Nonreductive Physicalism: Understanding Our Metaphysical Paradigm[1]

Juan Diego Morales
National University of Colombia

1. Introduction

Nonreductive physicalism (NRP) is the metaphysical thesis that claims that all the entities of our world constitute an ontological and causal network that is fundamentally physical but, however, cannot be reduced to nor fully explained by the laws, properties, and concepts that the basic physical science can discover and articulate. My purpose in this paper is to analyze the proposal of NRP and to argue that this philosophical approach should be understood in terms of macrophysicalism, that is, emergentism. My claim is that this version of physicalism is a philosophical theory that allows us to understand the coherence and irreducibility of the different scientific approaches, from microphysics and chemistry to psychology and sociology, trying to explain the various levels of organization of our empirical world. In the first part I analyze the standard (that is, the functionalist) formulation of NRP, which claims that although the higher level facts metaphysically supervene on the facts of the lower levels, ultimately on the microphysical facts, they cannot be reduced to the latter because of their multiple realizability. I explain the kind of criticisms that in recent years this perspective has received about its capability to account for the *causal irreducibility* of the higher level properties, a problem which arises from the assumption of the metaphysical supervenience of the macro-properties on their microphysical realizers or conditions; an assumption that is plausibly an empirically false claim. Then, I introduce emergentism or macrophysicalism as a nonreductive physicalist proposal which claims that the higher-level properties cannot be reduced to their lower level bases because although they are *metaphysically dependent* on the latter, *are not determined* by these. Finally, I explain the downward causal influence that on this view the higher level properties should have on the lower causal processes.

2. Glossary:

Emergentism (or macrophysicalism): the physicalist theory that claims that some of the fundamental phenomena our world are essentially macrophysical, that is, physical phenomena which cannot be reduced to,

nor understood purely in terms of the properties and relations of their microphysical components.

First/second order property: a second order property is an object's property of having one or other (called first order) property which plays a specific role.

Lower/higher level property: a higher level property is a property that is instantiated in virtue of (because it depends on) a lower level property.

Macrophysical/microphysical property: a macrophysical property is a property that is instantiated by a physical system composed of other physical systems. A microphysical property is a physical property that characterizes the most basic and simple physical entities that may exist.

Microphysicalism: the physicalist theory that claims that every entity of our world (e.g. chemical, biological, neurophysiological, mental, social, and so on) metaphysically supervene on – are metaphysically determined by – their basic physical constituents, that is, their ultimate microphysical elements.

Reduction: the relation between two (set of) properties whereby one of them is nothing over and above the other.

Supervenience: a set of properties (A) supervenes on another set of properties (B), just in case there cannot be a difference in A without a difference in B.

3. The physicalist approach

One of the most important philosophical problems in the history of our thought is the question about human special particularity. In the beginning of *Modernity*, Descartes introduced his mind-body dualist proposal in order to account for this peculiarity. But we know that this proposal entails seemingly intractable problems. From this very same time, philosophers like Spinoza and Leibniz have noted that Descartes' perspective could not be correct because it could not explain the necessary causal interaction between the body and the mind. Inheriting the anti-Cartesian spirit and incorporating a scientific perspective, physicalism develops criticisms against any theory which attempts to understand mind and matter as two distinct realities, arguing that our world, and therefore the human mind as one of its constituents, should be understood as fundamentally physical.

Physicalism claims that *the entities that constitute our world are physical entities*, phenomena which the physical sciences must discover and articulate in their theories.[2] Contemporary philosophers have considered

physicalism as *both an a posteriori and contingent thesis*. It is a posteriori because it tries to overcome the problems of its direct predecessor, materialism. The latter was established as a metaphysical doctrine that attempted to specify the entities of our world in an a priori way, in terms of a specific set of features that supposedly defined the material; features such as conservation, deterministic and on contact interaction, impenetrability, inertia, and solidity (see, for example, d'Holbach 1770). But this a priori specification proved to be wrong. It is now clear that if any of these conditions is necessary for something to count as material, then physics speaks of immaterial entities (see Crane & Mellor 1990, 186). Nonetheless, a posteriori physicalism faces not a minor problem: the so-called Hempel's dilemma, which is based on an intuitive distinction between current physical science and complete or ideal future physical science. Hellman puts it in these terms:

> [C]urrent physics is surely incomplete (even in its ontology) as well as inaccurate (in its laws). This poses a dilemma: either physicalist principles are based on current physics, in which case there is every reason to think they are false; or else they are not, in which case it is, at best, difficult to interpret them, since they are based on a 'physics' that does not exist—yet we lack any general criterion of 'physical object, property, or law' framed independently of physical theory. (1985, 609)

Physicalists respond to this problem in a very interesting and, I think, successful way; by affirming that their doctrine can be understood in terms of *the complete physical science* we can find and clearly recognize *as a descendant of the current physical science*. This is Papineau's formulation:

> The idea here is to appeal to the categories represented by current Physics Departments, but to allow some wiggle room for future developments. So we might think of 'physical' as referring to all those categories that bear some *resemblance* to the categories recognized in contemporary Physics Departments. For example, 'physical' might be understood as equivalent to something like 'displaying mathematically simple and precise behaviour'. (2008, 130)

Then, physicalism argues that the entities that constitute our world are those that *that* physical science needs for its understanding and explanation. Therefore, this theory will be *contingently* true only if the claims of the physical science upon which it rests come to account for our empirical world *in a proper and all-sufficient form*. On this perspective, all macroscop-

ic and microscopic systems will be physical, that is, completely explainable by the physical science. Nonetheless, this leaves open the status of the necessary connection of the different levels of organization of our word, from microphysics, chemistry, and biology to psychology, sociology, and economics. Reductive physicalism claims that all the properties of our world are identical and reducible to the properties of its most basic level, that is, its microphysical level; meanwhile, nonreductive physicalism (NRP) argues that although higher level properties maintain a necessary connection with the properties of the basic physical level, they are neither identical nor reducible to these.

4. The functionalist formulation of nonreductive physicalism

Nonreductive physicalism, considered by philosophers like Jaegwon Kim as "a position that can deservedly be called 'the received view' of today" (1993, 339), is the ontological perspective that claims that all the entities of our world constitute an ontological and causal network that is fundamentally physical and, however, cannot be reduced to the laws, properties, and concepts that the level of the basic physical science can discover and articulate. It argues that although all the systems of our world are both wholly composed of and metaphysically depend on the properties and entities of its most basic level, that is, its microphysical level, the properties of the so called special sciences – from chemistry and biology to psychology, sociology, and economics – are neither identical nor reducible to the properties of this basic level.

Most contemporary philosophers have understood the physicalist perspective following a supervenience theory, according to which the properties of our world supervene on and therefore are metaphysically determined by its microphysical facts (see, for example, Chalmers 1996, Kim 2005, and Shoemaker 2007). The notion of supervenience has been introduced and developed with the primary aim of accounting for a naturalist and physicalist non-reductive proposal, which intends to support both the priority of the natural and physical phenomena of our world, and the irreducibility and difference of properties and phenomena that in principle cannot be understood as physical, such as the mental, moral, political, and economic. It is precisely this idea that philosophers of morality as G.E. Moore and R.M. Hare, and philosophers of mind like Davidson, Fodor, and Putnam have in mind when affirm their naturalistic commitments. For example, based on the idea that there cannot be "strict" psychophysical laws, Davidson articulates his non-reductive physicalist proposal, which he

calls anomalous monism, claiming that the mental properties supervene on the physical properties even though they cannot be reduced to these (1980, 214).

But Davidson's proposal is not the only theory accepting the conjunction of the priority of the physical that is articulated in terms of supervenience, and the irreducibility of the mental or the special[3] properties in general. Another very important theory is the non-reductive physicalism that Putnam and Fodor developed in the 1960s and 1970s of the 20th century, which is based on the powerful argument of the multiple realizability (MR) of the special or higher level properties/kinds. Based on the intertheoretic model of reduction proposed by Nagel, and his idea of "bridge-laws" that can correlate predicates of the special sciences with predicates of the basic physics in a bi-conditional form, Putnam and Fodor's argument is that special properties can be instantiated by, or realized on, multiple dissimilar physical structures and that, for this reason, only an open, extensive, and artificial disjunction of all the actual and possible realizers of a special property could constitute its physical reducer. But the problem is not only that such disjunction could be empirically implausible; it is that even if such disjunction could turn out to exist, it could not be logically sufficient to achieve the reduction just because, to put it in Kim's terms, "[a] disjunction of heterogeneous kinds is not itself a kind." (Kim 1992, 9)

Most authors believe that even if the higher level properties cannot be reduced because of their MR, they are metaphysically determined by their physical realizers. In fact, this idea seems to follow from the very formulation of the physical realizability of the special properties. It was Putnam (1970) who introduced this theory to account for the relation between the logical and functional states of a Turing Machine and their particular physical implementations in terms of what he called a relation between first order and second order properties. A second order property is the property of having one or other property that plays a specific role (of causal and non-causal dependencies). According to this perspective, higher level properties are both second order and MR properties because there are different basic physical properties which can play the functional role specified by the former. Moreover, because second order properties are fully defined in terms of their functional role, and because this role is played by each of their physical realizers, the kind of non-reductive physicalism that appeals to this notion of realization can be understood as assuming a clear *metaphysical determination* between the physical realizers and the higher realized properties. Now, given that this non-reductive physicalism affirms

that the physical bases of the metaphysical supervenience of the higher level properties are not only physical but microphysical (see, for example, Chalmers 1996, Kim 2005, and Shoemaker 2007), this kind of perspective is counted as a kind of microphysicalism; that is, as the *non-reductive microphysicalism* states, because of their MR, special properties cannot be identical to or reducible to their microphysical bases.

Although this form of non-reductive physicalism which affirms the irreducibility of the higher level properties on the basis of their MR is one of the most accepted approaches, plausibly the most accepted theory of the second half of the 20th century, in recent years it has received very strong philosophical criticisms especially about its capability to account for *the causal irreducibility of the higher properties*. For authors such as Kim, their idea is relatively simple. First, they accept the anti-reductive principle whereby a disjunction of heterogeneous kinds is not itself a kind. Then, they ask whether a reductive position is constrained to take the derivational model of Nagel, in which each higher level kind (property) must have a nomologically coextensive kind in the reduction base, and they respond: "No; for it isn't obvious why it isn't perfectly proper to reduce kinds by identifying them with properties expressed by non-kind (disjunctive) predicates in the reduction base" (Kim 1992, 10). In the third step, they claim with the anti-reductionist that special properties are realized by events that belong to completely heterogeneous microphysical kinds (the MR thesis). Fourth, they argue that special causal powers of special events are inherited from (in fact, are identical to) their microphysical causal powers. In conclusion, as special classes are MR, and since in each case the causal powers of a special instance are identical with its microphysical powers, special kinds are really disjunctions of microphysical kinds, not natural kinds in themselves.

We can see that the argument crucially depends on the acceptance of the fourth step that Kim has called the *causal inheritance principle*: "If [a special property] *M* is instantiated on a given occasion by being realized by [a microphysical property] *P*, then the causal powers of this instance of *M* are identical with (perhaps, a subset of) the causal powers of *P*" (1993, 355). NRP is committed to this principle since, as we have seen, a second-order property (the realized property) is metaphysically determined by its first order realizers.[4] Kim's argument (see also Lewis 1980 and Bickle 1998), which can be understood as a movement of local reduction, leads to the conclusion that what at first seems like a higher level property finally cannot be treated as an unitary property providing genuine causal power to its

instances, but as a combination of dissimilar microphysical properties that provide different causal powers to each of its instances.

But the conclusion that these philosophers derive is unacceptable to nonreductive physicalists who argue that there are real higher level states that have basic and irreducible properties and causal powers, and that an explanation of the world cannot be completed until we have a satisfactory account of them. NRP claims that the movement of local reduction cannot explain the common features that the special states have (e.g. what all the pain states have for being mental states; see, for example, Block 1980 and Shapiro 2008) and, therefore, does not account for the very existence of the higher level entities. Finally, the problem for NRP is, in the very terms of Kim, "to state an alternative principle [to the causal inheritance] on just how the causal powers of a realized property are connected with those of its realization base; or explain, if no such connections are envisioned, the significance of the talk of realization" (1993, 355).

5. The nonreductive physicalism of emergentism

The fundamental idea of emergentism is that there exist physical *systems* having properties that their constituent parts don't have, and that can neither be reduced to nor explained by the properties of these parts. In this sense, the emergentist perspective understands the physical world as an orderly process of events located at different levels of hierarchy and instantiating the mereological relation of *being part of*; e.g., the microphysical events constitutes *in a complex way* the biological events; these constitute *in a complex form* the mental events; and the last constitute *in a complex manner* the social events.

Emergentism assumes a physicalist ontology with respect to the concrete realm, that is, the realm of objects, events, states, processes, and every entity as spatiotemporally conceived. In this sense, for example, Alexander comments:

> We thus become aware, partly by experience, partly by reflection, that a process with the distinctive quality of mind or consciousness is in the same place and time with a neural process, that is, with a highly differentiated and complex process of our living body. We are forced, therefore, to go beyond the mere correlation of the mental with these neural processes and to identify them. There is but one process which, being of a specific complexity,

> has the quality of consciousness. […] It has then to be accepted as an empirical fact that neural process of a certain level of development possesses the quality of consciousness and is thereby a mental process; and, alternately, a mental process is also a vital one of a certain order. (1920, 5-6)

This is precisely the ontological thesis which Fodor defends and calls *token physicalism*, "the claim that all the events that the sciences talk about are physical events" (1974, 397). Although at first glance this seems to be a completely viable way to state a physicalist commitment, many authors (see, for example, Chalmers 1996, Kim 2005, and K. Bennett 2008) have developed arguments that show that token physicalism is too weak to be established as an acceptable and sufficient form of physicalism, since it is compatible with property dualism, the theory that claims that the properties of the higher levels of our world are connected with the physical level properties *in a merely contingent form*.

Most contemporary philosophers have articulated the property dualist proposal as opposed to a theory of supervenience, stating that the fundamental tenet of this kind of dualism is that higher level properties do not metaphysically supervene on, and therefore are not completely determined by the microphysical conditions. But property dualism denies not only the metaphysical supervenience of the higher properties on the microphysical conditions; *it denies that there is a metaphysical dependence between them*. This is precisely the meaning of its statement that the higher properties are connected with the microphysical properties in a *completely contingent* form. This means that *there is neither a determination nor a dependency metaphysical connection* between the two sets of properties and, therefore, according to this view, that it is entirely possible both the instantiation of the physical properties without the instantiation of the higher level properties, and vice versa, the instantiation of the special properties without their physical realization (for example in Cartesian substances).

Both property dualism and emergentism states that higher level properties *do not* supervene on, and therefore are not metaphysically determined by, the microphysical properties and relations from which they emerge; it is in this sense that we say that an emergent is something different from, additional to, and non-derivative from its emergent basis. However, there exists a crucial difference between these perspectives:

emergentism claims while property dualism denies a *metaphysical dependency connection* between the higher levels and the level of the microphysics. This metaphysical dependence between the emergent special properties and their microphysical bases follows from two crucial facts: firstly, from the fact that the emergence connection is a type of mereological relation which, as such, connects the properties of the whole with the properties of the parts in an essential form. And secondly, it follows from the fact that the emergent property is not simply different from and additional to the properties of the constituents, *but a special organization of these elements* which, as such, fully and ontologically depends on them.

On this understanding, emergentism is *a kind of non-reductive physicalism*. A physicalism as it argues that special properties are no more than higher level organizations of purely microphysical entities and, as such, fully depend on them. And a non-reductive proposal, because it affirms that such higher organizations are emergent, that is, *not metaphysically supervenient on* and so neither identical with nor reducible to the microphysical bases from which they emerge.

And here we can find the crucial difference between the functionalist and the emergentist (macrophysicalist) formulation of NRP: the former claims, while the second denies the thesis of the metaphysical supervenience of the macro-properties on their microphysical conditions. We have seen that this is the reason why functionalism should accept Kim's causal inheritance principle and, in consequence, cannot account for the irreducibility of the causal relevance of the special properties. But the assumption of this metaphysical supervenience is plausibly an empirically false claim: it seems to be against results coming both from the physical science itself, as when we talk about holistic or systemic physical properties not explainable from nor reducible to their constituent conditions,[5] and from the special sciences' greatly successful theories and experiments that provide explanations and predictions which, as far as we know, are not reducible to the microphysical laws and explanations from which they must arise.

We have seen that authors such as Kim think that NRP faces insurmountable problems about the alleged *irreducibility of the causal powers* of the special properties. But this problem becomes the trouble that NRP has of accounting for the real and irreducible causal influence that the higher level properties should have on the world, especially on the basic level of reality, that is, the level of microphysics. In sum, we can say with Kim that the problem of NRP, and emergentism as one of its exponents, becomes the problem of the *downward causal influence* that the special properties

should have on the basic physical level of reality. Let us examine the emergentist response to this question.

6. Downward causation

It was Donald Campbell who in his 1974 article "'Downward Causation' in hierarchically Organised Biological Systems" introduced the expression 'downward causation,' and even its notion. The psychologist and philosopher, concerned primarily with problems of philosophy of biology and evolutionary epistemology, starts from the idea of a hierarchical organization of biological systems and advances the thesis that the higher level entities have *some kind* of causal influence on lower level entities through the *selection* the former exert on the latter. For him, we necessarily have to assume, as physicalist theorists, the following two principles:

> (1) All processes at the higher levels are restrained by and act in conformity to the laws of lower levels, including the levels of subatomic physics. (2) The teleonomic achievements at higher levels require for their implementation specific lower-level mechanisms and processes. Explanation is not complete until these micromechanisms have been specified. (1974, 180)

These two principles synthesize the physicalist implications of NRP. However, they are not sufficient. Campbell argues that in order to understand the hierarchical organization of nature, we need to add two emergentist principles:

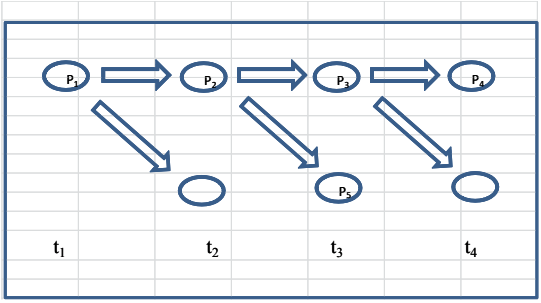
> (3) (The emergentist principle) Biological evolution in its meandering exploration of segments of the universe encounters laws, operating as selective systems, which are not described by the laws of physics and inorganic chemistry, and which will not be described by the future substitutes for the present approximations of physics and inorganic chemistry. (4) (Downward causation) Where natural selection operates through life and death at a higher level of organisation, the laws of the higher-level selective system determine in part the distribution of lower-level events and substances. Description of an intermediate-level phenomenon is not completed by describing its possibility and implementation in lower-level terms. Its presence, prevalence or distribution (all needed for a complete explanation of biological phenomena) will often require reference to laws at a higher level of organisation as well. Paraphrasing Point 1, all processes at the lower levels of a hierarchy are restrained by and act in conformity to the laws of the higher levels. (1974, 180)

According to this author, the laws of the higher levels have some causal influence on the *distribution* of lower level events. That is, the instantiation of higher level laws and properties selects the instantiation of some lower properties by *constraining the range of their possibilities* (see Juarrero 1998). Following this interpretation, we can say that the idea of downward causation is necessarily articulated from the concepts of *selection* and *constraint*, which in turn presuppose the existence of *a variety of possibilities at the lower level to be constrained*. In other words, downward causation works as the decrease in the degrees of freedom given at the lower physical levels of the natural systems.

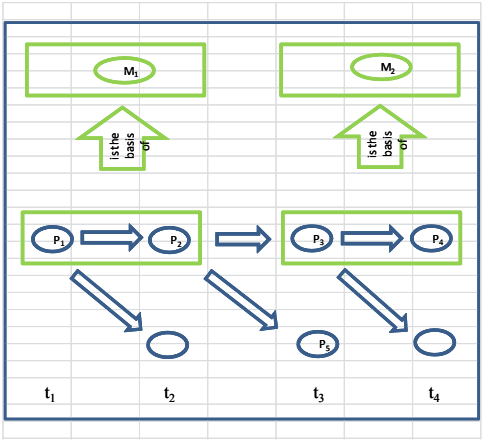
An example that is used in recent years to suggest plausible emergent processes and the action of downward causation is that of protein folding. This is the process by which a protein reaches a three-dimensional structure enabling it to fulfill its biological function. On this example, Murphy and Brown comments:

> [I]f a protein could be composed of (only) 85 amino acids (actually some have 200), the number of proteins allowed by the laws of chemistry would be 10^{110}, which is equal to the mass of the universe measured in units of the mass of a hydrogen atom times the age of the universe measured in picoseconds. Biochemistry itself can never explain why the world contains the proteins it does, since it explains equally well why we could have had a vast number of sets of entirely different ones. We need top-down accounts that involve information about what existing proteins do in organisms' bodies in order to explain why these ones exist and others do not—we need to know their *functions* in larger systems. (2007, 64)

To get a clearer idea of the philosophical articulation of this kind of causation or causal influence, let us suppose in a simplified and formal way the following microphysical laws: (i) the probability of an instantiation of P_1 causing an instantiation of P_2 is 0.5, that is: $Pr(P1 \rightarrow P2) = 0.5$; (ii) $Pr(P2 \rightarrow P3) = 0.5$; (iii) $Pr(P2 \rightarrow P5) = 0.5$; and (iv) $Pr(P3 \rightarrow P4) = 0.5$. Let us diagram the different causal possibilities admitted by these microphysical laws as follows:

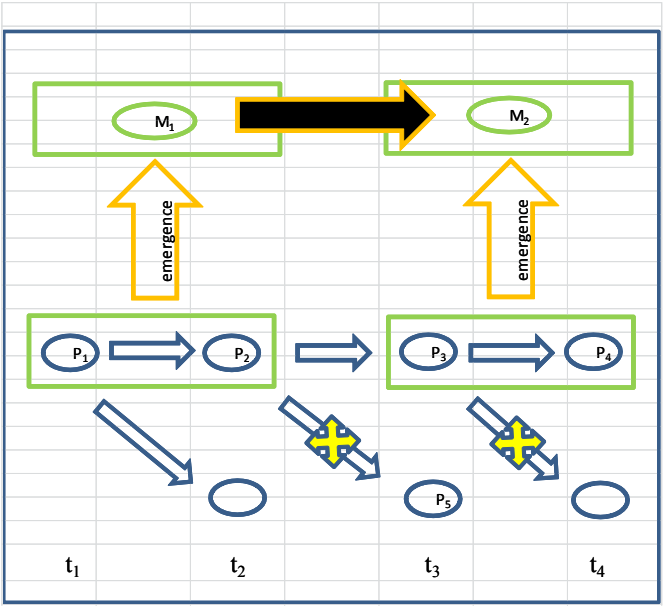


Now, let us suppose that $P_1 \rightarrow P_2$ realizes the higher level, mental state M_1, and that $P_3 \rightarrow P_4$ realizes the mental state M_2. We would have something like what is shown in the following diagram:



If this is so, from a purely lower physical point of view (that is, from the instantiation of its microphysical realizer $P_1 \rightarrow P_2$) the instantiation of M_1 could still cause different courses of events which are not necessarily mental; for example $P_5 \rightarrow P_6$. Precisely, this is a consequence of the existence of some indeterminacy at the lower levels: from a single microphysical state (say, P_2) it can follow many different courses of events (say, either P_3 or P_5).

However, the probability of the arrangement and occurrence of the various events changes when we introduce a higher level law that constrains the possibilities given at the lower basal level. Let us then suppose the higher level, psychological law: (iv) $Pr(M_1 \rightarrow M_2) = 1.0$. In this case, if we have an instantiation of M_1 that is realized by $P_1 \rightarrow P_2$, and we have the fulfillment of the psychological law, then we will necessarily have the lower causal chain $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_4$. In this case we would have the following diagram:



In this kind of circumstances we can ask to the microphysicalist why the causal process $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_4$ (and thus $M_1 \rightarrow M_2$) is instantiated, and no other different lower processes which are compatible with the lower level laws which are present, as for example $P_1 \rightarrow P_2 \rightarrow P_5 \rightarrow P_6$, or $P_1 \rightarrow P_2 \rightarrow P_5 \rightarrow P_7$, or other different ones. The nonreductive, emergentist answer is that the lower physical possibilities governed by the lower physical laws are constrained by the higher level law $M_1 \rightarrow M_2$, which increases the probability of the instantiation of $P_1 \rightarrow P_2 \rightarrow P_3 \rightarrow P_4$ over the others.

Whether this kind of macro-causation ends up being a fact of our world or not is essentially an empirical question which consists in the existence of two conditions: the necessary *under-determination* given at the lower levels, and the existence of the higher level laws that constrain the lower level courses of events. Then, if this kind of phenomenon constitutes a fact of our world it is possible the existence of multiple levels of organization with their own laws and causal influences that would end up complementing each other. As stated by Campbell, Van Gulick (1993, 252), and Sperry (1986, 268), the higher level laws do not contradict, not change nor violate the lower ones. For this reason it is emphasized that not only the special laws must conform to the lower, but the laws of the lower levels must act in accordance with those of the higher levels. But the mere assertion of the existence of multiple causal laws and levels is not enough. To understand the relationship and *dependency* of the higher level laws vis-á-vis the lower ones, we must remember that the former only function as higher level constraints of the latter and, therefore, can only exist while the latter take place; without the existence of lower level laws involving different degrees of freedom and under-determinacy it is impossible the occurrence of higher level laws acting as their constraints.

If NRP in its emergentist account is empirically correct, our world is a largely complex, rich, and hierarchical world; a world constituted by higher level laws as determinant factors of the courses of events at the lower levels that to *some extent* are nomologically and causally under-determined. Moreover, it seems that our current basic physics, quantum physics, assures us one of its conditions: microphysical indeterminacy.[6] NRP, as a philosophical position, shows us its conceptual and metaphysical possibility. The rest will have to be confirmed or refuted by empirical work.

Bibliography

Alexander, Samuel. 1920. *Space, Time, and Deity. Vol. 2*, London: Macmillan.

Bennett, Karen. 2008. "Exclusion Again." In *Being Reduced. New Essays on Reduction, Explanation, and Causation*, edited by Jakob Hohwy & Jesper Kallestrup, 280-305. New York: Oxford University Press Inc.

Bickle, John. 1998. *Psychoneural Reduction: The New Wave*. Cambridge, MA: MIT Press.

Block, Ned. 1980. "What is Functionalism?" In *Readings in Philosophy of Psychology*, edited by Ned Block, 171-184, Cambridge, MA: Harvard University Press.

Campbell, Donald. 1974. "'Downward Causation' in Hierarchically Organised Biological systems." In *Studies in the philosophy of biology. Reduction and related problems*, edited by F. J. Ayala & T Dobzhansky, 179-186. Berkeley: University of California.

Chalmers, David. 1996. *The Conscious Mind*. Oxford: Oxford University Press.

Crane, Tim & Mellor, D. H. 1990. "There is No Question of Physicalism." In *Mind,* Vol. 99, No. 394: 185-206.

Davidson, Donald. 1980. *Essays on Actions and Events*. Oxford: Clarendon Press.

d'Holbach, Paul-Henri. 1970. *System of Nature*, [1770] Translated by H.D. Robinson, New York: Burt Franklin.

Fodor, Jerry. 1974. "Special Sciences (Or: The Disunity of Science as a Working Hypothesis)". In *Emergence: Contemporary Readings in Philosophy and Science*. Massachusetts Institute of Technology, edited by M. Bedau & P. Humphreys (2008), 395-409. Cambridge: The MIT Press.

Gillett, Carl. 2007. "Understanding the New Reductionism: The Metaphysics of Science and Compositional Reduction," *The Journal of Philosophy*, Vol. 104, No. 4: 193-216.

Hellman, Geoffrey. 1985. "Determination and logical truth." *Journal of Philosophy*, vol. 82, no. 11: 607-16.

Hitchcock, Christopher. 2012. "Probabilistic Causation," *The Stanford Encyclopedia of Philosophy* (Winter 2012 Edition), Edward N. Zalta (ed.), URL = <http://plato.stanford.edu/archives/win2012/entries/causation-probabilistic/>.

Juarrero, Alicia. 1998. "Causality as Constraint." In *Evolutionary Systems*, edited by G. Van de Vijver et al., 233-242. Dordrecht: Kluwer Academic Publishers.

Kim, Jaegwon. 1992. "Multiple Realization and the Metaphysics of Reduction." *Philosophy and Phenomenological Research*, vol. 52, no. 1: 1-26.

Kim, Jaegwon. 1993. *Supervenience and mind. Selected philosophical essays*. New York: Cambridge University Press.

Kim, Jaegwon. 2005. *Physicalism, Or Something Near Enough*. New Jersey: Princeton University Press.

Lewis, David. 1980. "Mad Pain and Martian Pain." In *Readings in Philosophy of Psychology*, edited by Ned Block, 216-222, Cambridge, MA: Harvard University Press.

McLaughlin, Brian. 1992. "The Rise and Fall of British Emergentism." In Beckermann, A., Flohr, H. & Kim, J. (Eds.), *Emergence or Reduction?: Essays on the Prospects of Nonreductive Physicalism*, 49-93. Berlin: Walter de Gruyter & Co.

Morales, J.D. MS. "Non-reductive physicalism and the problem of causation in the special sciences." In *The emergence of mind in a physical world*, PhD dissertation, National University of Colombia.

Murphy, Nancey & Brown, Warren. 2007. *Did My Neurons Make Me Do It? Philosophical and Neurobiological Perspectives on Moral Responsibility and Free Will*. New York: Oxford University Press Inc.

Papineau, David. 2008. "Must a Physicalist be a Microphysicalist?" In *Being Reduced: New Essays on Reduction, Explanation, and Causation*, edited by Jesper Kallestrup and Jakob Hohwy, 126-148. New York: Oxford University Press.

Putnam, Hilary. 1970. "On Properties." In E*ssays in Honor of Carl G. Hempel: A Tribute on the Occasion of his Sixty-Fifth Birthday*, edited by Nicholas Rescher et al, 235-254. Dordrecht: D. Reidel.

Shapiro, Lawrence. 2008. "How to Test for Multiple Realization," *Philosophy of Science*, 75: 514–525.

Shoemaker, Sidney. 2007. *Physical realization*. New York: Oxford University Press.

Sperry, R. W. 1986. "Macro- versus Micro-Determinism." *Philosophy of Science*, vol. 53, no. 2: 265-270.

Van Gulick, Robert. 1993. "Who's in Charge Here? And Who's Doing All the Work?" In *Mental Causation*, edited by J. Heil & A. Mele, 233-256. Oxford: Clarendon Press.

---

[1] Thanks to Brian McLaughlin, Alejandro Rosas, and an anonymous referee for this journal for valuable comments on this work.

[2] Here I will use the general sense of 'entity' and 'phenomenon' for including both particulars (as objects, events, and processes) and what many theorists take as universals (as properties, relations, and laws).

[3] Henceforth, I will use "special property" to refer to the properties of the special sciences.

[4] Here I do not have space for a detailed analysis of the *subset account of realization* which claims that the causal powers of a higher level, realized property are *a subset* of the causal powers of each of its realizers (see, for

instance, Shoemaker 2007). Nonetheless, I think that there is a direct argument for the idea that, on this proposal, higher level properties should be finally reduced. Following the principle of causal individuation of kinds (that is, the idea that a property is a singular and unitary natural property if and only if its instances have similar causal powers; see, for example, Kim 1992 17 and Gillett 2007 196) we have to say that the physical causal powers in virtue of which a realizer occupies the functional role of a special property (the causal powers that this theory considers that are a subset of the entire set of this realizer's causal powers) should individuate both the higher level property (because these causal powers are necessary for the instantiation of this property) and the lower level realizer property (because these causal powers are sufficient for the instantiation of this lower level property). It follows that, against the subset account of realization, the causal powers of a higher level property are *identical with* the causal powers of each of its realizers (for a detailed articulation of this argument see Morales Manuscript).

[5] Two of the most recurrent *physical* examples that seem to show the falsity of the microphysical supervenience is the phenomenon of the quantum states of entanglement (see, for instance, Papineau 2008) and the fact that in General Relativity, according to Einstein's field equations, the relativistic gravitational field of two or more objects is neither the sum nor the product of a linear function of the gravitational fields of its constituent objects (see, for instance, McLaughlin 1992).

[6] Given the most widely accepted interpretation of the quantum theory of matter, most contemporary theorists maintain at least the possibility of a causally and nomologically non-deterministic world; a world in which the events are not fully determined by antecedent events and the laws governing their appearance and, therefore, where causation is basically probabilistic; where causes act by increasing the probabilities of their effects (see Hitchcock 2012 for example).