The Metaphysics of Emergence

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Abstract There are powerful arguments for the conclusion that causally efficacious emergence is not possible. I address three such arguments, two by J. Kim and one by Hume (though Hume's argument is not commonly recognized as having relevance to emergence). I conclude that all three arguments involve presuppositions of entity or thing based metaphysics, and that, when this is recognized as unviable and a process metaphysics adopted instead, the metaphysical possibility of causally efficacious emergence is seen to be unproblematic.

Resumo Há argumentos fortes para a conclusão de que a emergência causalmente eficiente não é possível. Analiso aqui três desses argumentos: dois de J. Kim e um de Hume (apesar de o argumento de Hume não ser comummente reconhecido como relevante para a emergência). Concluo que os três argumentos implicam pressupostos de metafísicas baseadas em entidades ou coisas e que, uma vez reconhecido isso como inviável e adoptada uma metafísica processual, a possibilidade metafísica de emergência causalmente eficiente deixa de ser problemática.

The emergence of some properties – e.g., triangularity – is trivial to account for, but also (in general) trivial in its consequences. There are, in fact, strong arguments that all emergent phenomena are causally epiphenomenal, including you and me. I will argue that these positions are framed by a false metaphysics – a metaphysics of substance and particle – and that when a more acceptable metaphysics – a metaphysics of process – is adopted, emergence shifts from being

a strange, contested phenomenon, reserved for major seemingly inexplicable issues such as life and mind, to being a ubiquitous and quotidian phenomenon, including for life and mind. Undoing a metaphysical barrier to the very possibility of accounting for emergent life or mind, of course, does not in itself provide a model of such emergence: it is brush clearing, to open up the possibility of constructing such models.

Emergence and Organization

Emergence is supposed to be a form of origination of new causal powers in new organization. New organization, in turn, is usually interpreted to mean new *levels* of organization, with levels differentiated within a mereological hierarchy grounded on some level of basic entities or particles. In the familiar picture, quarks, gluons, and electrons form atoms, which form molecules, which form biological systems, which yield mental systems and social systems. The central 'mystery' seems to be what 'yield' could amount to in the move from biological systems to mental systems.

Jaegwon Kim

Some intuitions would have 'yield' be constituted as an emergence of the mental from the biological, but just what "emergence" could be, and whether it is a real possibility at all, are contentious issues. Jaegwon Kim, in particular, has two powerful arguments against the possibility of causally efficacious emergence that I would like to

address.[1] These are the pre-emption argument and the causal regularities argument.

The Pre-Emption Argument

The conclusion of the pre-emption argument is that any purported causal powers of a presumed emergent level are superfluous to and pre-empted by those of the emergence base: all emergents are at best causally epiphenomenal. Suppose, for example, that we consider a mental phenomenon that is emergent from an underlying chemical-biological base. If this mental phenomena is to have causal power, then it must have consequences for other mental phenomena. But those other mental phenomena will have their own chemical-biological base, and so the first mental phenomenon must causally effect that *base* for the second phenomena in order to have any causal effects on the *emergent* second phenomena.

But the first mental phenomenon has its own chemical-biological base, and, assuming that the physical-chemical-biological world is causally closed, that first base must causally effect the second base too, in a way that suffices to produce the second emergent phenomena. The presumed causal consequences of the first mental phenomena on the second base, thus, are superfluous relative to the causal consequences of the first chemical-biological base on the second base. Any supposed causal consequences of the presumed emergent phenomena are, in this manner, pre-empted by the causal consequences of the base for that presumed emergence, and it is otiose to attribute any causal power to such emergences beyond the causal powers of their bases.

This general form of argument iterates down the mereologically hierarchical levels till some basic particle level is reached. At this point

[1] Kim, 1993, Kim, 1998.

there is no lower level, and the argument ceases to apply: all causal power resides at this most basic level of particles.[2]

The Causal Regularities Argument

The causal regularities argument[3] reaches the same conclusion as the pre-emption argument, but it is simpler and, in my judgement, more revealing of the underlying metaphysical presuppositions that frame both arguments.

Consider a configuration of particles interacting with each other starting from some initial configuration, and possibly with boundary conditions. The interactions will proceed in some form or another, and that form will, in general, be in part dependent on the initial and boundary configurations. Correspondingly, the results of those interactions, perhaps for regions of the world outside of this particular set of particles, will also be in part dependent on those initial and boundary configurations.

The configurations make a difference, then, but, so Kim argues, there is no *causality* except at the level of the basic particles. The configurations are more like stage setting for the causal interactions of the particles, and differing configurations may well yield differing (kinds of) outcomes, but these are just causal regularities of the particle interactions – there are no new causal powers in the

[2] If there is no such basic level of particles – with components within components unboundedly – then the pre-emption argument seems to iterate unboundedly, draining all causality out of the universe – not a happy consequence (Kim, 1998). We have no idea at this point in history whether or not there is any such bottoming out of physical scales, but it is unsettling for a metaphysical model to have its coherence depend on such an apparently contingent fact (Kim attempted to address this – Kim, 1988 – but his attempt is not satisfactory – see Campbell & Bickhard, 2011, and below).
[3] Kim, 1993.

configurations. All causality is in the basic particles – everything else is "epiphenomenal causation".

So, new configurations can yield new causal regularities, but cannot yield new causal powers. The manifest causal regularities are causally epiphenomenal relative to the particles.

A Question-Begging Metaphysical Assumption

Metaphysical emergence is supposed to yield new causal power in new organization, but both of Kim's arguments conclude that this is not possible.[4] In Kim's view, all causal power is micro-causation – at the level of basic particles. Particles can participate in organization, but particles do not have any organization per se. Organization is precluded as being a possible locus of causal power in the underlying metaphysical assumptions; organization is relations in the void, emptiness. Relations in emptiness are not substances or particles, and, thus, cannot be causally efficacious. In the assumption that causality is resident (only) in particles, Kim begs the question against emergence as yielding genuine causal power, not just causal regularity, in organization.

This assumption plays out rather obviously in the causal regularities argument. It also underlies the pre-emption argument: if a purported emergence base includes the particle configurations

[4] Note that both arguments assume that there are no new causal laws that apply to such new organizations, and yield new causal powers in virtue of the applicability of those special laws. This kind of assumption was characteristic of certain British Emergentists (Beckermann, Flohr, Kim, 1992), and is precluded in Kim's arguments by the assumption that the world is *micro*-physically causally closed: if so, then there is no room for higher level laws to intrude into the micro-physical causal particle dance. If there were such higher level special laws, then they would, by assumption, be not derivable from lower level laws and organization – if such a derivation were possible, then there would be no special higher level law, only the working out of causal regularities of lower level particle configurations.

(properties of and relations among the particles), then any causal regularities resulting from that configuration are already accounted for by the causal regularities of the base, and any assumption of causal power that might be emergent is superfluous. If there *were* special configuration-applying laws, as for (some versions of) British emergentism, then they would intrude on the causal regularities resulting from the base, but they would violate the assumption of micro-physical causal closure.

Both the causal regularities argument and the pre-emption argument, then, assume that organization is not a legitimate locus of causal power, and, thus, that emergence is at best causally epiphenomenal. In precluding organization as a potential locus of causal power in the framing metaphysical assumptions of the arguments, the causal regularities argument and the pre-emption argument beg the question against the possibility of emergence: if organization cannot be a potential locus of causal power, then causally efficacious emergence in organization is simply presupposed to be not possible.

But There Are No Particles

This assumption against organization, however, is not only question-begging, it is false. It is motivated by an assumption that the basic reality of the world is constituted by particles. If that is so, then those particles are the obvious locus for causal power, and it requires some additional assumption, such as British emergentist special laws, to render organization causally efficacious beyond the causality of the particles.

But there are no fundamental particles.

A metaphysics of particles encounters both metaphysical and physical problems. Metaphysically, nothing would ever happen in a

universe of point particles: they have a zero probability of ever interacting. If the presumed basic particles are assumed to be of finite volume, not point particles, then they do have organization, and encounter impossible problems about, e.g., how (and with what velocity) force is transmitted through them, whether they are divisible, what form they have, how they interact beyond hitting each other, how *attraction* could possibly occur, and so on.[5]

If we assume that particles interact with each other via various kinds of fields – a standard assumption today – then the assumption against organization has already been abandoned: fields are intrinsically organized, and have whatever 'causal' consequences they have in part due to those organizations. So, organization cannot be precluded as a potential locus of causal power, and, thus, emergent causal power *in* organization cannot be metaphysically precluded by a priori assumption.

The point about fields being intrinsically organized becomes even stronger when quantum field theory is considered: in this, our best contemporary physics, there are no particles. Everything is quantum fields, and quantum fields interact in part due to their organization: organization has causal power if anything does. What remains of the notion of particle is a quantization of field interactions.[6] These quantizations are mathematically akin to oscillatory phenomena, which, as for a guitar string, will be of integer or half integer numbers of wave-lengths. So, guitar string oscillations are 'quantized', but there are no guitar sound particles. Similarly, there are quantized excitations of quantum fields and quantum field interactions, but there are no quantum field particles.[7]

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[5] Campbell, 2009.

[6] Cao, 1999; Halvorson & Clifton, 2002; Huggett, 2000; Weinberg, 1977; Weinberg, 1995; Zee, 2003

[7] Both loop quantum gravity and string theory posit lowest level 'structures' – loops or strings – but it is arguable that an organizational relationalism is still

A particle metaphysics, thus, suffers from both metaphysical and empirical problems. The standard modification is to posit particles interacting via fields, but fields have very different properties than particles and do not support the mereological assumptions made in a particle framework. Even stronger, according to our best physics, there are no particles, and everything is fields.

Organization *Can* be a Locus of Causal Power

If everything is quantum fields, then everything is process: quantum fields are processes. In a sense, we have a return to Heraclitus and away from the substance-particle tradition of Parmenides, Empedocles, and Democritus.[8]

Processes are inherently organized, and have whatever consequences they have in part due to those organizations. So organization *can* be a locus of (new) causal power, including, perhaps, the organizations that constitute you and me (and Kim). Emergent causal power is metaphysically possible.

A Note on Supervenience

During the latter part of the 20th century, it was hoped that the notion of supervenience would be able to do the work of emergence, but without the apparently problematic aspects of emergence. The idea was that something supervenes on a base if there can be no differences in the supervenient property or phenomena without changes in the base. There were multiple technical details to work out about various kinds of supervenience and their relations to the

required, and, in the case of loop quantum gravity, is manifest (Smolin, 2001; though these issues are still controversial: Weinstein & Rickles, 2013).

[8] Bickhard, 2009; Bickhard, in preparation.

supervenience base, but ultimately it was realized that supervenience does not have much metaphysical power. Supervenience does little more than preclude certain kinds of dualism, and, perhaps, most importantly, to postulate a supervenience relation, even if in some sense correct, does nothing to *explain* how or why the supervenient properties or phenomena exist at all.

Kim's arguments were most often framed within assumptions of supervenience, and one consequence is the problem of causal drain mentioned above: if causality is, via either the causal regularities argument or the pre-emption argument, always resident at the lower mereological level[9], and if there is no lowest level of particle, then causality drains unboundedly down the mereological levels and out of the universe. There is no level at which causality can reside.

One response to this problem of causal drain was to remove relations, thus configurations, from the base – a micro-base constituted by entities (perhaps particles) and their properties and a macro-level constituted by the relations (configurations) among the lower level entities. In this manner, the pre-emption argument is blocked: the causal "regularities" of the configuration cannot be account for by the base because the base does not include the relations. Those "regularities" then constitute causal properties not derivable from the base. These higher level causal properties, then, will not drain down the levels, and causal drain is blocked.

This framework even yields a kind of emergence: the emergence of such new causal properties at higher levels.[10] This is not classical British emergence, however, because the higher level causal properties

[9] Note that the notion of supervenience presupposes some sort of mereological framework: otherwise it becomes difficult to differentiate base level from higher level.
[10] Kim, 1988.

would be in principle derivable from lower level laws together with information about configurational (relational) conditions.[11]

Thus Kim avoided causal drain by removing relations from his definition of the base – and thereby introduced a kind of emergence. But it is difficult to see how such powerful metaphysical work can be accomplished by a stipulational definition. One perspective on this point is provided by noting that Kim's causal regularities argument would still apply in this framework: simply take particles, properties, *and* relations into account, and nothing more than causal regularities will result – no new causal powers. Which definition is the metaphysically "right" one?

The definition of supervenience in terms of levels – the mereological assumption, motivated by the particle metaphysics – is itself at fault here. There is no metaphysically correct definition so long as the framework of mereological particle-configuration levels is assumed: relations in the base or not in the base is an ad-hoc stipulation, not well defined in the actual (assumed) physics of the matter. There are two interrelated problems: 1) (roughly) mereological levels is one mode of organization, but it is not the only mode, and 2) the assumption of a fixed particle base, also an assumption motivated by a mereological particle view, is at times approximately satisfiable, but is simply false about many rather important kinds of organizations of process.

Regarding point 1): organisms, for example, exhibit multiple kinds and forms and degrees of "level crossing", making it difficult to specify what the levels are and how they relate to each other. Is the circulatory system, for example, above or below the level of the kidneys? To the side? The capillaries inside the kidneys? And so on.

Regarding point 2): Some entities, such as a rock, more or less satisfy a mereological framework with a fixed base of atoms. But

[11] McLaughlin, 1992.

others, such as a flame or a living organism, do not. Process organizations that are far from thermodynamic equilibrium are constituted as flows from the environment and back to the environment. It is the flow per se that constitutes the system, not any presumed particle base. Consider, for example, fixing the atoms in and nearby to a candle flame, but then considering that those atoms no longer have the momenta that they do in the flame, but, instead, random momenta. There would be no flame. Similarly, if all of the presumed atoms in a candle flame 'base' were suddenly frozen (a particular case of having different momenta from when actually participating in the constitution of the flame), again there would be no flame. The candle flame *is* the flow of oxygen into the higher temperature regions of the flow and the resultant flow of waste products out of that region.[12]

Far from thermodynamic equilibrium processes, such as a candle flame, cannot be stable in time unless they are constituted in ways that those far from equilibrium conditions are maintained, and this requires interaction with an environment. The far from equilibrium conditions are themselves relations to an environment: if the ambient temperature is raised to the level of the candle flame high temperature region, the flow ceases and the flame ceases.

This necessity for ontologically constitutive flow falsifies assumptions of fixed particle bases. The necessity for far from thermodynamic equilibrium conditions falsifies assumptions of any kind of independent base, and, thus, of the adequacy of supervenience to account for phenomena such as candle flames (or living systems, etc.). Specifically, supervenience cannot handle relations external to a presumed supervenience base: The longest pencil in a box can cease

[12] Just as the river is the flow of water for Heraclitus (Graham, 2006).

to be the longest pencil in the box if a longer pencil is put into the box, but the base that constitutes the pencil has not changed.[13]

Being the longest pencil in the box is not generally of great importance, to the pencil or to much of anything else, but being in a relation of far from thermodynamic equilibrium with an environment is of essential ontological importance to flames, hurricanes, cells, cats, and people. And these thermodynamic relations are also not compatible with fixed base supervenience models. These are phenomena that are realized in and as process organizations, process flows, not particle bases.

So, emergence is metaphysically not precluded by Kim's arguments. Furthermore, supervenience does not suffice to account for emergent phenomena, and is not even applicable to far from equilibrium organizations of process. So, supervenience is not only not sufficient to account for emergence, supervenience is not necessary for emergence. Still further, mereology and levels are not necessary for emergence: emergence is emergence in organization, and organization may or may not be organized as (mereological) levels. But these points are difficult to discern so long as a particle metaphysics is assumed.

Hume's Argument

Analysis of Kim's arguments against emergence have shown them to be unsound as blocks to metaphysical emergence, and uncovering the problematic premises of these arguments has uncovered an alternative framework – a process framework, possibly in the form of quantum fields – that is more satisfactory both metaphysically and empirically, and that does not preclude the possibility of emergence.

[13] Teller, 1992.

There is another argument that would, if sound, block emergence, though historically it was not directed at emergence, and its relevance to emergence is less often noted. This is Hume's argument against deriving norms from facts. I will argue that 1) if this argument were sound, it would preclude emergence, 2) it too involves a false premise, and 3) that the false premise has deep connections with Kim's premise.

Hume doesn't actually elaborate an argument against deriving *ought* from *is*. Instead, he claims that deducing ought from is "seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it".[14] Multiple suggestions have been made concerning how to fill out this argument, and whether it is sound or not[15], usually within some framework of deduction. One assumption that has to be made, however, for this argument to work is that no new terms can be introduced in a valid deduction that cannot be ultimately cashed out in the terms already available in the premises of the deduction. The claim is that new terms, such as "ought", cannot be introduced unless they are definable using terms already available, and the terms ultimately available are those in the premises. So, if any new terms are back-translated through their definitions – substituting the defining phrase or clause for the defined term (or phrase or clause) – and any defined terms in those definitions also back-translated, and so on, ultimately we reach a point at which all valid conclusions of the deduction are stated in terms that were available in the premises. If those terms in the premises are, by assumption, only terms of facts, terms of "is", then the conclusion too will involve only terms of fact. Any terms in the conclusion that partake of "ought" will be invalid, because they cannot be back-translated into terms available in the premises.

[14] Hume, 1978, Book III, Part I, Section I.
[15] Schurz, 1997.

If this assumption is not made for Hume's point, then it cannot follow: it is a necessary, and perhaps sufficient, assumption for Hume's 'argument' to go through. It is this assumption that has relevance for issues of emergence.

If back-translation is necessary for any new terms validly introduced, then the only new terms possible in a valid conclusion are those that are some sort of grammatical combination of terms already in the premises. A limitation to such combinations is the logical-grammatical equivalent of limitations to combinations of Democritean atoms or mixtures of Empedoclean substances: it is a limitation that precludes the (emergent) production of new kinds of terms or properties or entities. That is, it is not just "ought" that is precluded from valid deductions based on factual premises, but any other kind of potential emergence as well: any new terms can only be combinations of factual terms in the premises, so what the terms refer to can only be combinations of factual references in the premises. The parallel here is between mereological combinatorialism for the case of particles and grammatical (or logical) combinatorialism so long as abbreviatory forms of definition are the only recognized form of definition: in neither case can anything beyond combinatorial spaces be constructed.

Implicit Definition

Not all definitions, however, permit back-translation. If there is a sound form of definition that does *not* support back-translation, then it is at least possible that "ought", as well as terms for other forms of new phenomena, might be validly introduced that nevertheless cannot be rendered in the terms of the premises. Implicit definition is such a form of definition.

Implicit definition was not known to Hume, so it is not anomalous that he did not take it into account. Implicit definition was introduced around the advent of the 20th century by, among others Hilbert.[16] Formal implicit definition has more than one form: the form that I take to be most relevant here is the idea that a set of axioms will implicitly define the class of models that will satisfy those axioms.[17] Finding out what range and sorts of models will be implicitly defined in this sense requires investigation; such a definition is in no way an abbreviation for what is being defined, and, correspondingly, there is no way to back-translate by substituting the defining expression for the defined expression. Implicit definition does not permit back-translation, and, so, the very possibility of implicit definition refutes a crucial assumption in Hume's 'argument': it *is* possible to validly introduce terms into a conclusion that cannot be rendered in terms already available in the premises.

Such terms *might* refer to phenomena that are not just combinations of phenomena mentioned in the premises; they might be emergent. In any case, the apparent block to the possibility of emergence from Hume's argument is removed.

Thus, a process metaphysics, which is recommended on both metaphysical and physical grounds, undermines Kim's arguments and against emergence, and shows that potentially causally efficacious

[16] Hilbert, 1971. It was strongly opposed by, for example, Frege and Russell. Nevertheless, implicit definition is now a core part of mathematical model theory (e.g., Chang & Keisler, 1990).

[17] Hilbert proposed, for example, to formalize geometry with a set of axioms that implicitly define the class of models. "Two Xs determine a Y", for example, could be interpreted as "Two points determine a line (the line through the points)" or it could be interpreted as "Two lines determine a point (so long as points at infinity are accepted in the case of parallel lines)". In general, in formal implicit definitions, any interpretation of the terms that satisfies the implicitly defining relations constitutes a model, and the axioms implicitly define the class of models for those axioms. The standard definition of a mathematical group, for example, is an implicit definition that has an infinite number of models.

emergent properties in process organizations make sense. And recognizing the possibility of implicit definition[18] shows that a background assumption in Hume's argument is false, thus removing that apparent block to the possibility of emergence.[19]

Both Kim's and Hume's arguments assume that the only possible kinds of changes are changes in configurations of particles (Democritus), mixtures of stuffs (Empedocles), or the grammatical equivalents of such configurations or mixtures. In both cases, no new kinds of basic realities are created, just reconfigurations of unchanging substrata for superficial change.[20]

Ubiquitous Emergence

In the process view advocated here, all new organization will have new properties. Some will be causally efficacious; some will not. Some will be important or interesting; most will not.

Emergence is quotidian and ubiquitous – it is everywhere (and everywhen): rocks, water, candle flames, tables, temperature, and so on. It is not limited to important/interesting phenomena, such as life and mind, though life and mind are two of the most important/interesting instances. Hume's and Kim's barriers to the very possibility of emergence are removed, but this leaves the task of modelling interesting and important emergences, such as life and mind, to be addressed.

[18] I have mentioned only logico-mathematical implicit definition here. There are also more dynamic, functional kinds of implicit definition, often rendered as dynamic functional presupposition (Bickhard, 2009; Bickhard, in preparation; Hale & Wright, 2000).

[19] Note that the point here is not that implicit definition entails process, but that implicit definition blocks Hume's argument *against* emergence. This opens the *possibility* that process can account for metaphysically genuine emergence; it is a brush-clearing point.

[20] Bickhard, 2009; Bickhard, in preparation; Gill, 1989.

Conclusion

Emergence seems mysterious, even metaphysically impossible, because of background assumptions of a false metaphysics which, if they were correct, *would* make emergence impossible. But emergence is neither impossible nor mysterious – it is ubiquitous, and, as a simple possibility, almost trivial: new properties are emergent in new organization.[21] Some emergences, however, do require special, difficult, sometimes puzzling models to be able to account for them.[22]

[21] Note that there is no mention of levels here. Levels may be an aspect of some organization, but it is not necessary for the model of emergence outlined.
[22] See, for example, Bickhard, 2009 and Bickhard, in preparation, for models of some normative emergences.

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