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Title	C.D. Broad on emergence and machresis
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Publication date	2026-10-12
Original Citation	Walmsley, J 2026, 'C.D. Broad on emergence and machresis', Synthese, vol. 208, no. 4, 198, pp. 1-20. https://doi.org/10.1007/s11229-026-05845-x
Type of publication	Article (peer-reviewed)
Link to publisher's version	https://www.scopus.com/pages/publications/105053339201 - 10.1007/s11229-026-05845-x
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Download date	2026-11-17 12:48:51
Item downloaded from	https://hdl.handle.net/10468/19605



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C.D. Broad on Emergence and Machresis

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Abstract

This paper re-examines C.D. Broad's theory of emergence with a view to situating it within contemporary debates about emergence and machresis. While Broad's 1925 account in *The Mind and Its Place in Nature* lacks an explicit treatment of the causal powers of emergent phenomena, I show that his neglected earlier 1919 paper, "Mechanical Explanation and Its Alternatives," contains a detailed example of how components may behave differently when organised into higher-level systems. This analysis, I argue, anticipates Carl Gillett's recent concept of 'machresis', according to which composed entities constrain the powers of their components. By reconstructing Broad's views in this light, I show how his theories can be understood as a form of "supervenience without reducibility." Moreover, this reconstruction enables a substantive response to standard objections concerning downward causation. I conclude that, taken together, these different elements of Broad's account, far from being historical curiosities, remain a viable and philosophically fruitful framework for analyzing contemporary cases.

Keywords: Emergence; C.D. Broad; Machresis; Downward Causation; Non-reductive Physicalism

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- **Acknowledgements**: I am very grateful to audiences at conferences in Bristol and Rome for comments on earlier drafts of this paper. My sincere thanks also go to David Walsh and two anonymous referees, whose suggestions have greatly improved the discussion.
- **Funding Information**: None to Declare
- **Data Availability Statement:** Not Applicable

- **Conflicts of Interest:** None to Declare

1 Introduction

C.D. Broad has been described as "the most careful and sophisticated"[1] of the so-called British Emergentists; in his work in particular, the central doctrines of that group receive their most nuanced formulation, expressed in a way that is recognisably continuous with contemporary interest in the concept of emergence. But despite this, the account of emergence that Broad gives in Chapter 2 of his (1925) book *The Mind and Its Place in Nature* remains somewhat unsatisfactory, at least insofar as it omits or abbreviates an account of the causal powers of emergent features thus described. Although Broad discusses the question of mental causation more generally in Chapter 3 of the book, he does not explicitly tie it to his emergentism in particular. And yet, as Jaegwon Kim has shown in a series of influential papers (e.g., Kim 1992; 1997; 1999), any would-be emergentist both owes an account of emergent causal powers, and allegedly struggles to provide it. Indeed, this problem of 'downward causation' is the reason that Kim, and others, have rejected emergentism *in general* as a "halfway house" that is "inherently unstable."[2] Furthermore, as McLaughlin argues in his seminal paper "The Rise and Fall of British Emergentism," Broad and his compatriots rely on a set of examples that, after a century of scientific progress, "seem enormously implausible."[3]

It is my contention, however, that Broad does more to meet these challenges than is often recognised. In a neglected 1919 paper entitled "Mechanical Explanation and Its Alternatives," Broad works through the details of an example concerning how chemical behaviour may be different when those chemicals compose a biological (or living) system, and thus *does* attempt to provide something of an account of the causal powers of emergent features. Importantly, this example foreshadows the contemporary

[1] Wilson (2013, p.203)
[2] Kim (1999, p.5)
[3] McLaughlin (1992, p.54)

concept of 'machresis' (or 'machretic determination') that has recently been developed by Carl Gillett (2016; 2017; 2019) with respect to modern scientific examples. So, in addition to Broad's 1925 account of an upward compositional relationship between an emergent and its base, his 1919 paper *also* suggests a kind of 'downward' constraint or determination analogous to the empirical cases of machresis that Gillett discusses.

With these considerations in mind, the following discussion aims to reconstruct the various elements of Broad's views in terms that resonate with the framing of contemporary debates, thereby clarifying both some aspects in which his account differs from those of other British Emergentists and why it continues to merit philosophical attention. I begin with Chapter 2 of *The Mind and Its Place in Nature*, where Broad's conception of emergence can be usefully reformulated—in contemporary terminology—as "supervenience without reducibility." I then turn to his 1919 essay, in which he provides a detailed analysis of an example wherein chemical components may exhibit different behaviours when incorporated into a biological system. This analysis, I suggest, is an early precursor of the kind of "machresis" developed by Gillett and applied to a wide range of contemporary examples.

To be clear, my purpose here is not to defend Broad (or Gillett) as *correct* about any particular case, nor to settle the larger question of whether genuinely emergent phenomena exist; these are contested matters that lie beyond the scope of this paper. Similarly, given that the different aspects of Broad's account appear at distinct times and places in his work, it would be premature to conclude that he intended to provide a 'unified' theory that incorporated both emergence and machresis. Rather, my aim is to show that a closer reading of Broad demonstrates both the possibility of re-assembling and interpreting his view in terms that are continuous with contemporary debates, and the availability of responses within his framework to several of the objections traditionally levelled against it. With due respect to McLaughlin, then, it may be

said that reports of the "fall" of British Emergentism were, at least in Broad's case, somewhat premature.

2 Broad's account of emergence.

Broad's account of emergence is, in contemporary terms, an attempt to formulate a supervenience-based non-reductive physicalism[4], whilst avoiding some of the problems of weaker and stronger—or epistemic and ontological—theories, elements of which may be found in the other British Emergentists. Let us begin by spelling out this part of his view, in typical Broad style, with two initial caveats.

First, Broad—like the other British Emergentists—intended his theory to be a very general one that would cover the relations between physics and chemistry, and between chemistry and biology, in addition to (as the title of his 1925 book suggests) those between the mental and the physical. For this reason, to illustrate his view, Broad draws on a variety of examples that may no longer seem appropriate (given that, as McLaughlin points out, the development of quantum mechanics made possible a *reductive* explanation of chemical bonding, and that the discovery of DNA makes it look like a similar relationship holds between the levels of biology and chemistry). But even if McLaughlin is right, given the contemporary resurgence of interest in scientific emergentism, it may still be viewed as a live question whether emergentism is the correct description of *other* examples, including the mind-body relation or, indeed, the group-individual relation.[5] For the time being, therefore, I will set aside controversies about particular *examples*, focussing only on the *theory* of emergence that Broad constructs.

Second, relatedly, this narrower task seems to be as much as Broad himself (officially) wishes to accomplish in chapter two of *The Mind and Its Place in Nature*. There, he says that his aim is simply to outline the theory of emergence in relation

[4] Or, 'supervenience without superdupervenience' as one might put it, following Horgan (1993) and Wilson (1999; 2002)

[5] On the latter see, e.g., Elder-Vass (2010) or Walmsley (2015).

to its alternatives, without necessarily arguing for its truth in any particular domain or set of inter-level relationships, writing (p.53):

> "I do not expect to be able to give a conclusive answer …But I hope at least to state the possible alternatives clearly, so that people with an adequate knowledge of the relevant empirical facts may know exactly what we want them to discuss, and may not beat the air in the regrettable way in which they too often have done."

Indeed, later (p.59) he says:

> "I cannot give a conclusive example of [the Theory of Emergence], since it is a matter of controversy whether it actually applies to anything. But there is no doubt, as I hope to show, that it is a logically possible view with a good deal in its favour."

Broad *does* argue for the truth of emergentism with respect to the mind-body relationship in the final chapter of *The Mind and Its Place in Nature*. In that later discussion, Broad meticulously outlines and classifies what he takes to be the seventeen possible metaphysical theories about the relationship between the mental and the physical, eliminating all but a handful. And whilst he does grant that some form of Russellian neutral monism could be developed into a successful position, he ultimately arrives at emergentism as his preferred account, writing (p.647):

> "If there were no facts to be considered except the normal ones, and we rejected all the alleged abnormal facts dealt with by Psychical Research, I should regard Emergent Materialism as on the whole the most reasonable view to take of the status and relations of matter and mind in Nature."

The fact that this is expressed as a conditional perhaps glosses over a lot that *could* be said about Broad's mature view of the nature of the mind in general (and of mental causation in particular). Of course, Broad is famous (some might say *in*famous) for his lifelong interest in—and sympathy with—the field of 'psychical research' and the paranormal, and so a more detailed unpacking of the antecedent in the above quotation would likely reveal a slightly different understanding than that which he

presents in chapter two of *The Mind and Its Place in Nature*. But that remains a topic for another paper; it is enough to say, for the present discussion, that Broad does in fact favour an emergentist view, even if the above qualifications mean that he is only officially presenting it as a coherent position.

Broad's abstract summary of his emergentist view, expressed in terms of relationships between hierarchically-ordered compositional levels, focuses on the impossibility of deducing higher-level features. He writes (1925, p.61):

> "Put in abstract terms the emergent theory asserts that there are certain wholes composed (say) of constituents A, B, and C in a relation R to each other; that all wholes composed of constituents of the same kind as A, B, and C in relations of the same kind as R have certain characteristic properties; that A, B, and C are capable of occurring in other kinds of complex where the relation is not of the same kind as R; and that the characteristic properties of the whole R(A,B,C) cannot, *even in theory*, be deduced from the most complete knowledge of the properties of A, B, and C in isolation or in other wholes which are not of the form R(A, B, C)." (My emphasis)

He goes on to point out that the 'mechanistic' (i.e., reductionist) theory rejects the last clause of this summary.

Expanding on this, there are three main aspects to Broad's theory of emergence. The first is an attempt to characterise physicalism with a supervenience thesis, which itself consists of the conjunction of what we might think of as a 'no zombies' clause, and a 'no ghosts' clause. The former amounts to the claim that the same arrangement of the lower level components *necessarily* gives rise to the same higher level features of the composed whole; there is a kind of upward determination (p.64):

> "No doubt the properties of silver chloride are completely determined by those of silver and chlorine; in the sense that whenever you have a whole composed of these two elements in certain proportions and relations you have something with the characteristic properties of silver-chloride …"

Relatedly, the second part of the supervenience thesis amounts to the claim that changes in the higher level feature cannot come about without corresponding changes in the lower level; the higher level *depends* on the lower level (p.54):

> "Certain characteristically different ways of behaving may be regarded as absolutely unanalysable facts which do not depend *in any way* on differences of structure or components. This would be an absurd view to take about vital behaviour, for we know that all living bodies have a complex structure even on the macroscopic scale, and that their characteristic behaviour depends in part at least on their structure and components."

The last clause of this quotation includes a curious hedge in the form of the expression "in part at least," perhaps suggesting that vital behvaiour does not *fully* depend on structure and components. But the formulation is later strengthened (on p.67, more on which below) when Broad writes that "the characteristic behaviour of a living body is *completely* determined by the nature and arrangement of the chemical compounds which compose it" (my emphasis). Nonetheless, the conjunction of these two claims—emergent features are dependent on and determined by their bases—foreshadows the oft-cited early characterisation of mind-body supervenience from Davidson (1980, p.214), according to which "there cannot be two events alike in all physical respects but differing in some mental respects, or that an object cannot alter in some mental respect without altering in some physical respect." So here, Broad is attempting to develop what we might call, in contemporary parlance, a supervenience-based formulation of physicalism (see, e.g., Wilson 2005).

Next, by way of establishing the non-reductive part of his theory, Broad follows the other British Emergentists by emphasising the disconnect between higher and lower levels in terms of deducibility or predictability. On p.59, he says that on the emergentist theory:

> "[T]he characteristic behaviour of the whole *could* not, *even in theory*, be deduced from the most complete knowledge of the behaviour of its components, taken separately or in other combinations, and of their proportions and arrangements in this whole." (My emphasis)

And thus (p.67–8):

> "…no amount of knowledge about how the constituents of a living body behave in isolation or in other and non-living wholes might suffice to enable us to predict the characteristic behaviour of a living organism. This possibility is perfectly compatible with the view that the characteristic behaviour of a living body is completely determined by the nature and arrangement of the chemical compounds which compose it, in the sense that any whole which is composed of such compounds in such an arrangement will show vital behaviour…"

It is worth juxtaposing Broad's view here with epistemic aspects of the views advanced by two of the other British Emergentists: John Stuart Mill in his (1843) *A System of Logic* and George Henry Lewes in the second volume of his *Problems of Life and Mind* series, entitled *The Foundations of a Creed* (1875). In some places, whilst Mill and Lewes also emphasise that emergent features cannot be deduced or predicted on the basis of knowledge of the lower levels on which they depend, they also seem to suggest that this difficulty may only be *temporary*; in the case of chemistry, Mill (1843, p.267) restricts the claim to the "present state of our knowledge" and, concerning the relation between water and its constituent hydrogen and oxygen atoms, Lewes (1875, p.414), suggests that "Some day, perhaps, we shall be able to express the unseen process in a mathematical formula; till then we must regard the water as emergent."[6]

This is not to say, however, that Mill and Lewes advocate a 'weak' or merely epistemic theory of emergence overall. One could, for example, read the quotations in the previous paragraph not as providing a definition of emergence, but simply as

[6] On the same page, but regarding other chemical examples, Lewes also later writes "Who, before experiment, could discern nitric acid in nitrogen and oxygen? Who could foresee that gold would be changed into chloride if plunged into a mixture of two liquids (hydrochloric and nitric acid), in either of which separately it would remain unchanged? Yet it is no extravagant hope that the day will arrive when we shall not only know the separate operations of the agents, but their mutual modification in the product which emerges from their union."

admissions of our fallibility with respect to which properties *really are* emergent; we might regard them as emergent as a working hypothesis, but *reject* that label in the future, when the "present state of our knowledge" has developed enough to allow a deduction. An ontological emergentist suitably attuned to the process of scientific hypothesis revision could take such a view. Indeed, in a later passage from *A System of Logic*[7], quoted by Stephan (1999, p.90), Mill's claim is stronger when it comes to the experience of *colour*:

> "For example; since there is a phenomenon *sui generis*, called color, which our consciousness testifies to be not a particular degree of some other phenomenon, as heat or odor or motion, but intrinsically unlike all others, it follows that there are ultimate laws of color; that though the facts of color may admit of explanation, they never can be explained from laws of heat or odor alone, or of motion alone, but that however far the explanation may be carried, there will always remain in it a law of color. I do not mean that it might not possibly be shown that some other phenomenon, some chemical or mechanical action for example, invariably precedes, and is the cause of, every phenomenon of color. But though this, if proved, would be an important extension of our knowledge of nature, it would not explain how or why a motion, or a chemical action, can produce a sensation of color; and, however diligent might be our scrutiny of the phenomena, whatever number of hidden links we might detect in the chain of causation terminating in the color, the last link would still be a law of color, not a law of motion, nor of any other phenomenon whatever."

This suggests that Mill thinks that in fact *some* higher-level laws are 'ultimate'; as we shall see below (and as Stephan 1999, p.90 argues) Broad advances a similar argument with respect to phenomenal qualities.

In any case, it would be fair to say that Broad is much clearer and more precise about the modal force of the non-deducibility relationship; as I emphasized in the quotations above, he is at pains to point out repeatedly that this inability is an *in principle* one that cannot be accomplished "even in theory." He spells this out with

[7] Mill (1843), Book 3, Chapter XIV, §2 (p.346)

reference to a hypothetical 'mathematical archangel' or Laplacian supercalculator (equipped with calculating powers exceeding those even of Sir Ernest Rutherford![8]) for whom such a deduction would still be impossible.

For this reason—and this is the third component of Broad's theory of emergence—any statement of the correlation (or supervenience relationship) between higher and lower levels must itself be a 'brute fact,' like those described by Samuel Alexander (1920).[9] Broad describes these statements as 'trans-ordinal laws,' explaining that (p.77-8):

> "A trans-ordinal law would be one which connects the properties of aggregates of adjacent orders …A trans-ordinal law would be a statement of the irreducible fact that an aggregate composed of aggregates of the next lower order in such and such proportions and arrangements has such and such characteristic and non-deducible properties."

By way of elucidation, Broad returns to the example of Silver Chloride mentioned above (p.64–5):

> "But the law connecting the properties of silver-chloride with those of silver and chlorine and with the structure of the compound is, so far as we know, an *unique* and *ultimate* law …a law which could have been discovered *only* by studying samples of silver-chloride, and which can be extended inductively *only* to other samples of the same substance."

Note, however, that Broad does not think that this view about 'brute facts' thereby commits him to a kind of mysterianism about mental states and the physical states on which they supervene. He explicitly points out that such brute fact trans-ordinal laws can be used for the scientific purposes of prediction and explanation, once they have been discovered; their only peculiarity is that they must actually be *discovered*, rather than deduced on the basis of the lower-level intra-ordinal regularities (p.79):

[8] Rutherford was, by then, Director of the Cavendish Laboratory in Cambridge, and so highly revered that Broad could not resist characteristically poking some good-natured fun at him.

[9] Broad acknowledge Alexander here, writing (p.55) that the correlation between an emergent feature and the lower level on which it depends "…must simply be swallowed whole with that philosophic jam which Professor Alexander calls 'natural piety.' …[I]t is perfectly possible …that there are certain ultimate differences in the material world which must just be accepted as brute facts."

> "There is nothing, so far as I can see, mysterious or unscientific about a trans-ordinal law or about the notion of ultimate characteristics of a given order. A trans-ordinal law is as good a law as any other; and, once it has been discovered, it can be used like any other to suggest experiments, to make predictions, and to give us practical control over external objects. The only peculiarity of it is that we must wait till we meet with an actual instance of an object of the higher order before we can discover such a law; and that we cannot possibly deduce it beforehand from any combination of laws which we have discovered by observing aggregates of a lower order."

Staying with the case of chemistry—and its relation to perceptual qualia—Broad then illustrates the emergentist theory with what Stephan (1999, p.186-7) and Gustavsson (2017) have pointed out is an early version of Frank Jackson's (1982) 'knowledge argument.'[10] Take a standard textbook-style chemistry description of, for example, ammonia, such as the following (p.71-2):

> "Nitrogen and Hydrogen combine when an electric discharge is passed through a mixture of the two. The resulting compound contains three atoms of Hydrogen to one of Nitrogen; it is a gas readily soluble in water, and possessed of a pungent and characteristic smell."

Broad claims that the Laplacian supercalculator or mathematical archangel, armed with a complete and exhaustive knowledge of the lower level facts and laws,

> "…could deduce from his knowledge of the microscopic structure of atoms all these facts but the last. He would know exactly what the microscopic structure of ammonia must be; but he would be totally unable to predict that a substance with this structure must smell as ammonia does when it gets into the human nose. The utmost that he could predict on this subject would be that certain changes would take place in the mucous membrane, the olfactory nerves and so on. But he could not possibly know that these changes would be accompanied by the appearance of a smell in general or of the peculiar smell of ammonia in particular, unless someone told him or he had smelled it for himself. If the existence of the so-called 'secondary qualities,' or the fact of their appearance, depends on the

[10] Indeed, in a recent interview, Jackson himself has acknowledged this history: see Garvey (2020)

> microscopic movements and arrangements of material particles which do not have these qualities themselves, then the laws of this dependence are certainly of the emergent type."

Broad's theory of emergence, then, is an attempt to formulate a supervenience-based non-reductive physicalism, with the added point that statements of this relationship in the form of trans-ordinal laws are fundamental, or 'brute fact,' features of reality for which there is no further explanation. On the epistemic dimension, Broad's view is modally quite strong: the non-deducibility of descriptions of emergent features is an *in principle* one, which could not be overcome simply by acquiring a more detailed knowledge of the entities and laws at the lower level. But Broad's view is also a 'metaphysical' one; it does not just make a claim about our epistemic capacities, but actually amounts to a theory about the world itself and the laws that govern it. On p.77, Broad writes:

> "On the emergent theory we have to reconcile ourselves to much less unity in the external world and a much less intimate connexion between the various sciences. At best the external world and the various sciences that deal with it will form a kind of hierarchy. We might, if we liked, keep the view that there is only one fundamental kind of stuff. But we should have to recognise aggregates of various orders. And there would be two fundamentally different types of law, which might be called 'intra-ordinal' and 'trans-ordinal' respectively."

Despite this metaphysical component, it would be a stretch (as well as an anachronism) to regard Broad's account as what we would now call 'ontological emergence.' In chapter two of *The Mind and Its Place in Nature*, Broad does not *explicitly* make a claim about the novel downward *causal* powers of emergent features, and in this respect, his view is different from other British Emergentists, such as Alexander (1920) and Morgan (1923), who *do*. McLaughlin (1992) argues that Broad is *committed* to downward 'configurational forces' but as we shall see in the next section, this need not be construed as problematic.

This leaves us with an interesting interim conclusion. When classified along contemporary dimensions, Broad's view is certainly strong, but not obviously ontological in the sense of asserting an explicit claim about downward causation, and it has an epistemic component, but not of the weak (contingent or temporary) kind.[11]

Moving on, however, we can better make sense of Broad's theory of emergence by including other aspects of his work, and by comparing it to some contemporary treatments. Carl Gillett's (2016) recent discussion, for example, explicitly teases apart ontological emergence and strong emergence in a way that I think applies to Broad's view. Importantly, the concept of "machresis" or "machretic determination" that Gillett develops not only characterises an example that Broad outlines in a neglected paper from 1919, but also provides sufficient resources to respond to the classic objections to emergentism hinted at above.

3 Broad and Gillett on Machresis

In a well-known and influential series of papers, Kim (1992; 1997; 1999) has argued that the would-be emergentist faces a number of challenges when it comes to the question of what emergent features actually *do*. First, Kim has argued that according to what he calls "Alexander's Dictum," to be is to have causal powers, and therefore that realism about emergent features requires that they do *something*.[12] This immediately rules out any kind of emergentist epiphenomenalism. Second, Kim has argued, if emergent features *do* have downward causal powers, then the causal closure of the physical is violated; genuine emergent downward causation means that one cannot even be a physicalist about *the physical*, and so emergentism must *a fortiori* fail in its attempt to formulate a non-reductive physicalism. And finally, if one tries to avoid

[11] For a longer defence of this claim, see Walmsley (2019).

[12] Kim (1992, p.214). Kim names the principle thus because it can be found—appropriately enough—in another work of the British Emergentist tradition: Alexander's (1920) *Space, Time, and Deity*. The principle does not originate with Alexander, though: it stems from the 'Eleatic principle' of Plato's *Sophist*. When questioned by Theaetetus, the Eleatic Stranger replies that the mark of real existence consists of the possession of causal powers; see *Sophist* 247d-e

this dilemma by supposing that emergents somehow inherit their causal powers from the lower level features on which they supervene (Kim calls this the 'causal inheritance principle') then the position collapses into a form of reductionism. All three horns of the resulting trilemma—epiphenomenalism, non-physicalism, and reductionism—are positions that the emergentist is trying to *avoid*.

I think that, in Broad's 1919 paper (and more recently in Gillett's work) there is a way around this set of problems. Both Broad and Gillett develop similar conceptual resources to show that emergent features can *make a difference* by determining or constraining the lower level features on which they depend (or from which they are composed) without either collapsing into reductionism or abandoning physicalism. Gillett coins the expression 'machretic determination' or 'machresis' to characterise this relationship. So, in what follows, I'll outline Broad's 1919 example, before sketching the similarities to Gillett's concept and arguing that this warrants a reconsideration of the ongoing viability of Broad's overall account (even if he did not present it as a single, unified, one).

First of all, in his (1918) paper "Body and Mind", Broad shares Alexander's distaste for any theory that denies causal powers to emergent features, writing (p.258) that "The most foolish of all theories as to the relation of body to minds seems to be epiphenomenalism; next to it is parallelism…" Then, in his 1919 paper "Mechanical Explanation and Its Alternatives" Broad outlines an example whereby *lower* level features exhibit novel properites and behaviours only when they are structured so as to compose a higher level entity. In a lengthy passage that foreshadows the formalism of the discussion in *The Mind and Its Place in Nature*, Broad (1919, p.113–4) writes:

> "Let A, B, C be compounds in the chemical sense, i.e., first order groups. Let X be a second order group consisting of A, B, and C in certain definite proportions and positions, and with a definite structure in space. Let the atoms in A be $\alpha_1 \ldots \alpha_p$, those in B be $\beta_1 \ldots \beta_q$ those in C be $\gamma_1 \ldots \gamma_r$. Let us call the structures of A, B, and C, σ_{A}, σ_{B}, and σ_{C}, respectively, and the state of their surroundings $\mathrm{S_A}$, $\mathrm{S_B}$, and $\mathrm{S_C}$, respectively. Then

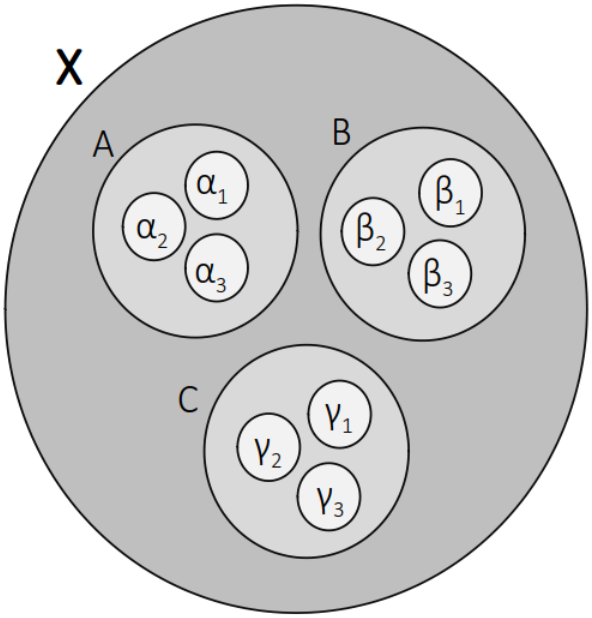
presumably the chemical behaviour of A is $f_{\mathrm{A}}(\alpha_1 \ldots \alpha_p, \sigma_{\mathrm{A}}, \mathrm{S_A})$ that of B is $f_{\mathrm{B}}(\beta_1 \ldots \beta_q, \sigma_{\mathrm{B}}, \mathrm{S_B})$, and that of C is $f_{\mathrm{C}}(\gamma_1 \ldots \gamma_r, \sigma_{\mathrm{C}}, \mathrm{S_C})$. What we know from ordinary chemistry is that over a very wide range of variation a change in the variables $\mathrm{S_A}$, $\mathrm{S_B}$, and $\mathrm{S_C}$ is irrelevant. Naturally, we never know that all possible changes in them will be irrelevant. Now take the behaviour of the second order complex X. In the first place, we can write this as $f_{\mathrm{X}}(\mathrm{A}, \mathrm{B}, \mathrm{C}, \sigma_{\mathrm{X}}, \mathrm{S_X})$. Here, σ_{X} refers to the structure of the second order complex in terms of the first order complexes taken as elements, and by $\mathrm{S_X}$ to the surroundings of the complex X taken as a whole."

So far so good: we have a stuctured whole (or composite entity)—such as a living biological system—whose components are themselves chemical composites of atoms. And at each level of compositionality, the behaviour of the entity in question is determined in part by its structure and in part by its surroundings. Now, how does the behaviour of the *components* change in the situation where they form part of a structured whole? Broad continues …

"Now let us consider, e.g., the behaviour of A in this complex. B and C, with their structures and components, σ_{X}, the structure of the complex, and $\mathrm{S_X}$ the surroundings of the complex, will now all be lumped together as $\mathrm{S_A}$, the surroundings of A in the function $f_{\mathrm{A}}(\alpha_1 \ldots \alpha_p, \sigma_{\mathrm{A}}, \mathrm{S_A})$ which expresses A's chemical behaviour. Now all that we know from chemistry is that the value of the latter function is unaltered or alters in certain known ways over a wide range of variation of $\mathrm{S_A}$; we do not know that it will remain unaltered or will alter in any of these ways if $\mathrm{S_A}$ be varied beyond these limits. Now in some second order complexes, such as living organisms, $\mathrm{S_A}$ will be very different from any of the surroundings which have been tried in ordinary chemistry, and it will not, therefore, be surprising if A should exhibit *new and unexpected* properties. The same remarks of course apply to B and C." (My emphasis)

Given the complex presentation that Broad provides, it may be helpful to clarify the technicalities with the diagram in Figure 1:

Fig. 1 Diagram of Broad's (1919) formalism:



In sum, we have a situation where:

- A is composed of components $\alpha_1 \ldots \alpha_p$, with structure σ_{A}, surroundings $\mathrm{S_A}$, and consequent behaviour $f_{\mathrm{A}}(\alpha_1 \ldots \alpha_p, \sigma_{\mathrm{A}}, \mathrm{S_A})$,
- B is composed of components $\beta_1 \ldots \beta_q$, with structure σ_{B}, surroundings $\mathrm{S_B}$, and consequent behaviour $f_{\mathrm{B}}(\beta_1 \ldots \beta_q, \sigma_{\mathrm{B}}, \mathrm{S_B})$,
- C is composed of components $\gamma_1 \ldots \gamma_r$, with structure σ_{C}, surroundings $\mathrm{S_C}$, and consequent behaviour $f_{\mathrm{C}}(\gamma_1 \ldots \gamma_r, \sigma_{\mathrm{C}}, \mathrm{S_C})$, and as a result,
- X (a second order, composed, group) is composed of components A,B,C, with structure σ_{X}, surroundings $\mathrm{S_X}$, and consequent behaviour f_{X}(A,B,C, σ_{X}, $\mathrm{S_X}$)

But importantly, in this scenario, when A is a composing part of the complex X, $\mathrm{S_A}$ *includes* B and C, as well as σ_{X} and $\mathrm{S_X}$. So, let's retiterate, it would be "unsurprising" if A were to exhibit *new and unexpected* properties: f_{A} is different

when A is part of X, compared to when A is taken separately. In other words, A may behave differently when (and only when) it is a composing part of the whole X along with B and C; *parts may behave differently in wholes*, and this is entirely consistent with Broad's account of emergence in *The Mind and Its Place in Nature*. Broad concludes the passage by saying:

> "We should doubtless express this fact, if it proved to be a fact, verbally by saying that A, B and C had latent chemical properties which were always present, but only appeared in certain special surroundings. There is no objection to this mode of expression so long as we remember that it is purely verbal, and that it does not alter the fact that some part of the behaviour of the second order complex could be neither deduced nor suspected from a knowledge of the behaviour of its parts and other surroundings."

Note the way in which Broad concludes this passage with a precursor to the account of emergence he provides, some six years later, in *The Mind and Its Place in Nature*. Here, Broad is simultaneously avoiding embroiling himself in a metaphysical controversy over alleged latent or potential properties (since he describes it as merely a verbal convention) and also noting that the attribution of such properties could not be used in a way that would violate the non-deducibility clause of his later emergentism.

I describe Broad's account in this way—concerning how components behave differently when, and only when, they are parts of composite wholes—in order to note the striking way in which this example foreshadows the recent discussion provided by Carl Gillett (2016; 2017; 2019). Gillett coins the term *machresis* (or the expression *machretic determination*) to designate the "non-productive determinative relation between composed and component entities such that composed entities determine some of the powers of their components through role-shaping or role-constraining."[13] This seems to be a fitting description of the hypothetical example that Broad describes above, wherein the behaviours of chemical components are constrained or determined in virtue of their being part of that composed biological entity. There is much to be

[13] Gillett (2016, p.359)

said for the concept of machresis, but for the purposes of the present discussion, let us focus on three points of similarity between Broad's example and Gillett's concept.

First, in virtue of the bi-directional constitutive and determinative relations that are part of this kind of scientific emergentism, Gillett describes the position as a kind of 'mutualism' (in contrast to the 'fundamentalism' of reductionists, for whom the constitutive and determinative relationship is one-way). On the one hand, there is an 'upward' determination or compositional relationship between levels. Just as we saw in Broad (1925), emergent entities are dependent on and determined by the components that compose them; this is the basis of what I have characterised above as Broad's supervenience claim. And on the other hand, just as is suggested in Broad (1919) there is a 'downward' machretic determination whereby the behaviour of the components is constrained in virtue of them being composing parts of an emergent whole.

With respect to Broad's (1919) example above, X (a living biological system, with characteristic 'vital' behaviour) would count as the emergent whole if its properties and behaviours were in-principle undeducible from the properties of its constituting components, chemical elements A, B, and C (each of which is *also* constitutively composed of atomic elements $\alpha_1 \ldots \alpha_p$, etc.). This is the 'upward' compositional relationship between successive levels, and would obtain in cases of emergence where the higher level supervenes on the lower level, as outlined in the previous section. But in virtue of being a composing part of X, A's behaviour is determined or constrained in potentially "new and unexpected" ways (likewise, *mutatis mutandis*, for B and C); this is the 'downward' machretic determination that Gillett describes—X determines some of the powers of its components through role-shaping or role constraining. In sum, chemical elements may behave differently when they are composing parts of emergent biological wholes.[14]

[14]Note: given that this example from Broad's (1919) paper is really only supposed to demonstrate the downward determiniative constraint that is characteristic of Gillett's concept of emergence, it's not essential here that X actually counts as an *emergent* feature. Nonetheless, since I stated above that the example *is* consistent with Broad's account of emergence in his (1925) book, I have included that possibility here in this elucidation.

Second, Gillett (2016) demonstrates that this mutualist relationship is applicable—and indeed *used*—across a range of different sciences at different levels. He gives examples of machresis that can be found in the sciences that describe the flocking behaviour of birds, the relation between individual neurons and neuronal populations, and symmetry breaking in physics.

Taking the first of these cases by way of example, we can map this on to Broad's (1919) analysis. Gillett (2016, p.202) quotes a description of flocking behaviour in birds and other vertebrates from Couzin and Krause (2003, p.2), who write:

> "[I]t is usually not possible to predict how the interactions among a large number of components within a system result in population-level properties. Such systems often exhibit a recursive, nonlinear relationship between the individual behavior and collective ('higher order') properties generated by these interactions; the individual interactions create a larger scale structure, which influences the behavior of individuals, which changes the higher order structure, and so on."

In Broad's terminology here, X (the emergent whole) would be a flock of starlings which exhibits novel and in-principle unpredictable population-level properties such as the intricate flight patterns characteristic of a 'murmuration'. A, B, and C (etc.) would be the individual birds that constitutively (and exhaustively) compose the flock. And the composed entity, the flock, machretically constrains the behaviour of the individual birds; birds behave differently when they are parts of flocks.[15]

As mentioned above, Broad intended his discussion of emergence in *The Mind and Its Place in Nature* to be a very general one that is applicable to many of the inter-level relationships that obtain between the phenomena studied by the various sciences. But one of the reasons McLaughlin (1992) gives for the 'fall' of British Emergentism

[15] It should be noted that, when it comes flocking in *artificial life*—concerning, e.g., Reynolds's (1987) famous computer-simulated 'boids'—such emergentist claims as have been made are disputed; Stephan (2006) has argued that such behaviour is reductively explainable. It is unclear whether Stephan's analysis extends to more complex cases of real-world *natural* flocks.

is precisely that a range of scientific developments—such as the quantum mechanical revolution or advances in biochemistry—undermine the kind of example-driven arguments provided by the British Emergentists. McLaughlin (1992, p.90) writes that,

> "...for a while, the winds of evidence were in [The British Emergentists'] sails; but the winds gradually diminished, and eventually ceased altogether to blow their way. Without these winds in its sails, the British Emergentist movement has come to an almost complete halt."

At the very least—given the diverse contemporary examples that Gillett cites—we might reply that the winds of evidence are starting to pick up again, and the descendants of British Emergentism now also have better sails for catching that breeze.

Finally, as Gillett (2016, ch.7) demonstrates, the kind of 'downward' machretic determination posited here (and endorsed by scientific emergentists) avoids the notorious problems of downward causation, mentioned above. First, the potential collapse into epiphenomenalism is avoided, because lower level entities behave differently when, and only when, they are part of such emergent complexes. Emergent features that machretically constrain their constitutive lower level features really *do* something novel; they are, as it were, a difference that makes a difference. In Broad's terms, emergent entities such as living biological systems and their properties constrain the behaviour of the chemical elements that compose them: A, B, and C manifest their powers differently when they are part of X.

Additionally, Gillett (2017, p.258) points out that machresis is not a kind of *direct* downward causation; instead, *causal* relationships (in the strict sense) obtain only at the lower level between (machretically determined) components and their effects. Indeed, Gillett (2019) explicitly describes machresis as a 'foundational determinative relationship' that is an *alternative* to downward causation for scientific emergentists, and most recently, (2025, p.67) reminds us that "this downward synchronic determinative relation is also not causal ..." framing the relationship instead as a case whereby

"such machretic relations [...] work through what are labeled the 'constraints' of the relevant whole upon its parts."

Given that emergent features give rise at most to a kind of 'mediated' downward relationship by constraining the causal roles of their component entities, Gillett (2017, p.259–60) concludes:

> "As well as machresis providing a coherent picture for [strong] emergence that accommodates its key features, we therefore also have good reasons to believe that machresis makes sense of the only kind of downward causation that plausibly exists in science and nature."

So machresis is sufficient to avoid epiphenomenalism, without violating the causal closure of the physical, and since there is no need for the scientific emergentist to posit a causal inheritance principle (quite the opposite, in fact), the risk of collapsing into reductionism is avoided. Thus Kim's classic objections to emergentism can be met head-on.

One potential objection here concerns whether it is correct to say that Broad really does deny "full on" downward causation of a kind that would succumb to Kim's objections. Of course, neither Broad nor any of the British Emergentists actually use the *expression* "downward causation," and neither do they draw the subtle metaphysical distinction between causation and determination that Gillett's account of machresis makes use of. But can we sustain the claim that Broad (like Gillett) intends his characterisation of the 'downward' relationship between emergent wholes and their parts as one of determination rather than causation?

Such an objection is all the more pressing since there are at least two instances in the (1919) paper where Broad uses the word 'cause' in a way that seems to resemble the kind of relationship to which Kim objects. On p.121, Broad writes that "volitions in minds can be part causes of movements in matter" and then later says "I see no reason to doubt that volitions may be part causes" of changes in a living body. I think that such a worry can be addressed in three, related ways.

First, the 'downward' determinative relationship exhibited in the example drawn from Broad's (1919) paper appears to be a *synchronic* one, and not the sort of diachronic one that would be required for robust *causation*. It is worth noting that Broad's description of the differences at the lower level, when the lower level components compose an emergent whole, is expressed in the *properties* and *powers* of the lower level components, which Broad permits may be called "latent." It is not so much that X directly *causes* (or, as Gillett might say, 'produces') differences in A, B, and C's behaviour; rather, the proper causes of A, B, and C's behaviour are their own (lower-level) properties, which are only manifest when they constitutively compose X.

Second, Broad's view on causation in general, and on mental causation in particular, is decidedly Humean (and, therefore, somewhat sceptical of whether a metaphysics of robust causal necessitation can be justified by the psychological and empirical evidence we have available to us). In his posthumously-published (2023) "Notes on Causation" Broad stresses the way in which our interpretation of causal relations between events ultimately derives from our own experience of agency in the world. Further, as I mentioned earlier, Broad *does* include a discussion of *volition*—what we would now call 'mental causation'—in Chapter 3 of *The Mind and Its Place in Nature*, though not specifically in the context of his theory of emergence. Here, Broad discusses the traditional mind-body problem, and specifically the common sense view that (p.96) "…on the face of it, my mind acts on my body whenever a desire to move my arm arises in the former and is followed by this movement in the latter." He says (p.102):

> "[i]t is natural enough that we should think that we know immediately that our volition is the *sufficient* condition of the movement of our limbs. If we think so, we are certainly wrong; and Mr Hume's arguments prove that we are. […] It does not follow that we are wrong in thinking that we know, without having to wait for the result, that the volition is a *necessary* condition of the movement."

This is perhaps why, in the (1919) paper where Broad mentions volitions as causes of movements in matter, he repeatedly emphasises that they are *part* causes; they may count as such because they precede the behavioural effects, but only insofar as they supervene on (and machretically constrain) an earlier set of (lower level) brain states whose properties and powers do the *real* causal work.

Finally, I should note that the argument of the present paper does not strictly require that Broad presents a single, unified account of the *conjunction* of emergence and machresis. My aim has been to show that Broad's (1919) paper contains an early example of machresis that is *consistent* with his (1925) discussion of emergence, and that taken together (and by comparison with Gillett), this conjunction remains viable and potentially fruitful for contemporary debate. It is perhaps *surprising* (or even disappointing) that this element of Broad's 1919 discussion did not find its way into his more mature formulation of emergence in 1925, but the elements of such an account can nonetheless be interpretively pieced together from Broad's *oeuvre* as a whole.

In short, Gillett's concept of machresis is a good characterisation of the example found in Broad's 1919 paper, and if conjoined with the theory of emergence found in *The Mind and Its Place in Nature*, it could also help Broad's account to avoid some of the objections that have been levelled against it. In addition, this also gives us ground to mark Broad's view out as somewhat different from those of other British Emergentists. It is not of the 'weak' (or merely epistemic) variety, but neither is it of the 'ontological' variety—like that of Alexander and Morgan—which posits the kind of direct 'downward causation' that Kim identifies as problematic. It is better, and justifiable, to understand Broad as putting forward—in different places—a combination of what we might now call supervenience *and machresis* without reduction. In a slogan: "Parts (sometimes) behave differently in wholes, and *this* is why wholes are (sometimes) more than the sum of their parts."

4 Concluding remarks

Reports of British Emergentism's demise typically rest on two alleged difficulties: first, objections concerning the plausibility of 'downward causation,' and second, the purported explanatory successes of scientific reduction in domains that the British Emergentists themselves regarded as central. Although McLaughlin's 1992 paper was entitled "The Rise and Fall of British Emergentism," the preceding considerations suggest that a conjunction of Broad's ideas, at least, are not only viable but also strikingly prescient. His account can be reconstructed in ways that align closely with central strands of the contemporary debates on both emergence *and* machresis; moreover, such a reconstruction reveals that Broad can be read as offering a substantive response to the standard objections surrounding 'downward causation.'

Indeed, Broad's theory does seem applicable to some contemporary examples, so by way of conclusion, let me briefly sketch just two. First, Boogerd et al. (2005) apply both Broad's 1925 theory of emergence, and his 1919 machretic account to cellular physiology, and some aspects of biochemistry in general. In brief, some cases of enzyme catalysis in cellular biochemical networks are such that, they argue, "a systemic property is not predictable, even in principle, from the properties of subsystems in isolation." (p.159) In such cases, some biochemical reactions can only occur when catalysed as part of a systemic intracellular network (expressing what Broad described as a 'latent' chemical property); once again, chemicals behave differently when they are part of a living organism.

Second, although Broad himself is sceptical regarding the possibility of group minds and collective intentionality, Walmsley (2015) has nevertheless applied his theory of emergence to questions concerning the relation between individual- and group-judgments in collective decision-making. Paradigmatic cases such as the well-known 'discursive dilemma' (see, e.g., List and Pettit 2006; 2011) illustrate the point:

while a group judgment supervenes on the judgments of its individual members, it cannot be straightforwardly derived from them without appeal to something resembling a Broad-style trans-ordinal law that specifies how individual judgments are aggregated. This is precisely what gives rise to the *dilemma*: depending on whether one aggregates the judgments of individuals at the level of the premises of a case, or at the level of conclusions, distinct collective outcomes can arise. However, once an aggregation principle is stipulated—making it functionally analogous to a brute-fact trans-ordinal law—the dilemma can be resolved into a singular emergent group judgment. However, since individual decision-making is often shaped by the awareness that one's judgments will be incorporated into a collective outcome via a particular aggregation procedure, agents may reason or vote differently as members of a group compared to how they would in isolation. As List and Pettit (2011, p.62) observe, processes of collective deliberation frequently exhibit a form of "'feedback' from the group-level attitudes that are being formed to the individual members involved in forming them." This, once again, resembles a kind of machretic determination of individual preferences: group judgments are not reducible to the sum of their members' judgments, and individuals themselves may act differently when situated as constitutive parts of a collective.

Although these examples have only been sketched briefly here, they nonetheless suggest that, in addition to anticipating certain contemporary theoretical developments, diverse elements of Broad's account merit ongoing attention as a framework for analyzing specific cases. In this light, either McLaughlin's declaration of the 'fall' of British Emergentism appears premature, or else we must acknowledge that certain of its elements have indeed re-emerged.

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