The Rise and Fall of a Myth about British Emergentism

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Abstract — While emergentism enjoys some good fortune in contemporary philosophy, attempts at elucidating the history of this view are rare. Among such attempts, by far the most influential certainly is McLaughlin's landmark paper "The Rise and Fall of British Emergentism" (1992). While McLaughlin's analysis of the recent history of emergentism is insightful and instructive in its own ways, in the present paper we offer reasons to be suspicious of some of its central claims. In particular, we advance evidence that rebuts McLaughlin's contention that British Emergentism did not fall in the 1920–1930s because of philosophical criticism but rather because of an alleged empirical inconsistency with fledgling quantum mechanics.

Keywords — British Emergentism – Emergence – Non-Reductive Materialism – Logical Empiricism – Quantum Mechanics – Complementarity

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1. Introduction: On the history of emergentism

Emergence is nowadays a recurrent topic in many areas of philosophy, be it in metaphysics, philosophy of mind, or philosophy of science. In all of these fields, emergentism acts as an umbrella term referring to a wide range of distinct views with different agendas that nonetheless share a common core commitment to the existence of emergent entities in the world. Emergent entities are taken to be idiosyncratic in the following sense—a sense which each variety of emergentism takes great care to precisely characterize—: emergent entities somehow depend on some set of basal conditions, and yet they also enjoy some sort of autonomy from, or irreducibility to, these very same conditions. As such, one can readily appreciate the attraction of emergentism in any of its numerous guises. While emergent entities are at the same time dependent on and distinct from their basal conditions, emergentism purportedly allows for striking a balance between traditionally antagonistic views such as, for instance, reductive materialism and dualism with respect to the mind/body problem or the unity *versus* the disunity of science in the philosophy of science.

Surprisingly enough, while emergentism enjoys some good fortune, or at least some intense discussions, in contemporary philosophy, attempts at elucidating the history of this view are rare. Apart from some contributions to the history of emergentism in antiquity (Heinaman 1990; Caston 1997), most existing work focuses on the period ranging from approximately 1850 to 1930, when emergentism received its first systematic formulation (Blitz 1990; Stephan 1992; Fagot-Largeault 2002). Of these contributions, by far the most influential certainly is McLaughlin's landmark paper "The Rise and Fall of British Emergentism" (1992), which by now has defined the somewhat definitive, received view of the recent history of emergentism[1]. Apart from some discordant but faint voices (Bedau and Humphreys 2008; Sartenaer 2016), most philosophers discussing emergence typically endorse, and hence uncritically participate in circulating, McLaughlin's historical diagnosis of the bad fortune of British Emergentism (*e.g.,* Goldstein 1999; Crane 2001; Garrett 2013; Onnis 2023). As such, they are slowly turning it into some sort of unquestionable doxa.

This widespread endorsement notwithstanding, we have strong reasons to believe—and we intend to demonstrate in the present paper—that the received view inherited from McLaughlin's work is, for the most part, mistaken. To support this claim, we open this paper by scrutinizing McLaughlin's view on (the fall of) British Emergentism (Section 2). In particular, we extract four claims that we take as constitutive of McLaughlin's construal of this view and identify those we plan to object to. On this basis, we then advance arguments to rebuke McLaughlin's erroneous historical claims (Sections 3 and 4).

[1] As far as metrics are concerned, McLaughlin's paper dominates the field with more than 900 citations on Google Scholar (on July 2, 2024). Insofar as emergentism did enjoy a wide variety of forms in numerous countries during the 19th and 20th centuries, it should also be stressed that McLaughlin's label of "British Emergentism," though a common term of trade nowadays, is quite infelicitous (a fact that McLaughlin himself readily acknowledges). In spite of our belief that this confusing term should be completely discarded, we will stick to it here for the sake of not obscuring our main point.

2. McLaughlin on (early) emergentism

McLaughlin expressed his views on the history of emergentism in a series of papers ranging over almost three decades (McLaughlin 1992; 2003; 2019). Because his take on the topic did not substantially evolve over time, and because it is his initial 1992 paper that was seminal in settling the orthodoxy on the topic up to this day, we chose this influential contribution as our main resource to capture his analysis of the fate of emergentism. In a nutshell, it proceeds along the following lines.

(i) British Emergentism, which began with John Stuart Mill's *System of Logic* in 1843[2], abruptly collapsed in 1925 after Broad's *Mind and Its Place in Nature*, which is to be taken as the most mature work of the movement.
(ii) British Emergentism did not fall for philosophical reasons or criticisms. As things stand, the doctrine was even free of philosophical fallacies.
(iii) British Emergentism actually fell for empirical reasons. In particular, it is the advent of quantum mechanics (and its subsequent developments) that was responsible for the premature demise of this view.

In McLaughlin's own words:

> It is not at all surprising that Broad's *The Mind and Its Place in Nature* was the last truly major work in the British Emergentist tradition. Its publication in 1925 was followed soon after by the advent of the quantum mechanical revolution (1992, p. 57);
>
> Quantum mechanics and the various scientific advances it made possible are arguably what led to British Emergentism's fall (1992, p. 54);

and

> So far as I can tell, British Emergentism does not rest on any "philosophical mistake". It is one of my main contentions that advances in science, not philosophical criticism, led to the fall of British Emergentism. (1992, p. 90)

It is noticeable that these historical claims are to be understood against the backdrop of McLaughlin's following *conceptual* contention:

(iv) British Emergentism, *viz.*, the view according to which there exist higher-level, irreducible configurational forces in nature in addition to the fundamental forces of physics, is false. British Emergentism is not false only at some level—say the chemical—that could be threatened by a putative reduction to the quantum level. It is

[2] Lewes (1875) was the first to coin the term "emergent" to refer to Mill's notion of "heteropathic effect," which is commonly accepted as the first systematic formulation of emergence. However, emergence did not gain significant popularity until the early decades of the 20th century, thanks to the works of authors such as Alexander (1920), Morgan (1923), and Broad (1925).

> false *simpliciter*, at each and every level one could think of, be it biological, mental, or social[3].

Again, in McLaughlin's own words:

> The doctrine of emergent determination due to configurational vital, psychological, or social forces is, I contend, simply false (1992, p. 91);

and

> Chemical properties are not emergent […]. Neither, on the evidence, are vital properties. Any mental properties that admit of functional analysis are likewise nonemergent. (1997, p. 17)

Together, we take claims (i)–(iv) to delineate McLaughlin's view on British Emergentism. Claim (iv) is anhistorical and, as such, will not be contested here (though it could). Although we have reasons to be wary of claim (i), we are ready to grant it in the light of its essentially verbal nature[4]. In what follows, we will argue rather that claims (ii) and (iii) are mistaken.

As a result, it will be our main contention that British Emergentism did actually fall, *pace* McLaughlin, because of severe and relentless philosophical criticisms, and not at all because of any scientific development triggered by the advent of quantum mechanics. On the contrary, we will even show that early quantum mechanics was mostly conceived of as hospitable—rather than antagonistic—to early emergentism.

3. On the alleged philosophical flawlessness of British Emergentism

As we just saw, part of McLaughlin's view encapsulated in claim (ii) that British Emergentism was free of "philosophical mistakes," such that we should not expect the doctrine to have fallen as the result of philosophical criticism. In the present section, we show that, on the contrary, British Emergentism has been massively and severely objected to on purely philosophical grounds and that it is the convergence and crystallization of these critiques into logical empiricism that paved the way for the premature decline of this view. We then turn to arguing

[3] Like Kim (2005), McLaughlin would be ready to consider the case of consciousness/qualia slightly differently, though also with a reductionist penchant (see, *e.g.*, McLaughlin 2003, p. 639; or McLaughlin 2019, p. 31).

[4] The truth of this claim ultimately bears on the exact time at which British Emergentism is supposed to have fallen, as well as on the sense in which Broad's emergentism should be considered "more mature" than, say, Mill or Morgan's emergentisms (which belong to the same movement while being very distinctive views). Though it is of course pointless to settle on an exact date or monograph as the end point of a movement whose decline was a diffuse process, it should be noted that many emergentist works of this early tradition appeared well after Broad (*e.g.*, Wheeler 1928; Whitehead 1929; Morgan 1933; Sellars 1933). Moreover, after the fall of British Emergentism, the doctrine never completely disappeared. It actually remained dormant by reshaping into different forms and under different names, for instance, as a strand of the (pre)philosophy of biology at the time, namely organicism (Nicholson & Gawne 2015).

that downplaying the impact of the early philosophical objections to British Emergentism, as McLaughlin's analysis urges us to do, leads to a misunderstanding about how contemporary varieties of emergentism are in fact developing. As we shall indeed see, it turns out that most forms of contemporary emergentism have been set up precisely in such a way as to circumvent the philosophical pitfalls that once plagued British Emergentism.

3.1. The "philosophical mistakes" of British Emergentism

Discussions concerning emergence did not disappear—far from it—after 1925. Emergence remained, for a long period, a hot topic prompting critical appraisals from the most prominent philosophical authorities of the time (*e.g.*, Russell, Carnap, Sellars[5], Nagel, Hempel, and Feigl). These discussions mostly converged on raising a bundle of recurrent philosophical caveats, whose instrumental role in the premature fall of emergentism has been mostly overlooked. We only discuss here the most vexing of these[6]. We then turn to highlighting the manner in which they constituted together a red line that was almost impossible to cross for the vast majority of philosophers with a sympathy toward logical empiricism.

From the outset, as a self-proclaimed "third way" between reductive materialism and substance dualism, emergentism faced strong internal tension. Emergent entities were indeed supposed to be dependent for their very existence on some basal conditions, and yet, in spite of such a dependence, they were also to be construed as autonomous from these conditions. But how is it possible for some given entity to be at the same time dependent on and autonomous from—or, in alternative phrasings, grounded in and yet distinct from, determined by and yet novel with regard to, supervenient on and yet irreducible to—some given underlying basis? Is there not some inherently unbearable paradox at the very core of emergentism, forcing us to get our heads around some kooky ideas like the one according to which a given (putatively emergent) whole, which is by very definition a set of parts, is also somehow "greater than" its parts?

In the heyday of British Emergentism, the inconsistent, incoherent, or "logically invalid" nature of the very idea of emergence itself—hence of emergentism as a view essentially capitalizing on it—had been immediately emphasized (MacKinnon 1924). Right at the beginning of the history of emergentism, the "appealing paradox" of emergence (Ablowitz 1939) was vigorously denounced as forcing the entire doctrine into an inescapable dilemma: either it gave up on genuine autonomy by guaranteeing a strong form of dependence—hence collapsing back to reductive materialism in disguise (Russell 1926); or it gave up on a minimal dependence of the emergents on their bases while leaving room for the former's genuine autonomy—a step toward

[5] Wilfrid, who is by now more renowned than his emergentist father, Roy Wood.

[6] British Emergentism has indeed been targeted by numerous other philosophical attacks. However, because these mostly came from thinkers who would quickly become even more marginal than the emergentists themselves in the face of the rise of logical empiricism (*e.g.*, the vitalist Driesch (1926) or the animist McDougall (1929)), it is arguable that these attacks did not significantly contribute to the fall of British Emergentism.

full-fledged dualism. Between those two horns and according to early rebuttals of the view, there was simply no safe logical space to be found (Pepper 1926)[7].

Derivative of its (disputed) internal inconsistency, actual cases of emergence were considered as either too easy or, on the contrary, too difficult to come by. British Emergentists' attempts at salvaging emergence from incoherence required them to cook up more or less intricate stories about how some classes of phenomena could in fact be "dependent on and yet distinct from" some basal conditions. A case in point was Broad's own criterion of non-deducibility *a priori*. According to Broad, colliding billiard balls were paradigmatically resultant (that is, non-emergent), for one could in principle readily anticipate their future trajectory by deducing it *a priori* from the laws of motion (together with knowledge of some boundary conditions). By contrast, chemical reactions were to be considered as emergence-conducing. No one should indeed ever be in a position to deduce the exact nature of the products of a reaction from a complete knowledge of the reactants, for the laws of chemistry were supposedly only knowable *a posteriori* (such that, we were told, we cannot anticipate the smell of ammonia until we smell it (Broad 1925, p. 71))[8].

However, such convolutions, among many others of the same stripe, were quickly considered, and rightly so, to miss the mark (Baylis 1929; Stace 1939; Pap 1952). With respect to Broad's criterion, it was indeed pointed out that there is no obvious reason why the laws of motion should be of a different nature to the laws of chemistry. There crucially lacked a story as to why only the former could be known independently of some empirical contact with colliding objects.

A well-known side effect of these early dubious attempts at salvaging emergence is that, depending on the particular attempt, emergents were either dramatically proliferating or, on the contrary, becoming so rare and elusive that they suspiciously appeared as the result of some frivolous metaphysical fantasy. A typical symptom of such an affliction is impossible to miss while browsing the works of early emergentists: either emergentism is staged through toy examples, which, if taken seriously, should lead us to believe that emergence is in fact so easy to come by that emergents are ubiquitous[9]; or actual "genuine" cases of emergence are only to

[7] It is striking to realize the extent to which Pepper's early objection to emergentism anticipated what is nowadays considered as the most serious challenge to the view (at least in its standard varieties), namely, Kim's causal exclusion argument (Kim 2005). And Pepper, just like Kim after him, was very happy to settle for the first horn of the dilemma he pointed to, namely, reductive materialism.

[8] This line of thought was typical of British Emergentism and not only of Broad. See, for instance, Lewes' own contention that no one could ever discern nitric acid in nitrogen and oxygen prior to experiments (1875, p. 370).

[9] Classical examples are the properties of liquid water, which cannot be traced back to those of hydrogen and oxygen (Mill 1843, p. 243; Lewes 1875, p. 369–370), any breach of linearity, as in the case of the hazardous nature of a triple dose of medicine that does not lead to a triple pace of recovery (Bain 1870, p. 39), crystallization (Morgan 1913, p. 27), any liquid or solid states in general (Morgan 1923, p. 65–66), or even the edible nature of sodium chloride, which should be irreducible from the toxic nature of its components (Broad 1925, p. 59). Misleading toy examples of the like did not disappear after the re-emergence of emergentism in the 1960–1970s (see, *e.g.*, Sperry's infamous wheel rolling downhill (Sperry 1969)). Yet, putative cases of emergence are more readily associated nowadays with scientifically respectable enforcers, such as symmetry breaking, scale invariance, or algorithmic incompressibility.

be found in those domains, typically life, mind, or consciousness, where scientific understanding was—and still is, to some extent—sparse.

That emergence is an incoherent concept and that, as a result of attempts at salvaging it from incoherence, one was forced to make emergent entities either ubiquitous or elusive, was already, in and of itself, a serious "philosophical mistake," which did not go unnoticed by the early critics of British Emergentism. Yet, there was still another, related defect that certainly was the worst of all, and which led many thinkers to consider emergentism as outrightly ludicrous (Montague 1929; Russell 1931; Malisoff 1939; Hull 1943): there was never any convincing reason to believe in emergentism in the first place. More importantly, there was never even any prospect of someday coming up with any such reasons. As things stood, in a dogmatic move that was taken as typical of bad metaphysics, British Emergentism proclaimed its own inscrutability. In Alexander and Morgan's own (now infamous) terms:

> The existence of emergent qualities […] is something to be noted, as some would say, under the compulsion of brute empirical fact, or, as I would prefer to say in less harsh terms, to be accepted with the 'natural piety' of the investigator. It admits no explanation (Alexander 1920, p. 46–47);

and

> Consider and bow the head […]. That, in some sense, should be our loyal attitude towards all emergents. (Morgan 1923, p. 4)

From all that has been said, it appears that embracing British Emergentism in the 1920–1930s was an explicit act of piracy against the flourishing body of views that quickly became the most widespread and influential movement in Western philosophy at the time, namely, logical empiricism. Though there was of course plenty of room for disagreement inside the relatively vague boundaries of such a movement[10], many of its most influential proponents were committed to two ideas that were frontally conflicting with the core tenets of emergentism (*e.g.*, Carnap 1938). First, thanks to a scrupulous analysis of its language, philosophy was to strive to become scientific, which involved getting rid of obscurantist professions of faith about the existence and nature of unobservable metaphysical whims. Second, a scrupulous analysis of its language was concomitantly supposed to expose the fundamentally unified structure of science. It is no surprise that, in the face of this, a doctrine such as British Emergentism and its commitment to forms, "relatedness," irreducible forces, laws, and the like, which had the peculiarity of entailing a piecemeal picture of science as made of numerous autonomous domains, was to be seen as deeply wrong or, even worse, *meaningless*. Examining the logical structure of the notion of emergence inevitably amounted to revealing the incongruity of the view (Morris 1926; Malisoff 1939; Henle 1942). Subsequent history was to prove logical empiricists right: in the middle of the 20th century, Western philosophy was mainly about reductionism as a

[10] Here, we follow Übel (2007) in considering that there is no clear doctrinal reason to operate a distinction between logical empiricism and logical positivism (the former being associated with early proponents of the movement such as Carnap or Schlick, and the latter with their successors such as Hempel or Feigl). We then settle for the generic label of "logical empiricism" to designate all the philosophers participating in this wide movement regardless of some (possibly important) divergences.

gateway toward the progressive unification of the sciences (Nagel 1935; 1949; Hempel & Oppenheim 1948; Kemeny and Oppenheim 1956; Oppenheim and Putnam 1958).

Pace McLaughlin and against claim (ii), it now appears that, in the years following its sudden rise in popularity, British Emergentism was under violent *philosophical* attack. Its conceptual quirks were diligently identified and processed in the most influential venues and by the most influential thinkers of that time[11]. And rightly so: British Emergentism was full of philosophical oddities that stood in sharp conflict with the way in which serious philosophy was supposed to be done at that time. Claiming to have some emergentist penchant in the 1930–1960s certainly was a very efficient way to become professionally mocked and marginalized[12]. We contend that it is this very hostile intellectual climate that precipitated the fall of British Emergentism, and not, as we will show shortly, some alleged empirical conflict with early quantum mechanics.

3.2. Learning from one's mistakes

Before turning to this, we support our contention by showing that most contemporary forms of emergentism are developing with an acute awareness of the philosophical pitfalls that once plagued early emergentism (rather than by striving to be, as McLaughlin would have it, quantum-kosher). On this particular matter, it is striking to first point out that what is currently dubbed the "re-emergence of emergence" (after Cunningham (2001)), which is taken to have occurred in the 1960–1970s, historically coincides with the decline of logical empiricism (and not with what could have been, perhaps in another possible world, some belated awareness that quantum mechanics was actually hospitable to emergence all along)[13]. As things stand, with logical empiricism's inhibitory influence on metaphysics gone, and with the concomitant recognition of several serious impediments to the dream of a fully unified science, time was ripe for emergentism to return to the fore.

Of all of the architects of the re-emergence of emergentism, none has been more influential than the metaphysician Jaegwon Kim, whose pioneering works have—somewhat paradoxically to be sure, for he was an ardent reductionist—settled the research agenda for emergentism up to this day. It is certainly in his landmark paper "Making Sense of Emergence" (1999) that Kim produced the most pivotal analysis of emergence, acting as a genuine transmission belt

[11] Emergentism was discussed at the *Sixth International Congress of Philosophy* at Harvard University in 1926 and, in the same year, during a symposium at the *Aristotelian Society*. It was often the topic of critical discussions in leading journals such as *Mind*, *The Journal of Philosophy*, and *Erkenntnis*. In addition, it was severely disregarded by philosophers whose voices counted (*e.g.*, Russell, Carnap, Nagel, and their philosophical allies).

[12] Although we will not address this point here, it is noticeable that, at the time, being an emergentist (or a holist, "wholist," organicist, vitalist, or any other associated metaphysical position) was also politically incorrect in the wake of national socialism (Gilbert & Sarkar 2000).

[13] The death certificate of logical empiricism is traditionally (though of course symbolically) considered to have been delivered by Passmore (1967). As far as the return of emergentism goes, it can be traced back to a constellation of antireductionist moves in numerous scientific fields (*e.g.*, Glansdorff & Prigogine 1971 in physics; Wilson 1975 in biology; Sperry 1969 in neuroscience), together with the rise of non-reductive materialism in the philosophy of mind (Putnam 1967; Davidson 1970; Fodor 1974).

between early emergentism, which he mostly scrutinized through the works of Lloyd Morgan, and today's varieties of the doctrine, which, one way or the other, have to position themselves with respect to Kim's view[14].

In his seminal paper, Kim offers what he takes to be a charitable reconstruction of emergence as it was once upheld by British Emergentists on the basis of concepts that were crafted by proponents on non-reductive materialism in the 1970s, *viz.*, supervenience and downward causation within a layered picture of the world[15]. What matters for us here is that Kim's critical take on emergence recapitulated each and every one of the main philosophical flaws that once plagued British Emergentism, and which we addressed in Section 3.1. Such a recapitulation is essentially encapsulated into Kim's notorious "causal exclusion argument," which was initially devoted to mitigating the conceptual viability of non-reductive materialism (Kim 1989) and was subsequently turned, by association, toward emergentism (Kim 1992). In a nutshell, Kim's argument places emergentism in front of a disastrous dilemma (the sort of which Pepper already identified in 1926): either emergentism collapses to reductive materialism (in which case emergents are ubiquitous but philosophically innocuous) or it verges on ontological dualism (in which case emergents are rare and elusive, prompting obscurantist moves). In no way can emergentism, according to Kim, "have the cake and eat it too" (Kim 2005, p. 22).

Given the influential nature of Kim's challenge to emergentism, it is no surprise that, nowadays, each and every form of emergence is crafted in such a way as to escape causal exclusion or, equivalently, in a way to overcome the pitfalls of early emergentism. In this respect, three main lines of investigation have recently emerged. The first investigates how the first horn of Kim's dilemma could still be hospitable to some metaphysically shallow sort of irreducibility at the expense of the ubiquity of emergence, a case in point being Bedau's "weak emergentism" (1997). By contrast, the second—"strong emergentism," associated with the second horn of the dilemma—is committed to ontological irreducibility together with an understanding of downward causation that is not conducive to full-blooded dualism, as in Gillett's "mutualist emergentism" and his elusive "machretic" (hence non-causal) downward determination (2016). In addition to these two canonical families of approaches to emergence, non-standard alternatives have flourished on the basis of a common repudiation of some of the very framing assumptions of Kim's argument, including the layered picture of the world (Humphreys 2016; Sartenaer 2018).

Regardless of the direction in which current investigations of emergence go, what matters for us here is that *none of them*, while assuming some relevant doctrinal continuity with the early works of British Emergentists, have a scintilla of concern with the empirical adequacy to

[14] With more than 1200 citations on Google Scholar (on July 2, 2024), Kim's 1999 paper is likely the most discussed journal article on emergence that has ever been published up to this day.

[15] Actually supervenience and (functional) irreducibility; however, the latter is supposed to be enforced by downward causation. That British Emergentists actually did understand emergence in such a way has recently been challenged (Sartenaer 2019; Humphreys 2021). In addition, while supervenience has mostly been popularized in the functionalist philosophy of mind of the 1970s, the concept did have some historical antecedents in the moral philosophy of Moore. The same goes for downward causation, which is typically traced back to the works of Campbell (1974), though it was already in use (actually in a more relevant way with respect to emergence) in Ruyer (1939).

quantum mechanics (a fact that McLaughlin could not of course be aware of in 1992 but certainly could have in 2019). On the contrary, it even appears that the main current lines of research on emergence are all developing in such a way as to overcome, through their avoidance of causal exclusion, the *philosophical* flaws of their ancestors.

4. On the alleged quantum refutation of British Emergentism

So much for McLaughlin's claim (ii): British Emergentism did fall (at least partly) for philosophical reasons. But what about claim (iii), according to which it was emergentism's empirical inadequacy with respect to the fledgling quantum theory that precipitated the decline of this view? We now show that this contention is also historically mistaken.

To do this, we proceed in two steps. We first show that the intellectual climate triggered by the advent of quantum mechanics was far from being hostile to emergentism (and other related philosophical doctrines). On the contrary, the discovery of the fundamentally "leapy" behavior of matter was mostly welcome as the possible missing piece of emergentism, thanks to which emergence (and the discontinuities that go with it) was to become at last physically—so scientifically at the time—respectable. We then turn to the views of some of the founding fathers of quantum theory and emphasize the extent to which they can charitably be interpreted as, at the very least, emergentism-friendly.

4.1. When quantum theory fuels emergentism

> The organicist theory in physiology and sociology, the theory of mutation [...], the *quantum theory*, the 'Gestalt theory' [...], all bear witness to this increasing recognition of the fact of emergence. (Wheeler, quoted in Hodder, 1927, p. 38; emphasis is ours)

It is by these very words, uttered at the *Sixth International Congress for Philosophy* at Harvard, that the entomologist W. M. Wheeler expressed his confidence that emergentism was, in 1926, very much adequate for the scientific image of his time[16].

Several years later, J. C. Smuts was invited to give the opening lecture, entitled "The Scientific World-Picture of To-Day," at the *Centenary Meeting of the British Association for the Advancement of Science,* later published in the journal *Science*. In his talk, Smuts diligently undertook to provide an overview of the "situation in science" as of the year 1931. There, he argued that quantum mechanics had put the "older mechanistic conception of nature" on hold and had concomitantly opened the door for a "new monism." According to Smuts:

[16] These words did not ultimately find their place in the written summary of Wheeler's talk published in the *Proceedings of the Sixth International Congress for Philosophy* (Wheeler 1926). However, it appears that he said them orally, as Hodder's 1927 retranscription exactly matches, almost word for word, the one (in French) of Gilson (1926, p. 518).

> [T]he quantum and life seem to have this in common, that they both behave as wholes [...]. A whole is not a sum of parts, or constituted by its parts [...]. The part in the whole is no longer the same as the part in isolation [...]. [T]he electron within an atom is no longer a distinct electron [...]. It would almost seem as if the world in its very essence is holistic. (1931, p. 301)

Given both these symbolic lectures, one could immediately be suspicious of the idea that quantum mechanics was ever an open threat to British Emergentism, which it supposedly refuted, at least as far as claim (iii) goes, around 1925. These quotes have not been cherry-picked. Be it in leading philosophical or scientific journals, emergence and quantum mechanics were frequently positively associated with one another (Lloyd 1927; Jennings 1927; Haldane 1934). Some research fields even capitalized on such a recurrent and positive association. In his influential contribution to the evolutionary synthesis, *Tempo and Mode in Evolution* (1944), the paleontologist G. G. Simpson put forward the notion of "quantum evolution" to refer to his saltationist (though monist) view of the evolutionary process in a way that synthesized Morgan's emergent evolutionism—which actually consisted of the first systematic version of British Emergentism—with the fundamental quantum nature of matter (Goudge 1965).

As far as we know—and we have browsed the relevant literature for a while now—there is not a scintilla of textual evidence that quantum mechanics has ever been considered as a serious thorn in the side of British Emergentism. Even in the heyday of logical empiricism, philosophers not enamored with emergence were very cautious about how quantum theory could ultimately impact British Emergentism in the long run. While some did indeed express some belated and vague "hope" that quantum mechanics might ultimately threaten emergentism (Berenda 1953), others readily admitted that the reduction of biological phenomena—not even mentioning the mental—to a quantum basis was something of a "risky and speculative guess" (Feigl 1958, p. 414).

As things stand, the philosophical reception of quantum mechanics from the 1920s onward was mostly indicative of a *corroboration* of emergentism rather than its alleged refutation (as we will show more clearly in Section 4.2). As far as claim (iii) is concerned, we contend that the burden of proof still rests on McLaughlin's shoulders, as long as he does not provide the relevant textual evidence that we have been painfully striving unsuccessfully to find. On this particular point, McLaughlin's own lack of references in support of his (however substantial) claim is very troublesome. As he himself indicates, the only two sources he offers appeared to him *after* he completed his 1992 paper, leaving one wondering on which basis he came to believe in the refutation of British Emergentism by early quantum mechanics in the first place. More importantly, none of the sources McLaughlin advances offer the slightest support for his claim. The first actually is nothing else than Feigl (1958), where, as we just saw, the reductionist threat that quantum mechanics could constitute toward emergentism is not taken very seriously by the author himself, without a word about the way in which the theory could have impacted the historical fate of British Emergentism in one way or the other. The second one is Nagel (1952; quoted by McLaughlin in his 1963 version), which is even more anecdotal on that point. There is no better way to show this than by quoting *in extenso* what Nagel has to say there about quantum mechanics:

> [M]odern quantum theory is capable of explaining the facts concerning the specific heats of solids, and presumably also all other thermal properties of solids. Accordingly, although relative to classical kinetic theory the thermal properties of solids are not sums of the properties of their parts, relative to quantum theory those properties are such sums. (1952, p.26)

We are very far from having evidence here that both of these authors endorsed, as McLaughlin claims they did, "the relevance of quantum mechanics as a serious challenge to the main theses of Emergentism" (1992, p. 54, footnote 6). To put it mildly, if Feigl and Nagel's words are all that McLaughlin has to offer in support of claim (iii) in the face of the plethora of positive associations of early quantum mechanics with British Emergentism that one can easily find in the 1920–1940s literature, the prospects of our rebuttal look very good indeed.

Of course, a reasonable objection could be that none of the numerous authors we have mentioned to support our rebuttal of claim (iii) were theoretical physicists, let alone quantum mechanicists[17]. It could well be that philosophers, geneticists, entomologists, or paleontologists did indeed lack a minute understanding of quantum theory, to the effect that their enthusiasm at exploiting it to sustain their emergentist penchant was mostly misguided. To address this objection, we now delve into the writings of some of the great figures of the quantum revolution. From there, we provide further evidence that quantum mechanics did not refute British Emergentism—quite the contrary.

4.2. Emergence and early quantum theorists

The pioneers of quantum mechanics unanimously acknowledged that the quantum hypothesis, initially put forward by Max Planck in 1900 to address a specific issue concerning black body radiation and the associated Rayleigh–Jeans (so-called "ultraviolet") catastrophe, sparked a scientific revolution by introducing a fundamental discontinuity in physics. The very idea of the quantum of action, being indicative of the existence of discrete energy transfers at the microscales of matter, challenged numerous classical, deeply-rooted Newtonian or macroscopic intuitions. Scientific paradigms were then colliding and ultimately shifting (so it goes, under a Kuhnian perspective). In the process, long-cherished philosophical assumptions were put into jeopardy, such as the commitments to a worldly causal structure, determinism, principles of individuation, or even the perennial subject/object distinction.

This state of scientifico-philosophical turmoil around the 1920–1940s has been extensively and aptly discussed by historians and philosophers of science. The gist of these discussions is, however, quite clear: the quantum revolution has been an ideal intellectual atmosphere for metaphysical speculations to widely blossom, be they about life, free will, psychology, or even religion (Van Strien 2022). The quantum of action was indeed conceived of by many quantum theorists as a way to break free from the sober commitments inherited from 19th century

[17] Should such an objection have any traction—which we show it does not—, it would impact McLaughlin's view as much as our rebuttal of it, insofar as, as far as we know, Nagel and Feigl were not quantum physicists.

physics, such as mechanism, determinism, and materialism. On that very point, and in spite of notorious connections—both personal and intellectual—between early quantum theorists and logical empiricists, it has also been convincingly shown that the attempts of logical empiricists at setting limits to these quantum-based speculations were mostly unsuccessful (Faye & Jaksland 2021; Van Strien 2022).

It is against the backdrop of such a context that McLaughlin's analysis of the fate of British Emergentism has to be appreciated. Among the burst of metaphysical speculations coming from the fledgling community of quantum theorists, McLaughlin claimed to have identified some recurrent theme that would have passed unnoticed, namely, a covert but relentless reductionism. As far as claim (iii) goes, early quantum theorists would indeed have shown British Emergentism to be mistaken: purported emergent phenomena—were they chemical, vital, mental, or social—were supposedly revealed as reductively explainable, at least in principle, in the light of (the promises of) quantum theory.

We believe that claim (iii) is only indicative of an utter ignorance of the exact nature of the history of the quantum revolution. In this regard, it is striking to realize that McLaughlin's only supporting material consists of an entirely decontextualized allusion to Niels Bohr's planetary model of the atom, which is claimed to have offered, in spite of its inadequacy, a reductive template for the chemical properties of atoms. From there, after a quick reference to Heitler and London's *ab initio* calculations of the hydrogen molecule in 1927, the road was supposedly and definitely paved toward a full reduction of chemistry, biology, psychology, and the social sciences (the steps in between being mere dots to be connected in due time; this is nothing else, we recall, than McLaughlin's claim (iv) concerning the empirical falsity of emergentism *simpliciter*).

However, McLaughlin's appeal to the (sole) authority of Niels Bohr in order to vindicate claim (iii) is, according to us, entirely out of place and, as we now show, self-defeating. Not only did Bohr put forward his planetary model for purely theoretical reasons[18] but he himself drew no reductionist implications from it—quite the contrary actually—as he was well aware of the inexorable tension that his "classical" model had with the quantum nature of its elements (Jammer 1966). It is even arguable that Bohr did embrace to its fullest extent the irreducible dualism between the microscopic and macroscopic worlds that quantum mechanics seemed to suggest. As Jammer pointed out:

> Bohr did not try to bridge the abyss between classical and quantum physics, but from the very beginning of his work, searched for a scheme of quantum conceptions which would form a system just as coherent, on the one side of the abyss, as that of the classical notions on the other side of the abyss. (1966, 88)

[18] Bohr developed his model to overcome the lack of a satisfactory explanation for the stability of atoms in Rutherford's previous "nuclear model" by positing electrons on fixed orbits corresponding to certain energy ratios while being able to discontinuously move from one orbit to another according to certain well-defined energy quanta.

It is this very commitment that led Bohr to develop his notorious, overtly antireductionist idea of *complementarity*, to which McLaughlin surprisingly makes no reference whatsoever.

Originally, the concept of complementarity arose from Bohr's unease with wave–particle duality, as put forward by de Broglie in 1924. Bohr found himself perplexed by how the very same equation—$E = h\nu$—could yield conflicting depictions of physical entities, *viz.*, wave-like or particle-like features, depending on the chosen mathematical framework. In addition, observations failed to definitively settle the question, as illustrated by the double-slit family of experiments (which were first carried out by Young on visible light in 1801 but re-enacted by Dadisson and Germer on electrons in 1927). This led Bohr to conclude that these seemingly irreconcilable "pictures" were, in fact, "complementary" (Bohr 1928), meaning that they were both indispensable, stemming from equations whose validity remained unquestioned, and yet also mutually exclusive, as they never manifested simultaneously.

At its most general level, Bohr's complementarity ultimately referred to a constraint on the scope of applicability of our usual concepts to certain levels of description. Space-time, causation, waves, particles, position, and velocity were to be understood as arising from a microscopic realm that does not inherently contain them. As such, through his commitment to both the determinism of physical laws (Bohr 1933, p. 458) and the irreducibility of levels of description, Bohr certainly was committed to some sort of epistemological pluralism (with a holistic twist; Honner 1987; Bitbol 1996a) or emergentism (Harré 2006; Faye, personal communication). Bohr's antireductionist stance is even more manifest as soon as we note that he himself extended complementarity well beyond physics to cover the putatively irreducible descriptions of the realms of biology or psychology. In Bohr's own words:

> The existence of life must be considered as an elementary fact that cannot be explained, but must be taken as a starting point in biology, in a similar way as the quantum of action, which appears as an irrational element from the point of view of classical mechanical physics, taken together with the existence of the elementary particles, forms the foundation of atomic physics (1933, p. 458);

or

> The use we make of words like 'thought' and 'feeling,' or 'instinct' and 'reason' to describe psychic experiences of different types, shows the existence of characteristic relationships of complementarity conditioned by the peculiarity of introspection. (1937, p. 297)

When we realize that Bohr's complementarity entails that "physics alone can never suffice to give a full account of organic life," or that "[u]ltimately, life remains unexplainable by physicochemical means" (Van Strien 2022, p. 367), how could we reasonably consider the pioneering work of this physicist to be responsible for the fall of a doctrine whose core commitments were exactly the same?

Of course, it could well be that, if other pioneering quantum physicists were to have upheld strong reductionist views and been vocal about them, to the effect that, in spite of Bohr's

influence and prestige—notably among philosophers at the time—, it would have tilted the balance in disfavor of British Emergentism. However, that was hardly the case (Faye, personal communication). Our focus on Bohr's idiosyncratic view here, even if prompted by McLaughlin's own analysis, was, again, not cherry-picked. We could have discussed a plethora of other great figures of the quantum revolution and shown that they mostly converged on a recurrent, general antireductionist theme that poorly squares with an alleged opposition to British Emergentism.

To give a taste of this, let us simply consider Heisenberg (1969, p. 104) and Pauli (1957, p. 132–133), who conceived of the impact of a macroscopic observer interacting with a quantum system as the source of an irreversible and unpredictable transformation leading the system to a new, more integrated reality. Born (1951, p. 72–73) also assumed that there was no direct analogy to be found between the operations of the macroscopic and microscopic worlds, therefore undermining the reductionist flavor of classical physics. Some early quantum theorists, on the model of Jordan (1932, p. 819), were even, to some extent, more radical than British Emergentists themselves in their opposition to reductive materialism, arguing that quantum mechanics was giving support to the existence of nonmaterial entities such as souls or entelechies. It is noteworthy that such a general antireductionist penchant was even shared by physicists hostile to the so-called "Copenhagen interpretation" of the quantum formalism. One may think of Schrödinger himself, who was arguably committed, at least in the early phase of his career, to a distinctive form of emergentism (Bitbol 1996b, p. 133). In the very words of the theoretical physicist Polkinghorne in his introductory essay on quantum theory, it clearly appears that the instigators of quantum mechanics were mostly committed to the idea that "nature fights back against a relentless reductionism" (2002, p. 80).

As things stand, a case could even be made that, with quantum mechanics, British Emergentism's obscurantism was to become scientifically respectable. By suggesting a "scientifically proven *Ignorabimus*" (Van Strien 2022, p. 383), the quantum revolution made it scientifically legitimate to ponder the idea that life, among other putatively emergent phenomena, could ultimately be accepted as merely given. Given this and against claim (iii), in the present day, a century after the quantum revolution, it is not surprising to witness the fact that quantum mechanics—as well as its subsequent developments, notably under the form of quantum field theory—is still an ideal breeding ground for emergentism in its many guises[19].

5. Conclusions

In his 1992 landmark paper, McLaughlin offered an insightful and valuable analysis of the recent, mostly "British-centered" history of emergentism. McLaughlin's contribution was also

[19] See, for instance, to mention here but a few proposals that positively associate quantum mechanics with emergentism: Teller (1992); Humphreys (1997); Kronz & Tiehen (2002); Loewer (2012); Wallace (2012); Bain (2013); or Guay & Sartenaer (2016). Note that we do not endorse here the relevance of quantum mechanics for emergentism. Our goal is merely to emphasize that quantum mechanics is not—and, more importantly for our purpose, *was* not—an open threat to emergentism.

timely because emergentism was then coming back to the fore and, accordingly, was in need of clarifying and securing its own core commitments, an endeavor that could only benefit from a clear view concerning the strengths and weaknesses of its earlier versions. As such, McLaughlin's works have unquestionably contributed to enriching renewed discussions on the tangled relationship between emergentism and reductionism.

Though enlightening on numerous points, it is unfortunately also the case that elements of McLaughlin's analysis now appear questionable, notably given the scarcity of the evidence initially advanced to support them. In particular, McLaughlin's diagnosis of the reasons that led to the fall of British Emergentism have appeared more and more perplexing in the face of a growing body of work directly relevant to the historical episode at stake, to the point that time was finally ripe to look into it afresh.

It is such a context that led us to advance reasons in this paper to be suspicious of two important elements of McLaughlin's diagnosis, namely, that British Emergentism was supposedly free of "philosophical mistakes," to the point that the fall of the doctrine should not be imputed to a genuinely philosophical opposition (claim (ii)), and that it was rather an empirical conflict with the fledgling quantum mechanics that was actually responsible for the marginalization of this view (claim (iii)). In contrast with McLaughlin's popular view on this matter, we have advanced counterarguments allowing us to claim that British Emergentism actually did fall—or at least experienced serious setbacks—in the 1930s in the face of the concomitant rise of logical empiricism and that such a demise was not triggered in any way by the rapid development of quantum physics.

Apart from the inherent satisfaction of contributing to a better understanding of some particular pieces of the history of philosophy and science (as well as of the philosophy of science), our aim here was not purely exegetical. We indeed firmly believe that a better understanding of the reasons why the development of early emergentism was put into jeopardy can only lead to a better appreciation of current debates on emergence and reduction in the sciences.

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