions? – I don't know.) Again, this all seems like a wasted opportunity for one of the movers and shakers in the field to critically reflect on his own methodology – of how one is to proceed, one is tempted to say, *after physics* has done its work.

The third topic dealt with at length in part two is that of narratability – another concept brought into the foreground of philosophy as a result of Albert's own endeavours. In Chapter 5, using a simple dynamical model (simpler now, I believe, than in his previous work), Albert argues that a world described by a relativistic quantum mechanics cannot be *narratable* – that is, cannot such that the 'entirety of what there is to say about it can be presented as a single *story*, [cannot be such that] the entirety of what there is to say about it can be presented as a *single temporal*

sequence of *instantaneous global physical situations* (p. 109). A consequence of this failure is that observers in frame K won't be able to predict what observers in frame K' are going to measure: thus 'to present the entirety of what there is to say about a relativistic quantum-mechanical world, we need to specify, *separately*, the quantum-mechanical state of the world associated with every space-like hypersurface' (p. 111). While once it was thought that this phenomenon was a pathology of wavefunction collapse, Albert argues that in fact there is no difference between collapse and Everettian approaches on this score – obliterating in the process a chief selling point of the many-worlds view. While not entirely explicit about what precisely is unacceptable about narratability failure, he seems to take it that to accept such failure is to give up on cherished ideas about what science is in the business of doing. The only response, he claims, is to posit a privileged frame of reference, and so give up on a geometric understanding of special relativity to a neo-Lorentzian, mechanical one.

Clearly, once again, all this is a very big deal. But sadly, yet again, it seems that little definitive can be taken away from all this, largely because Albert opts not to engage with important rejoinders that have been directed to his argument since its previous incarnation. For example, Wallace and Timpson have argued that narratability failure can be marshaled to argue against precisely the sort of configuration space realism defended in this book, and moreover that such failure is perfectly understandable, indeed unsurprising, when we think of the quantum state as being defined on spacetime.[1] This paper was published in 2010 and Albert has had plenty of time to engage with it. So why does he choose not to do so? For all its faults, my own experience of the philosophy of physics has been of a deeply collaborative enterprise – surely an aspect of it that deserves to be treasured and that we should be working hard to nurture. In that respect, the comparative remoteness of this work somewhat made my spirits sink.

David Albert's contributions to the philosophy of physics are impossible to overstate. But I do not think there is anything inconsistent in admiring Albert and choosing not to invest in this book. While I emphasize again that it represents compulsory reading for those working closely in the issues it touches on, mostly for the best of reasons, its imperious tone is a put-off and its barriers to entry rather high. I suggest that it be read on a need-to-know basis.

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[1] Wallace D, Timpson CG (2010) Quantum mechanics on spacetime I: spacetime state realism. *Br J Philos Sci* 61(4):697– 727.