Wilson on Metaphysical Emergence

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Abstract

I critically examine Jessica Wilson's views concerning the relationship between Weak emergence and Physicalism and between Strong emergence and Physicalism, and also her defense of libertarian free will in *Metaphysical Emergence* (2021).

Keywords: Metaphysical emergence, Weak emergence, Strong emergence, Physicalism, Fundamental interactions, Free will.

Jessica Wilson's *Metaphysical Emergence* (2021) is a wonderful book. It addresses a wide range of central metaphysical issues from an overarching theoretical perspective. Not only is it must-reading for anyone who works on metaphysical emergence, it contains a wealth of material that should be of interest to anyone who works on physicalism, realization, the metaphysics of complex systems, the metaphysics of ordinary objects, consciousness, mental causation, or free will.

As the title of her book makes evident, Wilson is concerned with metaphysical emergence—metaphysical, rather than merely epistemic emergence. More specifically, she is concerned with whether special science and (scientific and folk) mental kinds, properties, and their instances metaphysically emerge, respectively, from physical kinds, properties, and their instances. A central aim the book is to examine the relationship between that issue and physicalism (15).[1] I'll focus on that aim.

What, then, is physicalism? Wilson takes the core idea of physicalism to be that our world is fundamentally physical.[2] What counts as physical? Wilson appeals to a physics-based conception of the physical, with a caveat in response to Hempel's (1969) famous dilemma (23). The first horn of that dilemma is that if by the physical we mean what is posited by current physics, then, since current physics is incomplete and at least to some extent inaccurate, the claim that our world is fundamentally physical is false. The second horn is that if instead we mean what would be posited by an ideally completed physics that is in fact true of our world, then, since we don't know what such a physics would posit, the

[1] Numerals in parentheses are references to page numbers in the book.

[2] She takes the notion of fundamentality as a primitive (31).

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claim that our world is fundamentally physical is largely vacuous. Current physics, for instance, has no need of the hypothesis that there are mental phenomena, but mightn't it turn out to be the case that the physics in fact true of our world does? As Wilson conceives of the physical, it is whatever would be posited by the completed physics in fact true of our world, with the following caveat: A mental feature is not to be counted as a physical feature even if that physics would posit it. She calls this constraint on her physics-based conception of the physical "the no fundamental mentality constraint" (23). She uses it to impose a constraint on physicalism: any doctrine deserving of the name 'physicalism' should be incompatible with the physics in fact true of our world having to posit mental phenomena. She doesn't state a "no fundamental chemical" or a "no fundamental biological" constraint. When discussing physicalism, her attention is typically focused on the place of the mental in nature. I think she would, though, accept such additional constraints. It is clear, for instance, that if the physics in fact true of our world would have to posit entelechies or a fundamental vital force, she would take physicalism to be false (8).

Unlike a term like 'causation', the term 'emergence' is a term of art. Its uses are many and varied both in the philosophical and in the scientific literature.[3] Indeed, they are so diverse that one wonders whether there is even any common core idea. Focusing on metaphysical emergence narrows things down. It is fairly common ground in the philosophical literature at least that whenever there is metaphysical emergence, there is something that emerges and *something else* that it emerges from; that metaphysical emergence is incompatible with reduction; that it always involves emergent properties; and, moreover, that the bearers of emergent properties are complex entities: macro-entities constituted by micro-entities.

Wilson maintains that the core idea of metaphysical emergence is that of dependence with autonomy (1). Emergents are dependent on what they emerge from, yet autonomous from them. She is concerned with emergence from the physical. She calls the kind of dependence that she maintains is required for it, "co-temporal material dependence" (1); and she distinguishes two kinds of autonomy: ontological and causal. She states: "The coupling of co-temporal material dependence with ontological and causal autonomy [...] is most basically definitive of the notion of (metaphysical) emergence" (1). Let's consider, in turn, her notions of ontological autonomy, co-temporal material dependence, and causal autonomy.

What ontological autonomy from the physical comes to is just failure of emergents to be identical with anything physical. Following Wilson in using 'feature' as a blanket term for kinds and properties (including relational properties), if a feature S metaphysically emerges from a physical feature P, then S is not identical with P or any other physical feature. Following her in using 'token feature' as a term for a particular entity's having a feature at a time or throughout an interval of time, if a token feature S emerges from a token physical feature P, then S is not identical with P or any other physical feature token. Further, if a feature S emerges from a physical feature, then any entity that has S is not identical with any physical entity. She takes reduction to require identity claims, and so maintains that metaphysical emergence is incompatible with reduction.

[3] See, for example, the essays in Bedau and Humphreys 2008.

Wilson doesn't explicitly state a definition of 'co-temporal material dependence'. But from her discussion (Ch.1), I take it that she holds that an entity's having a feature S at a time t (what she calls "a token feature S") co-temporally materially depends at t on a configuration of fundamental physical particles having a physical feature P at t (what she calls "a token feature P") just in case at t, the configuration of fundamental particles is coincident with the entity and has a physical feature P that minimally nomologically necessitates S. (Wilson suggests how this could be modified should our world turn out to be gunky (24), but the modification needn't concern us here.) I take it that although a physical feature P must minimally nomologically suffice for S if S emerges from P, P needn't be nomologically necessary for S. Co-temporal material dependence on the physical is compatible with an emergent feature's having multiple physical emergent bases. A token of feature S might emerge from a token of feature P, while a different token of feature S emerges from a token of feature P*, where P and P* are distinct physical features.

Turn to causal autonomy. Wilson holds that emergent features have causal powers: powers to produce certain kinds of effects when an entity has them in certain circumstances. She takes token features, an entity's having a feature at a time or throughout an interval of time, to be the primary *relata* of the causal relation (40). She takes token features to have causal powers too, "token powers" (72). By that I take it she just means that they have causal effects in virtue of being tokens of the features in question and the circumstances in which they are instantiated. She distinguishes two kinds of causal autonomy, and uses the distinction to distinguish two kinds of metaphysical emergence. Her distinction between the two kinds of metaphysical emergence plays a major role throughout the book, so let's turn to it.

Wilson characterizes the two kinds of metaphysical emergence as follows:

> Weak Emergence. What it is for a token feature S to be Weakly metaphysically emergent from token feature P on a given occasion is for it to be the case, on that occasion, (i) that S co-temporally materially depends on P, and (ii) that S has a non-empty proper subset of the token powers had by P (72).
>
> Strong Emergence. What it is for token feature S to be Strongly metaphysically emergent from token feature P on a given occasion is for it to be the case, on that occasion, (i) that S co-temporally materially depends on P, and (ii) that S has at least one token power not identical with any token power of P (120).

The definitions include the same first condition, co-temporal material dependence (explained earlier), but their respective second conditions express different kinds of causal autonomy. In cases of Weak emergence, the token feature S is causally autonomous from the token feature P in that it has a different complete causal profile from the complete causal profile of the token feature P: The token powers of the token feature S (i.e., its effects) are a proper subset of the token powers (the effects) of the token feature P. Thus, every effect of the token feature S is an effect of the token feature P, but the token feature P has effects that the token feature S doesn't have. In cases of Strong emergence, a token feature S has at least one token power (one effect) that is not identical with any token power (any effect) of the token feature P; it does so in virtue of feature S's having a causal power not possessed by P.

I regard Wilson's characterizations of Weak and Strong emergence as entirely stipulative, and so to be judged solely in terms of their theoretical fruits. Of each, we should ask whether there are any instances of the kind of emergence in question, and, if so, what theoretical consequences that has. I'll be concerned with whether there are any instances of the kinds in question, and, if so, the theoretical consequences of that for physicalism, where physicalism is understood to be the thesis that our world is fundamentally physical.

Before turning to those issues, however, I want to first briefly consider other notions of emergence in the literature. Some theorists would deny that causal autonomy, in either of Wilson's two senses, is among the conditions "most basically definitive of the notion of (metaphysical) emergence" (1). They maintain that emergent features can be epiphenomena, and so devoid of causal effects.[4] Let's call that kind of emergence "epiphenomenal metaphysical emergence". One might try to characterize it along Wilson's lines in terms of co-temporal material dependence with the null set of causal powers. Wilson discusses epiphenomenalism (97–101, 140–141). She points out that in the literature, the leading candidates for epiphenomena are the phenomenal or qualitative characters of subjective experiences—their what it is like for the subject aspects—, and argues that they are in fact causally efficacious. I agree with her view that they are causally efficacious. Still, the notion of epiphenomenal metaphysical emergence is coherent; it is an *a posteriori* issue whether there is any. Let it suffice to note, then, that although Wilson sometimes seems to suggest that Weak and Strong emergence are the only two basic kinds of metaphysical emergence, I take it that her considered position is that they are the only basic kinds of metaphysical emergence that we have reason to believe may be found in our world. Of course, epiphenomenal emergentists will disagree even with that weaker claim, but I'll say no more about epiphenomenalism.

As concerns a number of other at least apparently different notions of emergence in the literature, Wilson argues either that they fail to be notions of *metaphysical* emergence or else they in fact involve either Weak or Strong emergence. I recommend in this connection reading her chapter "Complex Systems". It is informative, but it would have benefited from a discussion of the notion of emergence used in solid state physics. That notion is certainly not the notion of Strong emergence in her sense. It would have been instructive to know whether she thinks it involves Weak emergence or instead that it isn't a kind of metaphysical emergence, and why. Be that as it may, I'll now focus just on her notions of Weak and Strong emergence.

Weak and Strong emergence are not so-called because Strong implies Weak but Weak doesn't imply strong. Neither implies the other. They are incompatible: It is impossible for a token feature S to be both Strongly and Weakly emergent from a token feature P, for the simple reason that it can't be the case that the token causal powers of S are a proper subset of the token causal powers P and also the case that S has a token causal power not had by P. Given that they are incompatible, one might wonder why she labels them "Weak emergence" and "Strong

[4] See, for example, Chalmers 1996.

emergence".[5] She doesn't explicitly say, but I take it that she so labels them because she holds that Weak emergence from the physical is weaker than Strong emergence from the physical in the following way: Weak is compatible with physicalism, while Strong is not.

Wilson defends the twofold claim that (a) there is Weak emergence and there may well be Strong emergence, and that (b) while Weak emergence is compatible with physicalism, Strong emergence is incompatible with physicalism. This twofold claim will be my central focus.

Wilson tells us that physicalism is committed to Physical Causal Closure: the thesis that "every lower-level physical effect has a sufficient purely lower-level physical cause" (41). (I take it that the thesis isn't supposed to entail causal determinism. A sufficient cause of an effect must determine the objective probability of the effect, but that can be less than 1 if causal determinism is false.) Weak emergence is compatible with Physical Causal Closure, since the causal powers of the emergent will be a proper subset of the causal powers of its physical base. In contrast, Strong emergence, she tells us, is incompatible with Physical Causal Closure: If there is Strong emergence, then there are at least some lower-level physical effects that do not have any purely physical lower-level sufficient cause (41).

Wilson's formulation of Physical Causal Closure invokes a notion of level, and so presupposes a notion of levels in nature. To be sure, proponents of metaphysical emergence standardly maintain that nature is layered, with higher levels metaphysically emerging from lower levels. Wilson could of course appeal to Weak and Strong metaphysical emergence to characterize two different notions of levels in nature. But the Physical Causal Closure thesis is not supposed to entail that there is metaphysical emergence of even the Weak kind. If, then, the notion of levels invoked in Physical Causal Closure is not to be understood in terms of metaphysical emergence, how should it be understood? What is a level? It is uncontroversial that there are macro-micro levels, but they are just a matter of scale. A proper micro-constituent of a macro-entity will be at a lower level, lower scale, than the macro-entity. But any micro-configuration of physical particles that makes up an entity (at a time) will be at the same scale as that entity (at that time). Systems of particles arranged mountain-wise are at the same scale as mountains, and so not at a different level in the micro-macro sense. So what, then, is a level? Wilson discusses that question (24–30), but doesn't commit to a definitive answer to it since she seems to want to remain neutral on certain issues.

I won't pursue the question of how 'level' should be understood in the Physical Causal Closure thesis. The reason is that I think that Wilson needn't appeal to a notion of levels in order to formulate a physical causal closure thesis that is suitable for her purposes. Given her no fundamental mentality constraint, she could reformulate Physical Causal Closure just as the thesis that every physical effect has a sufficient purely physical cause (one that determines its objective probability). She could then claim that if any mental features are Strongly emergent, that thesis is false, and so physicalism is false since there are *fundamenta* that are not physical. (To address the issue of whether there is chemical or biological

[5] The terms 'weak emergence' and 'strong emergence' get used in the literature, though not in a uniform way. I'm here just concerned with her terms 'Weak emergence' and 'Strong emergence' as she defines them.

Strong emergence, issues she doesn't pursue, one could appeal to a no chemical or no biological constraint on the physics-based conception of the physical.)

Mainly for readability, rather than using 'features' and 'token features', I'll now, for the most part, frame the issues in terms of properties (monadic properties, dyadic ones, etc.), and in terms of states and events as the *relata* of the causal relation. Nothing, I believe, will turn on this shift in terminology. Unless I explicitly indicated otherwise, I'll take states and events to be an entity's having a property at a time or throughout an interval of time, and so what she calls a token feature.

Wilson maintains that Weak emergence is widespread among the special sciences yet compatible with our world being fundamentally physical. Reductive physicalism, she holds, requires that every contingent entity, event, or property be identical, respectively, with some physical entity, event, or property, but that isn't required for our world to be fundamentally physical, and so isn't required for physicalism. A kind of non-reductive physicalism could be true (55–58). She doesn't herself embrace non-reductive physicalism, however, at least not across the board. As I mentioned, she takes there to be reason to believe that there may very well be certain cases of Strong emergence, and so reason to believe that even non-reductive physicalism, as a general doctrine, may very well be false; but of that, more shortly. Let's first look more closely at the relationship between Weak emergence and non-reductive physicalism.

Wilson's notion of Weak emergence requires a modification if Weak emergence across the board is supposed to guarantee non-reductive physicalism. The nomological requirement on Weak emergence is that if a feature S Weakly emerges from a physical feature P, then P is minimally nomologically sufficient for S. That condition is compatible with the law linking S and P being a fundamental law of nature, a law that doesn't hold in virtue of other laws and conditions. The notion of Weak emergence is thus silent about whether the laws linking Weak emergents with their physical bases hold in virtue of physical laws and physical conditions. If S is, for instance, a mental property, the law will be a psychophysical law. The existence of fundamental psychophysical laws is incompatible with physicalism, reductive or non-reductive. If mental properties are distinct from physical properties, and there are fundamental laws in which they figure, then it's not true that our world is fundamentally physical, even if the instances of mental properties don't make a non-redundant causal contribution to the course of physical events (or indeed even if they are epiphenomenal). Mental properties and their instances would be, respectively, fundamental properties and property instances. Since Weak emergence is compatible with fundamental psychophysical laws, it is possible for Weak emergence to hold across the board and yet non-reductive physicalism be false. To avoid this result, the condition of co-temporal material dependence must be amended. It must be amended to include the requirement that the law linking S and P not be a fundamental law of nature; it must be a law that holds in virtue of physical laws and physical conditions.

It should be noted that while this amendment is needed if Weak emergence is to serve the purpose in question, the condition of co-temporal material dependence should not be so amended in the characterization of Strong emergence if Strong emergence is to do the work Wilson intends it to do. A Strong emergentist should hold that laws linking emergents with their physical bases are fundamental laws; and so, not ones that hold in virtue of physical laws and physical conditions. Thus, if Weak and Strong emergence are to do the work that Wilson intends, the

two kinds of emergence require different kinds of co-temporal material dependence, not just different kinds of causal autonomy.

It is fairly common for self-billed non-reductive physicalists to claim that although there are contingent objects, events, and properties that are not physical, they are *realized*, respectively, by physical objects, events, and properties. Realizers are supposed to be more ontologically fundamental than what they realize, thus allowing a kind of non-reductive physicalism. This agreement among non-reductive physicalists is thin, however. 'Realization', like 'emergence', is a term of art. We must be told what's meant by the term. Non-reductive physicalists oblige, but there are a number of non-equivalent relations that get called 'realization' in the literature. As Wilson makes clear, she takes Weak emergence to be realization (vii).[6] She readily acknowledges that there are various notions of realization in the literature, but she seems to hold that they all involve the notion of Weak emergence. She seems to view them as invoked to try to help explain how the kind of causal autonomy required for Weak emergence is implemented. Her view seems to be that if there is realization of any of the kinds in question, then there is Weak emergence.

If, as I've argued, in cases of Weak emergence, the laws linking an emergent with its physical bases must be non-fundamental, it cries out for explanation how it is that such laws hold in virtue of physical laws and physical conditions. Non-reductive physicalists typically want an account of realization that yields such explanations. The role-functionalist notion of realization as causal role occupancy, for instance, yields an explanation of why laws that invoke functional properties hold in virtue of physical laws and physical conditions, and so are not fundamental laws, even though functional properties are not identical with the physical properties that occupy the roles in question. The notion of Weak emergence itself won't yield an explanation of how laws citing Weakly emergent properties hold in virtue of physical laws and conditions.

It is important to note, moreover, that while a role functionalist may hold a view of causation according to which functional states and their physical realizers meet the causal autonomy condition for Weak emergence, a role functional needn't hold such a view. Role functionalists hold that a functional state is a second-order state of being in some state or other that has certain causal effects, and that the first-order states that have those effects realize the functional state. It is open to a role functionalist to maintain that a functional state, a state of being in some state or other that has certain effects, does not itself cause those effects. Its realizers do. That's compatible with functional states figuring in causal explanations of the effects in question.[7] But it is incompatible with Weak emergence.

Weak emergence requires that there be a certain kind of causal overdetermination. As Wilson points out, the kind in question will be different from the familiar kind of causal overdetermination that occurs when, for instance, the shattering of a window is overdetermined by two rock throws (40–46). If one of the rocks throws had not occurred, the window would still have shattered, but not in precisely the manner and at precisely the time in which it in fact shattered. Weakly emergent events, if there are such, don't overdetermine the effects of their

[6] See also Shoemaker's (2009) subset view of realization. Wilson tells us that the subset view of realization was first proposed by Michael Watkins (vii).

[7] For details, see McLaughlin 2006, 2015.

physical bases in that way. The effects of a Weakly emergent event will be precisely the same in manner and time of occurrence as those of a proper subset of the causal effects of its physical event base. Wilson regards this kind of overdetermination as unproblematic, since it is compatible with Physical Causal Closure. It is indeed compatible with Physical Causal Closure. But it cries out for explanation how such overdetermination could occur in our world. We need an explanation of how emergent events can have certain causal effects that their physical base events have, even though those effects would have occurred in precisely the same manner and time even if the emergent event had not occurred.

Whether there is overdetermination of the kind Weak emergence requires, and so whether there is Weak emergence, depends on the answers to questions about the *relata* of the causal relation and about the nature of causation. As Wilson points out (40–44), Jaegwon Kim (1998, 2005) wonders what causal work an emergent state or event could possibly be doing were there such overdetermination, given the causal work done by its physical base. A leading non-reductive physicalist response to Kim's no-work objection is that he is assuming a productive notion of causation, and causation is, rather, a kind of counterfactual dependency (Loewer 2007). Whether this response is available to Wilson depends on some issues about which she is silent. If the entity, feature, or time of a token feature are essential to the token feature, then token features are too fragile to serve as the *relata* of the causal relation on a counterfactual theory of causation.[8] It thus matters whether they are essential to the token feature. Wilson is silent about that.

It is, moreover, uncertain why a non-reductive physicalist would have to appeal to the kind of overdetermination required for Weak emergence. That isn't required if role functionalism counts as a kind of non-reductive physicalism, since, as I've noted, it is at least open to a role functionalist not to countenance the kind of overdetermination Weak emergence requires. It also remains open to a non-reductive physicalist to eschew Wilson's view of the *relata* of causal relations as feature tokens in favor of a coarse grained view of events, and to maintain that every event is identical with some physical event, but deny that special science and mental event types reduce to physical event types.[9] Further, it remains open to a non-reductive physicalists who embraces Wilson's view of the *relata* of causal relations as feature tokens to argue that special science and mental tokens have novel causal powers in a way that is compatible with Physical Causal Closure: They could have novel effects without having novel physical effects. It's been argued, for instance, that special science and mental events will screen off their underlying physical bases from having certain non-physical effects that those special science and mental events have.[10]

Notice that if the kind of view of causation last mentioned is viable, then Strong emergence, as Wilson defines it, isn't incompatible with Physical Causal Closure. A Strongly emergent state or event can have an effect that its physical base doesn't have, yet not have any physical effect that its physical base doesn't have. That's compatible with Physical Causal Closure. Wilson's intent, though, is clearly that Strongly emergent features have novel physical effects, physical effects that lack sufficient purely physical causes (54), so that if there are Strongly

[8] See Lewis 1986.
[9] See, for example, Davidson 1970.
[10] See, for example, Yablo 1992.

emergent features, then Physical Causal Closure is false, and hence physicalism is false. She may be taking it as given that an emergent couldn't have a novel effect (one its physical base doesn't have) without having some or other novel physical effect (one its physical base doesn't have). That may be so, but the issue has certainly not been settled. There is no such consensus about causation. I suggest that rather than getting into the weeds about whether a special science state or event could have novel effects without having novel physical effects, Wilson should modify the definition of Strong emergence so that it explicitly requires that Strongly emergent token features have at least one physical effect that their physical token feature base lacks.

To return to Weak emergence, although Wilson has much of interest to say about non-reductive physicalism and causation, she doesn't say enough to establish that any doctrine deserving of the label "non-reductive physicalism" requires appeal to the kind of overdetermination Weak emergence requires. Moreover, if a non-reductive physicalist maintains there is overdetermination of the kind in question, she owes us an explanation of how it is that there is such overdetermination. The notion of Weak emergence won't help to answer that question. As concerns Weak emergence and non-reductive physicalism, then, my main take away points are that it remains unresolved whether there is overdetermination of the sort Weak emergence requires, and so whether there is Weak emergence, and also whether any doctrine that counts as non-reductive physicalism must appeal to Weak emergence.

Let's turn, finally, to Strong emergence. Wilson claims that libertarian free will requires the Strong emergence of decisions and acts of will, and so is incompatible with Physical Causal Closure, and thus incompatible with physicalism (281). Of course, if there is in fact no such libertarian free will, physicalism faces no such threat. The book's jaw dropper is that Wilson maintains that there is "good reason to think that we have free will of libertarian, Strong emergent variety" (281). She makes a case that we have *prima facie* reason to believe that we have libertarian free will, and that that *prima facie* reason has thus far not been defeated. Her considered position seems to be that we are entitled to believe it until it has been defeated. At one point, though, she says something stronger: "I conclude that there is actual free will of both Weak and Strong varieties" (281). That, however, can't be the best way to state the conclusion she intends. Weak and Strong emergence, you'll recall, are incompatible. If decisions or acts of will are Weakly emergent, then they are not Strongly emergent; and if they're Strongly emergent, then they are not Weakly emergence.

In what remains, I'll focus just on Wilson's claim that decisions and acts of will are Strongly emergent. I'll simply assume, for the sake of argument, that a libertarian notion of free will requires that.

Wilson tells us a novel causal power of a Strongly emergent feature will be a novel fundamental power (54), a power to influence the course of physical events that no physical feature has. Indeed, Strong emergentism, she tells us, "is committed to there being at least one other fundamental force beyond those fundamental forces currently posited" (50) by physics. The force would be a configurational force, a fundamental force, yet one that can be exerted only by complex configurations of particles. As she notes (46-49), in McLaughlin 1992, I claimed that one finds this idea in some of the literature in the British Emergentist tradi-

tion, and that such configurational forces are compatible with Schrödinger's equation, and also that it is an empirical question whether there are such forces. I stand by those claims.

I also claimed in McLaughlin 1992 that I am deeply skeptical about whether there are any fundamental configurational forces, that there seems to be no evidence for their existence, and compelling empirical reason to think there are no such forces. I stand by those claims too. Such forces would involve complex configurations of physical particles participating in fundamental interactions in the physicist's sense of "fundamental interactions". As concerns fundamental interactions in that sense, Wilson says whether there are fundamental configurational interactions is an "open empirical question contingent on as yet unconducted experiments establishing that […] one or more fundamental interactions come into play only under certain comparatively complex circumstances" (283). If, however, that were such fundamental configurational interactions, then current physics would be wrong in a deep way that there is no evidence to believe it is. I'll now elaborate on this point, drawing heavily from a pair of superb articles by the physicist Sean Carroll (2021, 2022). I'll briefly sketch things in broad strokes; for technical details presented in an accessible way, see the Carroll articles.

Quantum field theory includes the Standard Model of particle physics and also gravitation in the weak-field limit of general relativity. It doesn't cover gravitation near black holes; it is silent about the very early universe, about dark matter and dark energy, and also about interactions energies below certain thresholds. Conditions required for its applicability are that gravity is weak and interactions involve energy transfers below a certain threshold. But as Carroll (2021, 2022) points out, human brains and our earthly environment fall well within its scope of applicability.

The key point for present purposes is this: In the field dynamics of quantum field theory, interactions are *local*.[11] They are local in that fields directly interact with other fields only at spacetime points. That is to say, the dynamics of each field at any spacetime point are directly influenced only by the values and derivatives of the other fields at that same point, and not by anything happening elsewhere. That fundamental interactions are local is inextricably baked into the theory. Quantum field theory could, for instance, accommodate new kinds of particles and new kinds of fundamental forces. But the discovery of fundamental configurational interactions would refute the theory. It thus isn't just that quantum field theory doesn't now posit fundamental configurational interactions, it cannot countenance them. Such direct fundamental interactions would involve whole regions of spacetime. That is incompatible with relativity theory.

Quantum field theory has been enormously successful in its regime of applicability, and, as noted, human brains fall well within that regime. The truly enormous empirical support quantum field enjoys soundly defeats any intuitions we might have about there being a fundamental force of will.

Still, to be sure, fundamental configurational interactions can't be ruled out *a priori*. Suppose, then, that current physics has gone very badly wrong indeed, since there are fundamental configurational interactions (relativity theory be damned). Suppose further that acts of will are co-temporally materially dependent on complex neural events, which are in turn co-temporally material dependent on

[11] Entanglement is not local, but it isn't an interaction in the physicist's sense.

events involving astronomically complex micro-configurations of physical particles that participate in fundamental interactions, and so locality fails. Physical particles don't obey the same basic equations when they are in a human brain that they obey when inside a block of ice, even though at some scale human brains fully decompose into physical particles.

Suppose all that is so. Why would it follow that there is libertarian free will? Why would the imagined yet undiscovered fundamental force be a force of will, rather than a fundamental configurational physical force? If acts of will are not identical with the events involving the astronomically complex configurations of particles that (by hypothesis) participate as wholes in such fundamental interactions, but only materially dependent on them, then the question remains whether the acts of will themselves participate in fundamental interactions. Any physical event from which an act of will Strongly emerges will (by definition) nomologically necessitate the act of will, as will any other physical event that nomologically necessitates the physical event in question if nomological necessitation is transitive. Mightn't the acts of will only Weakly emerge from their complex physical base events? Mightn't the acts of will even be epiphenomena, devoid of any effects, and so only be epiphenomenally emergent from those complex physical events? I take it that Wilson's answer to both questions would be "No," but I myself don't see why the answers would be "No". I find it deeply obscure how fundamental configurational interactions, even if there were such, could yield libertarian free will.

Since I've focused mainly on what I take to be some remaining issues for Wilson's view, let me once again express my admiration for *Metaphysical Emergence*. There is much of interest in the book that I haven't even touched on. The book will, I believe, contribute to setting the research agenda on a wide swath of metaphysical issues for years to come.

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