An Emergentist Argument for the Impossibility of Zombie Duplicates

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Some influential arguments in the metaphysics of consciousness, in particular Chalmers' Zombie Argument, suppose that all the physical properties of composed physical systems are metaphysically necessitated by their fundamental constituents. In this paper I argue against this thesis in order to debate Chalmers' argument. By discussing, in non-technical terms, an EPR system I try to show that there are good reasons to hold that some composed physical systems have properties which are nomologically necessitated by their fundamental constituents, i.e., which emerge in the sense of the socalled 'nomological supervenience' views.

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The text

During 2015 Reinaldo José Bernal Velasquez was a postdoctoral researcher at the Institut Jean-Nicod, thanks to a Fernand Braudel IFER scholarship. He worked within the research group "conscience et ipséité", directed by Dr. Uriah Kriegel. His research interests mainly involve the Philosophy of Mind and the Philosophy of Science; in particular, the metaphysical questions within these fields.

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Abstract

Some influential arguments in the metaphysics of consciousness, in particular Chalmers' Zombie Argument, suppose that all the physical properties of composed physical systems are metaphysically necessitated by their fundamental constituents. In this paper I argue against this thesis in order to debate Chalmers' argument. By discussing, in non-technical terms, an EPR system I try to show that there are good reasons to hold that some composed physical systems have properties which are nomologically necessitated by their fundamental constituents, i.e., which emerge in the sense of the socalled 'nomological supervenience' views.

Keywords

Philosophy of Mind, Zombie Argument, Phenomenal Consciousness, Physicalism, Emergence, Bell's Theorems

Un argument émergentiste pour l'impossibilité des zombies

Résumé

Des arguments parmi les plus influents dans la métaphysique de la conscience, en particulier « l'argument des zombies » de Chalmers, supposent que toutes les propriétés physiques des systèmes physiques composés résultent avec une nécessité métaphysique de leurs constituants fondamentaux. Dans cet article je remets en question cette idée et l'argument de Chalmers. A travers la discussion, en termes non techniques, d'un système EPR, j'essaye de montrer qu'il y a de bonnes raisons pour soutenir que certains systèmes physiques composés ont des propriétés qui résultent avec nécessité nomologique de leurs constituants fondamentaux, c'est-à-dire, qui émergent dans le sens des théories de « survenance nomologique ».

Mots-clefs

Philosophie de l'esprit, argument des zombies, conscience phénoménale, physicalisme, émergence, théorème de Bell

Sommaire

Introduction

Chalmers (Chalmers D., 1996) advanced a still influential argument, labelled 'The Zombie Argument', to state that consciousness is not a physical property[1]. He claimed that a world identical to the actual one in all its physical aspects, but where there is no phenomenal consciousness (Nagel T., 1974; Block N., 1998), is conceivable. Thereby he concluded that, *in the actual world*, consciousness is not a physical property. He wrote:

1. In our world, there are conscious experiences.

2. There is a logically possible world physically identical to ours, in which the positive facts about consciousness in our world do not hold[2]2.

3. Therefore, facts about consciousness are further facts about our world, over and above the physical facts.

4. So materialism is false (Chalmers D., 1996: 123)[3].

The question is if 'there is' a metaphysically possible world W* which is an exact physical replica of the actual world W and yet lacks consciousness. For the physicalist, there is no such world. He takes consciousness to be a physical property and, therefore, he would claim that an exact replica of W in every physical aspect would necessarily include consciousness. However, this claim alone would beg the question as Chalmers presented it. Chalmers argued for the possibility of the zombie world' *W** with a line of reasoning that is based on a 'global supervenience' claim:

If,

(premise 1) Facts about consciousness are not microphysical facts[4].

And,

(premise 2) "[H]igh-level facts and laws are entailed [with logical necessity] by all the microphysical *facts* (perhaps along with microphysical laws)" (p. 71).

Then,

(conclusion 1) A world *W** microphysically identical to the actual world *W* "will have the same macroscopic structure as ours, and the same macroscopic dynamics" (p. 73).

And yet,

(conclusion 2) There would be no conscious experiences in *W**.

The purpose of this paper is to contest Chalmers' Argument. To do so, I shall not question the main intuition behind it: that facts about consciousness cannot result (panpsychism aside) from microphysical facts in virtue of a *metaphysical* necessitation relation[5]. Instead, I will argue against the acceptance of premise 2—a central tenet of 'microphysicalism'—by favouring a 'nomological supervenience' variety of physicalist emergentism (NS-emergentism)[6]. The argument I will advance is grounded on Bell's (Bell J., 1964) Theorem, which concerns the correlations in EPR experiments. I should emphasise that this argument will be presented without technical terms or formulas; *no training in quantum mechanics is required to follow it*.

To be sure, in the philosophy of science arguments for emergentism based on quantum entanglement and critiques to microphysicalism have a relatively long history[7]. But note, first, that in the philosophy of mind microphysicalism remains as a prevalent view among physicalists. In Papineau's words, "many […] philosophers seem to think of physicalism as some kind of commitment to the primacy of the microscopic. In their view, physicalism doesn't just say that everything is physical.

1. The Zombie Argument is a version of 'the Conceivability Argument' advanced by (Kripke S., 1980) and others. See (Chalmers D., 2010).

2. Chalmers strongly relates logical modality with metaphysical modality: "[...] the metaphysically possible worlds are just the logically possible worlds (and [...] metaphysical possibility of statements is logical possibility with an a posteriori twist)" (Chalmers D., 1996: 38).

3. In (Chalmers D., 2002; Chalmers D., 2010) Chalmers presents the argument with an alternative form that stresses the entailment from conceivability to possibility: "If it is conceivable that there are zombies, it is metaphysically possible that there are zombies" (Chalmers D., 2010: 107), and argues for the validity of this entailment.

4. This premise amounts to the exclusion of panpsychism, which Chalmers discusses in (Chalmers D., 1996), (Chalmers D., 2002) and (Chalmers D., 2010).

5. This intuition frequently underlies as well arguments for panpsychism. See, e.g., (Strawson G. et al., 2006).

6. Emergentism is not always conceived as a form of physicalism. Indeed, (Crane T., 2001) claims that it is incompatible with physicalism, and some authors, e.g. (Nida-Rümelin M., 2006), propose emergentist views as forms of dualism.

7. For an extensive discussion of microphysicalism see (Hüttemann A., 2004). Concerning arguments for the existence of emergent properties based on quantum entanglements, (Humphreys N., 2008) is among the most influential.

It also says that everything is microscopically determined" (Papineau D., 2008: 126). Secondly, note that the majority of arguments for emergent properties in physics concern weak emergence or *epistemological* emergence, and are rarely applied in a straightforward manner in the metaphysics of consciousness[8]. This paper is an attempt to contribute to the debate of The Zombie Argument by showing, with a relatively simple case, *why* and *how* NS-emergentism threatens its validity. I shall not advance an original interpretation of Bell's Theorem or a new view on emergentism.

Surely, the interpretation of quantum mechanics and, in particular, the interpretation and significance of Bell's Theorem, are open questions that are still highly debated. However, it is fair to claim that there is wide agreement on the idea that will be central: Bell's Theorem plus the empirical adequacy of quantum mechanics provide strong reasons for believing in the existence of nonlocal effects in nature[9].

In the following sections, first, I will introduce the central notions that I will be using. Second, I will describe a two-particle EPR experiment and introduce Bell's Theorem. Third, I will propose an emergentist interpretation of nonlocal correlations. Forth, I shall elaborate on the consequences of the previous interpretation of Chalmers' ZombieArgument and address five plausible objections.

Physicalism, supervenience and related notions

In this section I will advance the definitions of supervenience', 'physicalism', 'microphysicalism' and 'NS-emergentism' I shall adopt.

Supervenience

Chalmers defines 'supervenience' in a canonical way, as follows: "B-properties supervene on A-properties if no two possible situations are identical with respect to their A-properties while differing in their B-properties"[10](Chalmers D., 1996: 33). A-properties constitute the 'supervenience base' of B-properties. He introduces this concept in order to elaborate the aforementioned *premise 2* and *conclusion 1*. This definition concerns properties, but analogous definitions can be stated to relate other kinds of items like entities, structures, facts, events, and laws. I will use 'supervenience' in this more general sense.

Supervenience is a reflective, transitive and non-symmetric relation. Now, let us distinguish, as is usually done, between 'logical supervenience' (L-supervenience) and 'nomological supervenience' (N-Supervenience) depending on whether the modal operator in 'possible situations' quantifies over logically or nomologically possible worlds respectively. N-supervenience must be distinguished from nomological supervenience emergence (NS-emergence). As we will see, in NS-emergence there must be a fundamental law of nature linking the emergence base with the emergent property. By contrast, N-Supervenience admits a metaphysical necessitation relation as the link between the supervenience base and the supervenient property[11].

Physicalism

Imagine a world *W** defined as an exact physical replica of the actual world *W*: Every physical entity of *W*, with its properties and history, has a qualitatively identical counterpart in *W**12[12]. If physicalism is true, then for *W** to be a physical replica of *W* is for it to be a replica tout court: Everything that exists or obtains in *W* has an identical counterpart in *W**. All the organisms, persons, institutions, facts, events, etc., of *W*, are replicated in *W**. On the contrary, if physicalism is false, then *W* and *W** differ: some entities of *W* lack their counterpart in *W**. Accordingly, I take physicalism to be the view that all the entities inhabiting the actual world, their properties, and all the facts and events involving them, have a physical nature in the following sense:

> *(Physical Nature)* An item has a physical nature if it L-supervenes on a set of physical items.

Here, 'physical items' includes physical entities, their properties, and their spatiotemporal

8. For the distinctions weak/strong emergence and ontological/epistemological emergence, see (Chalmers, D. 1996) and (O'Connor T., Wong H., 2012) respectively. Arguments for the existence of emergent properties in physics that, explicitly or arguably, present *ontological* views, include (Anderson P., 1972), (Humphreys N., 1997), (Sewell G., 2002), (Mainwood P., 2006) and (Howard D., 2007).

9. For a survey of the current state of opinion regarding Bell's Theorem, see (Bell M., Gao S., forthcoming).

10. About supervenience see, e.g., (McLaughlin B., 1995).

11. This is so because a metaphysical necessitation relation holds in every nomologically possible world.

12. By 'the history' of a physical entity I mean its complete-trajectory relative to some frame of reference of space-time.

histories. Clearly, if physicalism holds the totality of physical items in our world constitutes a sufficient supervenience base for *everything* there is in it, including in particular social reality in Searle's sense (Searle J., 1995).

I shall not attempt to provide a complete account of what it is for an item to be physical. This would require an extensive digression with little chances of success[13]. Intuitively, it is clear that a proton, a molecule and electric charge are physical items. By contrast, cheques and prices are not, even though they have a 'physical nature' if physicalism holds. I will briefly come back to this question latter.

Physics, being an empirical science, is open to substantial revisions. But let us accept the standard atomistic picture it proposes: Physical entities are either (simple) particles or systems composed by them, and the laws of physics govern (or describe) the way these entities interact with each other[14]. I will label 'basic properties' the ones that are instantiated by particles; 'high properties' the ones that are systemic, i.e., instantiated by physical systems *as* a *whole*; and 'non-physical properties' the remaining ones (which have a physical nature if physicalism holds). Note that some properties can be attributed as high or as basic, for instance mass and electric charge, while others can only be attributed as high, for instance temperature and rigidity.

Microphysicalism

Imagine a world *W*** defined as an exact microphysical replica of the actual world *W*: All of the most basic physical entities of *W*, together with their properties and history, have qualitatively identical counterparts in *W***. If microphysicalism is true, then for *W*** to be a microphysical replica of *W* is for it to be a replica tout court: Everything that exists or obtains in *W* has an identical counterpart in *W***. In addition to persons, institutions, etc., in *W*** are replicated all the composed physical systems of *W* together with their properties, e.g., the macroscopic objects that are rigid and have a given temperature. On the contrary, if microphysicalism is false, then *W* and *W*** differ. Analogously to the case when physicalism is false, W and *W*** may differ regarding, say, social phenomena. But now, unlike the case when physicalism is false, W and *W*** can also differ in physical respects: some composed physical entities of *W* may lack an identical counterpart in *W***.

Accordingly, I take the central thesis of microphysicalism to be, using Chalmers' words, that "high-level facts and laws are entailed [with logical necessity] by all the microphysical facts (perhaps along with microphysical laws)" (Chalmers D., 1996: 71). Now, the 'microphysical facts', strictly speaking, are those that exclusively involve simple particles. Therefore, microphysicalism can be stated as the view that all the entities inhabiting the actual world, their properties, and all the acts and events involving them, have a microphysical nature in the following sense[15]:

> *(Microphysical Nature)* An item has a microphysical nature if it L-supervenes on a set of basic physical items.

'Basic physical items' *exclusively* includes (simple) particles, their properties, and their spatiotemporal histories. Clearly, if microphysicalism holds the totality of *basic* physical items in our world constitutes a sufficient supervenience base for *everything* there is in it including, besides social constructs, composed physical systems with their (high) properties and relations.

Note that the microphysical reality on which, according to microphysicalism, everything L-supervenes, should not be conceived as involving items not belonging to the lowest level of physical ontology. Otherwise, microphysicalism would lose what makes it appealing in the first place: the idea that everything can be ontologically reduced in terms of *simple* entities, with their (basic) properties and relations, without residue. Moreover, if 'the microphysical' were to include items beyond the basic ones, a sharp distinctionbetween this fundamental level and higher ones could hardly be justified.

Microphysicalism is intuitively clear and has the advantage of proposing an austere ontology.

13. For a definition of 'the physical' aimed at avoiding Hempel's dilemma see, e.g., (Papineau D., 2008).

14. I use 'particles' in a wide sense. In quantum mechanics there is a wave-particle duality, and quantum field theory provides a unified frame for particles and fields. For instance, electrons are treated as excitations of an electron field, and the excitations of the electromagnetic field are photons.

15. For (Hüttemann A., 2004) microphysicalism can be articulated in at least three different ways: as a thesis of 'micro-determination' (that concerns properties), as a thesis of 'micro-government' (involving laws), and as a thesis of 'micro-causation'. With the inclusion of a few plausible assumptions it is possible to derive these theses from the articulation in terms of L-supervenience I advanced.

Imagine we have to create an exhaustive inventory of all the items that ever existed or obtained in the actual world. If microphysicalism is true, when we include all the basic physical items the inventory is complete. It is undoubtedly useful for *epistemological* purposes to include items that are not basic, but these would be redundant from the ontological point of view16[16].

Certainly, microphysicalism looks appealing and is easily taken as being a central tenet of contemporary natural science. Indeed, for Chalmers (Chalmers D., 1996; Chalmers D., 2010) materialist monism is *committed* to microphysicalism. For instance, he writes: "It is widely agreed that materialism *requires* that *P* necessitates all truths" (Chalmers D., 2010: 110, my italics), where "*P* [is] the conjunction of all *microphysical* truths about the universe" (Chalmers D., 2010: 110, my italics). However, the argument I will present, if sound, shows that contemporary natural science warrants the plausibility of the denial of microphysicalism.

One may wonder if it is not the case that the truth of microphysicalism entails the truth physicalism and if, conversely, the truth of physicalism does not entail the truth of microphysicalism. It should be clear that the truth of microphysicalism *logically* entails the truth of physicalism: if microphysicalism is true, a microphysical replica of *W* is also a physical replica of *W*. In contrast, whether the truth of physicalism entails the truth of microphysicalism is an empirical question: that a microphysical replica of *W* is also a physical replica of *W* is not an *a priori* true statement. Indeed, I will motivate on empirical grounds the thesis that this statement is false. After showing that NS-emergentism is incompatible with microphysicalism, I will argue, on the basis of contemporary physics, for the plausibility of the thesis that there are NS-emergent physical properties in nature. If this thesis is right, the worlds *W** and *W*** (as defined before) do differ: There are NS-emergent properties in the actual world *W* which are replicated (by definition) in *W** but not (for empirical reasons) in *W***.

16. Microphysicalism is not committed to epistemological reductionism, i.e., it does not entail the possibility of reducing to basic physical theory every other scientific theory.

NS-Emergentism

As mentioned, I will be concerned with NS-Emergence, which is an *ontological* and *synchronic* view. I shall adopt McLaughlin's definition17[17]:

> If *P* is a property of *w*, then *P* is emergent if and only if (1) *P* supervenes with nomological necessity, but not with logical necessity, on properties the parts of *w* have taken separately or in other combinations; and (2) some of the supervenience principles linking properties of the parts of *w* with *w's* having *P* are fundamental laws […] A law L is fundamental if and only if it is not metaphysically necessitated by any other laws, even together with initial conditions. (McLaughlin B., 1997: p. 39)

NS-Emergence is ontological in the followingsense: the emergent properties are conceived as something 'over and above' the corresponding emergence bases[18]. Even though their existence depends on the existence of the bases, they are *further* constituents of reality. Ontological views, in general, are motivated by the intuition that, even though there surely are tight relations between high properties and basic ones, and even though we can better understand higher-levels with models at lower-levels, some high properties— the emergent ones—are (at least) as real as the basic ones are considered to be[19].

NS-Emergence is *synchronic* because the emergent properties are conceived as coexisting with the corresponding emergence bases. Note that synchronic relations of emergence cannot be causal (at least in orthodox views, where causes always precede their effects) in contrast with diachronic relations.

Now, notice that microphysicalism is incompatible with the existence of NS-emergent properties. In fact, these views entail respectively:

17. McLaughlin's (McLaughlin B., 1997) view is an elaboration of Van Cleve's (Van Cleve J., 1990) view. Historically, these are reminiscent of Broad's (Broad C. D., 1925) emergentism.

18. In McLaughlin's definition of NS-Emergence, the 'emergence base' of property P is constituted by the "properties the parts of w have taken separately or in other combinations" (McLaughlin B., 1997: 39).

19. According to Hüttemann (Hüttemann A., 2004), the attractiveness of microphysicalism derives precisely from the success of micro-explanation. Besides, it should be noted that McLaughlin (McLaughlin B., 1997) himself does not assert that the emergent properties he defines do exist.

(MPH) Every high property is logically necessitated by basic items.

(EMG) Some high properties are not metaphysically but nomologically necessitated, via fundamental laws, by basic items.

In the following section I will argue in favour of EMG on the base of contemporary physics. Certainly, it is not possible to *prove* thereby that microphysicalism is definitely flawed, since any scientific theory can be false. However, microphysicalism is motivated by the acceptance of contemporary theories in natural science, and thus it is legitimate to argue against it using contemporary physics.

Nonlocality and NS-Emergence

In order to argue for EMG I will elaborate a case with the EPR experiments and Bell's Theorem[20]. It has three significant advantages: First, it involves determination relations within microphysics, avoiding problems that appear in attempts to relate properties that belong to significantly different 'levels' (e.g. the microphysical and the macrophysical) or to different sciences (e.g. physics and biology)[21]. Second, this case avoids the causal exclusion problem (Pepper 1926; Kim 1992, 1999, 2005)[22]. We will notice that quantum entanglement is not epiphenomenal and yet poses no problem of causal overdetermination. Third, the existence of EPR correlations is strongly supported by empirical evidence. Indeed, Howard writes:

> How and why the properties of a pair of previously interacting and, therefore, entangled-quantum systems fail to supervene on the properties of the two individual systems taken separately is perfectly well understood and today routinely demonstrated in the laboratory, as in experimental tests of Bell's theorem […] By my lights, the quantum correlations characteristic of entangled joint states have a better claim to the status of emergent properties than do any of the other properties elsewhere in nature so far nominated for the prize (Howard D., 2007: 150)[23].

The EPR Argument

In a famous article (Einstein A. *et al.*, 1935), Einstein, Podolsky, and Rosen claimed that quantum mechanics is incomplete and thus unacceptable. They conceived a *Gedanken* experiment and discussed the solution that quantum mechanics would provide. In Bohm's (Bohm D., 1951) version, an 'EPR experiment' is as follows[24]:

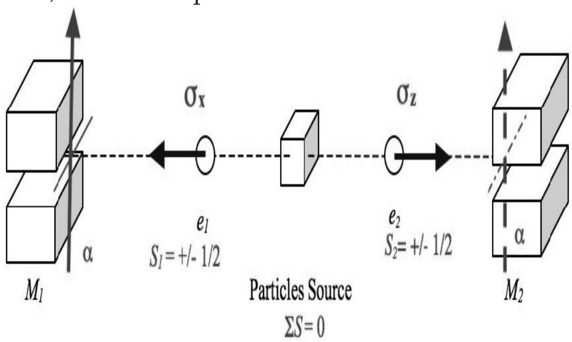

Figure 1. Bohm's version of an EPR experiment.

Initially, there is a source of electrons and two Stern-Gerlach magnets. These systems are spatially separated, they are not connected by any further system, and the space between them is empty. An electron is a particle that has a 'spin' property that, when measured, will always take one of two possible values: +½ or -½. A Stern-Gerlach magnet is a device for measuring the spin in a given direction depending on its orientation.

A row of the EPR experiment, divided in three consecutive intervals, proceeds as follows:

- *(Δt1)* Both magnets are oriented in the same direction α. The source contains a system composed of two interacting electrons that has a null total spin: $\sum S = 0$[25].

20. For a thorough and illustrative exposition without technicalities of EPR experiments and Bell's Theorem, see (Mermin D., 1985).

21. Indeed, within physics itself the nature of the relation between the underlying quantum world and the macroscopic systems is an open issue referred to as 'the measurement problem'.

22. Replies to the causal exclusion argument can be found, e.g., in (Loewer B., 2001), (Shoemaker S., 2002), (Woodward J., 2008), (Kistler M., 2009) and (Campbell J., 2010).

23. Howard (Howard D., 2007) proposes a definition of supervenience for the physical context, and then advances a definition of 'emergence' as the failure of supervenience. Unfortunately, he does not elaborate on this conception of emergence and he does not show exactly why and how quantum entanglement would violate supervenience.

24. EPR experiments can involve different types of particles and concern different properties. They are habitually discussed under Bohm's version because it illustrates the situation in a simpler manner than the original EPR setup and makes the question of locality more salient.

25. According to quantum mechanics since the electrons are interacting they have become 'entangled'.

- *(Δt2)* The source emits the electrons. Electron *e1* travels towards magnet *M1* and electron *e2* towards magnet *M2*.

- *(Δt3)* Electrons *e1* and *e2* encounter magnets *M1* and *M2* respectively, and each one is deflected either in direction α or in direction -α. Thereby, a measurement (in direction α) of the corresponding spins is obtained: S1 = +½ if e1 is deflected in direction α, S1 = +½ if e1 is deflected in direction –α, and likewise for *e2*. I will label '*M1/e1*' and '*M2/e2*' the events of *e1* and *e2* interacting with *M1* and *M2* respectively[26].

Quantum mechanics predicts two possible outcomes for each row of this experiment: {*S1* = +½; *S2* = -½} or {*S1* = -½; *S2* = +½}. The combinations {*S1* = +½; *S2* = +½} and {*S1* = -½; *S2* = -½} are excluded. This is not surprising, since recall that ∑S = 0. It also predicts that the two possible outcomes are equiprobable.

Now, it happens that quantum mechanics represents the state of the system composed of *e1* and *e2* with a 'wave function' that does not attribute individual values for *S1* and *S2* during *Δt1* and *Δt2*; *e1* and *e2* are represented as being in 'entangled' states[27]. However, for Einstein *et al.* *S1* and *S2* must always have definite values. Thus, they claimed that quantum mechanics provides an incomplete representation of reality[28].

In fact, quantum mechanics provides a 'holistic' picture of the experiment: During *Δt2* electrons *e1* and *e2* are not in states with a definite value for their spins, but in a 'superposition' of states: *e1* is in a superposition of [*S1* = +½; *S1* = -½], with each of these sub-states having the same probability of obtaining, and analogously for *e2*. Now, when the measurements *M1/e1* and *M2/e2* occur, *S1* and *S2* acquire definite values that are correlated as indicated. Einstein *et al.* claimed that this picture resulted from the incompleteness of the theory. If this picture were correct, a principle of 'locality' that they deemed non-negotiable would be violated[29].

Let us consider two disjoint closed volumes in physical space, *A* and *B*. Locality says that a change in the properties of physical systems enclosed in *A cannot* determine any change in the properties of physical systems enclosed in *B*, unless there is some signal going from *A* to *B*. By a 'signal' I mean some wave, or some travelling particle, or something of the sort. In a slogan, the principle of locality precludes 'spooky actions at a distance'. Now, the holistic picture violates locality for the following reason: If, during *Δt2*, the values for *S1* and *S2* are not determined, at the moment of the measurement (during *Δt3*) there must be a physical relation between *M1/e1* and *M2/e2* which ensures that the correlations obtain, i.e., that only the outcomes {*S1* = +½; *S2* = +½} and {*S1* = -½; *S2* = +½} occur. But, ex hypothesi, no physical system connects *M1* with *M2* and, moreover, the measurements *M1/e1* and *M2/e2* can be made simultaneously. No signal could have travelled from *M1/e1* to *M2/e2* or vice-versa.

In contrast to the holistic picture, the EPR group proposed an intuitive and straightforward explanation: Given that ∑S = 0 and *Sn* = ±½, only two outcomes are possible. The outcome {*S1* = +½; *S2* = -½} obtains when, during *Δt2*, *e1* is in the state *S1* = +½ and *e2* in the state *S2* = -½, and analogously for {*S1* = -½; *S2* = +½}. Accordingly, the measurements during *Δt3* only revealed the states that the electrons were in while travelling towards the detectors.

Theories along the lines of the last picture are called (deterministic) 'local-hidden-variable-theories' (LHVT)[30]. These theories, first, suppose that the quantum mechanical description of the state of the system composed by *e1* and *e2* is incomplete in the following sense: there are 'elements of reality' (Einstein A., *et al.*, 1935) that are not represented in the theory (the 'hidden-variables') which account for the correlations. Second, these theories aim at explaining the correlations preserving locality.

26. In some interpretations of quantum mechanics these events cause the wave function to 'collapse' (one of them alone is sufficient for the collapse). The entanglement is thusbroken and there is a 'decoherence'.

27. Technically, a 'wave function' is a function defined in a Hilbert space (a complex vector space). When a wave function, φ12, represents two systems, these are said to be entangled when φ12 cannot be formulated as the product of two functions, φ1 and φ2, representing these systems separately.

28. The details of the formulation of the argument are suppressed for being unnecessary for present purposes.

29. Entangled systems also violate a principle of 'separab lity' which, according to (Howard D., 1985), was the primary reason for Einstein's unwavering belief in the incompleteness of quantum mechanics.

30. (Clauser J., Horne M., 1974) generalised Bell's Theorem for the case of stochastic LHVT. For a discussion see (Brown H., Timpson G., forthcoming).

For many years it was considered that no experimental evidence could favour one of the mentioned pictures over the other. Indeed, the EPR argument was not meant to question the empirical adequacy of quantum mechanics; the discussion was purely conceptual. However, in a seminal paper John Bell (Bell J., 1964) showed that the prediction given by quantum mechanics for a 'generalised' EPR experiment differs from any prediction that a local-hidden-variables-theory-could give. This opened up the possibility for tests and empirical arguments.

Bell's EPR experiment

Bell considered a slightly different set-up for theEPR experiment:

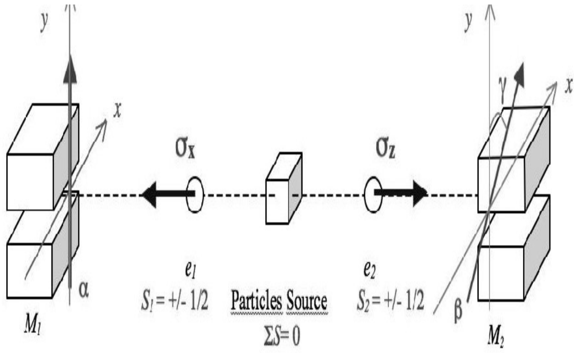

Figure 2. Generalised EPR experiment.

Now, there is an angle *y* between the orientations of magnets *M1* and *M2*. Under these conditions, quantum mechanics provides the following prediction (Bell 1987: 15)[31]:

(QMP) <(σx.α)(σz.β)> = -cos *y*

The symbols {σx; σz; α; β} stand for unitary vectors, and a dot between two of them represents the scalar product. Respectively, vectors {α; β} represent the orientations of magnets *M1* and *M2* (they form an angle y), vectors {σx; σz} represent the spin-states of *e1* and *e2*, and the products (σx.α) and (σz.β) represent the measurements *M1/e1* and *M2/e2*.

The products (σx.α) and (σz.β) can take two possible values: +1 and -1. If we have (σx.α) = +1 this means that e1 was found to have its spin in direction α (the orientation of *M1*). If on the contrary we have (σx.α) = -1, this means that e1 was found to have its spin in the direction -α (opposite to the orientation of *M1*); analogously for (σz.β), *e2* and *M2*. Accordingly, for each row of the experiment there are four possible results corresponding to the values of (σx.α) and (σz.β): (+1; +1), (+1; -1), (-1; +1), or (-1; -1), and the product (σx.α)(σz.β) can take one of two values: +1 or -1. Now, the expression <(σx.α)(σz.β)> represents the statistical distribution of the product (σx.α)(σz.β) over several rows of the experiment.

According to *QMP*, each one of the four possible combinations of (σx.α) and (σz.β) has an associated probability that depends on the angle y (the angle between α and β). Let us consider three examples. First, take *y* = 0. This corresponds to the original EPR setup where the magnets are oriented in the same direction. Following *QMP*, <(σx.α)(σz.β)>= -1. This coincides with what we saw: Always, when one of the electrons is deflected in the direction of orientation of the magnet, the other is deflected in the opposite direction.

Second, take *y* = π/2. Following *QMP*, <((σx.α)(σz.β)>= 0. This means that, statistically, there is no correlation between the results in M1/e1 and M2/e2. Sometimes we have (σx.α)(σz.β)= +1, sometimes (σx.α)(σz.β)= -1, and both situations are equiprobable.

Finally, take *y* = π/4. Following *QMP*, <(σx.α)(σz.β)>= 2½ /2 ≈ 0,7. This means that it is more probable to obtain [(σx.α)(σz.β)]= +1 than [(σx.α)(σz.β)]= -1. Approximately two times out of three *both* electrons are deflected either in the directions of orientation of the respective measuring magnets, or in directions contrary to these.

Bell's Theorem

Bell's theorem has different versions that result from the proof of a 'Bell inequality'[32]. Since these proofs are inevitably highly technical I shall not present one[33]. However, the meaning and consequences of the theorem can be presented in non-technical terms.

Bell's Theorem concerns the predictions that (deterministic) LHVT can provide for generalised EPR experiments. According to these theories, each of the spin-states that *e1* and *e2* occupy (represented by σx and σz) is completely determined independently of the other (hence locality), by inaccessible features (hence

31. This prediction is derived from the wave function that describes the system composed by the interacting electrons *e1* and *e2*.

32. Bell's papers where he presents or discusses his theorem are compiled in (Bell J., 1987).

33. For an explanatory derivation and discussion of Bell's Theorem see, e.g., (Greenstein G., Zajonic A., 1997).

hidden- variables) that account, respectively, for the values of (σx.α) and (σz.β) (which represent the measurement *M1/e1* and *M2/e2*)[34].

The theorem, in one of its forms (Bell 1987: 37), results from the proof of the following inequality:

(BT) | P(α, β) - P(α, β') | + | P(α', β) - P(α', β') | ≤ 2

In *BT* two possible orientations for each magnet are considered: α and α' are orientations of *M1*, and β and β' are orientations of *M2*. The function P represents the left hand of *QMP*:

P (α, β) = <(σx.α)(σz.β)>

P (α', β) = <(σx.α')(σz.β)>

Etc.

Bell's Theorem states that *any* LHVT is constrained by inequality BT. Accordingly, any prediction of a LHVT for the quantity on the left, for any values of {α; β; α'; β'}, is going to be minor or equal to 2.

In contrast to LHVT, quantum mechanics, as expected, violates BT for certain values of {α; β; α'; β'}. Note that, since α.β = cos *y*, *QMP* can be rephrased as:

(QMP) P (α, β) = - α.β

Now, let us take, e.g., {α = 0; β = 3π/8; α' = -π/4; β' = π/8}. From *QMP* we obtain:

P (α, β) = 1/2½

P (α, β') = -1/2½

P (α', β) = 1/2½

P (α', β') = -1/2½

With these values, the inequality in *BT* is violated:

| P (α, β) - P (α, β') | + | P (α', β) - P (α', β') | = (2) (2½) > 2

Several EPR experiments to test 'Bell's Inequalities' have been conducted, the most famous of which were by A. Aspect and his colleagues[35]. They showed a systematic violation of Bell'sInequalities and great accuracy in the predictions of quantum mechanics.

Note that what Bell's Theorem and the corresponding experiments strongly suggest is that theories that assume the existence of hidden variables *and* locality (i.e. LHVT) cannot be accurate. A *nonlocal*-hidden-variables-theory can reproduce the predictions of quantum mechanics, as is the case with Bohm's (Bohm D., 1951) theory[36].

The correlations predicted by quantum mechanics do not depend on whether or not the measurements of spin are realised simultaneously. Thus, the hypothesis of the existence of unnoticed signals connecting events *M1/e1* and *M2/e2* must be discarded (unless one is willing to sacrifice a principle of relativity which says that there is an upper limit for the speed of any signal connecting two spatiotemporal events)[37]. Indeed, no 'information' can be transmitted from *M1/e1* to *M2/e2*: from the results *M1/e1* it is not possible to deduce the results *M2/e2*, except for the particular cases with α = ± β (the original EPR cases)[38].

In short, Bell's Theorem shows that the system composed by *e1* and *e2* behaves in a way, described by *QMP*, which does not result from a causal interaction between intrinsic properties of *e1* and *e2*[39]. In the next section, I will show why Bell's theorem plus the empirical adequacy of quantum mechanics undermine microphysicalism.

Microphysicalism and the EPR experiment

Recall McLaughlin's definition of NS-Emergence, and consider, in the EPR experiment, the system that is constituted by the entangled electrons. On the one hand, this system, *w*, has two

34. According to local-hidden-variables-theories, the fact that quantum mechanics's prediction has a statistical form, namely the distribution <(σx.α)(σz.β)> = -cos *y*, reflects our ignorance of the underlying mechanisms governing, on one hand, the behaviour of *e1* when it interacts with *M1*, and on the other hand, the behaviour of *e2* when it interacts with *M2*.

35. The first experiments to test Bell's inequalities were doneby (Clauser J., et al., 1969) and (Freedman S., and Clauser J., 1972). Aspect's experiments were done in the early eighties. See: (Aspect A., Grangier P., and Roger G., 1981); (Aspect A., Grangier P., Roger G., 1982); (Aspect A., Dalibard J., and Roger G., 1982).

36. Bohm's theory is nonlocal in a very deep sense. In the words of Greenstein and Zajonic, it "goes beyond simple nonlocality, and calls upon us to see the world as an undivided whole" (Greenstein G., Zajonic A., 1997: 148).

37. For a proof that the EPR correlations are compatible with special relativity see (Shimony A., 1986).

38. It could be claimed that in the particular cases α = ± β there is information flow. However, if there were information flow in these cases there should be information flow in every case. *QMP* does not give to the cases with α = ± β any privileged status.

39. Causality is such that, if event c causes event e, c happens before e. The idea of instantaneous and yet causal relations is contrary to relativistic physics and, in general, to current orthodoxy.

parts, corresponding to *e1* and *e2*. Each of these electrons occupies a spin-state (represented by σx and σz), and thus each part of *w* can be said to have the property of being in a spin-state[40]. It is in virtue of these properties, *p1* and *p2*, that *e1* and *e2* are deflected when they encounter magnets *M1* and *M2*[41]. On the other hand, w occupies a state of quantum entanglement of its constituents *e1* and *e2*, and thus w can be said to have the high (or 'systemic') property *P* of being in this state[42]. It is in virtue of w having property *P* that the measurements *M1/e1* and *M2/e2* produce results that have the statistical correlations that *QMP* captures.

Now, it seems clear that *P* supervenes on *p1* and *p2* with nomological necessity, not with logical necessity, in virtue of fundamental laws of nature. First, the relation between *p1*, *p2* and *P* is nomological. In fact, there is a correlation among σx and σz, and thus a relation between *p1*, *p2* and *P*, which are contingent. The prediction that quantum mechanics provides *via* its laws, i.e. *QMP*, has empirical content. Indeed, according to Bell's Theorem any LHVT would make a different prediction. Second, *P* (nomologically) supervenes on *p1* and *p2*. Two systems *w* and *w*', which are both constituted by two interacting electrons that instantiate *p1* and *p2*, cannot differ with respect to instantiating *P*. Third, underlying *QMP* there are fundamental laws. In particular, that freely interacting systems become entangled is a fundamental principle of quantum mechanics; it is not derived from other principles that would be more fundamental. In sum, the EPR experiments and Bell's Theorem seem to show that there are physical systems (at least the ones involved in these experiments) which instantiate properties that are something over and above the properties of their constituent parts.

Another way to see the implications of the EPR experiments for microphysicalism is to focus on the significance of Bell's Theorem. A LHVT supposes that the parts of *w*, *e1* and *e2*, *individually* instantiate some properties (corresponding to the hidden variables), *h1* and *h2* respectively, which *completely* determine the behaviour of the system, particularly, the property *P* of *w*. That no LHVT can be accurate means that the system *w* has a property that does not result with metaphysical necessity from the properties of its individual constituents.

Note that *P* is causally efficacious. Let us adopt the following criteria for causality, restricted to the domain of Physics: An event *c* causes an event *e* if and only if: *(i)* There is a nomological relation between *c* and *e*, *(ii) c* temporally precedes *e*, and *(iii)* there is a transfer of energy—a conserved quantity—from *c* to *e*[43]. Now, take '*c*' as the event corresponding to the emission of the two electrons by the source, and '*e*' as the conjoint event {*M1/e1*; *M2/e2*} that reveals nonlocal correlations. Clearly, there is a causal relation between *c* and *e*. Firstly, there is a nomological relation between event *c* and *e*, and *c* precedes *e*. After the emission of a pair of electrons, the interactions *M1/e1* and *M2/e2* occur following the pattern given by *QMT*. Secondly, there is a transmission of energy (by means of a collision) from the source of electrons to the magnets *M1* and *M2* which makes them flash[44]. Now, the causal relation between *c* and *e* constitutively involves (given Bell's Theorem) property *P*. It is this property what is causally responsible for a property *e* has, namely, the correlations obtaining between *M1/e1* and *M2/e2*. Accordingly, *P* makes a difference in causal interactions: it has the causal power of producing correlations[45].

Additionally, note that *P* has a downward causal influence which, as previously announced, eludes the causal overdetermination problem. This problem arises when an effect has more than one sufficient cause, and this is not the case with *e*. As we saw, even though the systemic property *P* causally influences the behaviour of the constituents of the system *e1* and *e2*, only *c* causes *e*. In fact, *P*'s

40. It is unusual to refer to quantum systems as having properties. These are normally said to occupy states, described by the corresponding wave functions. However, given the definitions proposed by Chalmers (Chalmers D., 1996) of 'supervenience' and by McLaughlin (McLaughlin B., 1997) of 'emergence', I should also talk in terms of 'properties'. Thus, when talking about a system that is in a state *S*, I will say that 'it has the property' of being in a state *S*.

41. Recall that to say that *e1* and *e2* occupy spin-states σx and σz is *not* to say that there is a definite value for their respective spins before the events *M1/e1* and *M2/e2* take place.

42. This state is represented by a wave function from which *QMP* is derived.

43. For a defence of Conserved quantity theories of causality see, e.g., Dowe (2000) and Salmon (1998).

44. In general, every device that detects *X* requires to be perturbed by *X*, and this involves an energy transfer.

45. Alternatively, we can say that *because* the EPR system has the nonlocal property *P*, event *c* causes event *e*.

causal work is to constraint the behaviour of *e1* and *e2* in the way described by *QMT*[46].

In sum, the systems of the EPR experiments seem to violate MPH and hence microphysicalism. There is no metaphysical necessitation from (1) the fact that an electron is a particle with a spin that, when measured, is found to be such that it can only take two opposite values with equal probability, to (2) the fact that a system constituted by two electrons and with null total spin behaves, when the spins are measured, in accordance with *QMP*. By contrast, the systems of the EPR experiments seem to support EMP, i.e., they seem to instantiate a high property nomologically necessitated, *via* fundamental laws, by basic items.

Back to Chalmers' Zombie Argument

In the previous sections I questioned the validity of Chalmers' Zombie Argument, by arguing that there are good reasons to consider that microphysicalism, and thus the claim that "high-level facts and laws are entailed [with logical necessity] by all the microphysical *facts*" (Chalmers 1996: 71), are wrong. I did so by showing a case in favour of NS-Emergentism.

To be sure, I did not give reasons to consider that phenomenal consciousness is a NS-emergent property. Indeed, from the fact (if it is a fact) that some relatively simple quantum systems do have NS-emergent properties, nothing seems to follow about the nature of consciousness. In principle, only extremely complex macroscopic biological organisms are conscious, and consciousness raises distinctive philosophical questions. However, notice that the fact (if it is a fact) that some relatively simple quantum systems instantiate NS-emergent properties asks for a non-microphysicalist ontology of the natural world, which *opens up* the possibility for there being emergent properties beyond microphysical systems[47]. Now, there are reasons which are independent of any consideration about quantum mechanics to hold that consciousness must be an emergent property, emerging from physical items[48].

I would argue that the *prima facie* conceivability of Chalmers' zombies results from the fact that consciousness is an *intrinsic* property. As Chalmers himself says when discussing Type-F (or 'Russellian') monism, "physics characterizes physical entities and properties by their relations to one another and to us. […] physics says nothing about the intrinsic nature of these entities and properties" (Chalmers, D., 2010: 133). Therefore, "[w]e only think we are conceiving of a physically identical system [when we conceive the zombie world] because we overlook intrinsic properties" (Chalmers, D., 2010: 134). It is important to note that here Chalmers refers to intrinsic properties of *particles*; if consciousness is a NS-emergent property, it is an intrinsic property of composed (and very likely extremely complex) physical systems[49].

To finish, I will briefly discuss five objections to the argument I have presented.

Objection 1: The claim that consciousness could be a NS-emergent property coincides with Chalmers' (Chalmers D., 1996) "naturalistic dualism" view: he claims, precisely, that consciousness supervenes nomologically, but not metaphysically, on the microphysical.

Reply: Chalmers says when presenting naturalistic dualism: "It is therefore more natural to consider experience as a fundamental property that is not a physical property, and to consider the psychophysical laws as fundamental laws of nature that are not laws of physics" (Chalmers D., 1996: 128 – 129). Accordingly, for Chalmers the psychophysical laws that would be involved in the nomological supervenience of consciousness relate something physical with something that is *not* physical (in accordance with the conclusion of The Zombie Argument). This contrasts sharply with the conception of NS-emergentism that I advanced, which involves physical laws that relate physical items.

46. See Kistler (2009) for an elaboration of the idea that the causal powers of emergent properties consist in being constraints on the behaviour of entities at lower levels.

47. Indeed, quantum mechanics does not restrict entanglement to microphysical systems composed by a few particles. In principle, *any* interacting physical systems become entangled. Of course, there is the question of why we do not experience (at the macroscopic level) any superposition of states, which is the core of the measurement problem. For a discussion see, e.g., (Brown H., Wallace C., 2005).

48. In (Bernal Velásquez R. J., 2012) I argue that emergentism about consciousness is the best alternative if one is a materialist realist about consciousness. About emergence in the philosophy of mind see (MacDonald C., MacDonald G., 2010).

49. In (Bernal Velásquez R. J., 2012) I argue that consciousness is an intrinsic property and that it is instantiated in complex systems.

Follow-up to Objection 1: Suppose there are indeed psychophysical laws in virtue of which consciousness NS-emerges. Now, there is still the possibility for consciousness to be non-physical. In fact, it is arbitrary to take the psychophysical laws as being 'laws of physics' and, thereby, to affirm that consciousness is physical, instead of taking the psychophysical laws—following Chalmers—just as fundamental *laws of nature* that do not suppose that consciousness is physical.

Reply: I am not sure how to understand in what sense a law of nature could relate something physical with something non-physical. These laws are, minimally, statements that capture regularities in nature. Now, if there is a regularity involving a paradigmatically physical item *M* and some item *N*, this seems to be sufficient for *N* to fall in the category of having a physical nature. Why we think that, e.g., electromagnetic waves are something physical? After all, they are not objects of experience in any ordinary sense of the term; we represent these waves through quite abstract mathematical equations.

Suppose there is some item *N* whose metaphysical nature is an open question. Now, suppose we establish the existence of a law of nature relating *N* with some paradigmatic physical item *M*. Then, thanks to our knowledge of this law, we are able to produce or manipulate *N*, to explain or predict its instances, to account for its interactions with *M* (and thereby with other physical items), and so forth, just as we are able to do with electromagnetic waves. This seems sufficient to claim that *N* has a physical nature[50].

Certainly, if *N* is an epiphenomenal property, the previous line of thought does not apply: it is not possible to determine if *N* is instantiated, *N* does not interact with anything, and so forth. But then, I do not see on what grounds we could possibly claim that there indeed exists a property *N*, and that it falls under some law of nature.

Objection 2: Chalmers wrote: "high-level facts and laws are entailed by all the microphysical facts *(perhaps along with microphysical laws)*" (Chalmers D., 1996: 71, my italics). So, let us include within the microphysical laws those that correspond to quantum entanglement. Thereby, the putative NS-emergent property *P* would supervene on the microphysical with logical necessity.

Reply: This strategy would make microphysicalism collapse into the view I advocate, namely, that everything is either a physical item or L-supervenes on physical items. If in global supervenience physicalist metaphysics one includes in the supervenience base the NS-emergent property *P*, by the same token one should include *all* the different kinds of NS-emergent properties that exist, and notice that there are no reasons to discard them in complex and macroscopic systems. Thereby, firstly, one would be giving up microphysicalism. Secondly, if consciousness in particular is a NS-emergent property, and as such, one has to include it in the supervenience base, this amounts to considering it as physical.

Objection 3: Suppose that in the actual world *W* there is in fact a law *L* in virtue of which consciousness NS-emerges. Now, consider a world *W** that lacks *L*, and hence consciousness, but is otherwise identical to *W* in every respect. *W** is conceivable and would be a zombie world: every physical item in *W** (except consciousness) would have its counterpart in *W*.

Reply: Ontological views of emergentism, and in particular emergentism about consciousness, usually conceive emergent properties as having causal powers. Indeed, it is common to argue for the existence of an emergent property *E* on the basis of Alexander's Dictum (Alexander S., 1920): *E* is real because its instantiation endows its bearer with irreducible causal powers. So, *W** is not really conceivable: in the absence of *L* it would differ from *W* in many respects, namely, regarding the events directly or indirectly related to consciousness in a causal way.

Objection 4: Chalmers writes: "a microphysical description of the world specifies a distribution of particles, fields, and waves *in space and time*. These basic systems are characterized by their *spatiotemporal properties* and properties such as mass, charge, and quantum wave function state" (Chalmers D., 2010: 120, my italics). So, suppose that in the actual world *W* there are NS-emergent properties, and consider a world *W** that is a spatio*temporal* microphysical replica of *W*, i.e., *not* a time slice microphysical replica. The full *history* of every basic item in *W* has its counterpart in *W**. Is it conceivable for *W* and *W** to differ

50. Note that this line of argument leads to the claim of the instability of interactionism, i.e., of Type-D dualism in Chalmers' (Chalmers D., 2002) taxonomy. The factual existence of nomological interactions between conscious states and physical states (which may include brain states) would be sufficient to classify consciousness as physical.

in non-microphysical levels? Apparently not: in all probability, spatiotemporal high levels do L-supervene on the spatiotemporal microphysical level. Thus it seems that, when *W** is appropriately formulated, The Zombie Argument is valid even if there are NS-emergent properties in *W*.

Reply: This is a subtle point involving downward causation whose thorough discussion exceeds the scope of the present paper. Thus, I will only advance two remarks about the following scenarios: (1) there is no downward causation; (2) there is downward causation.

(1) Suppose the NS-emergent properties in *W* do not have downward causal powers. Then, it is certainly conceivable for *W* and *W** to differ in non-microphysical levels: In *W*, on top of the basic items, there are further items (the NS-emergent ones).

However, that a NS-emergent property has causal powers seems to entail that it has downward effects and, as I said, epiphenomenal emergent properties are not what ontological emergentism is usually about[51]. Thus, this first scenario is not really relevant.

(2) Suppose that the NS-emergent properties in *W* do have downward causal powers: There are top-down causal effects that influence the behaviour at the microphysical level. Now, recall that *W**, *ex hypothesi*, is identical to *W* at this level. The microphysical level in *W** behaves like the one in *W despite* the absence of NS-emergent properties. In this scenario, is it possible for *W* and *W** to differ at high levels? I will focus on a particular conception of the causal powers of NS-emergent properties and argue that *W* and *W**, despite having the same microphysical dynamics, differ regarding the laws of nature. If one is a necessitarian about laws, this might be a decisive point. If, on the contrary, one is a regularist or an antirealist, this might seem innocuous[52].

51. The entailment from an emergent property having causal powers to it having downward effects is a critical step in the formulation of the causal exclusion problem. See, e.g., (Kim J., 2005).

52. For the regularists, statements of laws of nature only capture the regularities we observe in the natural world. Accordingly, laws are nothing over and above these regularities. By contrast, for necessitarians the laws of nature are something over and above mere regularities. Their existence *explains* why some regularities factually obtain, and why they would obtain were counterfactual situations (framed in physically possible worlds) realised. See, e.g., (Schrenk M., forthcoming).

In the case for emergentism that I discussed, the causal role of the NS-emergent property is a constraining role. In virtue of property *P*, *e1* and *e2* behave in a correlated way when the spin measurements occur. Let us take it that, in general, when it comes to causality NS-emergent properties act as constraints for the behaviour at lower levels[53]. Now:

Take two subsequent times *t1* and *t2* in the history of the actual world *W*, and two subsequent times *t1** and *t2** in the history of *W**, such that: (i) between *t1* and *t2* there were downward effects (in *W*) due to the existence of a NS-emergent property *P*; (ii) the evolution of the basic items of *W** between *t1** and *t2** mirrors the evolution of the basic items of *W* between *t1* and *t2*[54].

Clearly, the microphysical evolution of *W* between *t1* and *t2* is nomologically determined by *P*: *W* finished at *t2* in a particular microstate *W(2)* partly because of *P*. By contrast, *W** finished at time *t2** in a particular microstate *W**(2) partly by chance. In *W* there is a law of nature, namely the one that captures the effect of *P*, which *W** lacks.

Objection 5: Forget about microphysicalism. The core of The Zombie Argument is the idea that no phenomenal fact can be metaphysically necessitated by physical facts; it points to the existence of an ontological gap. Now, to judge that consciousness may be a NS-emergent property is to deny the existence of this gap, since consciousness would emerge exclusively from physical stuff.

Reply: I agree with the idea that phenomenal facts cannot result from physical facts in virtue of a *metaphysical* necessitation relation. But, firstly, recall that I take NS-emergentism as a form of physicalism. Therefore, phenomenal facts, despite our deeply grounded dualist intuitions, are taken as physical facts. Secondly, recall that NS-emergence involves a *nomological*, not a metaphysical, relation, mediated by *fundamental* laws of nature. It would be in virtue of a law of nature that a complex physical entity would have phenomenal properties even though none of its physical parts has them. But this last point, clearly, is persuasive only for someone who holds a realist and necessitarian view about laws.

53. (Bishop R., Atmanspacher H., 2006) and (Kistler M., 2009), among others, propose this view.

54. Note that *t1** and *t2** do exist *ex hypothesi*.

Conclusion

Some arguments against the thesis that consciousness is a physical property, and in particular Chalmers' Zombie Argument, suppose the validity of 'microphysicalism': roughly, the view that all the physical properties of composed physical systems are *metaphysically* necessitated by their fundamental physical constituents. Through the discussion of the EPR scenario and Bell's Theorem, I questioned the validity of microphysicalism and favoured emergentist metaphysics in the sense of the nomological supervenience views. If this metaphysics happens to be correct, Chalmers' Argument loses part of its grounds, and, a possibility opens up for consciousness to be a physical property.

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