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Beyond Reduction: What Can Philosophy of Mind Learn from Post-Reductionist Philosophy of Science?ⁱ

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Several of the most familiar issues in philosophy of mind are concerned with questions about the *explanation* of mental phenomena, particularly whether they can be reductively explained or there are abiding and principled explanatory gaps surrounding phenomena like consciousness, qualia and intentionality. Other familiar issues are concerned with *metaphysics* of mind: whether some version of physicalism, dualism, or some other ontology provides the most reasonable interpretation of what we know about the mind and its relations to the natural world. Characteristically, all parties involved in these discussions assume that inter-theoretic reductions are the rule within the natural sciences, and that, as a consequence, abiding and principled psychological gaps would be uniquely interesting and problematic.

Reductionism was indeed a kind of orthodoxy in philosophy of science through much of the 20th century. Yet during the period that reductionist assumptions have been most in evidence within philosophy of *mind* (during the latter half of the 20th century), philosophers of *science* have criticized reductionism on a number of fronts, and today we are largely in an era of post-reductionist philosophy of science. As a result, philosophy of mind at the turn of the millennium would seem to be one of the last bastions of 1950's philosophy of science. And if the philosophers of science have been right to reject the assumption that inter-theoretic reductions are widespread in the natural sciences, this ought to force philosophers of mind to rethink some of their most familiar problems, and indeed in so doing they may find themselves in philosophical *terra incognita*. This article will attempt an initial cartography of this new landscape.

1. A Brief History of Recent Philosophy of Mind

I shall begin by locating a number of familiar philosophical views with respect to the answers they give to four questions:

1. Is some form of inter-theoretic reduction the norm in the natural sciences?
2. Do the objects, properties and events of natural sciences like chemistry and biology metaphysically supervene upon those of physics?

3. Are mental phenomena like consciousness and intentionality reducible to something non-mental?
4. Do mental phenomena metaphysically supervene upon physical phenomena?

When I was a graduate student in the 1980s, some combination of reductionism and physicalism was still a kind of orthodoxy in philosophy of mind. Reductive physicalists characteristically answer yes to all four questions.ⁱⁱ But reductionists are not of one mind about the status of reductionism itself. Some view it as a kind of second-order empirical hypothesis: that it will turn out, in the end, that such inter-theoretic reductions will prove to be available. Others follow some of the Logical Positivists in viewing reducibility as a kind of *a priori* norm guiding work in the sciences, and thus to provide a kind of litmus for the methodological and ontological legitimacy for the special sciences (particularly psychology) and their objects.

As the twentieth century was entering its final quarter, a radical alternative to reductionism came upon the scene in the form of eliminativism. Eliminativists generally agree with reductionists that reduction and supervenience are the norm in the physical sciences, but they hold that such reductions are not available for mental phenomena, and that the proper attitude to take towards such a gap is to conclude that the kinds of objects postulated by “folk psychology” literally do not exist. They thus answer “no” to questions 3 and 4, though in the case of supervenience, the answer is “no” only in the trivial sense that nothing answering to the description of mental states really exists at all, and hence cannot supervene upon anything. Eliminativists also tend to agree with normative reductionists that there is an important relation between questions about inter-theoretic reducibility and questions of ontological legitimacy. A principled failure of reducibility in a special science like psychology would imply that it was suspect, both methodologically and metaphysically, thus spawning the need for a project of the “vindication of psychology.” As Jerry Fodor put it,

The deepest motivation for intentional irrealism derives...from a certain ontological intuition: that there is no place for intentional categories in a physicalistic view of the world; that the intentional can't be *naturalized*. (Fodor, 1987, page 97. Fodor addresses this fear of intentional realism as a way of motivating his own project of naturalizing the mind, and thus dispelling the fear.)

It's hard to see ...how one can be a Realist about intentionality without also being, to some extent or other, a Reductionist. If the semantic and

the intentional are real properties of things, it must be in virtue of their identity with (or maybe their supervenience on?) properties that are themselves *neither* intentional *nor* semantic. If aboutness is real, it must be really something else. (Fodor, 1987, p. 98)

There were several voices in the 1970s and 1980s sounding the call for recognition of an explanatory gap between mind and matter. (Nagel 1974, Jackson 1982, Searle 1982, Levine 1983) However, this view did not really re-enter the philosophical mainstream until the early to mid 1990s.ⁱⁱⁱ Some important proponents of the gap, like David Chalmers and Frank Jackson, further claimed that a principled and abiding explanatory gap entails an ontological gap as well, thus supporting either a substance or property dualism. (Chalmers 1996, Chalmers and Jackson 2001) Most of these writers assume, along with reductionists and eliminativists, that inter-theoretic reductions and supervenience are the rule in the physical sciences, and that the mind is unique both in giving rise to an explanatory gap and in failing to supervene upon things physical. The explanatory gap, or in Chalmers' terms, "the hard problem of consciousness," is thus seen to represent a unique and fascinating philosophical puzzle, not addressable by ordinary scientific means. Some, but not all, advocates of the explanatory gap argue that an abiding and principled explanatory gap (as opposed to one that was merely reflective of a current state of ignorance) entails a metaphysical gap as well, in the form of a failure of the mental to supervene upon the physical. They thus endorse what we might call a Negative Explanation-to-Metaphysics Connection Principle (or Negative EMC Principle):

Negative Epistemology-to-Metaphysics Connection (Negative EMC): the irreducibility of A to B entails that A does not supervene upon B.

Some non-reductive physicalists, like Donald Davidson (1970), likewise took the view that the mind is uniquely irreducible. Non-reductive physicalisms, however, had begun to take root in the 1980s for reasons unrelated to the explanatory gap, particularly due to the influence of Davidson's anomalous monism. A related view that emerged in the 1990s is the view sometimes called "mysterianism", associated with Colin McGinn. (1983, 1991) Mysterianism is at its root an epistemological view: that there is an explanatory gap in psychology, but that its roots lie in an inability of minds like ours to represent the explanatory relations between body and mind. Mysterians generally are nonreductive physicalists as well: they hold that mental properties

supervene upon physical properties, but that this supervenience is abidingly epistemically opaque to creatures with our particular representational capacities.^{iv} Mysterians and non-reductive physicalists thus answer “yes” to questions 1 and 2, along with everyone else so far; they answer “no” to question 3 (the psychological cannot be reductively explained by the physical) but “yes” to question 4 (the psychological supervenes upon the physical).

The views thus far surveyed are summarized in the following table:

	Reduction in Nat Sci.	Supervenience in Nat. Sci.	Psychological Reduction	Psychological Supervenience	Positive EMC	Negative EMC	Normative Reduction
Reductionists	Yes	Yes	Yes	Yes	Yes	Yes	Yes/No*
Eliminativists	Yes	Yes	No	No*	Yes	Yes	Yes
Dualists	Yes	Yes	No	No	Yes	Yes	No
Mysterians/Non-Reductive Materialists	Yes	Yes	No	Yes (mostly*)	Yes	No	No

* some reductionists, like the Positivists, took reducibility to be a normative condition, while others, like Oppenheim and Putnam, took it only as a hypothesis

** for eliminativists, the failure of supervenience is a trivial consequence of the claim that there are no mental states to thus supervene.

*** Davidson and other interpretivists reject supervenience on the grounds that there are always multiple equally-good intentional characterizations of a person’s behavior

It is worth stressing that every position thus far surveyed has shared common answers to the questions about the physical sciences: that the phenomena of sciences like biology and chemistry *supervene* upon those of physics, and that they can be *explained* by physical phenomena through inter-theoretic reduction. The basic notion of mysterianism does, however, suggest a more radical possibility that one might wish to explore: namely, that the connections between the *natural* sciences might turn out to be “gappy” and non-reductive as well. Such a possibility was hinted at in the 90’s in some publications by Stich and Laurence (1994) and Baker (1995), but to the best of my knowledge was not explored within philosophy of mind before Horst (2007).

Such a view is deserving of more exploration. For during the very time period that discussions were going on in philosophy of mind, on the assumption that inter-theoretic reduction is the rule in the physical sciences, philosophers of science were moving in precisely the opposite direction. The reductionist view of the unity of science favored by many of the Positivists and Logical Empiricists received withering and even decisive criticisms, coming both from within Empiricism and from without. If there is a

mainstream view about reduction in philosophy of *science* today, it is probably that reductionism, at least as conceived through most of the 20th century, was a failed project, motivated by a misguided apriorism from Postivist philosophy of science, that the special sciences are autonomous and self-justifying, and that there are in fact a variety of types of inter-theoretic relations to be found at the intersections of various sciences, few of them amounting to inter-theoretic reduction. As a result, although many conversations in philosophy of mind through the 1990s took themselves to be motivated by views in philosophy of science, the philosophy of science they were motivated by was more or less that of Oppenheim and Putnam (1958) or Nagel (1961), consisting of views that had already run their course within philosophy of science itself. In short, recent philosophy of mind has been one of the last hiding places of philosophy of science of the 1950s.^v

The question to be posed, then, is this: If we were to take into account the rejection of inter-theoretic reduction as a norm for the special sciences, what implications would this have for the mainline problematics in philosophy of mind? That is the question to be addressed in this paper. However, it is necessary to begin with a few preliminaries. First, it is important to clarify the notion of “reduction” that is at issue here. Second, while it is impossible to do more than rough justice to the many strands of anti-reductionist philosophy of science, it is important to at least canvass their major points. It is not possible to assess all of the possible objections to these arguments in the scope of this article, and so an extensive bibliography is provided for those wishing to pursue these issues further. Instead, the article will conclude with a survey of possible implications for philosophy of mind.

2. Reductionisms

The words ‘reduction’ and ‘reductionism’ have been used in a number of ways in philosophy of mind, only some of which are directly relevant to the current discussion. One of the most familiar uses of the word in philosophy of mind makes ‘reductionism’ a synonym for ‘type-type identity theory’ – the view that each mental type stands in a one-to-one relation with a corresponding physical type. (Place 1956) This view, popular in the 1950’s and 60’s, is now almost universally rejected by philosophers of mind.^{vi} Here, no new arguments are really called for, as the current orthodoxy has it that this view has

been decisively defeated by the functionalist case that functionally-defined systems are multiply realizable.

Type identity theory claimed both an “upward” and a “downward” relationship between mental and physical types. Given a mental type, one can infer “downwards” to physical type, and vice-versa. However, for purposes of *explanation*, it is clearly only the “upward” relations that matter. The core of reductionism can be preserved in a way that allows multiple realization so long as fixing the physical type allows inference upward to a unique mental type as well. As a result, neither scientists, nor indeed all philosophers, have been inclined to give up on some sort of “reductionism” – i.e., one that is weaker than type identity – even if they acknowledge the possibility of multiple realization for functional kinds.

Scientists, in particular, are often considerably more profligate in their bestowal of the label ‘reduction’ than are philosophers. Indeed, one can find the term applied not only to very partial part-whole explanations (e.g., serotonin reuptake explains depression), and indeed to very different forms of explanation such as what Kitcher (1981) calls “unifications”. Such a broad usage is probably not sufficiently precise as to be a proper subject of philosophical investigation (though see Bickle 1998), and is certainly too weak to underwrite claims of metaphysical supervenience.

The core of the traditional philosophical notion of reduction would seem to consist in its being a form of explanation that has the following distinctive characteristics. First, it is explanation of a system in terms of its parts – chemical reactions in terms of the properties of the atoms, for example. Second, it is explanation in which, once one has an adequate theory of the lower-level system in hand, one can then demonstrate that all of the salient features of the higher-level system are a necessary consequence of these. It is what I have elsewhere (Horst 1996) called a “conceptually adequate explanation”, and *broad reduction* (Horst 2007). This model of explanation was taken as canonical in two important periods in this history of philosophy of science. In the 17th century, it was favored by innovators in early modern science like Galileo and Descartes, who viewed it on the model of geometric proof and construction, in which one can begin with a conservative set of definitions and axioms and from these derive a rich set of theorems. In the 20th century, it was favored by the Logical Positivists and Empiricists, for whom the preferred model was not geometric construction but logical syllogism. Both explanations within a science and inter-theoretic reductions were viewed by the Positivists as being deductive in form. This might not be evident from the form in which

theories appear in science texts, but could be obtained through the axiomatic reconstruction of particular sciences and inter-theoretic reductions, a project that probably reached its zenith in the work of Ernst Nagel (1961).

This model of reduction had a number of historical motivations. For the early moderns (including British Empiricists as well as Rationalists), there was an existing assumption that knowledge (*scientia*) needed to take the form of a deductive system in which the premises were known with certainty. (Thus even Hume refuses to apply this epistemic honorific to laws of Newtonian science, placing them between knowledge and things to be consigned to the flames.) The rigor and certainty of mathematics provided a standard of knowledge to which they sought to make the study of nature conform; and thus their question was not “What is the form of the natural sciences?” but “Given this definition of ‘*scientia*’, is a *scientia* of nature possible?” (The Empiricists Locke and Hume famously answered *no*, awakening Kant from his dogmatic slumbers, while the Rationalists answered yes only at the cost of grounding the knowledge in divinely-provided innate ideas.) The Positivists likewise had normative motivations, this time grounded in an idea of “the logic of science.” This was an *a priori* standard that was to be used to analyze and even correct actual scientific practice.

But there is also a third philosophical appeal to this type of explanation that is common to the 17th and 20th centuries. What recommends this sort of explanation to a particular philosophical temperament is that it, and arguably it alone, provides a close connection between explanation and metaphysics. In short, if A is derivable (deducible, constructable) from B, then any possible world in which B obtains is also one in which A obtains. In other words, if A is derivable from B, A metaphysically supervenes upon B as well. This is thus a style of explanation that has metaphysical “oomph”: provide a reduction of this sort, and you get metaphysical supervenience for free. It is thus quite natural that scientists and philosophers alike should work very hard to find this kind of explanatory relationship when it is there to be found. It is a bit more curious why one should expect that it *is* always there to be found; such an assumption betrays more of a legacy of rationalism in analytic philosophy than many of its proponents might care to admit. (Kant’s expression “dialectical illusion” comes forcefully to mind.)

3. The Demise of Reductionism in Philosophy of Science

While everyone would agree that reductions are a particularly strong and useful form of explanation to have when one can get them, it is really a second-order empirical question whether and where they are in fact to be found. Subsequent philosophers who attempted to extend Nagel's project of axiomatic reconstruction began to discover that mechanics turned out to be a special case, and almost unique in being susceptible to this form of reconstruction. Toulmin, for example writes

In mechanics—and in mechanics alone—the intellectual content of an entire physical science could apparently be expounded as a single mathematical calculus. Here was a complete natural science free of logical gaps and incoherences....The temptation to hold theoretical mechanics up as a mirror to other branches of science, and to demand that other sciences be construed on the same model and achieve the same logical coherence, seemed irresistible. Yet the very formal perfection of theoretical ought surely to have ruled it out as the “type example” of a natural science, and prevented us from extrapolating conclusions about the “logical structure” of mechanics, so as to apply to natural sciences generally. Rather, we need to recognize how *exceptional* a science mechanics really is. (Toulmin 1974, p. 610)

Patrick Suppes, who had himself undertaken the project of axiomatizing a number of areas of science, likewise came to the conclusion that, while such reconstructions were possible in some areas of the sciences, they were by no means the rule. (Cf. Suppes, in Suppe 1974, p. 66)

Meanwhile, historicist philosophers of science began to make an important turn away from the normative, aprioristic project of the “logic of science” and towards the hands-on investigation of how science is practiced “in the wild”. Salmon (1971, 1984) and others showed decisively that some important methods of scientific explanation were not syllogistic. Various writers through the 80s and 90s noted that even when explanations could be reconstructed as syllogisms, these reconstructions came after the explanatory success had come through non-derivational forms (Schaffner (1967, 1974), P.S. Churchland (1986)), and the reconstruction misdescribed theories “in the wild” (Nersessian 1992, Craver 2002). And examination of what really takes place at the borders between theories revealed a much richer set of options, which were explanatorily useful and productive even when they fell short of reduction. (Darden and Maull 1977, Bechtel and Richardson 1993)

But perhaps most damningly, case studies of *purported* inter-theoretic relationships have seemed to lead to the conclusion that true reductions are actually

rather rare, and even the four or five much-touted examples do not deliver as advertised. As Silberstein puts it in the *Blackwell Guide to Philosophy of Science*,

Focus on actual scientific practice suggests that either there really are not many cases of successful epistemological (intertheoretic) reduction or that most philosophical accounts of reduction bear little relevance to the way reduction in science actually works. Most working scientists would probably opt for the latter claim. Often discussed cases of failed or incomplete intertheoretic reduction in the literature include:

1. the reduction of thermodynamics to statistical mechanics (Primas, 1991, 1998; Sklar, 1999)
2. the reduction of thermodynamics/statistical mechanics to quantum mechanics (Hellman, 1999)
3. the reduction of chemistry to quantum mechanics (Cartwright, 1997; Primas 1983)
4. the reduction of classical mechanics to quantum mechanics (such as the worry that quantum mechanics cannot recover classical chaos) (Belot and Eraman, 1997)

(Silberstein, 2002, page 94)

Additional critique has arisen from philosophy of biology, denying the reducibility of evolutionary biology either to molecular genetics (Levins 1968, Lewontin 1983) or to classical genetics (Kitcher 1984).

A number of these writers would describe their approach to philosophy of science as “naturalistic”. In philosophy of science, “naturalism” is a label that implies a rejection of any normative role given to standards imported from outside of the sciences themselves, such as the Positivist view of “the logic of science”. Such writers would insist that it is only in conjunction with a study of actual scientific practice that we can determine not only (a) where (if anywhere) a particular type of explanation (e.g., a reduction) is to be found, but also (b) what sorts of standards of explanation are appropriate to the several sciences. (And as “naturalism” in philosophy of mind often involves precisely such an aprioristic and normative view that the mind *must* be reduced to material phenomena, naturalistic philosophy of science and naturalistic philosophy of mind can make for surprisingly poor bedfellows.)

This is, of course, only a cursory overview of several broad trends within philosophy of science. It is impossible in the course of an article like this to provide

much more detail on the arguments for each position, much less to adjudicate questions on which there are remaining controversies.^{vii} In the context of this article, this exposition is largely preparatory to consideration of questions in philosophy of psychology and philosophy of mind. To put it briefly, *if* one accepts these anti-reductionist results in philosophy of science, what implications would this have for how one does philosophy of psychology and philosophy of mind? And in particular, to what extent would some familiar problematics be transformed or undone?

4. Philosophy of Psychology and Vindication

The issues are most straightforward in philosophy of psychology, where there has been a long-standing debate about the “vindication” of psychology. Such debate is partially about methodological matters that fall outside of the scope of this article, which is about reduction. (For example, whether it is a problem that psychology purportedly has only *ceteris paribus* laws.) But on the question of whether psychology is compromised by the existence of unbridgeable explanatory gaps and failures of reduction, it would seem that the clear answer ought to be that it is not. If the general view in philosophy of science favors the autonomy of the special sciences – the view that internal success in a special science is self-justifying and not held hostage to demonstration of reducibility – then there is no special reason to apply reducibility as a normative standard just because the special science in question happens to be psychology rather than biology or chemistry. (Compare Stich and Laurence 1994, Baker 1995) *This* vindication problem, at least, is just an ill-posed problem. And indeed more generally aprioristic normative approaches have fallen upon hard times in philosophy of science, and it is hard to see why philosophy of psychology should remain a lone exception.

There are also straightforward morals to be drawn about approaches to philosophy of psychology that *are* to be recommended: namely, the kinds of “hands on” philosophy of science that looks at what is going on in actual case studies in the sciences of cognition. These may involve some important differences from other sciences, without prejudice to their integrity. They may also serve as paradigms of kinds of explanation also required in other sciences: for example, the brain is a complicated feedback system that requires very different modeling tools from those of classical mechanics; however, it is arguably not the only such system to which, say, the

mathematics of nonlinear dynamics must be applied. Here studies that begin with the sciences of cognition (e.g., Bechtel and Richardson 1993, Bickle 1998) might actually produce insights that can be applied elsewhere as well.

5. Reductive Physicalism

In philosophy of mind, at least one tentative moral seems quite straightforward: post-reductionist philosophy of science is bad news for reductive physicalism. It was bad enough for the reductive physicalist that there seem to be explanatory gaps with respect to intentionality and consciousness. But so long as those gaps were confined to psychology, the appearance of such gaps could be offset by the sense that that appearance might be—indeed, *must* be—mistaken, given what we know about the natural world. If nature is generally united by reductive relations, it seems reasonable to conjecture that such relations will eventually be found for the mind as well. But if there are “explanatory gaps all the way down”, no such assurance is justified. Indeed, if explanatory gaps in the forms of failures of reduction are the rule rather than the exception in even the natural sciences, expecting psycho-physical reductions would mean expecting *closer* relations between brain and mind than are found between physics and chemistry. Such a hope might pan out, but its adherents are betting against long odds.

6. The Explanatory Gaps and Metaphysics

At first sight, then, post-reductionist philosophy of science looks like good news for proponents of the explanatory gap. It undermines much of the unease that might be felt about a unique gap in the case of the mental, which has been for many an important defeater for their intuitions that there is such a gap. But on the other hand, if it is “gaps all the way down”, the psychological gap ceases to be such a uniquely interesting and sexy problem as well. And in particular, it puts the dualist in an awkward position. For one important argument for dualism is based on the gap, plus what I earlier called the “negative explanation-to-metaphysics connection principle” (or Negative EMC Principle). This is the idea that a principled explanatory gap entails a metaphysical gap as well in the form of a failure of supervenience. Dualists have argued that there is no such gap within the natural sciences, hence only one physical substance, but a unique gap in

psychology, entailing exactly one additional substance, for a grand total of two. (Three if, like Descartes, you number God as a third.) But if it is gaps all the way down, Negative EMC does not entail dualism, but a radical ontological *pluralism*. (One might call it a “Dupreved” pluralism, in honor of ontological pluralist John Dupré.) And radical such a pluralism would seem to be: if abiding and principled gaps imply failures of supervenience, and chemistry and biology are not reducible to physics, then they do not supervene upon physics either. (And likewise, *mutatis mutandis*, for statistical mechanics/thermodynamics, etc.) This is a result that few will find easy to swallow.

There is, however, also an intuition that many experience here that, while there are explanatory gaps outside of psychology, the psychological gaps are in some way special, and they are special in a way that carries different metaphysical consequences than physics-chemistry gap. If this is so, it may be possible to avoid radical ontological pluralism even if we accept theory pluralism in philosophy of science. This is an issue that arguably faces all ways of addressing the problem.

In the following sections I shall examine three metaphysical possibilities: materialist, dualist and pluralist. I shall also mention in passing two additional strategies for dealing with the problems raised which I shall not dwell upon here. One of these is to simply hold out for a day when reductionism will make a stunning comeback. The other is to disavow the metaphysical side of philosophy of mind altogether, and to concentrate only on “hands-on” philosophy of psychology. I propose to ignore these options in the rest of the paper, but do so without prejudice to their possible virtues.

6.1 Non-reductive Physicalism and Mysterianism

There is nothing about mysterianism or non-reductionism that prevents its advocates from holding that it is true all the way down. Theory pluralism may provide a *challenge* to materialism and a monistic metaphysics, but it is not clear that it presents a *refutation*; and indeed the non-reductive physicalist might actually turn this to his advantage. If, say, chemistry is not reducible to physics, yet we are sure that it supervenes upon physics, this gives us good reason to assume that supervenience is compatible with the inavailability of reductions. And if it is compatible in one case, it should be compatible in all cases, including that of psycho-physical supervenience. One might even be inclined to say that non-reductive physicalism is in a *better* evidential position if one embraces theory pluralism.

There is something a bit illusory about this inclination, though. It can be seen by

noting that the strength of the position depends on the direction from which one arrives at it. Historically, the popularity of materialism came hand-in-hand with the popularity of reductionism. Indeed, what were taken to be reductive successes in the sciences were precisely what led people like Hobbes and Laplace to be materialists. Where there are reductions, supervenience comes at no extra charge. And if reductions are shown to be unavailable, it is natural for the physicalist to look to *non-reductive physicalism* as the most conservative fallback position. But suppose we start the other way: we start with irreducibility or mysterianism, and then ask, *What is the best metaphysical interpretation of irreducible correlations?* Now there seems to be little reason, other than some sort of philosophical taste (e.g., for desert landscapes) to prefer the view that an A-B correlation is grounded in a metaphysical necessity (that $B \rightarrow A$ in all possible worlds), over the view that it is merely a lawlike and/or causal connection. The non-reductive side of non-reductive materialism may be based on strong evidence; but the materialist side is more like a standpoint of faith. There is nothing wrong with standpoints of faith, but this deprives materialists of the rhetorical high ground aligning them with both reason and evidence and their opponents against it. Without reduction, materialism loses such grounding as it might have had in scientific explanation.

6.2 Dualism

The case is similar with respect to dualism. The dualist can accept the view that there are explanatory gaps all the way down. What he cannot accept is that they all entail metaphysical gaps, upon pain of ceasing to be a dualist by counting to three and beyond. There is, of course, a clear agenda here for the dualist: explain why the psychological gaps (for intentionality and consciousness) are different from the gaps in the natural sciences, and why this difference entails a difference in metaphysical import as well. For this writer, the intuition that there is such a difference is very strong, though of course that does not decide whether this indicates truth or the grips of a powerful illusion.

But there is a great cost to the dualist in making such a move. For to do so, she must give up the Negative EMC Principle. And this has been one of the key (perhaps *the* key) argument employed by dualists to establish their own position. The main reason that writers like Chalmers and Jackson (of a previous decade, at least) favor dualism is on the basis of the explanatory gap, combined with the view that abiding and

principled explanatory gaps entail ontological gaps as well. But if it is gaps all the way down, it would seem there is a forced choice here between abandoning dualism in favor of a more radical pluralism, or else abandoning the Negative EMC. To do the former is to cease to be a dualist; to do the latter is to retain dualism at the cost of giving up the prime evidence for it, thus making it also more of a standpoint of faith or of philosophical taste. And this applies, *mutatis mutandis*, to property dualism: if explanatory gaps entail distinct categories of properties, and there are many explanatory gaps, there are many distinct categories of properties.

6.3 Pluralism

We have thus come to the surprising conclusion that, without reductions, both dualism and materialism are harder to motivate. It is worth exploring the pluralist alternative. This involves at least a pluralism about theories or explanations – a kind of disunity of science view, at least so far as the kind of unity being denied is inter-theoretic reduction. What does it involve on the metaphysical side? There would seem to be at least two types of alternatives. One we might call “realist pluralism”: roughly, the view that there is an irreducible plurality of ontological kinds, numbering at least as many as the phenomena of irreducible (true) scientific theories. This is perhaps the view we find in John Dupré (1993), who argues that disunity of science is a result of a prior ontological disunity. (As reflected in the title of his book *The Disorder of Things*.)

But one might alternatively take a cognitivist or pragmatist or idealist approach to disunity, holding that failures of supervenience are ultimately an artifact of something about our cognitive architecture, or the interests with which we frame our several scientific theories, or the apparatus through which we interact with the world. Such views differ from both dualism and materialism, not at the level of “inventory ontology” (the list of things they hold to exist) but at the level of “critical ontology” – the account they give of *what it is to be a thing* in the first place. Pragmatists, idealists and cognitivists are inclined to characterize both dualism and materialism as versions of “naïve realism” – the view that the world unproblematically divides itself up into a canonical list of objects and properties in a mind-independent way – and propose their own respective accounts of objecthood. This sort of metaphysics might be applied to our problems as well, and indeed I will recommend one version of it in the end, which I call “Cognitive Pluralism”.

6.4 Realist Pluralism

The realist pluralist takes irreducibility of an object or property to be a mark of its being fundamental. On such a view, a radical theory pluralism on the epistemic side entails a radically pluralistic inventory on the ontological side. (It might be possible to distinguish the thesis that irreducibility implies fundamentalness from the Negative EMC, but only at the cost of divorcing ontology from scientific realism.) To the extent that one is wedded to this sort of realism and “fundamentalism”, this might be an attractive position. However, its metaphysical costs are both great and apparent. On the one hand, it is extremely ontologically profligate. Instead of one basic ontological kind, or even a handful, it ends up committed to hundreds or even more. Indeed, it probably ends up being even more profligate than Aristotelian metaphysics, which posited one substance kind for each species. On the other hand, at least some of its denials of supervenience seem quite suspect. Short of evidence that some particular chemical property is *underdetermined* by physical properties, we are generally wont to assume that fixing the physical properties for a possible world thereby fixes the chemical properties as well. This intuition might be defeasible in the face of possible empirical or philosophical argumentation, but it does hard. There is, in short, an unstable triad of views here:

- 1) the Negative EMC Principle
- 2) theory pluralism in philosophy of science
- 3) the intuition that the phenomena of natural sciences are metaphysically determined by the complete set of physical facts and laws cast at the level of the simplest physical objects.

The realist pluralist rejects 3, but it is by no means clear that this is the least costly move to make.

7. Cognitive Pluralism

As an example of a non-realist pluralist approach, I shall briefly develop a view that I call “Cognitive Pluralism”. (For a longer treatment, cf. Horst 2007, 2011.) The cognitive pluralist approaches scientific disunity in cognitive and pragmatic terms. To

have a scientific theory is not, after all, simply to passively reflect the world like Rorty's (1981) mirror of nature, but to actively model specific features of it, one (or a few) at a time. Modeling features of the world, in turn, involves both abstractions and idealizations. Abstraction involves screening out some features of the world to bring others into focus, like viewing an object through a particular type of lens.

Idealization (as I shall stipulatively use that term) is a special type of abstraction whose characteristic feature is that it screens out features that matter *in vivo*, thus creating a gap between behavior-as-reflected-by-the-model and real world kinematics. Thus, for example, a gravitational theory might be idealized in several ways: qua gravitational theory, it models only the gravitational aspects of kinematic problems, and brackets contributions of, say, electromagnetism. And thus, as Nancy Cartwright (1983) has pointed out, objects never behave exactly as gravitational theory, taken alone, would predict. (And hence we must view laws as stating something other than universal claims about how objects actually behave if we are to preserve the intuition that they are true. Cf. Horst 2011.)

In addition to this kind of "bracketing idealization", the model might also make "distorting idealizations", such as treating objects as point-masses. This is comparatively innocent in some cases, but ceases to be innocent when factors like aerodynamics are also in play. (A sheet of paper crumpled into a ball falls quite differently from a similar sheet folded into a paper airplane.)

A model also involves some particular representational system – a guiding metaphor, for example, and a choice of mathematical tools (a particular geometry or topology). Thus wave and particle models capture different aspects of the phenomena they model by employing different representational systems. *What* representational systems human minds can employ is, further, constrained by human cognitive architecture, and the models actually employed then constrain the kinds of information that can be captured and exploited as opposed to what is screened out. To idealize and apply a particular mathematical structure to a messy real-world situation is necessarily to lose information as the price paid for insight and computational tractability.

Given that scientific models are idealized, optimized for particular pragmatic goals, and subject to constraints of cognitive architecture, this can explain at least some types of failures of reducibility. Not all representational system are in fact reducible to a common denominator and are, in this sense, incommensurable. They can, nonetheless, be models of the same reality, as in the case of particle and wave models in classical

optics or quantum mechanics, much as one can take pictures of a single object from different angles and through different camera lenses. However, pasting together such snapshots does not produce, and could never produce, a master picture of how the object looks from all angles at once. Pictures do not work like that, and neither, quite plausibly, do theories or models.

The Cognitive Pluralist might further be inclined to view this feature of scientific disunity as a special case of a broader phenomenon that is indicative of human cognitive architecture. Mind and brain display a certain amount of modularity, or division of labor into special-purpose, task-optimized systems, even at the hardware level of the brain. Domain-specific reasoning, while probably not accomplished by a partitioning of brain hardware, seems to be an analogous phenomenon involving learned models rather than hard-wired modules. In both cases, models are driven by pragmatic constraints (or learning or of natural selection respectively) and subject to prior constraints imposed by cognitive architecture. Scientific models are idealized, local, and pragmatically constrained because they are a product of human minds and brains, and that is the kind of models human minds and brains are designed for. And, as a consequence, the question of whether a theory A can be reduced to B turns out to be an empirical question, *not just about how the world is, but about the capabilities of the mind itself, and how it represents A and B.*

This has led us from the cognitivist side of the story to the pluralist side: the hypothesis that scientific disunity, like domain specificity of reasoning and brain modularity, is not just a symptom of the immaturity of our scientific knowledge, but a necessary by-product of how our minds are designed. (Compare McGinn 1991, Pinker 1997)

As a purely epistemic claim, Cognitive Pluralism might be acceptable and even welcome to dualists and especially to materialist mysterians. It provides a model on which failures of reduction need not entail failures of supervenience, if only by providing an alternative explanation of scientific disunity. The monist only wants *reality* to be unified; if it is only reality-as-represented-by-us that is disunified, a unified world need not be in danger. It seems to me, however, that this move is bought at considerable cost. For if the materialist adopts a cognitivist or pragmatist slant on scientific theories, and thereby on the entities postulated by those theories, she is faced with the choice between skepticism and idealism that plagued the British Empiricists. Either the “matter” one is talking about is the sort of thing that appears in scientific theories, or it is

something else on the order of a Lockean real essence or Kantian *Ding an sich*. If it is the former, then “the world” really is disunified, because it consists in the patchwork of objects and properties found in the sciences, whose critical ontology lies at the interface between our minds (augmented by regimented practices of experimentation) and ultimate reality. “The world” here is, in Kantian terms, the phenomenal world, and is a possible object of knowledge, but apparently not unified knowledge. But if “the world” is more on the order of noumena – something other than reality-as-represented-in-our-theories – then it is unknowable to us, or at least starkly separated from our theories, thus leading to a Lockean form of skepticism.

The metaphysical side of cognitive pluralism is to embrace the kind of view that Kant recommended: that we preserve the possibility of scientific knowledge by treating it as knowledge of phenomena – albeit perhaps phenomena that we play a role in creating through regimented scientific experimental practice. (Compare Hacking 1983.) Here the lines between “realism” and “antirealism” are to my mind very thin – perhaps so thin as to be meaningless. (The real issue may be closer to what Cartwright (1994) calls “fundamentalism” rather than realism.) For the cognitive pluralist *need not* (and indeed *should not*) take the view that all ways of modeling the world are on a par with one another. Some models are more apt than others; and while cognitive architecture and pragmatic interests shape the space of possible models, it is experiment that settles the question of which of these are more and less apt. To fail to do this is to mistake daydreaming for science. Moreover, scientific models can even be epistemically privileged over other types of models, in that they are products of a kind of regimented empirical practice that excludes as much as possible of what are *arbitrary* byproducts of human interests and cognition, and insists upon setting things up so that the world itself decides as many crucial questions as possible.

What, then, should the cognitive pluralist say about the two issues that caused problems for other views: the implications for ontology and the apparent specialness of the psychological gaps? The ontological problem was framed in terms of supervenience, and this is a notion that the cognitive pluralist might regard with some suspicion. In particular, he ought to be concerned about standard formulations of supervenience within a modal metaphysics cashed out in terms of a possible worlds semantics (PWS). Consider how one gets at the notion of a possible world. One starts with a set of all propositions or a set of all states of affairs. A world is then conceived of

as being, or as being defined by, a mapping from this set onto truth values. A *possible* world is one in which there are no inconsistencies generated by such a mapping.

Now ought a cognitive pluralist to be happy with such a project? Well, perhaps at the level of it being one more conceptual tool that can do some limited amount of useful work. But if it is supposed to give insight into the deep structure of metaphysical reality, things look a bit suspicious. On the one hand, it is suspicious from a *cognitivist* standpoint. To start off speaking of “the set of all properties” (“all propositions”, “all states of affairs”) would seem to be exactly the kind of naïve realist move that the cognitive pluralist, *qua* cognitivist (or similarly idealist, pragmatist, social constructivist) takes issue with, as it assumes that there is some unique, canonical, mind-independent way that reality divides itself up into properties, propositions or states of affairs. The cognitivist may agree that there are enterprises in which one has to think like a naïve realist.^{viii} But the juncture at which one decidedly must avoid this impulse is when one is trying to do fundamental metaphysics.

The cognitive pluralist also has a problem with PWS *qua* pluralist. For PWS seems to assume that the various things we can represent through local models can be united into a single master system. PWS need not imply *reductive* unification – propositions can be consistent with one another without being reducible to a common denominator. But even highly apt idealized models can sometimes generate contradictions, as is in fact the case with General Relativity and Quantum Mechanics. The cognitive pluralist rejects the view that such a circumstance implies that at least one of the models is false or (globally) inapt. Indeed, each may deserve honorifics like ‘true’ or ‘apt’ as much as anything deserves them. And yet they can generate contradictions, due to the ways they are idealized and partial. If you want a kind of “truth” that entails consistency too, you need to work with unidealized theories. Perhaps God can get at this sort of Truth; but, the cognitive pluralist hypothesizes, the human mind cannot. But if two theories T1 and T2 are true of a world W, yet generate contrary predictions in some cases in W, then either W is not a *possible* world as that notion is generally understood (as that requires consistency) or else true theories do not imply their predictions. (Indeed, one could even derive the conclusion that the *actual* world is not a “possible world” in the sense required by PWS.)

What moral should one draw from this? I think the deep issue here is that scientific laws cannot be smoothly grafted onto the kind of semantic model represented by PWS, and may not be easily integrated with modal metaphysics at all. From the

cognitive pluralist standpoint, this does not imply that either enterprise (scientific modeling or modal metaphysics) is individually problematic, as Cognitive Pluralism holds that in general disparate models may not be integratable with one another. But it does seem to present problems for enterprises that require us to mix them together. And speculating on whether the truths of one science supervene upon those of another would seem to be just such an enterprise.

Finally, what about the intuition that the explanatory gaps in psychology are wider and deeper than those in the natural sciences? The cognitivist strain of the brand of pluralism I am recommending does have special resources for addressing this. Transcendental idealists like Kant and Husserl have already pointed out that there are special problems in trying to talk about subjective experience as though it were itself a thing in the world, related to other things in the world. On the one hand, a description of subjectivity seems to require a peculiar representational form, in which self/thought/object are related in a single intentional state, *not* as three objects in an objective relation, but rather as three moments of a single experience. Husserl additionally points out that to take either a thought or the transcendental subject and treat it as a *thing* (an *object*) is necessarily to distort it as it appears in lived experience. If this is correct, then there are problems in trying to create a mind-body theory (or better, an experience-body theory) that do not arise when relating two objects or systems of objects.

Further, for idealists and pragmatists, “ontology”, in the sense of the inventory of the world, is not metaphysical bedrock. There is a deeper enterprise of examining what it is to exist, or to be a unity. And this they cash out in terms of relation to a subject that thinks or has interests and practical interests. The point here is not that the inventory of the universe is first and foremost one of conscious subjects and that physical phenomena are causally or compositionally derivative from these. The point is not about inventory at all. But there is a deeply anti-reductionist moral here stemming wholly from the cognitivist/idealist/pragmatist side. And that is that *objecthood itself* needs to be cashed out in terms of cognition. What it is to be an object is to be the sort of thing that can be made a possible object of cognition. Objecthood, like Lockean qualities, is understood in terms that relate it to thinking subjects. And thus this account of objecthood is one in which subjecthood is in some sense “already on the scene” and “prior” to the objects of cognition. The priority is more of the logical than the causal or temporal sort, but it is an important sort of priority nonetheless, in that implies that at

some level subjectivity cannot be exhaustively explained in objective terms, be they natural-scientific or otherwise.

How plausible one finds such a position will, I suspect, depend very little on one's attitude towards the *pluralist* strand and very much on one's independent attitude to the costs and benefits of cognitivism, pragmatism or idealism as compared with naïve realism. (And of course, those who favor the latter generally do not call their view "*naïve* realism" in the first place.) However, if the earlier parts of this article are correct, the traditional arguments in favor of "realist" ontologies like dualism and materialism in fact turned quite a bit upon assumptions about reducibility and its relation to metaphysical supervenience. Theory pluralism takes away key arguments for both dualism and physicalism, and indeed if traditional assumptions about the negative EMC are retained, it leads to a radical ontological pluralism. Whether one makes the non-realist turn or not, then, it seems necessary to posit a greater gulf between science and metaphysics than most dualists and materialists have (with notable exceptions such as Locke) heretofore assumed. And with this in mind, the barriers to the cognitivist turn seem significantly reduced. Add to this that cognitivist story is one on which answer to several puzzles simply fall out – why there should be scientific disunities, why the psychological gap is special, and how to avoid radical ontological pluralism – and it would seem to be a strong contender and worth of our attention.

8. Conclusion

Philosophy of mind would seem to be at a crossroads. Familiar problematics have tended to be predicated upon the assumptions (1) that there are widespread reductions in the natural sciences, (2) that there are close relations between explanation and metaphysics, and (3) that it is safe to treat these problems from the standpoint of a naively realistic inventory ontology without recourse to critical ontology. The first assumption seems to have turned out to be empirically false as a second-order claim about the relationships between theories and models in different scientific domains. This, in turn, challenges the evidential status of all of the familiar positions. Reductive physicalism is damaged, perhaps past resuscitation. Without reductions, materialism is left without the primary means of arguing that inter-domain correlations are symptoms of metaphysical supervenience rather than some weaker relation, and hence even non-reductive materialism is set back. But the dualist alternative also loses argumentative

ground as it must either yield arguments based on the Negative EMC (in which case it too is ill-motivated) or else admit that there are failures of supervenience outside of psychology (in which case it ceases to be dualism and becomes a more radical pluralism). Moreover, the explanatory gap in psychology seems no longer to be a unique phenomenon; and if it is not unique, one might raise the question of whether it is as interesting or important as we might have supposed as well. There is, to be sure, an intuition to the effect that there is something *different* about the psychological gaps, but this intuition needs to be fleshed out in greater detail before it can be put to philosophical use.

The main suggestion of this article is therefore that post-reductionist philosophy of science forces us to rethink some mainline problems and positions in philosophy of mind. To this I have added an outline of what I take to be a promising way of proceeding: by re-examining philosophy of mind from the cognitive pluralist standpoint, which holds theory pluralism to be a product of how the mind conceives of the world, and to explore the cognitivist turn in metaphysics as an alternative to naively realistic inventory ontology.

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ⁱⁱ Depending on just what one means by 'reduction', functionalists who are also physicalists might or might not qualify as reductionists as well. If 'reduction' means type-type identity with *physical* or *neural* types, functionalists are not reductionists; but many functionalists do view their functional analyses as supplying a reduction of mental kinds to *functional* kinds, each of whose instances is token-identical with a physical particular.

ⁱⁱⁱ I would identify watershed events here as the 1994 Tucson Conference on consciousness, and particularly the controversy around David Chalmers' presentation there and related (1996) book.

^{iv} The term 'mysterian' is used in stronger and weaker senses. In its weaker sense, which I employ here, it is the view that some of the characteristically mental properties cannot be explained in non-mental terms. In its stronger sense, it denotes the view that the mental is utterly ineffable, even in mentalistic terms. I should also note that mysterianism does not itself commit those who hold it to supervenience or to materialism.

^v It is, sadly, not the only, or the best-publicized such hiding place. Mass-marketed books like E.O. Wilson's *Consilience* and Francis Crick's *The Astonishing Hypothesis* seem to make similar assumptions, and others of greater philosophical naivete. Wilson, for example, seems to think the greatest challenges to reductionism come from post-modernists and religious luddites; in fact they come from mainline analytic philosophers of science who have cut their teeth looking at the details of various actual sciences.

^{vi} The exception are those who are willing to extend the notion of "physical type" to include wildly disjunctive types, so that all of the realizing systems of, say, pain in physically different organisms are

lumped together with a liberal peppering of conjunction signs. This view may be useful for logic and metaphysics, but insofar as we are concerned with the explanatory value of inter-theoretic reductions, it is perfectly useless.

^{vii} I would commend the *Blackwell Guide to Philosophy of Science* chapter on reduction, emergence and as a starting place for those interested in reading further on these topics.

^{viii} Notably, in order to assess the fidelity or aptness of a representational system, one must compare it to an independent description of the world that is treated as canonical. The epistemologist may know full well that this description, too, is idealized, but *for purposes of the task of fidelity-assessment* treats it as though it described how the world is in itself.