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STRONG EMERGENCE NO, CONTEXTUAL EMERGENCE YES

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ABSTRACT

It will be argued that strong/radical emergence while possible is problematic on a number of fronts, in particular it is neither explanatory nor unifying. Fortunately, there is a better, more unifying and explanatory alternative that be will called contextual emergence. The notion of contextual emergence will be explicated and defended against competitors.

1. Introduction

The first section of the paper will be devoted to defining and refuting strong emergence. Section 3 will introduce an alternative conception of emergence called contextual emergence. The conclusion will briefly mention some examples of contextual emergence and will briefly discuss to what extent contextual emergence might help with the mind/body problem, hard problem or generation problem.

2. Strong emergence

One immediate problem with discussions about emergence is that different people use the same terms to mean very different things, the expression "strong emergence" is no exception. For more details about how different people use the term strong emergence and for more taxonomic background generally see Silberstein 2012. This paper will focus almost exclusively on ontological emergence (though not exclusively on strong emergence) as opposed to merely weak or epistemic emergence. No doubt there are cases of emergence that straddle these dichotomies, but that won't be the focus here. People often claim that in order to be in some sense ontologically emergent a phenomenon X must depend on the basal phenomenon Y in some ontic sense and yet be irreducible to it in some ontic sense. But the sense of dependency and autonomy here can differ radically from case-to-case and account-to-account. With regard to ontological emergence, a phenomenon X can be modally emergent, nomologically emergent or mereologically emergent with respect to base X. Claims about modal emergence pertain to ontological necessity, for example Chalmers (1996) and others argue that mental phenomena might fail to exist even in possible worlds where the same brain states exist. Claims about nomological emergence pertain to natural laws and nomological

necessity in the actual world, and mereological emergence is a claim about the properties of wholes not being in any way determined by the properties of their proper parts in the actual world (Silberstein, 2012). Chalmers has argued in the past (1996) that while conscious experience does not modally supervene on the physical it does happen to nomologically supervene in the actual world (this is strong emergence). Silberstein has argued on several occasions that quantum entangled states are mereologically emergent though not modally or nomologically emergent (1999, 2001, 2012).

People often argue from the alleged success of scientific reductive explanation (both compositional and intertheoretic reduction) to the claim that mental phenomena are the only exception to some sort of minimal supervenience physicalism (a modal claim). Chalmers (1996) for example argues that science gives us good reason to believe that everything but the mind logically or metaphysically/modally supervenes on fundamental physical facts. Part of the problem here, as people have pointed out, is the very idea that intertheoretic or compositional reduction counts as evidence for minimal supervenience physicalism. Such supervenience is not in and of itself explanatory, it does not guarantee that say mental properties either reduce to or ontologically depend upon physical properties in the actual world. Minimal supervenience physicalism is notoriously consistent with certain kinds of emergence and even certain kinds of dualism. Unsurprisingly, not only is such supervenience not sufficient for ontological reductionism, but ontological reductionism is not necessary for minimal supervenience physicalism. Theory reduction and compositional reduction could fail in the actual world and minimal supervenience physicalism still be true. Forget about modal claims, it is hard enough to make strong inductive inferences pertaining to ontological reduction or emergence about *the actual world* that are at least in part grounded in empirical considerations. For these reasons this paper will, as much as possible, focus on cases of ontological emergence in the actual world.

Strong emergence (some people call it "radical emergence" because it violates physicalism and reductionism of certain varieties) is the view most closely associated with C.D. Broad who claims for example that there are brute physio-chemical and psycho-physical bridge laws in the actual world. As Seager puts it:

> This latter view, that emergence should be understood in terms of a supervenience relation defined via nomological necessity is perfectly respectable and not unfamiliar. In essence, it was the view held by the so called British emergentists (see McLaughlin 1992), notably Alexander (1920), Morgan (1923) and Broad (1925). (Seager, 147, 2012).

Such brute bridge laws are supposed to involve nomological necessity and pertain to the actual world only.

Most people agree that the best case (many would say the only case but see Hendry 2006 and 2010 for an exception) to be made for strong emergence is conscious experience (Chalmers, Ibid). So let's assume for the moment that if the case can't be made there it can't be made anywhere. What follows is an argument that while conscious experience is no doubt irreducible to the physical in many respects, strong emergence does not help answer the hard problem or the "generation problem."

The generation problem (GP) or hard problem is this: assuming that matter is fundamental then how does mere insensate matter generate consciousness? For this problem to be as devastating as Chalmer's (Ibid) and others allege (independently of one's judgment about conceivability arguments) one has to assume something like that matter is *essentially* non-mental. As Montero puts it:

> Instead of construing the mind/body problem as finding a place for mentality in a fundamentally physical world, we should think of it as the problem of finding a place for mentality in a

> fundamentally non-mental world, a world that at its most fundamental level is entirely non-mental (Montero, 2010, 210)

Or as Strawson puts it:

> That is what I believe: experiential phenomena cannot be emergent from wholly non-experiential phenomena. The intuition that drives people to dualism (and eliminativism, and all other crazy attempts at wholesale mental-to-non-mental reduction) is correct in holding that you can't get experiential phenomena from P phenomena, i.e. shape-size-mass-charge-etc. phenomena, or, more carefully now—for we can no longer assume that P phenomena as defined really are wholly non-experiential phenomena—from *non-experiential* features of shape-size-mass-charge-etc. (Strawson, 2006, 20).

If we take GP seriously then consciousness must be fundamental *in some sense* no matter what your assessment of conceivability arguments. Strong emergence attempts to answer GP in terms of some brute fundamental psycho-physical bridge law of the sort described above. However, if we take GP seriously it would seem to rule out the very (physical or nomological) possibility of such a bridge law. How can the GP problem be true and strong emergence (psycho-physical bridge laws) also be true? That is, given GP it can't be true that such bridge laws possess only nomological necessity. Such a law is beyond the bounds of naturalistic explanation and is therefore not a natural law! So given GP radical emergence must be hold that such psycho-physical bridge laws are stand-alone, one of a kind, brute/fundamental and *metaphysically* necessary; presumably such a law isn't ruled out by conceivability arguments as long as they don't entail identity relations. The point is, you can't simultaneously hold that the physical is fundamental and essentially non-mental *and* that there is nonetheless some fundamental natural law (in the standard sense of the word "law") in our world alone that necessitates that if matter and matter alone, is in the proper

configuration conscious minds 'pop' out. Such a law can't be conceived as mere physical/nomological/natural necessity but must somehow be a *metaphysical* law, that *somehow* transcend the purview of science or the merely empirical. Indeed, such a law at least borders on the supernatural.

A stand-alone, one of a kind brute/fundamental *metaphysical* law is a Deus ex Machina—"and then a miracle occurred" kind of affair. That is, if matter is fundamental and essentially non-mental then radical emergence must be some sort of Occasionalism that replaces God with a miraculous law of nature. For those who want unity, such psycho-physical bridge laws are deeply disunifying no matter how you construe the nature of their necesssity. Again, such laws are a very strange thing to have the status of fundamental facts given ontological reductionism or physicalism for all other facts—i.e., given the right physical, functional, informational structure, etc., and POOF conscious experience appears! As many people have pointed out, a fundamental feature of the universe should be efficacious but strong/radical emergence is consistent with the causal closure of the physical—consistent with epiphenomenalism. Worse, radical emergence is only motivated by GP to begin with, which in turn is only motivated by physicalism or ontological reductionism, which means that consciousness (which itself can't be analyzed functionally) must be either epiphenomenal or it undercuts physicalism and ontological reductionism (a fact which Chalmers 1996 accepts and embraces).

Proponents of strong emergence will surely say that foregoing argument is question begging. As O'Connor puts it:

> It is sometimes suggested that there being metaphysically emergent capacities would be 'spooky,' not amenable to empirical investigation. But this is simply not the case. While they are basic features of reality, emergent capacities may nevertheless be fruitfully studied and eventually explained in detail in nonreductive fashion, by spelling out the basic inventory of emergent properties, detailing the precise conditions under which

> organized physical systems give rise to them, and isolating the precise behavioral impact their presence has on the system (O'Connor, 2014).

What kind of law are such laws, what makes them laws and how do they *explain* the phenomena in question? If laws explain by necessitating and necessitating requires showing why some phenomena must obtain given certain conditions, i.e., by showing that things could not have been otherwise, then such brute bridge laws don't *explain* anything. Perhaps one has a perfect correlation in such a case but that doesn't constitute an explanation, as we all know. Even proponents of the neural correlate of consciousness approach such as Searle's Biological Naturalism (2004) agree that finding such correlates would only be a first step—one can't stop there and say a new fundamental law has been discovered—one must then use that correlation to discover the *causal mechanism* that generates conscious experience. If one asks the question: "but why does conscious experience always arise in the actual world when certain material or functional conditions obtain", no answer will be forthcoming, it's just a brute fact/brute necessity about the actual world. That is not a 'nonreductive explanation', that is no explanation at all. This is especially troubling if such a psycho-physical bridge law is the only law in the "basic inventory of emergent properties" as Chalmers alleges. Even if one is willing to reject causal closure of the physical (CoP) as O'Connor is, there is still the question of *how* the "presence" of conscious mental states "impacts" brains states.

Such a stand-alone, one of a kind brute/fundamental *metaphysically* necessary law is a Deus ex Machina—"and then a miracle occurred" kind of affair. That is, if matter is fundamental and essentially non-mental then again, radical emergence must be some sort of Occasionalism that replaces God with a miraculous law of nature. This may be explanatory for some, but it isn't a natural or scientific explanation, nor is it a law of

nature, it's a brute law of meta-nature, surprising to not only the Mathematical Archangel but perhaps to God herself.

It might be said that we are just begging the question about what constitutes a natural law, about what can be natural. It might also be argued that GP implies not the impossibility of such bridge laws, but that in order to explain conscious experience there must be something that is not 'essentially non-mental' and this is precisely what such bridge-laws are. Perhaps the naturalness of laws is not quite the right way to make the point. Perhaps the point is that bridge principles are ad hoc and brutish in a way worse than regular laws because they don't map any (non-trivial) modal relations unlike regular laws of nature. Such bridge-laws are just stipulative and added after the fact to allow an account of the world in a God-of-the-gaps type fashion. They couldn't be used to generate a hypothesis. They aren't laws in the understood sense of the practice of science. They are constructs to link up parts of the world described by science, but that linking isn't itself the same practice as the science.

Why is reductionism or physicalism true and satisfactory for everything over the course of billions of years but then suddenly fails and is trumped in the end by psycho-physical bridge laws? Such a jarring violation of reductionism or unification makes a mockery of those very ideas. People worry about the status of the collapse postulate in quantum mechanics and yet such bridge-laws are far more unity-disrupting than that.

However, there is a more recent causal or dynamical, dualistic account of strong emergence that rejects CoP and physicalism as it pertains to mental properties up front. In other words, it rejects the following supervenience-based, synchronic, non-reductive physicalist conception of strong emergence that we were just criticizing:

> Earlier emergentists did not give very clear accounts of the relationship between the necessary physical conditions and the

> emergents, apart from the general, lawful character of emergence. Given the requisite structural conditions, the new layer invariably appears. Recent commentators have suggested that we think of this in terms of synchronic supervenience, specifically "strong" supervenience. So, for example, McLaughlin (1997) defines emergent properties as follows: "If *P* is a property of *w*, then *P* is emergent if and only if (1) *P* supervenes with nomological necessity, but not with logical necessity, on properties the parts of *w* have taken separately or in other combinations; and (2) some of the supervenience principles linking properties of the parts of *w* with *w*'s having *P* are fundamental laws" (39). (A law *L* is a fundamental law if and only if it is not metaphysically necessitated by any other laws, even together with initial conditions.) And though he does not say it explicitly here, it's clear that he thinks of this supervenience synchronically: given the 'basal' conditions at time *t*, there will be the emergent property at *t*. Van Cleve (1990) and Kim (1999, 2006a, 2006b) also think of the relation as a metaphysically contingent but nomologically necessary form of (synchronic) strong supervenience. (O'Connor and Wong, "Emergent Properties", *Stanford Encyclopedia of Philosophy*).

On this causal account of metaphysically emergent properties, "it will be natural to suppose that they are *caused* to be by the object's fundamental parts, which have latent dispositions awaiting only the right configurational context for manifestation." (O'Connor and Wong, 2015). In turn these newly arisen emergent properties such as mental properties can causally effect biological and physical processes. This conception of strong emergence is certainly a rejection of any kind of CoP, rejecting realization, and embracing downward causation. Therefore, it doesn't conflict with physicalism, reductive or otherwise. It is very important to understand what is meant by the word "caused" here:

> We do not use the term in this neutral manner. Our usage corresponds to the first of these: a power to produce or to generate, where this is assumed to be a real relation irreducible to more basic features of the world. Our favored technical term for this is "causal oomph." So understood, causation is not amenable to analysis in non-causal terms, but instead involves the exercise of ontologically primitive causal *powers* or *capacities* of particulars. Powers are either identical to, or figure into the identity conditions of, certain of the object's properties, which are immanent to those things as non-mereological parts (O'Connor and Wong, "Emergent Properties", *Stanford Encyclopedia of Philosophy*).

The type of causation specified here requires that under certain conditions, when a physical or biological system reaches say a certain degree of complexity of some sort, it has the irreducible causal power to produce or generate a new causally efficacious emergent property such as mental properties. Such properties are by hypothesis in this case *essentially different* and *completely novel* with respect to their emergent base. This causal power is not reducible to any other feature of the universe, contrary to what are called "Humean" accounts of causation which reject any irreducible causal glue in the universe in favor of "constant conjunction" and the like. Humean accounts of causation reduce causal talk to certain reliable regularities or patterns in the universe, though these accounts vary greatly otherwise. We agree with the causal strong emergentist that Humean causation could *not possibly* explain mental phenomena POPPING out of brains. We agree that rejecting Humean causation is a necessary condition for causal strong emergence, but it hardly seems sufficient. So obviously anyone inclined towards Humeanism about causation cannot possibly accept causal strong emergence, but being a realist about causation doesn't obviously make causal strong emergence of minds from brains naturalistically acceptable or explanatory. If this irreducible kind of causation is the

norm in the world or at least common, then why are mental properties the only properties where this sort of causation seems even remotely plausible to most people? For example, the analogue of this sort of explanation for the emergence of life from a chemical base doesn't seem at all natural or explanatory—it wouldn't count as a viable scientific hypothesis. So again, if mental properties are the only case of this sort of causation then we are back to the objections raised above.

Does this causal account of strong emergence escape the concerns leveled against the former conception? As we said, this causal account of strong emergence has an advantage in the sense that it rejects the basic tenants of physicalism at least regards mental phenomena, but it is largely still in the same position in that mental properties are the only plausible phenomena for which this sort of strong emergence might even be considered. Which is just to say that such causal strong emergence is equally damning for ontological and explanatory unity. After all, causal strong emergence cannot really alter the conception of matter as intrinsically non-mental without veering into pan(proto)psychist territory and it still maintains that while causally efficacious mental properties are irreducible, matter is in some sense fundamental. While the causal account of strong emergence has no worries about CoP and while this is property and not substance dualism, it still has to explain how nondual essentially mental phenomena and essentially physical phenomena can causally interact. In short, moving from law-talk to causation-talk isn't a cure-all for strong emergence. And while we agree wholeheartedly with the rejection of CoP, etc., on the part of the strong causal emergentist, on their account, mental properties are the only real exception to ontological reductionism or physicalism. This schism is the source of many of their ontological and explanatory problems. Let us bring this point home now.

With regard to emergent property dualism versus substance dualism, why is it more believable, more probable that causally potent qualia-baring immaterial souls/selves/subjects POP out of brain processes

under the right conditions than the claims of substance dualism? Interestingly, in what follows Kimble and O'Connor in considering the argument from realism about consciousness to theism, argue that the hypothesis of theism increases the probability that the admittedly potentially implausible claim of strong emergence of mental properties is true:

> We have suggested that the phenomenal realist may reasonably suppose the existence of basic, general laws connecting neural-state types and families of phenomenal-state types (corresponding more or less directly to distinct sensory modalities). Such laws will encode in part facts about specific emergent dispositions of fundamental physical particulars. Here is where we see the potential for design-style reasoning. It seems plausible that there are a variety of ways things might have been with respect to the fundamental constituents of the world. We do not have in mind the Humean claim that the very particulars there are might have interacted in fundamentally different ways. We mean, rather, that there might have been ever so many different sorts of entities having different sorts of basic dispositions from the ones that are manifested in our world. And in particular, it seems a priori rather unlikely that fundamental physical entities should have emergent dispositions toward phenomenal qualities. (that this is a plausible claim is suggested by the fact that many brash but otherwise reasonable philosophers judge the emergentist view to be an utterly implausible hypothesis about our own world, and some are tempted to declare it outright impossible.) Yet, given theism, it seems more to be expected, since we may reasonably suppose the conditional probability of there being agents capable of the kind of experiential life that we enjoy on the hypothesis of theism to be at least not very low, since it is reasonable to think that one of the goods a purposive world designer would wish to see in its creation are creatures of just that sort (Kimble and O'Connor 2011: 136-7).

Herein Kimble and O'Connor seem to be leveling/acknowledging much the same criticisms against strong emergence that we are, and in response claim that the assumption of theism makes it a much more probable and believable doctrine. We don't deny their inference as such, we just think it's telling that defenders of what is supposed to be a naturalistic account of conscious experience feel compelled to back it up with theism. For example, one cannot imagine Searle making the same claim about his Biological Naturalism. This is in keeping with precisely the line of attack we have been pursuing here in our rhetoric about strong emergence. To relate all this back to the last paragraph, causal strong emergence seems like the worst possible combination of materialism and dualism. We are stuck with brute, downwardly causal powers that make minds appear from insensate matter and we are still stuck with dualism. Why not just give up the ghost and embrace the package of theism and substance dualism? After all, doesn't the hypothesis of theism make substance dualism more probable (and vice-versa) than causal strong property emergence? The answer of course is because substance dualism violates both ontological and methodological naturalism. The worry of course is so does causal strong emergence, or if not, it fails to be explanatory in terms of unity, laws or even causation as those schemas are typically conceived in the rest of science.

Strong causal emergence would still have us believe that physicalism or ontological reductionism is true for everything except consciousness, that everything else in the universe is a nomological, logical or metaphysical consequence of the fundamental physical facts whatever they may be. To be fair science is in no position to rule out the very possibility of radical emergence and the doctrine is certainly not incoherent. However, again, this is a weird law or causal process by the lights of science given the stipulated nature of the rest of the universe. That is, such a law is beyond the bounds of naturalistic explanation! As Strawson says in defense of panpsychism versus radical emergence:

> Assuming, then, that there is a plurality of physical ultimates, some of them at least must be intrinsically experiential, intrinsically experience-involving. Otherwise we're back at brutality, magic passage across the experiential/non-experiential divide, something that, *ex hypothesi*, not even God can understand, something for which there is no reason at all as a matter of ultimate metaphysical fact, something that is, therefore, objectively a matter of pure chance every time it occurs, although it is at the same time perfectly lawlike (Ibid).

Strawson is right that such psycho-physical bridge laws or causal processes are for all practical purposes, supernatural, or worse that causal strong emergence just sneaks in pan(proto)psychism by claiming that matter has a disposition to manifest mental properties.

Perhaps it is unfair to strong emergence to focus on the possibly unique case of conscious experience. After all, philosophy of science in the last two decades has emphasized the disunity and pluralism of the sciences (see Silberstein 2002 and 2012). Some people might be tempted to argue from the apparent disunity of the sciences to strong emergence being relatively ubiquitous and not confined to the case of conscious experience. For example in Chapter three of his 2007 book Horst argues that philosophy of science no longer supports the assumption of widespread intertheoretic reduction in the non-mental special sciences and has thus abandoned the "metatheoretical" norm of intertheoretic reduction. Rather, the lesson of philosophy of science is that intertheoretic reduction (certainly as characterized by many philosophical accounts such as the Nagel model) is rare in the natural sciences. Horst addresses the implications of post-reductionist philosophy of science for the canonical views in philosophy of mind. His main conclusion is that given the state of disunity in the natural sciences, there is no longer much warrant for believing that: (a) physicalism (or naturalism) is highly probable; (b) that phenomena must be reduced to be real; or (c) that mind is unique in resisting intertheoretic reduction—

though he grants it may be unique for other reasons and may have special problems being reduced. Horst does not argue for the ubiquity of strong emergence as such but it is easy to see how that argument might go. Hendry (Ibid) argues that strong emergence is a reasonable possibility for certain features of chemical phenomena and many more have argued that the emergence of life is a case of strong emergence (Kauffman, 2002). Of course the inference from scientific disunity to strong emergence can always be blocked by the reply that said disunity is strictly a function of ignorance and not a reflection of the nature of reality. On the other hand, if the state of science now doesn't warrant a strong inductive inference for unity a la ontological reductionism, then the warrant for ontological reductionism is gone or at least postponed. Silberstein has argued that if conscious experience is not alone in being emergent (in some sense) then that makes emergence more plausible and less spooky (1998, 2001 and 2009).

How does it help matters though if *strong emergence* is more common? If it turns out that chemistry, life, mind and social phenomena are all strongly emergent, then that means we have multiplied our generation problems and multiplied the number of phenomena that must face the preceding concerns. The only good reason to believe in something like strong emergence for a given phenomenon is because you think it can't possibly be generated from purely physical phenomenon alone. This only makes the world even more disunfied and less amenable to scientific explanation. What we need is an ontological alternative to strong emergence, ontological reductionism or merely positing the phenomena in question as fundamental, e.g., panpsychism. Fortunately contextual emergence is such an alternative.

3. Contextual Emergence

3.1 Background

What makes most of us so skeptical about the possibility of strong emergence as defined here is the idea that matter is truly fundamental (perhaps even causally closed as well) and yet somehow in the right configuration essentially different robust phenomena such as minds can spring forth from it that were never present in the universe before that time. For many of us ontological emergence was supposed to be a robust alternative to ontological reductionism on the one hand (weak emergence) or some form of brute irreducibility or gaps in the unity of nature on the other (strong emergence). Whether such gaps are described as dualism, strong emergence, inherence or what have you they all appear to be bad news for the unity of nature. But what if this assumption about fundamentalism and how nature is structured is wrong? That is where ontological contextual emergence comes in.[1] In the first part of this section the necessary background will be given to properly define contextual emergence, it will then be defined and finally compared and contrasted with views that might appear to be similar.

It is not hard to see how we got to this unhappy place concerning emergence wherein we struggle to find alternatives to weak or strong emergence. The impasse is driven by the following widely shared metaphysical assumptions: reality is like an axiomatic system such that, at the end of the day, a feature of reality is either an axiom (fundamental such as the most basic physical entities) or a theorem (a logical or modal

[1] This paper is basically an outline of a manuscript in progress on contextual emergence provisionally titled *Emergence in Context,* by Robert Bishop, Michael Silberstein and Mark Pexton.

consequence of what is fundamental). If an axiom, then it falls in the fundamental/inherence category, if a logical consequence of the axioms (i.e., a theorem), then it falls in the conservative or weak emergence category. So for example if there were brute psycho-physical bridge laws of the sort posited by C.D. Broad or Chalmers, they would be just another part of the axiomatic base, in which case there really is no middle path between ontological reductionism and mind as fundamental. Given this picture of reality it seems there is only room for weak emergence or strong emergence in the sense of brute bridge laws or causal relations that we add to the axiomatic base that somehow operate over essentially irreducible new types or kinds. These novel properties may or may not possess unique "causal powers." And since this axiomatic picture of reality typically assumes causal or nomological closure of the physical or microphysical (CoP), such causal powers are problematic. Again, in such a case one either violates CoP and further threatens the physicalism/ontological reductionism that motivates it, or risks epiphenomenalism.

Leaving mind out of the equation for a moment, this picture of reality is often further grounded in the overwhelming assumption across the sciences in the West that more and more will be explained by digging deeper and deeper down into shorter temporal scales and smaller length scales for entities, laws and mechanisms that somehow locally explain the behavior of the (relatively more abundant) macroscopic phenomena. Examples historically include physical laws, atoms and their progeny such as quantum fields, genes, neurons, biological mechanisms, cognitive modules, computational rules and representations, and so forth. Philosophers began this way of thinking about reality with their positing of forms, substances, entities with 'primitive thisness,' intrinsic properties, metaphysical necessity or causal/nomological glue. In fact many scientists and philosophers would assert that to explain scientifically just is to reduce in some compositional/mechanistic sense or via some sort of intertheoretic reduction. Of course if that is true then

our dilemma concerning emergence is probably here to stay. There is another alternative however, let's call it *contextual emergence*. Simply put for now, the idea behind contextual emergence is that new properties, entities, laws, etc., emerge out of multiscale contexts of various sorts, that nature is inherently contextual. It is the contextual nature of reality that grounds emergence and makes it possible. This idea began with the work of Bishop and Atmanspacher on scientific explanation wherein the relationship between two theories such as quantum mechanics and chemistry seemed not to be well characterized as either Nagel type reduction or complete autonomy (e.g., Bishop and Atmanspacher 2006). As Atmanspacher puts it, "The way in which Bishop and myself introduced contextual emergence we referred deliberately and explicitly to the 'description of properties', not properties 'out there' in nature...So we left issues of ontology aside to begin with" (2014, 283). Let us call this epistemic contextual emergence. Bishop also began exploring an ontological form of contextual emergence (2005).

For Silberstein's part the kind of emergence he defended early in his career was called "mereological emergence", because it focused on the relationship between parts and wholes, and their properties. He argued that there are phenomena in quantum mechanics such as entanglement that in all probability tell against compositional accounts of entities and realization-based accounts of the properties of such entities (Hawthorne and Silberstein 1995, Silberstein 1999, 2009, 2012 and 2017a). Later in his career he argued that, even though they are less striking there are counter-examples to those same mereological doctrines (including related biological doctrines of the decomposition and localization of mechanisms) in classical nonlinear physical and biological systems as well (Chemero and Silberstein 2008; Silberstein and Chemero 2012 and 2013). He did not frame this sort of mereological emergence in terms of the contextual emergence of Bishop and Atmanspacher because the emergence in question is ontic. Indeed, he often called it "ontological emergence." But he did often emphasize the contextual nature of such

cases. For example, in the case of quantum superposition and entanglement the essential contextual feature is the 'classical' experimental set-up.

So as a side note, how does one frame mereological emergence with respect to the categories of weak versus strong emergence? In conversation, Chalmers calls mereological emergence "medium strength" emergence to distinguish it from strong emergence and weak emergence. By this he means to say that, for example, while quantum entanglement does seem to violate compositional and realization accounts of part/whole relations, and while something novel and ontologically irreducible comes into being (i.e., the entangled state), it is not a new natural kind or something essentially different from physics, e.g., mental or biological phenomena. This division is somewhat problematic in the sense that both strong and weak emergence can be construed as doctrines about intertheoretic reduction or relations between different property types and mereological emergence is about parts/wholes and their respective properties—what some call compositional reduction. However, Chalmers is right to interpret Silberstein as wanting mereological emergence to be *scientifically explicable and unifying* (unlike the fundamental psycho-physical bridge laws of radical/strong emergence), but not explained in terms of mereological reduction or synchronic determination. The focus was on the fact that entangled states have causal properties that are very different from the particles that 'enter in to' such states (e.g., they violate classical probability theory), at least on most interpretations of quantum mechanics (2017a).

The point is that both Bishop and Silberstein from the beginning of their work in this area were searching for accounts of multiscale emergence squarely grounded in science that were neither strong nor weak. We are happy to report that within the philosophy of science we are not alone in this venture. For example the University of Pittsburgh's Center for Philosophy of Science sponsored a 2015 workshop on

"Effective Theories, Mixed Scale Modeling, and Emergence." The description of that workshop runs as follows:

> How can data be extracted from observations of systems at a variety of spatial and temporal scales and then be combined to understand phenomena *without any attempt to reduce the theories or models appropriate at some scale to those appropriate at another* [emphasis ours]? Many such "mixed-level" explanations are, it seems, essential to successful scientific investigation. Multiscale modeling is playing an increasing role in many areas of science, including climate science, materials science, and developmental biology. This work suggests that interesting methods have by and large been overlooked by philosophers who primarily treat modeling (and intertheory relations) as restricted to two (spatial) scales—the "macroscopic" and the "microscopic." One aim of the conference is to consider the implication of recent work on the nature of multiscale modeling for our understanding of material behaviors, effective theories, and the kind of autonomy that often accompanies claims about emergence.[2]

The good news is that philosophy of science is seeking conceptions of emergence driven by scientific practice that are neither weak nor strong. Unfortunately however there is a schism in philosophy on work related to emergence. While philosophy of mind and metaphysics often focus on ontological questions about emergence, philosophy of science tends to restrict itself to more epistemic or strictly explanatory concerns (see Silberstein 2002, 2012). As Batterman puts it when it comes to emergence, "Instead of focusing on questions of correct ontology, I suggest a more fruitful approach is to focus on questions of proper modeling technique" (2015, 133). The goal is to erase that schism. In particular, the goal is to

[2]http://www.pitt.edu/~pittcntr/Events/All/Conferences/others/other_conf_2015-16/10-02-15_scalemodel/scalemodel.html.

spell out contextual emergence not just as an explanatory account, but as an account of reality based in science and philosophy of science, a naturalistic ontological conception of reality that provides a real alternative to weak emergence (ontological reductionism), strong emergence, physicalism and inherence. In short, this is an attempt to do naturalistic and science-based metaphysics.

Ultimately, the question is, are there good scientific reasons to believe in emergence that is:

- Explanatory without being weak
- Unifying without being reductive
- Non-hierarchical working across all length/time scales
- Often both ontic and epistemic
- Non-trivial but not rare and exotic

We believe these are appropriate desiderata for any account of ontological emergence. The claim here is that when it comes to explaining new and stable phenomena contextual emergence is the norm not the exception.

The long inductive argument for contextual emergence is that scientific explanation, both in terms of inter-theory relations and part/whole relations at multiple scales in complex systems, fails to be reductionist as standardly conceived. This is because the ontological picture of reductionism that tells us to always dig deeper down for explanation is false. The reason these simplistic reductions fail is not just a function of ignorance (weak emergence) or inexplicable brute correlations (strong emergence). Rather, said failure is a symptom of the equal fundamentality of context and contextual interactions at multiple scales. We believe that taken collectively, ontological contextual emergence is the overwhelming metaphysical message of the sciences. In short, reality is not structured like an axiomatic system, nor is it

primarily compositional. The universe is neither radically "dappled" nor reductive. Or if you prefer, the universe is not like a finite automata (e.g., Conway's Game of Life), wherein the fundamental building blocks are essentially physical, and everything else emerges conservatively/weakly from their dynamical interactions (e.g., like gliders in the life game). Therefore contextual emergence rejects the very premise shared by proponents of both strong emergence and weak emergence. Both those accounts of emergence start with the assumption that autonomous matter of some sort is truly fundamental in the way the building blocks are in the game of life. Whether we are talking about quantum entanglement, the relational nature of mass, epigenetics and systems biology, systems neuroscience and network theory, embodied cognitive science, and the like, we believe the message is clear: a simplistic reductive and mechanistic picture fails time and time again, and what we are really discovering is that order appears to come from contexts and interactions across multiple length and time scales, and not necessarily unidirectionally from smaller length and time scales. This is ontological contextual emergence.

3.2 Contextual Emergence Defined

Contextual emergence provides a framework to understand two things: 1) how novel properties are produced, and 2) why those novel properties matter. Contexts modally constrain systems. Modal-talk here is pluralistic and subsumes both causal and nomological explanations. These contextual constraints represent both the screening off and opening up of new areas of modal space. Moreover, these modalities are the result of constraints that are multi-scale. In all such cases what we take to be basic parts and their dynamics get constrained/determined/overridden by contextual features allegedly outside the system, often at different interacting scales, and then new and stable patterns arise. The relevant and determining contextual features will

vary from case to case, such constraints may be more or less concrete, but they include: physical, structural, topological and dimensional constraints.

The properties and behaviors in a particular allegedly more "fundamental" domain (including its laws) at smaller length and time scales offer at best some necessary but no sufficient conditions for the emergence of said phenomena. As with Mackie's INUS conditions, the "underlying" or "reducing" domain is a necessary part of a sufficient condition for properties and behaviors in that or other domains. Therefore phenomena at many different scales can count as contexts for phenomena at many different scales. The universe is not divided into autonomous/closed levels/scales—such constraints are multilevel. Think again of the way macroscopic measuring devices constrain the behavior and outcomes of quantum behavior. Laws and causes are constraints not "bosses" or "governors"—the universe is not like a computer. Some constraints are more universal than others, such as conservation laws and the symmetries behind them. Some global or systemic constraints at multiple scales trump what we think of as dynamical laws "governing" a system, e.g., various cases of universality wherein global dimensional and topological constraints trump local dynamics. The implication of all this is that in cases of ontological contextual emergence the emergent phenomena does not even nomologically supervene on phenomena at smaller length and time scales.

Contextuality in the ontic sense means a particular confluence of circumstances that produce a combination of constraints and stability conditions, stability conditions allow certain constraints to be 'activated', and the constraints can be heterogeneous in nature, again, they can be topological, dimensional or structural constraints, but they all limit the modal space available to the system (reduce its degrees of freedom) and open up new possibility spaces closed off outside of that context (add new degrees of freedom). This is a form of multidirectional

determination, since any causal process is bounded by these constraints and the constraints can be top-down, bottom up, side to side (as it were). In that sense there is no causation at all without a contextual limiting of modal possibility. Such emergent properties or features maybe causal, dynamical, etc., but they always result from global or systemic constraints or contextual features that are often immune to local perturbations.

Contextuality in the epistemic sense means a particular way of dividing the system and environment up so as to allow, for example, deductibility in the case of intertheoretic reduction. Some form of system environment distinction is always required, and deductibility always implicitly relies on concepts taken from the environment side of the line, and these can include stability conditions for the definition for variables to be the object of projectability.

3.2 Compare and Contrast: Contextual Emergence What It Is and Is Not

Let us start with the good news. Whereas in the past the idea of contextuality as ontologically fundamental would have met with general skepticism or hostility, there are now a number of metaphysical views that are at least in the ballpark of contextual emergence. We will briefly discuss three such views here for purposes of contrast. The first view is ontic structural realism (OSR). There are by now many varieties of OSR but let us focus on the following definition:

> OSR is the theory that this [relations] is all that there is. In opposition to the standard view, which tends to be defended by what we could call particularist ontologies, OSR says that the world is structure all the way down. What we call particular things and their natures are just invariant patterns in that relational structure. According to OSR, there are pervasive relations that make the world a connected and interdependent structure....Thus

> OSR is committed to an irreducible relational holism (Briceno and Mumford, 198-99, 2016).

At minimum OSR so defined is a rejection of both "primitive thisness" and intrinsic properties. Most of the objections to OSR as defined stem from the fact that it ultimately refuses to ground relations in any relata (something fundamentally non-relational). Of course there are various ways a proponent of OSR could try to define fundamental relations (e.g., modal structures, Ibid), but the basic worry persists regardless. One version of this objection goes like this, if abstract, perhaps even Platonic, modal structures are fundamental (such as those of fundamental physical theories), then how do we ever get a world of what appears to be concrete physical objects. That is, how can OSR save the appearances?

Thus even those ontologies that have some sympathy for relational holism are compelled to ground those relations in something fundamentally non-relational:

> OSR has correctly identified a problem. But OSR offers the wrong solution: a solution that empties the world of all its concreteness. Unless our world is a Platonic world of exclusively *ante rem* universals, OSR is wrong. Other holistic ontologies seem to do equal justice to the interdependent character of the world without abandoning the realm of the concrete. Monism, process metaphysics and dispositionalism are good examples. In all these metaphysics, there is at least one concrete bearer of the interdependent structure. There is the field, the one spacetime manifold, processes all the way down, or a choreography of powerful substances. All of these offer the requisite interdependence and holism....Unlike OSR, none of them claims that pure relations alone can do the job. (Ibid. 216-217).

Monism of various sorts will claim that the relations are grounded in the whole. For example "existence monism" claims that the universe has no parts since only the whole exists and "priority monism" holds that the

parts exist but the whole is prior to the parts such that the universe is an integrated whole (Schaffer, 2010). "Dispositionalism" is the view that properties are intrinsic dispositions in the sense that objects, entities and systems have no intrinsic properties except for dispositional properties. Objects, etc., have intrinsic dispositions to interact with the intrinsic dispositions of other objects in a symmetric fashion such that, "In Martin's example, the solution of water and salt is the joint product of the soluble salt and the solvent water, but these substances have many other dispositions, depending on the particular interactions they undergo" (Dorato, 2016, 239-40). What makes these dispositions intrinsic is that they could presumably exist in a possible world in which only that object exists, and indeed, such dispositions can exist unmanifested in this world.

So again, the good news from our perspective is that OSR, monism and dispositionalism will all involve some sort of ontological contextual emergence (OCE) and therefore we can consider them as allies and we hope the reverse. But it is important to see that OCE doesn't entail any of these views and is therefore not saddled with the objections that go along with these views. Let's start with OSR. Modal structure isn't fundamental in OCE, properties are, modal relations are defined by property compatibility/incompatibility relations. Modal structure is crucial for mapping the world epistemically and as an indicator of the ontologically importance of properties. It is one thing to say that relations (*in some sense*) need not ultimately be grounded in anything non-relational, but quite another to claim that relations as modal structures or some other abstracta are fundamental. OCE has no commitment to structure over concrete and other relata, it has no commitment to relations being defined in terms of modal structures or anything else pseudo-Platonic. Furthermore, the emphasis on structure in OSR misses the point of contextualism: that those structural properties, when they are ontologically important, are often produced in the contexts *provided by relata not other structures*. To place structure above relata, or relata above

relations, is a category error, since there is no non-contextual ordering of those things one can make. OSR fetishizes all sorts of formalisms, whether they ground modal relations in the real world or not. Indeed, in many OSR examples it is highly dubious that it is the structural properties whose compatibility with other properties produces the modal structure. The problem with OSR is not the acknowledgement of the importance of structure for some things or particular contexts. It is the inductive leap to say that the only thing that ultimately matters is structure.

It would be understandable to read OCE as just a kind of (w)holism in which, "in the limit, there may be only one thing, the universe, whose break-down into separable parts is no more than our conceptual imposition or construction upon this vast singular being" (Seager, 2014). Yet in the case of OCE, we must understand that it is relations and contexts all the way down, up and side-to-side; there need be no universe above and beyond these (e.g., no wave function of the universe as with the many-worlds interpretation of quantum mechanics). That is, there is need be no "view from nowhere." OCE claims that even the entities, relations and laws of "fundamental" physics are determined contextually. The context includes features at larger time scales and length scales. Therefore, in principle, the arrow of determination and explanation in contextual emergence—in accord with our best scientific understandings when we examine them closely—is not exclusively "bottom-up" but multi-directional. We believe that OCE is partly responsible for explanatory pluralism and disunity across the sciences.

So with regard to monism, OCE could perhaps fit with it but certainly doesn't necessitate it. After all the argument is that contextuality is fundamental, and contextuality is a relation between things, situations, etc. So we have a flavor of monism in that everything is connected, the whole isn't just the set of autonomous parts, but nor is it just ultimately one thing either. The different contexts and their interactions determine the nature of the whole—make it a whole. The necessity of contextual

structure within that one thing cannot be eliminated, so why is that monism as such. Indeed, given that different property manifestations require different contexts, the sheer number of modally salient properties in OCE requires a multitude of contexts. That is, from the perspective of OCE the idea that one could 'suck out' all the contexts and interactions from the world and there would still be 'the one' left over is highly dubious. We would want to see an empirical or scientific motivation for such a holism. To make the monism question interesting for us, i.e., is the universe is a bunch of things that are all interconnected or one thing that manifests as many different things, it must bear on some question grounded in science and natural philosophy. And since science is an activity that can only start in the context of screening off a subset of the many things/manifestations from each other, that will take some motivating (see Schaffer 2010 for such an attempt). In short, saying that at minimum you need at least one context for properties, etc., to emerge, isn't the same as claiming the world we live in could be a world produced by only one overarching context.

With regard to intrinsic dispositions we vacillate between a more or less harsh response. What exactly is an intrinsic disposition? Is that just an unanalyzed and fundamental feature of reality? How exactly does that work? Does every object have an infinite number of such dispositions, and is it like a hidden program or "instruction set" that tells the object what to do when it encounters one of an infinite number of things it might interact with? Presumably not, otherwise one is stuck with some metaphysical equivalent of the frame problem here. But if not then what does it even mean to claim that X and Y have an *intrinsic* disposition to yield Z upon interaction? What makes such dispositions *intrinsic?* If the answer is that they exist even unmanifested, why would one ever be justified in believing that when by hypothesis they only manifest upon interaction? How can there be a property that is both inherently intrinsic and inherently relational?

The less harsh reply is this. OCE is ecumenical with respect to intrinsic dispositions. Although the notion of intrinsic would have to be modified as it is only intrinsic when placed in a context (again, this may violate the very idea of intrinsic), and the context part isn't the usual emphasis of dispositionalists. But whether one says "system X has the disposition to manifest pre-existing property Y only in context Z", or "acquires property Y only in context Z" seems tangential to the question of the necessity of context Z for property Y to influence the world. After all, For OCE the headline is this: contexts are necessary to produce the properties that do stuff. So again, for this discussion to be of great interest to us it would have to be more than a merely metaphysical debate (see Dorato 2016 for such an attempt).

We think OSR, monism and dispositionalism entail OCE but not the reverse. So no matter how these metaphysical debates settle out, OCE is in business. But the spirit of OCE at least for us is to be skeptical of the very idea that in order to explain order and stability in the universe there must be some second-order, metaphysical and undetectable glue hiding behind the world of experience. It doesn't matter to us where you put the glue: in transcendent governing-laws that are like program-rules, in the properties of objects, in the wholeness of the universe, etc., for us, the contextual nature of reality removes any motivation for such glue. Unlike strong emergence, there is nothing spooky at all about the emergence of novel and stable new phenomena in a world in which what is fundamental is the scale invariant interdependence and of interactions of various phenomena.

One important criticism to consider here is that perhaps there are good, purely metaphysical considerations for believing that there must be dispositions that must be intrinsic in some sense. If so then OCE can't be true. There are certainly people who make that argument. (See Choi, Sungho and Fara, Michael, "Dispositions", *The Stanford Encyclopedia of Philosophy*.)

However, there are also those who claim that there need be no intrinsic properties or dispositions, or at the very least, that they are not be found in fundamental physics where you would most expect them (Ibid). There are those who argue that, based on how they are portrayed by physics, relatively fundamental physical properties such as mass, charge and spin are purely relational or purely extrinsic because these properties are defined in terms of how these particles behave in certain contexts. Others retort that this is just a methodological fact about physics with no metaphysical implication (Ibid). The truth is, this is in fact an ancient discussion in metaphysics with no consensus and no end in sight. To this day a standard argument for panpsychism is the claim that fundamental physical entities must have intrinsic properties and properties such mass, charge and spin are not intrinsic, they are extrinsic dispositions, therefore their intrinsic properties must be mental or experiential in some way. There are of course just as many arguments to the contrary (Ibid). A lot hinges in these discussions on exactly how one defines "intrinsic" and "extrinsic." In what follows, Alex Carruth (2008) in outlining one such position on extrinsic properties has perfectly captured what OCE is claiming in this regard:

> The model proposed by Martin and Heil, then, does not encourage us to think of powers as isolated, but rather as participating in a network or web of potency/dispositionality:
>
> "The model here is not a chain, but a net..." (Heil, 2005, 350)
>
> "Start with any disposition partner and you find a network—a Power Net." (Martin, 2008, 87)
>
> "Every disposition is, in this way, a holistic web, but not just an amorphous spread of potency." (6)
>
> In every power or disposition, an ineliminable reference to the infinity of potential partners is inherent. The powers that an

> object instantiates locate it within the intricate structure of this network, they define its connections, its potentiality for interaction. But, as Martin insists, this potency is not shapeless, raw or blurred round the edges; on the contrary, it is brought into sharp definition by the reciprocal partnerings which are possible for that object in virtue of the particular genuine powers it possesses, the network is infinitely intricate and complex, but equally it is perfectly defined and delineated. The network (and any particular power that participates in it) is disposed towards far more than it could ever manifest—whilst the potentialities which this intricate filigree of reciprocal partnerings for mutual manifestation are directed towards run to infinity, the number of mutual manifestations which actualise will always be much lower. This plenitude of potentiality, Martin claims, is "carried" by the relatively limited number of actual dispositions, and it is "natural that so little can carry so much" (Alex Carruth, "Molnar, Intrinsicality and Iterated Powers", Durham University, MA in Philosophy Module: Double Dissertation, 2008, unpublished).

Carruth also gives an excellent response to the "regress" problem which states unsurprisingly that "if the identity of powers is fixed by their relations to other powers, and these powers themselves only have their identity fixed in the same way, then either there is a vicious regress or else the fixing of the identities of powers relies upon circularity: a power F relies for its identity upon some other power G, whose very identity relies on the identity of F itself!" (Ibid, 38). Carruth argues that this problem is resolved by Bird as follows:

> Bird employs the resources of graph theory to explain how this is possible. In graph theory, the identity and distinctness of a vertex can be given as purely supervenient on the overall structure of that graph. There are some restrictions here: the graph must be asymmetric, in order that "such a graph would have no way of swapping vertices while leaving structure unchanged" (528). This

> adhered to, for any vertex which occurs within the structure of the graph, "the structure determines the identity of the vertices—the structure itself distinguishes each vertex from every other vertex i.e., the identity of vertices supervenes on the set of instantiations of the edge relation" (ibid.). The nature, and thus the identity, of each particular vertex which is occurent within the structure of the graph is given and determined by this structure. There can be no threat to these vertices of regress or circularity with regards to their identities, these are well grounded, albeit extrinsically, in the structure of the graph. Further levels of complexity can be built in so that structures can be generated to accommodate an infinity of vertices.
>
> Bird argues that we can adopt this model for understanding the way in which the identity of a particular power is given extrinsically, through the determination of its nature by way of the structural properties of the dispositional network. A particular power, then, is like a vertex (Ibid, 37-39).

It is unsurprising that both OSR (Ladyman and Ross, 2007) and OCE (Silberstein and Stuckey 2005 and 2007) have also invoked graph theory as way to think about such extrinsic dispositions. Of course, certainly nothing in this graph theory analogy *entails* that these properties or all properties must be fully relational. However, as Carruth says, "I argue that if parity of reasoning is to be maintained, and we adopt the model Bird suggests in order to defend against the 'regress argument'—that the natures of powers are given extrinsically in a manner analogous to the fixing of the identity of vertices in graphs—then this analogy must be maintained" (Ibid, 43). The point here is that while there is an ongoing debate in metaphysics about the possibility that all properties are fully relational, there is certainly no consensus on the matter, and that is because there is no knock-down no-go argument for the conclusion that dispositions must be intrinsic in some way.

Strong/radical emergence also stresses context or new conditions but OCE makes so-called "radical emergence" not spooky because new entities, properties and laws emerging relative to various contexts is the fundamental nature of reality from the "get go" and not some "and then a miracle occurs" for chemistry, life and mind. If there really was some autonomous fundamental physical entity, if CoP were true, if physicalism were true, or ontological reductionism true, etc., then ontological emergence would be about "spooky", metaphysically brute and disunifying laws or causes that allegedly "explain" why chemistry, life and mind just "pop' into existence under certain conditions. Again, while causal strong emergence mitigates these concerns to some extent, it is still the case that strong emergence seems confined to the emergence of the mental phenomena and fails to be explanatory.

We think it this very conception of strong emergence that generates such hostility, even among proponents of views such as those above that entail OCE. More specifically, it's important to note again that there are other views out there now that share much with contextual emergence. Most prominently what comes to mind are the ontological structural realism (OSR) of Ladyman and Ross in *Everything Must Go* (2007; hereafter, ETMG) and "the scale free universe" described in Thalos' recent book (2013). What is noteworthy here is that both parties are critical of emergence-talk. We will circle back to these views momentarily, but less us begin with stating some ontological implications of contextual emergence:

1) Physics is only fundamental in the sense that it applies everywhere in the universe. Physics provides the most universal constraints.
2) Physics constrains the special sciences but does not determine them—logically, metaphysically, nomologically or otherwise.
3) Indeed, the physical facts of our universe are neither necessary nor sufficient for the special science facts of our universe.

4) Supervenience (global or otherwise) and thus minimal physicalism is false in that two worlds could have identical physics and yet diverge with respect to special science facts.
5) Contrary to the game of life analogy used by Daniel Dennett, the universe is 'real patterns' *all the way down* in that there are no individuals at any scale in the universe, that is to say, no entities with primitive thisness and intrinsic properties. Physical facts and special science facts are symmetric in this regard. So in keeping with the analogy, it's not just gliders and such that are real patterns, so are the fundamental building blocks or "cells."
6) The only reason we use causation talk for special science real patterns and law talk for real patterns in physics is because some of the latter apply everywhere. So law-talk indicates no special metaphysical or nomological glue at bottom, it is still just patterns.
7) There is no interest and context-free mereological reduction or intertheoretic reduction of special science facts to physical facts to be had.
8) So all ontology is "scale relative" or exhibits "relative onticity" as Atmanspacher and Fred Kronz put it (1999). This includes both physics and the special sciences. Therefore the universe is not divided into autonomous levels with essentially different properties.

To circle back it seems clear to us that Ladyman and Ross, and Thalos do and would agree with most if not all of 1-8, yet they reject talk of emergence even in this world where most everything is contextually emergent given 1-8. We think their rejection is driven by the aforementioned dilemma that emergence talk is typically either invoking weak or strong emergence, which are both very different than contextual emergence.

Ladyman and Ross make it clear in ETMG that for them the use of the word "emergence" is never helpful, even when it designates a position they agree with. For instance, for years various philosophers have been using the term emergence to describe how features of quantum mechanics, such as entanglement, strongly suggest we should reject the idea of particles as *things* with intrinsic properties (Silberstein 2012, Humphreys 2013). This is certainly a point that Ladyman and Ross make in ETMG, yet there is little or no recognition of such philosophers in the book. One exception here is Andreas Hüttemann and here is what they say about him, "Hüttemann (2004, 52) [referring to quantum entanglement] is pleased to talk of 'emergence' whereas we never are" (ETMG 57).

Clearly we share some of Ladyman and Ross' concerns about needlessly wielding the term 'emergence.' There are the concerns about the ambiguity of the meaning of the word and the historical baggage it carries. For instance, they worry that emergence means vital forces, extra substances, or something mystical beyond scientific explanation (i.e., strong emergence). There is a particular worry that emergence implies downward causation and a violation of their primacy of physics (PPC) principle (Ibid, 44-45). They say that rejecting the latter is unscientific (45). On page 57 they say, "when someone pronounces for downward causation they are in opposition to science" (57, fn. 54). What exactly they mean by 'downward causation' is a tricky question and requires more exploration. The key is in their definition of emergence, "This doctrine warrants its name because it holds that 'higher' levels of organization 'emerge' indeterminably out of 'lower' level ones and then causally feedback 'downward'" (56). Clearly they want to reject the levels picture of reality (as in point 8 above) and they want to reject the mysterious configurational forces of the British Emergentists.

As should be clear from 1-8 we share Ladyman and Ross' rejection of "levels physicalism" and their rejection of emergence construed as meaning beyond scientific explanation, or invoking spooky new forces.

Nevertheless, it turns out that many genuine scientific explanations are not strictly reductive as we think they acknowledge in ETMG. We also share their skepticism of downward causation as construed by people like Kim and Papineau (see Silberstein 2012). However, both Silberstein and Bishop have argued at length elsewhere (Silberstein 2006, 2009, 2011, 2012 and 2016; Bishop 2005, 2011) that processes at larger length and temporal scales do constrain and determine 'lower level' processes. Scales interact and the constraint or determination of the behavior of any given scale or system is almost always multi-directional. Whether or not you call this 'causation' depends on your account of causation. Sometimes people call it reciprocal causation, sometimes just constraints, and sometimes global or systemic determination. In all cases however we call it OCE. We are not alone in making such points. There are by now several accounts of emergence that explicitly avoids all the offending elements Ladyman and Ross reject (e.g., Bishop 2005, 2008a, 2010b; Bishop and Atmanspacher 2006; Silberstein 2012). We hope to make it clear that the OSR of Ladyman and Ross do very much need an account of emergence that is neither the weak nor strong variety.

We think that there is a fundamental tension in ETMG given their asymmetry claim regarding physics and the special sciences: physics is often invoked in the special sciences but the reverse is never the case. For example we did not need to change physics to explain biology and we do not appeal to biological processes to explain phenomena from physics. The tension is that this principle seems to imply the causal closure of the physical (CoP), which Ladyman and Ross explicitly reject. If it is a universal exceptionless truth that the special sciences are never needed to explain (relatively) physical phenomena then presumably in the final analysis when it comes to explaining the behavior of the bran/body we should not need to invoke anything mental or social such as conscious intentional states. In ETMG they also explicitly affirm Papineau's argument for CoP from fundamental forces, "Some physical forces *were* found. None of the non-physical ones were" (42). We however would

argue that there are cases where the behavior of physical and biological systems do depend on certain contextual features that belong in the domain of one or another special science.

We see a similar story unfolding in Thalos' book *Without Hierarchy* (2013). She argues that emergence as typically conceived posits that the universe is divided into a hierarchy of relatively autonomous, and discrete levels (often defined in terms of spatial and temporal length scales) each with their own intrinsic and essential properties. She also adds that such emergence is typically conceived as an expression of non-reductive physicalism that embraces minimal supervenience physicalism, such that all the levels supervene on and emergence from a basic fundamental physical level. She does not use the language explicitly but it's clear that this brand of emergence accepts causal closure of the physical (CoP). Her criticism of said brand of emergence is as follows:

> Emergentists in today's intellectual climate, some of whom aim to defend autonomous sciences, proclaim that the unity of science does not lie in the reducibility of the various sciences to Physics, but rather in metaphysical relations of the entities and properties recognized by the "special sciences" to those recognized by Physics. Thus emergentism in contemporary hands still commits the error of acknowledging a Master Science, but it does it as a matter of metaphysics: it comes in the form of a master ontology of independent entities (2013, 21).

She is especially keen to critique this account of emergence because she espouses a view close to contextual emergence in many ways that she calls "scale free." In a scale-free universe the there is causal and other "activity" at every scale and all scales interact; there is no special or privileged scale at which to view activity in the universe (Ibid). In other words either the universe has a single fundamental scale or it has none and she maintains the latter. It is clear that she means to reject CoP, minimal supervenience physicalism and the levels or hierarchy view, all

consistent with our 1-8. She does not want her view to be conflated with the kind of emergence she is rejecting:

> An alert reader might suggest that my view—by the inelegant name of the scale-free universe proposal—might be a very strong, perhaps even radical, form of emergentism, but a variation of it all the same. After all, both are apparently in pursuit of an articulation of the (admittedly vague) credo that the whole is on some sense greater than, or transcends, the sum of the parts (Ibid, 33).

In addition to making it clear that she rejects the three aforementioned tenants of "emergence," she goes on to say, "Further, there is no 'emerging' on my view. True, there might have been eras in the life of the universe where there were fewer scales—or indeed more—at which there was real action than there are today. But it's not as if the action at higher scales *keeps* emerging from below in a sustaining way, as the emergentists imagine" (Ibid, 33).

Our take on her argument is as follows: The essence of emergentism historically is a story about how *essentially different or new higher-level* phenomena such as life or mind can *emerge from* some absolutely *more fundamental and essentially different underlying substrate*. She wants to make two points about this. First, this conception of reality (which reifies essences and levels) is an empirically unjustified barrier to scientific and ontological unity; it only makes things harder. We agree. Second, in her scale-free account nothing emerges in the odious strong sense described above and, therefore, her account is free of the many problems, mysteries and inconsistencies associated with a non-reductive physicalist account of emergence that maintains, for instance, both minimal physical supervenience and "downward causation." In her own words:

> I want to be very clear about my message: emergentism, as articulated by the conjunction of all of 1-4, is simply inconsistent, and therefore untenable, even unintelligible. And positively the only way out, while clinging to the sentiments regarding activity at every scale, is to dispense with the notion of levels altogether—and so with the very core idea of emergentism (Ibid, 43).

> Why does it matter that the relevant [emergent] feature be "new"? What work is the concept doing in the analysis? Well, the emergentist has to have some means of identifying the features of the world that are in some sense "emergent." (Note that I by contrast don't have to identify "novelty": I simply say there is activity at every scale—it's not confined simply to the micro. I refer to size scales, whereas they wish to refer to something else, something more subtle, something more metaphysical. Emergentists don't care about activity so much as they care about *novelty* at each scale or level (Ibid, 38).

Finally, from all this Thalos concludes that anybody who agrees with her vision of scale-free reality should just switch sides and stop aligning with emergentism. We have good news and bad news for Thalos. The good news is that contextual emergence is in complete agreement with almost everything she said above. The bad news is we are not going to abandon talking about emergence. However we do not see ourselves as fighting on the side of emergentism in some philosophical gang war of 'isms.' Several things need to be said, here.

First, there are many more views that go under the banner of emergence than Thalos considers, some of which are logically incompatible with one another. As we stress, pluralism about emergence is necessary precisely to avoid empty metaphysical turf wars.

Second, as we all know novel and robust phenomena do come into being and we want to know how and why this happens. Merely appealing to activity happening at all scales does not help us understand the

transitions that took place that were responsible for all the states and observables that exist at these different scales. Noticing that scales interact is only the beginning we need to study the science of such interactions. These explanatory tasks require scientific and philosophical investigation and reflection. One can acknowledge this phenomenological fact of novelty in the world without smuggling in any odious metaphysical baggage.

Third, Thalos uses some of the same examples (e.g., quantum entanglement and universality) in defense of a scale-free universe as we use to illustrate contextual emergence. Many of the examples she uses are cases that get discussed frequently in the emergence literature, including in our published work. As we noted previously, Bishop has been writing about epistemic and ontic contextual emergence for years, Silberstein has been writing about quantum entanglement for years and we have both written about universality. We are not alone of course. The point is that many people have been defending accounts of emergence for decades that are not her stereotype of emergence criticized by Jaegwon Kim and others. Alas, she neither engages nor even acknowledges that literature. There is also a vast literature on universality and emergence and she engages little of it beyond the work of Batterman. The point being that the primary concerns she is discussing have a historical context in science and philosophy that cannot be ignored for a deep appreciation of the issues. If nothing else we want to emphasize to Thalos that most of the people who are on the side of the angels from her perspective *are writing about emergence*.

Fourthly and most importantly of all perhaps, Thalos' book suggests that one either embraces some sort of (w)holism as she does or one embraces emergence. This is no doubt right for strong emergence, but not for contextual emergence. One of our take home messages is that it's not emergence *versus* holism. Even a wholist view must give an account of the transitions leading to new states and observables, and this is what contextual emergence seeks to do. Rather, it is precisely in part the scale-

free nature of reality in Thalos' terminology (we might call it interdependence and interpenetration of scales) that makes contextual emergence possible. For us emergence and wholism in her sense are two sides of the same coin.

The overarching point here is that we think Ladyman and Ross and Thalos are natural allies and we hope they come to view us as such even though we employ the dreaded e-word. Indeed, Ladyman and Ross in ETMG focus their argument for OSR and against the fundamentality of individuals from cases in quantum mechanics and relativity and therefore they feel compelled to address 'individualism in the special sciences' critically lest such individual entities be considered counter-examples to OSR. ETMG does an excellent job diagnosing why and explaining how analytic metaphysicians such as David Lewis and Kim ignored our best physics in their advocating Humean or mereological supervenience, and related metaphysical doctrines. However, given that they want to promote OSR as a general philosophy of science, Ladyman and Ross then feel compelled to give an account of the special sciences that allows OSR to take them ontologically seriously even though said sciences are all about individuals such as genes, neurons and brains. They want to show that such special science individuals can be subsumed under the OSR banner and that they are not counter-examples (this is their so-called "rainforest realism").

One could put the problem like this. In spite of their claim that it is real patterns all the way down, Ladyman and Ross do privilege fundamental physics, as this is the phenomena that exclusively motivates them to champion OSR. And therefore they get into trouble with the special sciences in which individuals are *not* a secondary derived category. Thalos wants to abandon all sense of privileged scales or 'levels' and Ladyman and Ross still very much privilege fundamental physics. On the other hand, Thalos does not need to justify individual oriented special sciences. Contextual emergence differs from both sides as it emphasizes that contextual emergence is the norm at various scales,

across scales and most importantly of all, in mixed scale interactions. Every science exemplifies contextual emergence. For example, whether there is a privileged scale or not is itself an interest relative and context dependent question. For a particular explanandum there may well be a privileged scale to view the question at. Even to define scales one needs to make reference to the real physical characteristics of systems and these pick out privileged scales. For example, the strong force has a scale associated with it and so does the gravitational force, but for nuclear binding the latter is largely irrelevant. Again, many current scales, etc., were not all there at the big bang, some of them come into existence through dynamic interaction and we ought to be able to explain this kind of emergence.

This is one reason contextual emergence is often both epistemic and ontic. Indeed, what counts as a part or whole in any given case is contextually dependent and therefore dependent on the theoretical representation of the system and environment in question. This isn't anti-realism or instrumentalism, but an acknowledgment that given contextual emergence there will be many different equally useful ways to carve up the world into parts, wholes, systems and sub-systems.

Unfortunately, the way in which Ladyman and Ross state their case or the way in which they were misread (take your pick), made many philosophers of the various special sciences (especially those espousing pluralism) feel as though the OSR of Ladyman and Ross is physics-centric fundamentalism and anti-pluralistic (i.e, "monistic"), in that the deep insights from reality come from physics and the special sciences require an error theory-like gloss (Silberstein 2012). For example, Ladyman and Ross say: "We now explain why we accord physics a special status. Most of the evidence for the primacy of physics was discovered in the nineteenth and early twentieth centuries....Some physical forces were found. None of the non-physical ones were" (42). They then go on to add that since the nineteenth century physics has come to partly unify the forces, and explain in some important degree chemistry, biology and

even cognitive science (42-43). From all this, they conclude, "So it is not merely that anti-primacy-of-physics hypotheses have been rejected in the history of science, but that specifically physical hypotheses and explanations have been successful in their place" (43). With statements like these it is perhaps easy to understand why Ladyman and Ross were interpreted as championing fundamentalism or even some subtle form of physicalism.

4. Conclusion

We believe that contextual emergence of some sort is probably the only game in town when it comes to alternatives to weak and strong emergence. However, the more an account of emergence is hampered by CoP, ontological reductionism, physicalism, realizationism, etc., the harder it will be to find room for contextually given emergent properties to do any real work in the world. The beauty of OCE as defined by us is that none of those tired metaphysical doctrines even get off the ground. The additional upside to this is that we can begin to deflate the generation problem because matter is not fundamental—contextuality is, nor is it essentially non-mental—it is essentially contextual or dispositional if you prefer—OCE allows for a kind of neutral monism (for more details see Silberstein 2014, 2017b, Silberstein and Chemero 2015, and Silberstein, Stuckey and McDevitt 2017). While there is no time to fully develop any particular case study here a moments reflection will yield countless examples where context and contextuality have been the key to scientific understanding, e.g., the role of the experimental set-up in quantum mechanics, the role of the Higg's field in the explanation of the existence of mass, the role of the cellular, bodily, external and social environment in epigenetics and systems biology, the role of the body and external environment in embodied cognition, the role of the environment in systems neuroscience, etc. Across the disciplines, when

we look at the direction science has taken in the last few decades, the best explanations often involve multiscale contexts.

OCE is a historically plausible account of how emergence can work. There is nothing in strong emergence that accounts for why all the physical history of the world plods along just fine then suddenly minds or what have you POP into existence. OCE specifies from the beginning, the nature of the metaphysics of the world that allows emergence by requiring contextual emergence from the start. OCE is a unificatory account of emergence, providing a framework that acknowledges differences but also a common structure to the way emergence in physics, chemistry, biology, and mind occurs. OCE makes contextual emergence the norm across the board from the very beginning. The cost of a pluralistic ontology is offset by the unificatory power and the ability of OCE to fit in with a story about the practice of science.

The metaphysical advantage of ontological reductionism is clear as a unificatory account of everything, but it ultimately fails to unify if strong/radical emergence is true for any phenomena. Given OCE, all scientific practice is a good guide to ontology (at least some of the time). Strong emergence can only map out an exemption from ontological reductionism a la mental phenomena. OCE is not about justifying an exemption from ontological reductionism, it is about challenging the false dichotomy between reductionism and emergence as they are found in scientific practice.

OCE and strong emergence are not even really in competition. As such the aim of OCE and strong emergence are very different. Strong emergence seeks to justify why reductionism is almost but not totally true, OCE seeks to account for how everything in nature can be understood by relation to other things in nature. OCE is not an account of strong emergence but a mapping of why the world sometimes looks reductionist and sometimes looks emergentist, but is in fact neither: it is contextual. If OCE is true there is no need for strong emergence.

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