

Commentary  
Andreas Hüttemann  
*What's Wrong with Microphysicalism?*  
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George Darby<sup>†</sup>  
g.a.darby@kent.ac.uk

1. Introduction

In this book Andreas Hüttemann argues against *microphysicalism*, whose «core doctrine is the affirmation of an *ontological priority of the micro-level*» (p. 7). Hüttemann distinguishes three ways of fleshing out the core: *Micro-determination* is the thesis that «the behaviour or the properties of compound systems are determined by the behaviour or the properties of their constituents but not vice versa»; *micro-government* holds that «the laws of the micro-level govern the systems on the macro-levels»; and *micro-causation* «claims that causation takes place in virtue of the causation on the level of the (ultimate) parts» (p. 2). He takes microphysicalism, in these various guises, to be motivated by what he calls *micro-explanation*, «the explanation of the properties on the macro-level on the basis of the properties of the micro-level» (p. 9). His primary concern is then to undermine this move; granting the success of micro-explanation, he argues at length that it nevertheless does not motivate any of those three further theses that might constitute microphysicalism proper. Along the way various considerations from natural science help to make a compelling case that the doctrine's status as a default assumption in many areas of philosophy ought to be reconsidered.

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† Department of Philosophy, University of Kent.

That it *is* a default assumption is reflected in Lewis's famous *Humean supervenience*. At least on the famous statement of the position in the Introduction to the second volume of Lewis's *Philosophical Papers* (1986a), this says that everything is determined by the distribution of intrinsic properties point-by-point. Hence this book's relevance to this special issue, as Humean supervenience appears on Page 1 as a paradigm of micro-determination, Hüttemann citing a portion of that official statement: «all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another [...]. And that is all».

To provide further context here, *What's Wrong With Microphysicalism?* touches on a number of themes that converge in recent work. Some of these have to do with arguments for metaphysical holism in quantum mechanics that have been around for a long time. Roughly, the properties of composite quantum systems in entangled states do not supervene on the properties of their component parts, and this has been brought up as a challenge to Humean supervenience by philosophers of science, Maudlin (2007), Ladyman and Ross (2007) being prominent. Similar ideas have recently received attention in mainstream metaphysics – see for example Jonathan Schaffer's recent defence (2010) of monism. Schaffer there also presents essentially philosophical arguments (as opposed to philosophically-interpreted scientific results) for the same conclusion, and this might be seen as exemplifying an increasing anti-reductionism. Since Hüttemann too discusses the use of quantum mechanics in the case against microphysicalism (but with a twist, mentioned below), alongside essentially philosophical arguments, it would not be too much of a stretch to see this book in the same tradition; indeed Schaffer (reviewing this book in Schaffer, 2008) recruits Hüttemann's work in support of his own project.

A further theme, which provides a tempting way of unifying this commentary, concerns the priority (rather than mere relevance) of science in its relation to metaphysics. This is explicitly a theme for those philosophers of science above; less clearly so for Hüttemann. Scientism involves a commitment to engaging seriously with scientific results, which Hüttemann certainly shares, but in the hands of Ladyman and Ross (for example) it goes much further, becoming a polemic against pointless exploration of «entrenched philosophical fetish[es]» (Ladyman & Ross, 2007, p. 21). Some themes in the book chime with the philosophers of science's quarrels with analytic metaphysics, but there is also plenty of engagement with its main concerns, and Hüttemann clearly

doesn't think that the whole enterprise is a waste of time. Nevertheless, I think that there is enough common ground to spin things this way for the purposes of this commentary. Another salient reason will concern causation; mainstream metaphysics in the broadly Lewisian tradition considers homely examples where Billy throws a rock at a window; perhaps Suzy threw one too, which would have broken the window if Billy's hadn't; this kind of example is often used in the literature to draw far-reaching conclusions. Maudlin rejects the Lewisian tradition, preferring what might be called a "laws-first" approach, and Hüttemann does something similar, claiming support from the way in which laws figure in actual science.

I share some of this scientific conviction too. But, having encountered Lewisian metaphysics at an impressionable age, I would also like to think that it is of more than merely scholastic interest. For this commentary, then, I'd like to think about how Lewisian metaphysicians might reply. Among others, three lines suggest themselves:

1. Deny that the evidence is anything like as conclusive as suggested. This goes especially for quantum mechanics, where the "holistic" reading of the formalism and of Bell's theorem has long been contested.

2. Anti-metaphysical philosophers of science (again acknowledging that Hüttemann might not want to be lumped in with them) tend to engage less with the scholastic details. Well they would, since they think it's a waste of time. But they do offer *rival* accounts of staples of analytic metaphysics; for example (and this certainly does include Hüttemann), alternatives to Lewis's treatment of causation. So we should attack those rival accounts. It would make a nice dialectical point if it could be shown that those scholastic details matter after all, and even nicer if, once the details have been tidied up, the rival accounts tend to converge on something like Lewis's anyway.

3. Dispute more directly the way the dialectical situation has been set up. In this case a strategy would be to wonder in what sense Lewis is really a microphysicalist.

I'll have a go at each in turn in the following three sections.

## 2. Quantum Mechanics vs Humean Supervenience

Hüttemann presents the standard argument from quantum entanglement, which goes like this (p. 47): If the state of a composite system is a product state, then it can be thought of as being one in which Particle 1 is in state A,

say, and Particle 2 is in state B. But some states, like the singlet state, are not product states. There is no way to think of this as representing Particle 1 in a particular state, without mentioning Particle 2 (and vice versa). Particle 1 and Particle 2 are then said to be *entangled*. Hüttemann puts the lesson like this:

There are spin states of the compound system such as [the singlet state] that do not allow the attribution of pure states to the parts of the compound. So the fact that the compound is in a determinate state cannot be explained in terms of determinate states the constituents occupy. Here we have an example of the failure of micro-explanation – or at least of one kind of micro-explanation, namely, micro-explanation of the *states* of compound systems.

This marks a departure from the more usual way of talking, which sees the lesson in terms of supervenience or determination: it's not that the compound state is to be *explained* in terms of the states of the parts, so much as that one would hope that it would *supervene* on the states of the parts. Hüttemann does then go on to link this with supervenience, citing Paul Humphreys' discussion (1997). However this is cashed out, though, Hüttemann thinks it somewhat orthogonal to his concerns: entanglement «provides a counter-example to part-whole micro-explanation of states – not, however, a counter-example to part-whole micro-explanation of the dynamics of compound systems» (p. 48). This (the twist mentioned above) leads into a novel argument that, when one pays attention to the *dynamics* of even an entangled quantum system, things appear better for micro-explanation. If I understand right (though Hüttemann doesn't put it this way, hence the qualifier), this would suit Hüttemann's ultimate aim: micro-explanation might succeed even in the quantum case (and see especially the bottom of p. 56), while micro-*determination* (here supervenience) fails. So again, the success of micro-explanation is no evidence for micro-determination, which fits with Hüttemann's overall strategy.

In the present Lewisian context, in any case, what is important is this failure of supervenience. Thus Schaffer, in his review of the book (2008, p. 255) re-emphasises that, whatever the outcome of Hüttemann's dynamic argument, micro-determination is threatened by the loss of «part-whole micro-explanation of states», and Hüttemann too positively endorses this line: «I agree with Humphreys (and others) that quantum entanglement is a case of emergence» (p. 48). So I think Hüttemann can be co-opted into the growing consensus that something like this does pose a very serious challenge to microphysicalism, and Humean supervenience in particular.

So, the key question: How could Lewis respond? One way would be to resist the supposed scientific evidence. Lewis famously hinted at something like this:

I am not ready to take lessons in ontology from quantum physics as it now is. First I must see how it looks when it is purified of instrumentalist frivolity; [...] doublethinking deviant logic; and [...] supernatural tales about the power of the observant mind to make things jump. If, after all that, it still teaches nonlocality, I shall submit willingly to the best of authority. (Lewis, 1986a, p. xi)

It is often replied that there *are* theories that fit the bill, and they are all nonlocal (they have to be, by Bell's theorem). But it is still open to question what *kind* of nonlocality they involve. A clear refutation of HS requires non-*supervenience*, and the conclusion that the experimental evidence requires *that* may be (and has been, and still is) resisted.

This response, however, leaves hostages to fortune. If the physical evidence, and the consensus (even if not overwhelming) on its interpretation, points to the failure of microphysicalism, then a good metaphysician ought not insist on remaining a microphysicalist. And so Lewis hints at another solution: «[I]f I defend the philosophical tenability of Humean Supervenience, that defence can doubtless be adapted to whatever better supervenience thesis may emerge from better physics» (Lewis, 1994, p. 474). This suggests an alternative line, again putting it in the context both of Hüttemann's book and of the present volume: Lewis thinks that his metaphysics will survive whatever physics throws up. But microphysicalism may well not survive whatever physics throws up; therefore Lewis is not (essentially) a microphysicalist. I'll explore this a bit more in Section 4.

### 3. FLOTEs and NULA versus Billy and Suzy

Lewis of course is famous for analysing causation in terms of counterfactual dependence, and counterfactuals via comparative similarity of possible worlds. The substantial literature on both of these components is grist to the scientific mill: Ladyman and Ross (2007, pp. 1, 3, 4, *passim*) see this approach to causation as another folly of analytic metaphysics; McKay Illari, Russo and Williamson's *Causality in the Sciences* (2011) opens with a manifesto along similar lines (at least as far as a more prominent place for science is concerned); and Maudlin (2007) advocates replacing Lewis's analysis of counterfactuals with an approach based on Fundamental Laws of Temporal Evolution

(FLOTES). Hüttemann too wants to give laws (his account of which gives precedence to their appearance in actual science over the “All Fs are Gs” mould) a more distinctive role, in what he calls the Nomologically Updated Ludovician Account (NULA), his alternative to Lewis’s account developed in Chapter 7. The laws-first, science-inspired FLOTE and NULA accounts are ranged against the counterfactuals-first, intuition-guided, tradition of Billy and Suzy.

The kind of reply I have in mind is this: Maudlin’s account (2007, Chapter 1) evaluates counterfactuals by fixing things at a Cauchy surface (the relativistic equivalent of a moment in time) so that the antecedent is true, and then letting the laws unfold. This makes it somewhat like the proposal of Jackson’s *A Causal Theory of Counterfactuals* (1977); but Jackson’s theory faces objections because of this feature (see Bennett, 2003, p. 209). What is interesting in this regard is that Jackson’s theory is seen as a step in a series of refinements on a basic idea, which ultimately lead to Lewis’s account (Bennett thinks that Lewis’s account is not the last word either, but that is a separate issue). Wouldn’t it be convenient if the more modern account inherited the same problems, and if the needed fixes were those that motivated the move towards the Lewisian orthodoxy? Well, space sadly precludes exploring this in the case of FLOTES; but I do think something like this might be pressed against Hüttemann’s NULA.

In Lewis’s original account (Lewis, 1973a), counterfactual dependence between *c* and *e* consists in two counterfactuals (“O” for “Occurs”):

(1)  $O(c) \Box \rightarrow O(e)$

(2)  $\neg O(c) \Box \rightarrow \neg O(e)$

For actual *c* and *e* (1) is automatically true and plays little further role in Lewis’s account, but an analysis of counterfactual dependence in general might as well include it – the usual possible worlds story (Lewis, 1973b) takes care of their truth conditions. Since Hüttemann wants to do without the possible worlds, and to avoid the mess of what to put in their place, he simply drops (1), swapping it (pp. 110, 112) for

(1\*)  $O(c) \wedge O(e)$

The major departure from Lewis’s system appears to be with (2), whose truth-value is to be «entirely a matter of laws of nature». Of course laws *figure* in Lewis’s analysis:  $p \Box \rightarrow q$  is (actually) true iff (more-or-less) the closest *p*-world

to actuality is a q-world, and comparative closeness to the actual world depends on match of particular fact and the extent of violations of the actual laws (Lewis, 1979). But the laws themselves emerge from the Humean mosaic via the Best System analysis.

Hüttemann's alternative approach is illustrated by two colliding billiard balls, A and B. A causes B to change direction; for concreteness let's say that A caused B to miss the pocket; the specific counterfactual he considers is *if A had not collided with B, B would have taken path  $b^*$  rather than path  $b$*  (so  $b^*$  in our case leads to the pocket,  $b$  does not).

The Lewisian analysis would go something like this: the minimal change (on the Lewis, 1979 criteria) has perfect match until some small violation of the actual laws to prevent the collision, thereafter everything unfolds as the laws require and B goes in the pocket. That gives the counterfactual dependence *if A hadn't collided with B then B would not have missed the pocket*, and the further analysis of causation in terms of that dependence delivers the required result – that the collision caused the miss. At this point the Lewisian analysis famously has a problem with pre-emption: take a situation where a bee was flying across the table and would have knocked B away from the pocket if A hadn't got there first. Now *if A hadn't collided with B then B would not have missed* is false, even though we still want to say that the collision with A caused the miss. This appears to be an ongoing glitch in the program, so it would be handy if Hüttemann's analysis avoided it.

So, the crucial passage is:

(2) turns out to be true because there is a law that tells us that B would have continued along path  $b^*$  if it had continued to be isolated. If B were isolated it would behave according to the Hamilton equations with the Hamilton function  $H = p^2/2m$ . Less pretentiously, it is Newton's first law that tells us how B will continue in the absence of a collision. The counterfactual (2) is true because there are laws about what would happen in the absence of the cause-event.

This analysis is adequate in general. We do not need possible world semantics for (1\*) and (2). (1\*) simply registers that the cause-event and the effect-event have occurred. (2) cites a law that states how a system that goes into the effect-event would have behaved if it had remained isolated. (p. 113)

The idea, then, is that the required counterfactual is made true by B's velocity shortly *before* the collision, plus Newton I, which has the isolated B travel straight to the pocket.

Hüttemann sees this as enjoying advantages over Lewis's account, importantly that it avoids the problem of pre-emption. Since he stipulates that the relevant counterfactual consider B in *isolation*, not just from A but from all outside interference, including the bee, on his understanding *if A hadn't collided with B then B would not have missed the pocket* will come out *true*, as required. So too, then, the NULA account of causation has it come out true that the collision with A caused B to miss the pocket.

So far so good. However:

(a) In Chapter 2, and starting with Galileo on free-fall, Hüttemann develops an unHumean account of laws, drawing on the idea of *continuously manifestable dispositions* that may be partially manifested in real situations, to be contrasted with dispositions whose manifestation is an «all or nothing affair» (p. 19). This plays a crucial role in Chapter 7, with the thesis that

laws of nature describe how systems would behave if they were isolated. [...] According to NULA it is exactly these kinds of counterfactuals that are appealed to in condition (2). [...] Laws of nature tell us how a system would behave if its behaviour were not caused to change by some external factor. (p.113)

But B in *complete* isolation, though it might indeed continue in a state of uniform motion (assuming there is then enough spacetime structure for this), won't reach the pocket (since there is no pocket to reach). The system needs to include at least the table, but not A, or the bee. «The absence of the cause-event» and «in the absence of a collision» suggest something more like this, but «if it had *remained* isolated» suggests something else again. So I suspect that there is value in objecting that more information is needed on what is meant by «the system», and «isolated». (On a similar theme, contrary to the quote above, neither (2) nor its particular instance in the case at hand appears to *cite* anything so general as a law at all.)

(b) Next, given a complete account of the relevant understanding of the *system in isolation*, we can look for counterexamples. Suppose I twirl a conker on string. The string's breaking causes the conker to fly off towards your window. Here Hüttemann needs a counterfactual something like

If the string hadn't broken, the conker would have continued to travel (approximately) in a circle).

But there doesn't seem to be any way of achieving an unbroken string simply by stipulating that the system remain isolated – in this case it's not, as suggested

in the quote, a matter of an *external* factor that needs to be excluded (that's what isolation achieves), but an *internal* factor that needs to be altered. (How does it need to be altered? Well, the state of the world at the time of the antecedent could simply be changed to make the antecedent true – the string suddenly breaks – as in Jackson's account. But the problems with Jackson's account (to do with sudden changes when large cause-events are considered) motivate a revision to having a small miracle some time before neatly bring about the antecedent, ... and we are back to Lewis.)

(c) Pre-emption problems are avoided because so much is excluded from the relevant law. But that also introduces spurious causes: Hüttemann is explicit that two events  $c$  and  $e$  causally depend on one another if (1\*) and (2) hold (p. 114), so it appears that this is a sufficient condition for causation. That means that any example of actual  $c$  and  $e$  that fits Hüttemann's way of cashing out (2) will give an example of causation. On that account, what ensures that the collision with A gets correctly attributed as a cause of B's missing the pocket is the fact that the law applied to just the system composing B (and the table), *in the absence of the collision with A*, results in B not missing the pocket. But as far as absence from the relevant system including B *in isolation* is concerned, there was nothing special about A. The same law, applied to the system composing B (and the table) in isolation, *in the absence of more-or-less any event you choose*, results in B taking path  $b^*$  to the pocket. That seems to ensure that more-or-less any event gets attributed as a cause too. Assuming that this result is undesirable, that would show that NULA is too liberal.

Perhaps what is needed is an additional clause concerning what happens when A is considered after all – but that would be something like Lewis's original clause (1) (but with Hüttemann's laws-based approach to its evaluation). Alternatively, the specification of what it is to consider B *in isolation from A* could be tweaked, perhaps to reflect the *minimal* change needed to bring about  $\neg A$ . But again, that is what Lewis's original analysis does.

(d) Lewis's analysis proceeds by focussing on one particular counterfactual:

If  $c$  hadn't happened,  $e$  wouldn't have happened.

That counterfactual, like any counterfactual, has its truth-value already, perhaps, as for Lewis, fixed by the general theory of counterfactuals (and note that Lewis's theory is built to deliver the truth-values that we all agree are correct – it is not prescriptive). This particular counterfactual may turn out to

be unsuitable for the analysis of causation: it clearly has one truth-value, Lewis needs it to have the other (as in the pre-emption problem). One strategy would be to find a different counterfactual, or perhaps to introduce more machinery such as *quasi-dependence* (as in the postscripts to *Causation* added in Lewis, 1986b, pp. 205ff). Whatever the details, the change is being made to the theory of causation, not the theory of counterfactuals. But Hüttemann's response *does* change the truth-value of the relevant counterfactual, to suit his specific purpose. This seems to change the wrong component. In the pre-emption case, if A and B hadn't collided, the miss still *would* have happened. That is *why* the counterfactual

If A hadn't collided with B then B would not have missed the pocket

comes out false, contrary to Lewis's requirement that it be true. The theory of causation should be revised to cope with the truth-values that counterfactuals are agreed to have, not the other way round.

I think there is mileage here in defence of the Lewisian approach by pressing these kinds of objections. Moreover, I would hope that tweaking Hüttemann's account to avoid the objections may take it back towards Lewis's. This reflects a general strategy in defence of analytic metaphysics: show that its products, while perhaps not drawn from the latest science, are of use even to its critics. (A similar strategy is suggested by Katherine Hawley, in her review (2010) of Ladyman & Ross, 2007, where she notes that Ladyman and Ross could use some of those products to overcome problems in their own brand of metaphysics.)

#### 4. In What Sense is Lewis a Microphysicalist?

Microphysicalism is certainly questionable from a variety of directions, as Hüttemann shows. I've suggested above some ways in which one might reply to some specific details in respect of Lewisian metaphysics, but (except insofar as the details are components in Hüttemann's overall plan) nothing to defend microphysicalism itself. Perhaps it can be defended (undermining the argument from entanglement would be a part of this), but suppose not. Then Lewis will have to make some kind of concession on the details. But perhaps those details (in particular, as suggested at the end of Section 2, the microphysicalism) are disposable.

For example, in the context of the conflict with quantum mechanics, I think that once one pays attention to the distinction between the *letter* (the official statement from Lewis, 1986a cited by Hüttemann as a paradigm of microphysicalism) and the *spirit* (the denial of necessary connections between distinct existences) of Humean supervenience, there is no real problem with entanglement – whether reality consists of many particulars instantiating spatiotemporal relations, or whether it consists of many particulars instantiating some other kind of relations, doesn't really matter to the core project. Whereas Hüttemann, then, sees microphysicalism as being driven by an argument from the success of micro-explanation, and no doubt that is the case for some of its defenders, for Lewis the microphysicalist component of Humean supervenience is merely a working assumption, and requires no particular motivation beyond a received view of classical physics.

I am fairly sure that this is the natural line of defence against Ladyman and Ross *et al.*, (and have argued for it in Darby, 2009). As further evidence for the spirit/letter, or perhaps hard core/protective belt, distinction, note that Borghini and Lando in this volume (their Section 4) find it natural to identify a Weak and a Strong version of Humean supervenience along similar lines. Like Borghini and Lando, I think that the thesis, among others, that the fundamental relations are the spatiotemporal ones is «*a posteriori* and concerns only our world and other worlds sufficiently similar to ours» (p. x, this volume). In the remainder of this essay I would like to acknowledge some doubts about this.

Famously Lewis says that HS is *contingent* in the passage immediately following the official statement of the doctrine in the introduction to the second volume of his *Philosophical Papers* (1986a, p. x):

Two worlds might indeed differ only in unHumean ways, if one or both of them is a world where Humean supervenience fails. Perhaps there might be extra, irreducible external relations, besides the spatiotemporal ones; there might be emergent natural properties of more-than-point-sized things; there might be things that endues identically through time or space, and trace out loci that cut across all lines of qualitative continuity. It is not, alas, unintelligible that there might be suchlike rubbish. Some worlds have it. And when they do, it can make differences between worlds even if they match perfectly in their arrangements of qualities.

Here Lewis appears to endorse an inference from conceivability to possibility («It is not, alas, unintelligible [...] [Therefore?] Some worlds have it.»). But elsewhere, for example in Lewis, 1986b (p. 90), he explicitly rejects

this. Again, in Lewis, 1983 (p. 362), he feels the need to allow for the possibility of epiphenomenal spirits, and the consequent need to formulate a contingent supervenience thesis is one of the motivations for natural properties in his metaphysics; but in Lewis (1986b, p. 73), wondering how spirits might be part of a world, given that worlds are unified by spatiotemporal relations, and having surveyed some ways round, such as allowing them to be related in time, he concludes: «I am not sure why I need to defend the possibility of spirit tales – after all, people have been known to accept impossible theories, as witness naive set theory – but in fact I think I give them at least as much room in logical space as they deserve». In the standard presentation, at least, the unification of worlds by spatiotemporal relations, and so the absence of disembodied spirits, are not contingent, and Lewis is content with this. Nor, partly because of the way modal realism is set up, is the denial of necessary connections. In a similar vein, the denial of dualism, which is surely no mere working assumption, might be guaranteed by locality: if there were irreducible mental properties then these would require more than a point at which to be instantiated (thanks to Helen Beebee for suggesting this).

The conflict with quantum mechanics, and the importance of microphysicalism in general, hinges partly on the sense in which Humean supervenience is contingent, and especially the status of spatiotemporal relations in this regard. There appears to be some flexibility in interpretation about why exactly Lewis's supervenience thesis *has* to be contingent, and how strong that commitment is. Clarifying this will give a better handle on the consequences of arguments such as Hüttemann's that appear to show that the doctrine is, as standardly presented, false.

## 5. Conclusion

Hüttemann's book contains compelling reasons to re-think, if not finally reject, the microphysicalist assumptions common to much of contemporary philosophy. This situates it in a growing and welcome movement towards more scientifically informed metaphysics. But the details matter both ways, and those details offer plenty of scope for reply by Lewisian metaphysicians. I look forward to seeing how this pans out in the near future.

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