

## Only explanation can reflate emergence.

### Abstract

*In a recent exchange in this journal I argue that accounts of emergence face the collapse problem, and I defend an explanatory approach to emergence as a solution to this problem. Alexander Skiles objects to my account, and proposes an alternative solution to the collapse problem. In this discussion note I take up this conversation, defending the explanatory account of emergence against Skiles' critique, and arguing that his alternative approach fails to solve the collapse problem.*

Keywords: Emergence, Explanation

### 1. Introduction

Philosophers and scientists use the term “emergence” for a phenomenon whereby particular macro-level properties display certain kinds of autonomy from the micro-level properties that give rise to them. For example, features of conscious experience, of artificial life configurations and of fundamental physical systems have all been described by philosophers and scientists as “emergent”.<sup>1</sup> Many philosophers have attempted to clarify this discourse by offering accounts of emergence, in which they articulate the precise nature of emergent autonomy.<sup>2</sup>

In a recent exchange in this journal I argue that accounts of emergence face a problem, the *collapse problem*, and defend an explanatory account of emergence as a solution to that problem. Alexander Skiles critiques my account, offering an alternative solution to the collapse problem.<sup>3</sup> In this discussion note I take up this conversation. In Section 2 I briefly introduce the collapse problem and my account of emergence, describe Skiles' critique, and respond. In Section 3 I describe Skiles' alternative proposal and show that it fails to solve the collapse problem.

### 2. Taylor's account and Skiles' critique.

#### 2.1 The “collapse problem” and Taylor's proposal.

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<sup>1</sup> See Chalmers, D. (2006); Bedau, M. (2003); Morrison, M. (2012)

<sup>2</sup> For example, see Wilson, J. (2010) and (2015), Barnes, E. (2012) and Chalmers, D. (1996) and (2006).

<sup>3</sup> Taylor, E. (2015b); Skiles, A. (2016)

In *Collapsing Emergence*, I show that accounts of emergence face the “collapse problem”.<sup>4</sup> Claims about emergence are relative to a distinction between micro-level properties, which form the emergence “base”, and macro-level properties, some of which may be emergent. The collapse problem is that for every purported case of emergence and account of emergence there are certain problematic properties in the micro-level base. With the inclusion of these problematic properties, the purported emergent fails to meet the criteria given in the account of emergence, and so the emergence “collapses”.

To illustrate the collapse problem, consider the historical case of C.D. Broad’s account of emergence, which both Skiles and I discuss in detail. According to Broad, a macro-level property is emergent if and only if its instantiation is not deducible from full knowledge of the properties in the micro-level base.<sup>5</sup> Broad took properties of chemical compounds, such as the water-solubility of sodium chloride, as cases of emergence, and argued that the instantiation of such properties could not be deduced from full knowledge of the properties of the relevant elements in isolation. The water-solubility of sodium chloride (macro-level) emerges from the properties of sodium and chlorine in isolation (micro-level), and so the water-solubility of sodium chloride cannot be deduced from full knowledge of the properties of sodium and chlorine in isolation. However, this apparent case of emergence disappears if the following property is included among the properties of sodium: *has the disposition to generate a compound that is soluble in water when combined with chlorine into sodium chloride.*<sup>6</sup> If this is one of the properties of sodium, then the water-solubility of sodium chloride is deducible from full knowledge of the properties of sodium and chlorine in isolation. The emergence “collapses” because with the inclusion of this property in the micro-level, water-solubility fails to meet Broad’s criterion for emergence.

The collapse problem generalizes to a wide range of different accounts of emergence, and so poses a general problem. It may seem obvious that we can avoid this problem by restricting the micro-level properties in cases of emergence to exclude the problematic properties that generate collapses. However, despite its initial plausibility, this restriction strategy is unsuccessful.<sup>7</sup>

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<sup>4</sup> Taylor, E. (2015b)

<sup>5</sup> Broad, C.D. (1925), pg 61.

<sup>6</sup> I will follow Taylor in presuming that this disposition manifests itself of natural necessity.

<sup>7</sup> In Taylor, E. (2015b) Section 3.

I develop a solution to the collapse problem that relies on a particular explanatory conception of emergence, and a principle governing non-metaphysical explanation. The explanatory conception of emergence (hereafter EM) is:

A macro-level property  $p$  is emergent iff there is no available explanation of the fact that the following regularity obtains of natural necessity: Whenever components  $A, B, C, \dots, n$  are combined in relation  $r$ , the resulting whole instantiates property  $p$ .<sup>8</sup>

The explanatory principle is the “factual non-equivalence condition” (hereafter FN) and is motivated by the idea that facts cannot explain themselves:

Where two sentences are ‘factually equivalent’ iff there is no metaphysically possible world in which either sentence is true and the other false, the factual non-equivalence condition states that *no explanandum can be explained by a sentence to which it is factually equivalent*.<sup>9</sup>

I use FN to show that collapse-inducing properties do not provide resources for explanation, and so that a collapse-inducing property in the micro-level cannot make an apparently emergent property non-emergent. According to EM, to show that a property is not emergent we have to provide an explanation, and collapse-inducing properties fail to do this. Thus the combination of EM and FN solves the collapse problem. I use this to motivate an explanatory account of emergence based on EM, which I develop and defend elsewhere.<sup>10</sup>

## 2.2 Skiles’ Objection

Skiles argues that my solution to the collapse problem fails because FN is false, and that this undermines the motivation for my explanatory account of emergence. Skiles uses the famous example of the tower and flagpole to generate a counterexample to FN.<sup>11</sup> Where

$p =_{\text{def}}$  The flagpole’s height is 10 meters

$p_c =_{\text{def}}$  The background conditions required to derive  $q$  from  $p$

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<sup>8</sup> Taylor, E. (2015b) pg 746

<sup>9</sup> Taylor, E. (2015b) pg 749

<sup>10</sup> Taylor, E. (2015a)

<sup>11</sup> As Skiles notes, this case is widely attributed to Sylvain Bromberger, and is a famous counterexample to Hempel and Oppenheim’s Deductive-Nomological account of scientific explanation. See Bromberger, S. (1966), Hempel, C. (1965) and Skiles, A. (2016) pg 836

$q =_{\text{def.}}$  The length of the flagpole's shadow is 5 meters

The conjunction of  $[p \ \& \ p_c]$  explains  $q$ .  $p$  and  $q$  are interderivable, if  $p_c$  is held fixed.  $[p \ \& \ p_c]$  and  $[q \ \& \ p_c]$  are therefore factually equivalent, as there is no metaphysically possible world in which either is true while the other is false. According to FN, a sentence cannot be factually equivalent to what it explains. However, Skiles argues that  $[p \ \& \ p_c]$  at least partially explains  $[q \ \& \ p_c]$ , despite their factual equivalence. This argument consists of two steps. First, Skiles argues that FN is a requirement on partial explanation as well as on full explanation, because the kind of circularity prohibited by FN should be prohibited in partial explanation as well as full. Second, Skiles proposes that any sentence that appears in a full explanation is a partial explanation, and so that  $[p \ \& \ p_c]$  at least partially explains  $[q \ \& \ p_c]$ , because  $[p \ \& \ p_c]$  fully explains  $q$ .<sup>12</sup>

If  $[p \ \& \ p_c]$  at least partially explains  $[q \ \& \ p_c]$ , and yet they are factually equivalent, then FN is false, and my solution to the collapse problem, which relies upon FN, is undermined.

### *2.3 Reply to Skiles' Objection*

In this section I will present two objections to Skiles' counterexample to FN. The first is that the counterexample involves self-explanation, and the second is that the counterexample relies upon a false principle about partial explanation.

Skiles argues that  $[p \ \& \ p_c]$  at least partially explains  $[q \ \& \ p_c]$ , but this is not the case.  $[p \ \& \ p_c]$  explains  $q$ , but if  $[p \ \& \ p_c]$  partially explains  $[q \ \& \ p_c]$  then  $p_c$  would appear in both the explanans and the explanandum, which would be a case of self-explanation. Because of these concerns about self-explanation we should be suspicious of the claim that  $[p \ \& \ p_c]$  at least partially explains  $[q \ \& \ p_c]$ . However, if we leave  $p_c$  out of the explanandum, such that  $[p \ \& \ p_c]$  does not at least partially explain  $[q \ \& \ p_c]$ , but instead only explains  $q$ , then this case is not a counterexample to FN because  $[p \ \& \ p_c]$  is not factually equivalent to  $q$ . There are metaphysically possible worlds in which  $q$  is true yet  $[p \ \& \ p_c]$  is false, including worlds in which a five-meter shadow is generated by a shorter flagpole and the sun in a different position.

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<sup>12</sup> Skiles, A. (2016) pg 836-834

However, even if we put this worry about self-explanation to one side, there is another, perhaps more serious problem with this counterexample. Skiles' objection depends on the principle that *it is at least sufficient for a sentence to yield a partial explanation if conjoining it with other sentences yields a (full) explanation*.<sup>13</sup> This principle (hereafter PE) faces counterexamples involving attempts at partial explanation that violate reasonable expectations about the contrastive nature of explanation.

Consider an attempt to offer a full physical explanation of a complex event, such as tennis player Andy Murray winning the 2016 Wimbledon final. A full physical explanation of this event will include a detailed physical description of the forces relevant to the event, including facts about the laws of gravity. Accordingly, the following sentence will appear in the full explanation: *According to Newton's law of universal gravitation, a particle attracts every other particle in the universe with a force directly proportional to the product of their masses and inversely proportional to the square of the distance between them*. If it is true that any sentence that can be combined with other sentences into a full explanation qualifies as a partial explanation, then this sentence must be a partial explanation of Murray's win. Yet intuitively this sentence is not even a partial explanation of the win.

Mere intuition is an insufficient basis for a counterexample, but one reason why we may have this intuition is that there is a contrastive element to an explanation of an event that this sentence does not display. When we explain an event, we often say something about why *this* event occurred rather than relevant alternatives. An explanation of Murray's win should help us to understand why it occurred as opposed to not occurring. This is not the requirement that the explanandum should be entailed by the explanans, but instead is the requirement that in certain kinds of explanation the explanandum should be *avored* by the explanans.<sup>14</sup> Facts about the laws of gravity do not favor Murray's win over Murray's loss, and so the sentence describing those laws does not partially explain the win, even if that sentence appears in a full explanation of the win. We can further motivate this favoring requirement by considering the fact that a full physical explanation of any event will include vast amounts of detail that, taken in isolation, would be explanatorily irrelevant to that event. This is especially the case when explaining events that are multiply realizable, such as economic transactions or social events such as elections and recessions.

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<sup>13</sup> Skiles, A. (2016) pg 836

<sup>14</sup> There are many cases of explanation to which this requirement does not apply, including the explanation of low-probability events. However, it does plausibly apply to certain explanations, and only one case is required for a counterexample to PE.

One might think that in partial explanations the partial explanans does not favor the explanandum simply because the explanation is partial, and so that there is insufficient information to permit favoring. However, consider a situation in which we are attempting to explain a particular crime, an attack on a person. The fact that the attacker was motivated by intense and poorly-controlled jealousy of their victim partially explains the attack and also favors the attack over relevant alternatives, though it does not entail that the attack happened. This motivation does not fully explain the attack, as it provides no information about the actual physical situation of the attack or about whether the attack was planned and so on, but it does partially explain the attack. As this case shows, partial explanation can favor without fully explaining.

Not all explanans favor the explanandum, and so favoring is not a requirement for all partial explanation. Full explanations of low-probability events, for example, will not exhibit favoring, and so neither will partial explanations of such events. However, it is a plausible requirement that any partial explanation that is part of a full, favoring explanation must also favor the explanandum. This fact about the contrastive nature of explanation makes sense of the intuition that the laws of gravity do not even partially explain Murray's win.

Skiles based his objection on the principle PE: *it is at least sufficient for a sentence to yield a partial explanation if conjoining it with other sentences yields a (full) explanation.*<sup>15</sup> However, I have shown that some sentences that appear in full explanations do not yield partial explanations of the same explanandum. This undermines PE, and so undermines Skiles' objection.

### 3. Skiles' Proposal and Response

#### 3.1 Skiles Proposal

In place of my proposed solution to the collapse problem, Skiles recommends an alternative based on the idea of *restricting* the micro-level bases of emergents to exclude collapse-inducing properties. I consider and reject such restriction strategies in my original paper, but Skiles offers a new version.<sup>16</sup> His proposal exploits the idea that the collapse problem is generated by properties that illegitimately

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<sup>15</sup> Skiles, A. (2016) pg 836

<sup>16</sup> Taylor, E. (2015b) Section 3.

*involve* the purported emergent. If we can exclude such properties from the micro-level base, argues Skiles, then we can solve the collapse problem.

Skiles develops this idea and makes it precise using the idea of *generic essence*. The generic essence of a feature is what it is to have that feature.<sup>17</sup> Skiles motivates his appeal to generic essence by asking us to recognize the difference between stating true conditions for a particular feature, and giving an account of that feature. We may state true conditions about a feature without saying anything about what it is to have the feature, which is what is required for an account. For example, consider the feature *being gold*. Say for the sake of argument that anything with the feature *being gold* must also have the feature *being the substance that Eleanor Taylor is thinking about at 11.10am on Tuesday November 29<sup>th</sup> 2016*. This is a true condition, but it does not give an account of what it is to have the feature *being gold*, and so it does not tell us anything about the generic essence of that feature. An account of what it is to have the feature *being gold* would involve facts about gold's chemical features, such as *being the element with atomic number 79*. So long as we recognize this distinction between a mere true condition and a genuine account, argues Skiles, then we have a basic grasp of generic essence.

Skiles then appeals to generic essence to precisify what it is for one property to involve another. Skiles uses Fabrice Correia's regimentation of statements about generic essence, which allows statements not just about the generic essence of single features but also of collections of features, like this:

$$\exists_{F_1, F_2 \dots} p$$

This reads, "What it is for some thing to have  $F_1$ , for some (perhaps different) thing to have  $F_2 \dots$  is (at least in part) for the proposition that  $p$  to be true."<sup>18</sup> The fact that this regimentation permits generic essence of multiple features is highly important for Skiles' proposed solution to the collapse problem, because, as he points out, although it may not be part of the generic essence of the feature *being sodium* that it creates a water-soluble compound when combined with chlorine, it is plausible that it is part of the generic essence of the features *being sodium* and *being chlorine* that their compound

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<sup>17</sup> Skiles, A. (2016) pg 838. Skiles uses work by Fabrice Correia and Kit Fine in this section. See Correia, F. (2006) and Fine, K. (2015)

<sup>18</sup> Skiles, A. (2016) pg 839

is water-soluble.<sup>19</sup>

Skiles proposes that what it is for one property to involve another is for one to feature in the other's generic essence. To avoid the collapse problem, we can stipulate that the micro-level base of a purported emergent should not include any properties that feature in the generic essence of the purported emergent. More precisely and generally, Skiles' solution to the collapse problem is this:

Say that a feature,  $\epsilon$ , is *directly involved* in a collection of features  $F_1, F_2, \dots$  iff  $\epsilon$  is a constituent of a proposition,  $p$ , which is such that  $\Box F_1, F_2 \dots p$ , and *involved* iff  $\epsilon$  stands in the transitive closure of direct involvement to  $F_1, F_2, \dots$ . Then say that  $F_1, F_2, \dots$  are *pure* of  $\epsilon$  iff there is no subcollection of  $F_1, F_2, \dots$ , either proper or improper, in which  $\epsilon$  is involved. Put concisely, to solve the collapse problem we demand the collection of features that constitute a micro-level base of an emergent feature  $\epsilon$  be pure of  $\epsilon$ .<sup>20</sup>

Skiles argues that because it is part of the generic essence of the collection of features *being sodium* and *being chlorine* that their compound is water-soluble, the micro-level properties cannot include the feature *has the disposition to generate a compound that is soluble in water when combined with chlorine into sodium chloride* because then the micro-level base would not be pure of the purportedly emergent property, *being soluble in water*. Skiles then argues that this solution generalizes, and so that we can solve the collapse problem by stipulating that the micro-level base of any emergent property must be pure of that property.

This strategy not only excludes collapse-inducing properties that directly involve the purported emergent, such as the case of water-solubility, but also excludes collapse-inducing properties that involve the purported emergent indirectly, such as by involving a feature that directly involves the emergent feature. Skiles also argues that this strategy is flexible because it is widely applicable across different accounts of emergence, and illuminating because it can be used to explore and articulate different forms of emergent autonomy.<sup>21</sup>

### 3.2 Response to Skiles' proposal.

Although Skiles' proposal is based on an apparently sensible response to the collapse problem, and

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<sup>19</sup> Skiles, A. (2016) pg 839

<sup>20</sup> Skiles, A. (2016) pg 840

<sup>21</sup> Skiles, A. (2016) pg 841

makes ingenious use of the notion of generic essence, in this section I will show that it fails.

According to Skiles part of the generic essence of the collection of features *being sodium* and *being chlorine* is that when combined these create a compound that is water-soluble. However, many other features are also apparently part of the generic essence of the collection of features *being sodium* and *being chlorine*. For example: when combined these create an ionic compound, and when combined these create a salt that is white in color. If we include water-solubility as part of the generic essence of this collection, then there is no principled reason to exclude these other features, among many others.

If water-solubility is part of the generic essence of *being sodium* and *being chlorine*, then it seems we must also include a wide range of other features as part of that generic essence. But then the generic essence will be a list of true conditions about the collection of features rather than an account of what it is to have those features. To give an account of these features and so to capture their generic essence, we should instead focus on the feature or features in virtue of which those conditions are true. For chemical elements, this would include features such as their atomic number, but not the fact that when combined with certain other elements they are soluble in one particular fluid, because the respective atomic numbers of sodium and chlorine are features, among certain others, in virtue of which some of their compounds are soluble.

This is a problem because it indicates that we do not have convincing grounds for taking *when combined creates a compound that is water-soluble* to be part of the generic essence of *being sodium* and *being chlorine*, as opposed to merely one of the true conditions about having those features. If water-solubility is not part of that generic essence, then properties involving water-solubility cannot be excluded from the micro-level base of water-solubility, and Skiles' solution to the collapse problem is undermined.

Related problems arise when we consider the relationship between the generic essence of individual features and of collections of features. Skiles argues that although it may not be part of the generic essence of *being sodium* to form a compound that is water-soluble when combined with chlorine, forming a compound that is water-soluble *is* part of the generic essence of the collection of features *being sodium* and *being chlorine*. It is important that the collection in question is *being sodium* and *being chlorine*, and *not being sodium chloride*, because the relevant micro-level base in Broad's case is the

properties of sodium and chlorine in isolation, rather than in a compound. However, there is no justification for taking water-solubility as part of the generic essence of the collection when it is *not* part of the generic essence of the individual features. It is true that sodium and chlorine create a water-soluble compound when combined, but as Skiles argues, a true conditional is not necessarily a truth about generic essence. There is no justification for taking water-solubility to be part of the generic essence of the collection of two features when it is not part of the generic essence of those features individually.

If we accept this worry and deny that water-solubility is part of the generic essence of the collection *being sodium* and *being chlorine*, then we cannot use Skiles' strategy to block the collapse problem in this case. Furthermore, without a clear, principled way to distinguish facts about generic essence from merely true conditions for having a certain feature, we cannot use this appeal to generic essence as the basis of a general solution to the collapse problem.

### *Conclusion*

I argue that accounts of emergence face the collapse problem, and propose a solution to the collapse problem based on an explanatory conception of emergence and a principle about explanation, the factual non-equivalence condition. Skiles argues that my solution fails because the factual non-equivalence condition is false, and offers an alternative solution to the collapse problem that appeals to generic essence. In this discussion I have shown that Skiles' objection fails because it is based on a false principle about partial explanation, and that his alternative solution fails because it provides no principled reason for excluding collapse-inducing properties from the micro-level bases of emergents. My solution to the collapse problem succeeds, and, *contra* Skiles, this success supports my explanatory account of emergence. Skiles attempts to show that we can use generic essence to solve the collapse problem, and hence "reinflate" emergence. But, as I have argued, only explanation can reinflate emergence.<sup>22</sup>

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<sup>22</sup> Thanks to Patrick Connolly, Alexander Skiles and an anonymous referee for helpful discussion and feedback.

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