On the Prospects for an Effective Metaphysics

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Introduction

Two trends in contemporary metaphysics that seem to pull in opposite directions:

(1.) In metaphysics of physics, a Dennett-inspired embrace of *non-fundamental* physics and its associated ontology, qua '*effective*' ontology: roughly, non-fundamental ontology reified *as conceptualized in non-fundamenal physics*;

(2.) In analytic metaphysics, increased insistence that metaphysics is the study of the *fundamental alone*.

Today. Consider whether (1) warrants an *effective metaphysics*: a metaphysics of the non-fundamental, conceptualized independently of consideration of the more fundamental.

Another title: *Can't we do metaphysics like we can do physics?*

Conclusions and Outline.

Upshot. No we can't! There is nothing in the concept of effective physics that legitimates an effective metaphysics.

- This points to a conclusion that has daunting implications for naturalistic metaphysicians.
- At the very least, brings into relief important aspects of the relationship between physics and metaphysics.

1. **Theme 1**: Tracing the Embrace of Classical Ontology *qua* Effective Ontology
2. **Theme 2:** The Fundamental as the Sole Province of Metaphysics?
3. **Illustration:** The Modal Metaphysics of Classical vs Fundamental Laws
4. **Reflections:** Why Effective Physics Doesn't License Effective Metaphysics

Qualifiers.

- I will assume both fundamentalism and that QFT is a fundamental framework.
- My argument does not directly address whether there are non-fundamental metaphysical facts, but rather whether there is reason to think we can access them in advance of a fundamental physics theory.

Tracing the Embrace of Effective Physical Ontology.

Effective ontology:

> *Effective ontology is non-fundamental ontology that is scientifically useful to reify when conceived of in the terms of the relevant non-fundamental science: that is, without consideration of anything more fundamental.*

- 'Effective entities' are basically 'real patterns'.
- Being non-fundamental, their existence is somehow *determined by* more fundamental ontology; as such, anything we can *derive* from a fundamental description will count as non-fundamental.
- Though popular in social / cognitive science, Dennett's ideas also embraced arise in philosophy of physics.

Wallace and Dennett

'Effective ontology' has been embraced by David Wallace (2014; *'Decoherence and Ontology, or How I Learned to Stop Worrying and Love FAPP'*, 2012).

Dennett's criterion: *A macro-object is a pattern, and the existence of a pattern as a real thing depends on the usefulness – in particular, the explanatory power and predictive reliability – of theories which admit that pattern in their ontology.* (Wallace 2012)

- Example: Tigers have an underlying microphysics, but we get a more useful scientific theory of tigers by attributing to them 'tigery' properties not found in microphysics.
- As such tigers are 'effective entities'.

Wallace and Dennett

- The practical and theoretical independence of effective ontology from the underlying microphysics suggests that the spatio-temporal boundaries of effective entities are *imprecise*. (This comports with everyday usage.)
- This imprecision implies that the laws of spatio-temporal evolution they accord with need only be approximate.
- **Vagueness criterion for effective ontology:** since 'being approximately ϕ' = 'being ϕ FAPP', if entities that are approximately ϕ qualify as effective ontology, then so do entities that are ϕ *simpliciter*, and vice versa.

Dennett and Decoherence.

The measurement problem: recovering classical macrodefiniteness from Schrödinger dynamics.
Start with a **wavefunction** for a system composed of a cat, and radioactive particle in a quantum **superposition**:

$$\psi_0 = (|\mathit{undecayed}\rangle + |\mathit{decayed}\rangle)|\mathit{cat}\rangle$$

Plugged into the **Schrödinger equation** of non-relativistic QM, this evolves into

$$\psi = (\alpha|\mathit{undecayed}\rangle|\mathit{alive}\rangle + \beta|\mathit{decayed}\rangle|\mathit{dead}\rangle)$$

such that $|\alpha^2| = |\beta^2| = 1/2$.

$$\rho_\psi = |\psi\rangle\langle\psi| = \begin{bmatrix} \alpha^2 & \alpha\beta^* \\ \alpha^*\beta & \beta^2 \end{bmatrix} = \begin{bmatrix} 1/2 & \alpha\beta^* \\ \alpha^*\beta & 1/2 \end{bmatrix} \neq \begin{bmatrix} 1/2 & 0 \\ 0 & 1/2 \end{bmatrix}$$

Dennett and Decoherence.

- Now suppose we consider the system within its *environment*.
- Using *decoherence theory*, one can show that, over very short timescales, the effect of the environment is to change the state of the cat-particle system into one that is approximately classically interpretable:

$$\rho_\psi = \begin{bmatrix} 1/2 & \alpha\beta^* \\ \alpha^*\beta & 1/2 \end{bmatrix} \xrightarrow[t \to t']{} \rho_\psi^e = \begin{bmatrix} 1/2 & \approx 0 \\ \approx 0 & 1/2 \end{bmatrix}$$

- The problematic inference terms have *almost* disappeared.
- But there is more: not only are quantum interference effects suppressed, but we get robustly classical ontology.

Dennett and Decoherence.

"It turns out that when we couple quantum systems to (things we ordinarily take to be) 'environments' (...), then we find that the dynamics of systems become quasi-classical. Firstly: The basis picked out by decoherence is ... a basis of wave-packets approximately localised in both position and momentum. And secondly: The dynamics is quasi-classical in the sense that the behaviour of those wave-packets approximates the behaviour predicted by classical mechanics... Structurally speaking, the dynamical behaviour of each wave-packet is the same as the behaviour of a macroscopic classical system." (Wallace 2012).

Dennett and Decoherence.

Thus, through decoherence, we recover *approximately localized entities* subject only to *tiny* interference effects, evolving in accordance with *approximately classical laws*. We thus recover entities that we can *treat as classical* for all practical purposes – and thus do science with *without reference to* QM.

Question: How do we get from these observations to taking classical ontology as real?

Dennett and Decoherence.

1. Approximately classical entities can be derived from a more fundamental ontology of wavefunctions.
2. By (1), if we could reify it at all, approximately classical ontology would be non-fundamental ontology.
3. By (2) and the 'vagueness criterion' for non-fundamental ontology, we can reify classical ontology iff we can reify approximately classical ontology.
4. There are practical gains to be had from treating some ontology as classical (eg: moon missions).
5. By (2), (3), (4), and Dennett's criterion, classical ontology exists.

Bottom line: 'The objects of which classical physics speaks are real, even if they aren't exactly as imagined in classical physics' (Myrvold 2015). What grounds this realism is that they *approximate* to what QM implies in an appropriate limit.

Going one step further.

- The above showed how to go from wavefunctions of non-relativistic QM to the entities of classical physics.
- Work by Myrvold (2015) has shown in detail how to derive wavefunctions from QFTs in the non-relativistic approximation in which the relativity of simultaneity is negligible: if "we are not dealing with processes that are spread out too far in space, and the temporal resolution with which we are concerned is not too small."

In what follows, I'll assume classical ontology is derivable from fundamental theories through two successive limiting procedures:

QFT $\longrightarrow$ **QM** $\longrightarrow$ **CM.**

In each case, the limits involve *limiting our measurements* to a *certain finite resolution* – they involve *not looking too closely*. Thus a *levels hierarchy* is defined by *decreasing sensitivity to the physics*.

Metaphysics as the Study of the Fundamental Alone?

- It seems that the ontology of non-fundamental physics is real.
- As such, engaging in non-fundamental physics *has realist prospects*.
- However, another trend has been to regard *metaphysics*, in contrast to physics, as the study of the fundamental alone.
  - 'Metaphysics is about the fundamental structure of the world' (Cameron 2011); 'Metaphysics, at bottom, is about the fundamental structure of reality' (Sider 2011); Metaphysics 'describes features of the world that are more fundamental than those of natural science' (Paul 2012); etc. See also Schaffer (2012).
  - (Arguably also Ladyman and Ross 2007).
- It was always unclear (to me at least) what the motivation for this view of metaphysics is.
  - *Can't we do metaphysics like we do physics?!*

Towards an effective metaphysics?

As a matter of fact, what most of us do is **effective metaphysics**: we give metaphysical interpretions of the less fundamental, *developed independently* from considerations of the more fundamental.

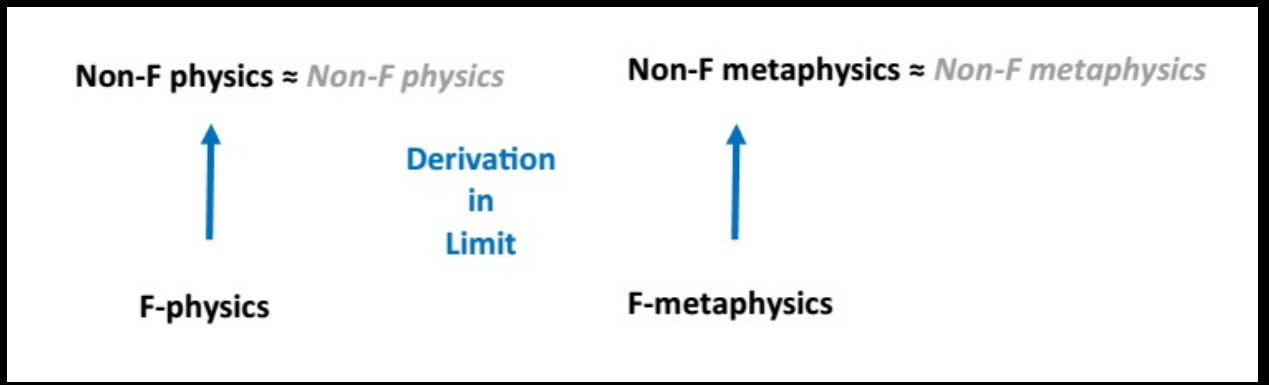
- The 'effective' in 'effective metaphysics' applies in two ways here: it *concerns* the effective, and is also effective in *how it is done*.
- But we can ask: does effective metaphysics have any realist prospect?

What makes its realist prospects non-trivial is that whatever non-fundamental metaphysical facts there are, they are presumably *constrained* by the more fundamental ones. Plausibly, they are *determined* by them.

Towards an effective metaphysics?

If pushed, what could we say to justify our practices?

- **Naturalistic defence:** "We pulled it off in physics, therefore reason to hope we can pull it off in metaphysics."



- Depends on there being *relevant analogies* between metaphysics and physics: depends on metaphysics *being like physics* in crucial respects.

On the prospects for an effective metaphysics.

These respects concern the ability of metaphysical theories to (1) approximate each other, and (2) imply each other in a limit.

> ***A prospect for EM:*** *Effective metaphysics will have prospects if we can show that we can ask metaphysical questions of effective physical ontology and have a hope of getting answers that approximate what more fundamental metaphysics implies, in the appropriate limit, even though developed without consideration of that more fundamental metaphysics.*

- **Claim:** The metaphysics of the non-fundamental does not and (arguably) cannot satisfy this criterion.
- **Illustration:** The modal interpretation of classical laws, vs a natural interpretation of fundamental laws.

The Canonical Debate over Classical Laws, Properties and Modality

- Consider how the metaphysics of classical laws is typically debated:
  - Humean 'best system' analysis (Lewis, Ramsey, Mill...)
  - Dispositional Essentialist analysis (Bird, Chakravartty, Ellis...)
  - 'Contingent Necessitation' ('governing' conception): (Dretske, Armstrong, Tooley).
- This debate is basically conducted over classical laws, such as Coulomb's law – hence not about the most fundamental laws. Nor do they engage (by and large) with quantum physics.*
- As such, this is an example of effective metaphysics in action.

The Canonical Debate over Classical Laws, Properties and Modality

The 'canonical' positions differ over three things: (1) the *modal* aspect of the properties defining natural kinds, and the interpretation of laws w/r/t (2) their *ontological priority* relative to kinds and (3) their associated *modality*.

Humeanism: laws *supervene* on a basis of *categorical properties*; as such, laws describing a given set of kinds are *secondary* and *contingent*; no *primitive modality*.

Dispositional essentialism: laws *supervene* on a basis of *essentially dispositional* properties: as such, laws describing a given set of kinds are *secondary* and *necessary*; there is *primitive modality* (in the property base).

DTA theory: laws involve primitive relations of 'contingent necessitation' between *categorical properties*: as such, laws are *not secondary* and *contingent*; there is *primitive modality*.

The Canonical Debate over Classical Laws, Properties and Modality

	Humean BSA	Disp. Ess	DTA
Laws Necessary	✗	✓	✗
Laws Secondary	✓	✓	✗
Primitive Modality	✗	✓	✓

- At most one of these can be true.
- Let's also assume for simplicity that they exhaust the conceptual space suggested by classical physics: that is, if classical physics were fundamental, then one of these would be true.

The Modal Metaphysics of Fundamental Laws.

- For all I know, any of these represent a coherent metaphysics of classical physics *considered in isolation*. (Hence the famed 'underdetermination' of metaphysics by physics.)
- But the modal landscape is very different in fundamental regimes: that is, for fundamental laws in *quantum field theory* (McKenzie 2014).
  - Hard to maintain that laws are secondary to kinds.
  - Reasons for thinking that laws applying to any given set of kinds are necessary.
  - No reason to posit primitive modality.
- Call this the 'fQFT' view.

The Positions Compared.

	Humean BSA	Disp. Ess	DTA	fQFT
Laws Necessary	✗	✓	✗	✓
Laws Secondary	✓	✓	✗	✗
Primitive Modality	✗	✓	✓	✗

- Clearly, the modal landscape looks very different at the fundamental than at classical levels.
- None of the classical positions are in any sense 'approximations' of the fQFT view.
- As such, it might look as if an effective metaphysics is ruled out: no metaphysics of classical physics gets the fundamental picture even approximately right.
- But this is too fast! Think more carefully about the prospects of an effective metaphysics.

Revisiting the Prospects for EM.

A prospect for EM: *Effective metaphysics* will have prospects if we can ask *metaphysical questions* of *effective physical ontology* and have a hope of getting answers that *approximate* what more fundamental metaphysics *implies, in the appropriate limit*, even though developed *without consideration* of that more fundamental metaphysics.

- We do not ask of effective metaphysics that it be an approximation to fundamental metaphysics *simpliciter*: it need only *approximate, in the appropriate limit*, what the latter *implies*.
- **But what would it even mean** for non-fundamental metaphysics to do this?
  - Seems mistaken twice over: once wr/t 'limiting relations',and once w/r/t 'approximation'.

Revisiting the Prospects for EM.

- When we do metaphysics of physics, we start with things that can stand in relations of approximation, such as properties and laws of motion.
- We then sort them into metaphysical categories.
- While *that which we categorize* can admit of degrees, *the categories themselves are clunky*.
  - We can't talk of property's being 'approximately intrinsic', or of being 'approximately primitively modal'.
- Because of this, we *cannot talk* of a metaphysics of the non-fundamental 'approximating' anything the more fundamental metaphysics implies in the requisite limit.
- However, it seems we cannot talk of what a fundamental metaphysics 'implies in the appropriate limit' either.
  - Can say that two events 'look' simultaneous in the limit of low temporal resolution; cannot say that something 'looks' intrinsic or primitive in such a limit.

Revisiting the Prospects for EM.

- Owing to the clunkiness of its categories, the notion of metaphysical theories *approximating* less fundamental theories, or *implying* them in the requisite limit, seems to make no sense.
- The relations between fundamental and non-fundamental metaphysical theories are not the relations between their subject matters.

⇒ **The relations which underwrite the possibility of effective *physics* are not relations that are available to an effective *metaphysics*.**

- While this in retrospect seems obvious, it shows we need to give more thought to what licenses (most of) our practices as metaphysicians.

Revisiting the Prospects for EM.

- While perhaps another relation can be found between more and less fundamental metaphysical theories, the fact that it is not the relation that underwrites effective science generates a problem for naturalism.
- The fact that the relation is not that which relates more and less fundamental *levels* generates a conceptual problem too.
- Unless another relation can be found, no reason to think we can profitably engage in metaphysics in advance of a fundamental physics theory.
- If nothing else, highlights a crucial difference between physics and metaphysics, and reminds us that we cannot as metaphysicians of science be seduced into thinking that what licenses science licenses what *we* do.

Selected References.

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