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REVIEW

ANDREAS HÜTTEMANN
What's Wrong With Microphysicalism?
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In *What's Wrong With Microphysicalism?*, Andreas Hüttemann argues against the ontological priority of the microphysical, in favour of a 'pluralism' that accepts physical systems of all scales as interdependent equals. This is thoughtful and original work, deploying an understanding of the relevant physics to mount a serious challenge to the dominant microphysicalist view.

Microphysicalism, as Hüttemann characterizes it, is the thesis of the 'ontological priority of the micro-level' (p. 7). As Kim puts it, the world is the way it is 'because the micro-world is the way it is' ([1984], p. 100). Hüttemann notes that microphysicalism comes in such specific forms as:

> *Micro-determination*: 'The behaviour or the properties of compound systems are determined by the behaviour or the properties of their constituents and the relations among them but not vice versa' (p. 7).
>
> *Micro-government*: 'The laws of the micro-level govern the systems on the macro-levels' (p. 7).
>
> *Micro-causation*: 'All causation takes place in virtue of the causation on the level of the (ultimate) parts – or the micro-level. Macro-causation is entirely derivative and piggybacks on the causation of the micro-constituents' (pp. 7–8).

Hüttemann would resist microphysicalism in all of these forms.

Note that microphysicalism, in all of its forms, is distinct from physicalism (as Kim [1998] points out, and as Hüttemann deftly explains: pp. 120–6). Physicalism may be characterised as the thesis that 'everything is the way it is *in virtue* of the physical' (p. 120; cf. Loewer [2001], p. 39). This is neutral as to what if any priority relations obtain among physical systems. Physicalism is thus

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compatible with the priority of the microphysical, as well as with the priority of the macrophysical, and with a pluralism on which physical systems of all scales are mutually interdependent ontological equals, *inter alia*. Hüttemann is a physicalist. But he is not a microphysicalist, in any sense. Rather, he is a pluralistic physicalist.

What I will be suggesting is that Hüttemann's own arguments actually provide more support for the priority of the macrophysical than they do for his own pluralistic physicalism. So I would join Hüttemann in rejecting microphysicalism, but would suggest that his arguments warrant an even more radical macrophysicalist conclusion, on which what is ultimately prior is the physical state of the whole cosmos.

Starting with micro-determination, Hüttemann's main objection is *the argument from mutual derivability* (pp. 79–81). Hüttemann notes that the behaviour of a whole is only determined by the behaviour of its parts via substantive *laws of composition*. For instance, the phase spaces of classical mechanical systems compose by taking Cartesian products, while the Hamiltonians of quantum mechanical systems compose by taking tensor products of Hilbert spaces. Now these laws are expressed as mathematical equalities. For instance, the quantum mechanical law of composition—for a *non-entangled* two-particle system—can be expressed (in simplified form) as

$$H_{\text{comp}} = H_1 + H_2 \tag{1}$$

Where H_{comp} is the Hamiltonian of the system, and H_1 and H_2 are the Hamiltonians of its associated particles. *But if this law is the physical basis for determination, then since it is an equality, it is symmetric.* H_1 and H_2 determine H_{comp}, but H_{comp} and H_1 equally determine H_2.[1] So Hüttemann concludes: 'The quantum-mechanical law of composition,... does not give rise to a hegemony or an ontological priority of the subsystems over the compound system' (p. 80). Instead 'we have an argument for the claim that parts and wholes in physics determine each other mutually' which provides evidence for 'the falsity of micro-determination' (p. 81).

By my lights, while Hüttemann is certainly right that the equation above is a symmetric equality, I think little of ontological consequence follows from that. The symmetry of the equation does not show ontological equality, any more than the symmetry of the equation between the height of the flagpole and the length of the shadow (given a fixed angle of the ray from the sun) shows symmetry of determination. Hüttemann considers this reply (pp. 82–4) and argues that the symmetry in the flagpole case is broken by the direction

[1] Hütteman (pp. 77–8) offers the useful analogy of the Boyle–Charles law $pV = RT$. This expresses a symmetric relationship amongst the triad of pressure, volume, and temperature. Solve for any two of these, and one can solve for the third.

of causation, but that nothing breaks the symmetry with the laws of composition. But why isn't *the direction of composition* just as much of a potential symmetry-breaker as the direction of causation? Of course, one can ask why not choose the direction of decomposition rather than composition, but equally one can ask why not choose the direction of effectuation rather than causation.

Hüttemann says that what is at stake is 'whether micro-explanation provides *evidence* for. . . an ontological priority of the micro-level. . .' (p. 84). I agree that it does not; but I don't see how to get the stronger conclusion of 'evidence for the falsity of micro-determination' (p. 81). It seems to me that the apt conclusion to draw is that symmetric laws of composition *simply do not themselves say if there is any privileged direction of determination* (just as the trigonometry invoked in the flagpole case simply does not itself say if there is any privileged direction of dependency). Symmetric laws of composition are thus *neutral* as between microphysicalism, macrophysicalism and pluralism, *inter alia*. All sides need to turn to further arguments.

The macrophysicalist does have a further argument to offer. For note that the equality cited above only holds for a *non-entangled* two-particle system. *This equality fails for entangled systems*. Indeed with entangled systems, *only macro-determination holds*. Thus Esfeld notes

> In the case of entanglement, it is only the description of the whole in terms of a pure state, . . . which completely determines the local properties of the parts and their relations . . . Therefore, quantum physics exhibits a substantial holism. ([1999], p. 26)

As Hüttemann puts matters, in entangled systems: 'the fact that the compound is in a determinate state cannot be explained in terms of determinate states the constituents occupy' (p. 47). Thus, it is simply *false* that micro-determination obtains in such cases. The only direction of determination that obtains generally in quantum mechanics is macro-determination.

Hüttemann discusses quantum entanglement (pp. 47–54) briefly, and argues that the *dynamics* can equally be handled from a micro-physical or macro-physical perspective. This is an important and interesting point. But even so, this only shows that dynamical (diachronic) determination is symmetric. There remains an asymmetry of synchronic determination (as he recognizes: p. 48). This seems sufficient to establish macro-determination as the only generally obtaining direction of synchronic determination. So here emerges a first point at which Hüttemann's own line of argument actually provides more support for macrophysicalism than for pluralism.

Turning to micro-government, Hüttemann's main objection is *the argument from non-isolation* (pp. 92–5). According to Hüttemann, 'Laws of nature

describe how physical systems behave in isolation' (p. 92), and so 'the instantiation of a law requires the system in question to be isolated' (p. 92). This has the immediate consequence that microphysical systems never instantiate laws at all, since none of them are isolated from the rest of universe. Indeed, this has the immediate consequence that *the only system that instantiates laws at all is the entire universe*, since that is (presumably) the only isolated system in nature. As Hüttemann explains: 'The interconnectedness of the whole universe forces us to the conclusion that the universe as a whole is the only proper object that can be said to instantiate a law' (p. 92).

I have qualms about some of the premises of the argument, but leave those aside. I only wish to note that the conclusion of the argument evidently does not support Hüttemann's pluralism. Rather it supports the priority of the macrophysical, since only the universe as a whole does any governing. So here emerges a second point at which Hüttemann's arguments actually favour macrophysicalism over pluralism.

Shifting to macro-causation, Hüttemann offers an account of causation in terms of laws (pp. 112–5). I have some qualms about this account of causation as well, but grant this for the sake of argument. For in any case, this account has the consequence that 'for an event to be a cause a law of nature has to be instantiated' (p. 115). This consequence allows Hüttemann to invoke his previous discussion of laws, to argue that since micro-physical systems do not instantiate laws, there can be no micro-physical causation. To which I would only add that *if* only the entire universe can instantiate laws, then there can only be macro-physical causation. So here emerges a third point where Hüttemann's own arguments favour macrophysicalism.

Putting this together, all three of the main lines of argument Hüttemann offers against microphysicalism converge on a macrophysicalist conclusion.

> *Macro-determination*: The properties of subsystems are determined by the properties of systems and not *vice versa* (argument from quantum entanglement).
>
> *Macro-government*: The laws of the macro-physical govern the micro-physical systems (argument from the universe being the only isolated system).
>
> *Macro-causation*: All causation takes place in virtue of the causation on the macro-physical level (argument from macro-government plus cause–law connection).

So I must conclude that Hüttemann has not gone as far as his arguments would go, since his arguments all converge on the monistic conclusion that what is ultimately prior is the macrophysical state of the entire cosmos.

There are also a few minor points I would complain about. Some of the argumentation goes too fast, and some of the examples seem misanalysed. For instance, Hüttemann treats diatomic rotating oscillators as having a rotating part and an oscillating part (pp. 92–4). But really these are just separate features of the whole system (it is not as if one atom is doing the rotating and the other the oscillating). I hasten to add that these complaints do not affect Hüttemann's main line of argument.

There is much to admire about *What's Wrong With Microphysicalism?* And there are many interesting discussions I have not been able to touch upon here. For instance, Hüttemann has interesting ideas about dispositions and laws (pp. 16–23), the explanatory gap (pp. 65–70) and counterfactual analyses of causation (pp. 110–5), *inter alia*. All in all, *What's Wrong With Microphysicalism?* is a provocative and rewarding read. It is to be applauded for posing a serious challenge to micro-physicalist orthodoxy, even if I think it does not quite go as far as it might.

References

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