

Reductionism and Holism — Two Types of Holism

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In this presentation, I attempt to show that there are two types of holism. This presentation is a preliminary study for a rather bold conclusion, which I wish to make, to the effect that reductionism requires holism, or more precisely, some reductionist practice requires a holistic perspective. I am not in the position to claim that this conclusion is applicable in every field of philosophy, but I wish to argue that we can accept this conclusion in the context of ethics.

In Western philosophy, it is now standard to see that reductionism and holism are mutually exclusive. Reductionism is the view that asserts, roughly, that the nature of a complex system is absorbed or subsumed by (that is, reduced to) the nature of the sum of simpler or more fundamental things. Formulated in terms of “levels,” as is often done in contemporary discussions in the philosophy of mind, reductionism asserts that the nature of a higher-level structure is reduced to the nature of the sum of its lower-level parts. On the other hand, holism is a denial of reductionism; that is, the view that holds that things can have natures as a whole that are not reducible to the natures of the sum of their lower-level parts. Given these distinct characterizations, it is fair to assume that we cannot take these two views simultaneously in discussing any philosophical issues.

Nevertheless, I wish to argue that there are some contexts in which it is more philosophically productive to accept that these two views, with a certain *proviso*, work hand in hand, and that a version of holism that is explanatorily useful is the view in which holistic properties have *constitutive* and *not eliminative* relationships with their base structure. In this paper, I attempt to present a preliminary theoretical consideration for that desired conclusion.

I

For clarification, let me say a few words about reductionism. Reductionism is the view that asserts that the nature of one domain of items is shown to be either absorbable into, or dispensable in favor of, the nature of another domain of items. Here, “items” can refer to, for example, objects, entities, properties, phenomena, events, facts, explanations, laws, theories, concepts, or meanings. This view commits to an asymmetric relation between two domains or sets of items. In the tradition of analytical philosophy, it is customary to distinguish two dimensions of reductionism: ontological reductionism and methodological reductionism (or “explanatory” reductionism for the reason that will be explicated below). Ontological reductionism asserts, roughly, that larger items or entities that exist are made from, thus reducible to, a

number of smaller items or entities; simply put, that everything is composed of nothing more than smaller parts. (The classical atomism is of this sort.) Asymmetry here is talked about the relation between two sets of existing entities.

This view is often contrasted with methodological reductionist positions. Methodological reductionism focuses on explanation or explanatory strategies (thus, is often called “explanatory reductionism”). It holds that explanations of items, such as scientific explanations of phenomena or entities, should be broken down to simpler units; larger items *are explainable in terms of* smaller units. Asymmetry here is on the relation between two sets of distinct explanatory devices (concepts, expressions, descriptions or theories). Depending on the nature of the items reduced, reduction will promote ontological or explanatory economy and unity. Assuming that two synonymous sets of concepts or expressions, one each from two different explanations, refer to the same entities, explanatory reduction between the two sets would accomplish ontological reduction; entities referred to by the first sets of explanation would be shown to be among the second set. This reduction is “eliminative” reduction, in the sense that the reducing set dispenses with the reduced set.

The account of reduction that has been used, implicitly or explicitly, in the recent debate of reductionism in the field of philosophy of science is of this type, and was originally formulated by Ernest Nagel in the 1950s¹. According to this account, which we may call the Nagel model, reduction is, as is well known, a relation that holds between two theories T_1 and T_2 if the laws of theory T_1 can be deduced from the laws of theory T_2 in either of the following two ways: (1) directly or (2) with the aid of “bridge laws.” Bridge laws, which are biconditional laws, must be assumed as *additional premises* that are open to empirical investigation. In the Nagel model, the connections between two theories *are a posteriori* lawful relations. Since bridge laws are additional premises, i.e., extra conditions added to the two theories, the theory T_1 is *conserved* as part of the base theory T_2 when the T_1 is derivationally reduced from the T_2 . Nagel reduction is a species of “conservative” reduction, not eliminative reduction, in that the reducing theory conserves the reduced theory.

How we can amend this Nagel model (as shown by Kemeny and Oppenheim’s criticism) or how these two versions of reductionism are related (such as the issue of how one implements the other) is a controversial issue. I do not want to get into its detailed discussion, but merely point out that my discussion in this paper will focus on the explanatory aspect of reductionism. Also I will talk of properties, since most of the contemporary

debates on reductionism, in particular in the field of mind-body problem, have centered on properties. In addition, I will use the terms “macro/ macro-level” and “micro/ micro-level” structure (properties, and so on) referring to “higher-level” and “lower-level” structures (properties, and so on). This is also because I want to follow the current academic trend in this area of study.

Holism, a view contrasted with reductionism, is the view that items, or a system of items, can have properties as a whole that are *not* reduced to, or explainable by, the sum of their parts. As is well known, the principle of this view was explicitly and concisely summarized by Aristotle in his *Metaphysics*: “The whole is more than the sum of its parts.” It is known that the issues of holism have traditionally appeared in the philosophy of biology, of psychology, and especially of the human sciences. I believe it is also important to point out the term “holism” has been often used in a rather loose, if not dubious, sense. Applying the notion of holism to various fields of study, some say, for example, that a volume of air has a thermometer reading (a “holistic” property, they would call) with respect to the movement of the air molecules. But a thermometer reading depends on arbitrary systems; currently we happen to use two different temperature systems (that is, Celsius and Fahrenheit). It seems to me that this sense of the idea “holism” diverges from a more legitimate sense of the view. My objective in this presentation is to clarify this “divergence.”

In line of the argument of holism, one often quotes what is called “emergentism” as a view contrasted with reductionism, because the view emphasizes that a system can have qualities that are not reducible to the system from which the qualities have “emerged.” I thus discuss emergentism as a cardinal case of holism.

II

Although it is now standard to trace the birth of emergentism back to John Stuart Mill’s *System of Logic*², Alexander Bain’s *Logic*³ and George Henry Lewes’s *Problems of Life and Mind*,⁴ there has been much talk of the notion of “emergence” in many other places since the middle of the nineteenth century: Samuel Alexander,⁵ C. Lloyd Morgan⁶ and C. D. Broad⁷ in Britain; William James,⁸ Arthur Lovejoy⁹ and Roy Wood Sellars¹⁰ in the United States; and Henri Bergson¹¹ in France. This view is popular even among modern scientists: for example, a noted neuroscientist, Roger W. Sperry,¹² wrote:

... the molecules of higher living things are moved around mostly by the living, vital powers of the particular species in which they’re embedded. They’re flown through the air, galloped across the plains, swung through the jungle, propelled through the water, not by molecular forces or quantum

mechanics but by the specific *holistic* vital and also mental properties – aims, wants, needs – possessed by the organisms in question (Italics mine).¹³

What is emergentism? In 1920’s, as principal proponents of the classic British emergentism, Samuel Alexander and C. Lloyd Morgan formulated a doctrine that later became known as “emergent evolution”¹⁴. To quote one of these philosophers’ ideas, Alexander wrote:

Physical and chemical processes of a certain complexity have the quality of life. The new quality of life emerges with this constellation of such processes, and therefore life is at once a physico-chemical complex and is not merely physical and chemical, for these terms do not sufficiently characterize the new complex which in the course and order of time has been generated out of them. Such is the account to be given of the meaning of quality as such. The higher quality emerges from the lower level of existence and has its roots therein, but it emerges therefrom, and it does not belong to that level, but constitutes its possessor a new order of existent with its special laws of behavior.¹⁵

Needless to say, this view had been influenced by the development of evolution theory. According to their view, roughly, emergentism holds that when physical entities reach a certain level of complexity, they come to have certain non-physical properties (hereafter, I simply use “physical” instead of “physical and chemical”). Macro-level properties “emerge”, or are brought into being, *when and only when* an appropriate set of base or micro-level elements occurs in a certain way in a physical entity. It should be noted that emergentists think that there are *no* lawful relations between macro-level emergent properties and their base elements. A biological version of the view, for instance, holds that what is characteristic about emergent properties of biological processes is that they have been non-nomologically brought into being as a result of a certain biological development but are *not* themselves biological phenomena.

Emergentism’s basic idea is that emergent properties “emerge” out of their basal biological and physical processes, but are new in virtue of, or not deducible from, the properties in the base level. Standardly, the view is understood to consist of the following two theses: (i) the thesis that emergent properties are ontologically dependent on the whole (not on parts) of their biological and physical base (microstructure), and (ii) the thesis that emergent properties are characteristically irreducible to, and unexplainable in terms of, properties and relations instantiated in their biological and physical base. (ii) can alternatively be expressed as the thesis that emergent properties constitute an

epistemologically autonomous domain, or are explanatorily unreachable or unexplainable, that is to say, “new.”

We can thus summarize emergentism with the following four points:

(1) Dependence

When aggregates of basic entities attain a certain level of structural complexity, genuinely novel properties (emergent properties) emerge. These emergent properties emerge only when appropriate “basal” conditions of the physical structure are present. The relationship between emergent properties and their biological and physical base structure is thus characterized as:

[Emergent properties are dependent on and determined by the “basal” conditions of the physical structure.]

To formulate this idea, we can use the well-established notion of supervenience, which is expressed as follows:

(S) A supervenes on B, if and only if any two things that are indiscernible in respect to their micro-level property (B) are indiscernible in respect of their macro-level property (A).

The above condition of dependence will then be formulated as:

[Emergent properties supervene on the properties instantiated in the “basal” conditions of their micro-physical structure.]

(2) Newness/ novelty

Lloyd Morgan explains the concept of emergence by contrasting emergent properties with properties that are merely and straightforwardly calculated and predicted from their base structure; he explains the latter as “properties ... which are additive and subtractive only, and predictable,” and characterizes emergent properties as “new and unpredictable.”¹⁶ In his explanation, Morgan emphasizes the idea of “newness” or “novelty.” Emergentism is hence considered to have the following tenet:

[Emergent properties are novel with respect to the micro-physical structure out of which they emerge.]

“Novelty” implies that emergent properties are epistemologically unreachable, that is, there are no nomic or lawful relations between emergent properties and their base properties in the micro-physical structure.

(3) Unpredictability

As suggested above,

[Emergent properties are unpredictable because they are new – in its epistemological sense.]

We should be careful in understanding this *unpredictability*, however. It is important to distinguish *inductive predictability* and

theoretical predictability. Emergentists were clearly aware of this distinction. Even though they are characterized as unpredictable, emergent properties are inductively predictable. Suppose, in the course of history, we have observed an emergent property, E , emerged from a system whenever the system instantiated a set of micro-level properties P . Then, we may predict that this particular system will instantiate E at time t given our knowledge or belief that it will instantiate P at t — an inductive conclusion; hence, it is inductively predictable. What emergentists deny is theoretical predictability of E on the basis of P ; we may know everything about P including the laws that govern properties and relations constitutive of P , but nevertheless this knowledge will not be sufficient enough to predict E . All the knowledge will not theoretically lead us to predict the emergence of E ; this is what is also captured by the notion of “newness” or “novelty” mentioned above, also by the idea of unexplainability formulated above.

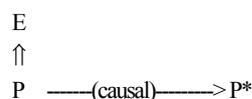
(4) Downward causation

The “newness” also has a metaphysical sense; namely, that an emergent property brings with it *new* causal powers. As stated in Alexander’s above quote, “constitutes its possessor a new order of existent with its special laws of behavior,” the view characteristically involves the claim that:

[Emergent properties exert causal power onto their physical base properties (in the micro-physical structure).]

This is the case of what has been called “downward causation.”

It is now widely considered that the view of emergentism has a serious flaw. The main reason is the claim of downward causation. It is generally assumed that any physical (micro-structural) base is characterized with what is often called the thesis of “causal closure of the physical (domain)”¹⁷ – a physicalist thesis that is widely accepted by contemporary physicalists or materialists. Its basic idea is that any physical property’s causal power suffices to bring about another physical property: Assuming a causal influence from outside that physical relation will infringe the “closure.” Even if an emergent property exerted causal power, as is claimed by emergentists, that power would be preempted or rendered redundant by the existing physical causal relation. More schematically, when a physical property P causes another physical property P^* to happen (P causes P^*) and an emergent property E emerges from the “basal” P , the causal power of E over P^* would be preempted; the relation “ E causes P^* ” would be preempted.



Certainly more should be said about this thesis, but I assume this conclusion and will continue my discussion. (So, my argument hinges on this physicalist thesis. Needless to say, emergentists are known to have accepted the physicalist framework.)

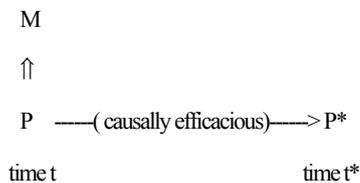
Emergent properties are considered to have no effective causal role, as is just shown. They are, however, *tightly* related to their base physical structure, which was also explained above; that is, emergent properties are dependent and determined by (in other words, supervene on) the conditions of the micro-physical structure. How should we coherently understand this? To answer that, I would like to introduce a distinction of two explanatory concepts that John Searle, a contemporary prominent scholar on the mind-body problem, introduced.¹⁸ Although I do not agree with Searle's argument, I find the distinction very useful here. So, I will just explain it below briefly, brief but sufficient enough to support my argument.

The two explanatory concepts are "causal efficacy" (or to use it as an adjective phrase, "causally efficacious") and "causal essentialness" (or "causally essential"). I will now proceed with rather precise terms. Suppose in a causal episode "e causes f," where e and f are event-tokens, e instantiates a micro-physical property P at time t and f instantiates a micro-physical property P* at time t*.

[*causal efficacy*: a property P is causally efficacious over P*, if and only if P causes P*.]

Here, P exerts certain causal power over P*. Suppose further that e instantiates a macro property M and that M emerges from the micro-structure of e at time t, that is, M supervenes on (or is dependent on, and determined by) P.

[*causal essentialness*: a property M is causally essential over P*, if and only if P causes P* and, at the same time, M is not causally efficacious over P*.]



In this causal episode, it is essential that M is in the picture, because M happens whenever P happens; nevertheless, M plays no causal role in bringing about P*.

Let me reiterate my above arguments using these new terms. As I have shown, despite emergentists' claim, an emergent property E does not have any causal influence over a micro-physical property P* in the base structure. Given that a particular

system instantiates E at time t when the system instantiates P at t, we can predict that the system will instantiate E at a different time t* whenever we know that it will instantiate P at t*; E happens whenever P happens (inductive predictability). Without this sort of observation, we cannot predict what emergent property emerges even when we know a particular system instantiates P* at t* (theoretical unpredictability). In the above case, when the system instantiates P, E must occur; it is necessary that E happens, even though E plays no causal role in P's bringing about P* (that is, the causal episode "P causes P*"). E is *causally essential*, even though it is not *causally efficacious*. In the emergentist framework, emergent properties are *causally essential*, even though they are not *causally efficacious*. Emergent properties at best carry important explanatory information, though they do not play any causal roles.

III

What I would like to do in what follows is to apply the just established conclusion about emergent properties to the discussion of holism. Again, holism is the view that items, or a system of items, can have properties as a whole that are not reduced to, or explainable by, the sum of their parts.

Consider the following supervenience relations: a property of being a "chair" supervenes upon the (properties of the) physical structure of the object; and the (property of) liquidity of water upon the molecule structure of the water; a thermometer reading about a volume of air upon the movement of the air molecules or its mean kinetic energy; moral properties upon non-moral (natural) properties; sociological phenomenon upon psychological one (if the psychological facts taken together are considered to determine the sociological facts). Among these supervenience relations, there are two types of relation¹⁹. Consider the liquidity of water and the "chairness." These properties supervene, respectively, upon the molecule structure of water and upon the physical structure of the chair. I call this kind of supervenience "*constitutive supervenience*" because, in these cases, the instantiation of the supervenient-base (subvening) (micro-level) properties *constitutes* the instantiation of supervening (macro-level) properties (for instance, the physical structure of a chair *constitutes* the "chairness" of the object; if there is not the physical structure, we *normally* do not have the "chairness."). In this type of supervenience, the supervening (macro-level) properties do not exist, unless their subvening (micro-level) properties, their constituents, exist. I take this notion of constitutive supervenience to be very useful here, because it entails that the existence of the subvening base is decisive for ascription of the supervening property while it allows us to maintain a non-reductive picture. On the other hand, in non-constitutive supervenience, the supervening (macro-level) and the subvening (micro-level) properties comprise distinct and independent ontological domains:

for example, a thermometer reading about a volume of air supervening upon the movement of the air molecules; a barometer reading supervening upon atmospheric pressure.²⁰ In these cases, there is a mere *correlation* between the two sets of properties. I thus call these supervenience relations “*correlative supervenience*.” By the term “correlation,” I mean a nomic relation. Thus, we can say that a property, M, merely *correlatively* supervenes on a physical structure, P, if there is a physically possible world where P is realized but M is not. In correlative supervenience, an entity has supervening properties *because of additional nomic features*; whereas in constitutive supervenience, an entity has supervening properties *just in virtue of its constitution*. Constitution is not a nomic relation, but echoes with the emergence relationship.

Since, as seen above, no nomic or lawful relations between emergent properties and their base properties are assumed, my discussion of emergent properties better fits with the notion of *constitutive* supervenience rather than that of *correlative* supervenience. Also if emergent properties are expected, as emergentists espouse, to play certain important explanatory, though not causal, roles, the idea of “causal essentialness” is very contributive here. The idea is that a macro property can be *causally essential* in explaining a micro-level (physical-level) causal episode, even when it is not causally efficacious for the matter. We may say that this is more true of the cases in which the instantiation of the micro-level properties constitutes the instantiation of macro-level properties. Suppose I throw away a chair, which shatters a window. Certainly the chairness of that object exerts no causal power over the window-shattering (it is the physicality of the chair), but the object’s being a chair is essential in explaining this episode (for example, “The *chair* I had thrown shattered the window”). On the other hand, human behavior can be explained solely in terms of psychology or physiology, without quoting, say, sociological ideas — which is probably evidence that these academic disciplines are distinct and independent of each other (one does not constitute the other); one is not part of the other.

This distinction leads us to claim that if we wish to talk of holistic properties which are expected to be explanatorily useful and thus should be “conserved,” not “eliminated,” it is wise to distinguish two types of holism depending on the relationship between the macro-level properties of a system as a whole and the micro-level properties of its parts: constitutive and correlative supervenience types. And in case we talk of the holistic views of *constitutive* supervenience type, we can certainly appeal to a strong (that is, essential) relationship between the macro-level properties and micro-level properties. We can thereby sensibly talk of causally inefficacious macro-level properties such as the liquidity of water and the chairness as a “holistic property” that is irreducible to its parts — and of the quality of “life,” as is claimed

by emergentists; well, I take the relation between “life” and the physical conditions as a *constitutive* supervenience relationship, as, I dare to say, Cartesian substance dualism has already become a little obsolete.

As long as we discuss holism of this type, I believe we can safely conclude that a holistic (macro-level) property, \underline{H} , of a system has to be instantiated in the system even though it does not play any causal role, because it constitutively supervenes on a set of base properties; \underline{H} , whose instantiation is constituted by its physical base structure, is causally essential to sustain its system, though it is causally inefficacious. This type of holism is clearly different from the type of holism in a loose sense which I hinted before in my presentation. In this second type of holism, macro-level properties of a system are so loosely, in other words simply nomically, related to their micro-level base that it is possible that the system is sustained even without the macro-level properties ascribed to the system. Remember the example I quoted above: a thermometer reading with respect to the movement of the air molecules. The movement of the air molecules is not necessarily constitutive of a thermometer reading, that is, some arbitrarily picked number. The liquidity of water at a certain temperature, on the other hand, is indispensable and essential if we wish to talk of the nature of the water at that temperature. Likewise, I believe emergentists would hope, “life” (or whatever they call) is indispensable and essential in talking of human beings.

My proposal here is not so much ambitious but important; that making the distinction as elaborated above would make the emergentist argument and the holist argument much stronger. Delineating the condition under which holistic (macro-level) properties play their roles would allow us not only to have the legitimate picture of holism but also to find the possible force of these holistic properties.

IV

Thus far, I believe I have rather clearly shown that we can make a distinction in the view of holism. But to point out that there are two types of holism is one thing, to show how we can use that distinction is another. Certainly I should say a few words on my whole project — on the conclusion to the effect that reductionism requires a holistic perspective.

What I have in mind right now is a discussion of the condition under which a holistic property can be explanatorily useful, though it is causally inefficacious, in our everyday life, say in ethical contexts. Peter Winch, in my interpretation, attempts to present one possible view for that in his paper “Eine Einstellung zur Seele (An Attitude toward a Soul).”²¹ In his argument, Winch examines Wittgenstein’s discussion on the difference between two statements “I believe that he is suffering” and “I believe that he isn’t an automaton.” To summarize his view, his conclusion is that we humans normally have some sort of (unconscious)

expectation toward human beings, which is not reducible to the host of knowledge and experiences we have had; it is not *justified* by other pieces of knowledge, but just *intelligible* to us. The gap is our asset. It is “part of the natural history of mankind”²². We may dare to say that the nature of the gap is similar to that of the relationship between emergent properties and their base properties. What I am inclined to point out here is that, as far as human beings’ behavior is concerned, holistic properties possibly have causally essential power on our actions and behavior. That rather bold conclusion, however, requires further precise discussions.

Notes

1. Nagel, E., *The Structure of Science* (New York: Harcourt, Brace & World, 1961).
2. Mill, J. S., *System of Logic* (London: Longmans, Green, Reader, and Dyer, 1843)
3. Bain, Alexander, *Logic, Books II and III* (London: Longmans, Green, Reader & Dyer, 1870)
4. Lewes, G. H., *Problems of Life and Mind. Vol. 2* (London: Kegan Paul, 1875)
5. Alexander, S., *Space, Time and Deity. 2 Vols.* (London: Macmillan, 1920).
6. Morgan, C. Lloyd, *Emergent Evolution*. (London: William & Norgate, 1923).
7. Broad, C. D., *The Mind and Its Place In Nature* (London: Routledge and Kegan Paul, 1925).
8. James, W., *Some Problems of Philosophy: A Beginning of an Introduction to Philosophy* (Lincoln and London: University of Nebraska Press, [1911] 1996)
9. Lovejoy, Arthur, “The Meanings of ‘Emergence’ and Its Modes,” in Edgar Sheffield Brightman (ed.), *Proceedings of the Sixth International Congress of Philosophy*, (New York: Harvard University, 1927).
10. Sellars, Roy W., “Levels of Causality: The Emergence of Guidance and Reason in Nature,” *Philosophy and Phenomenological Research* 20, 1-17.
11. Bergson, H., *L'Évolution Créatrice* (Paris: F. Alcan, 1912).
12. Sperry, R. W., “Mind-Brain Interaction: Mentalism, Yes; Dualism, No” *Neuroscience Vol. 5* (1980), pp. 195-206; “Discussion: Macro- Versus Micro-Determinism” *Philosophy of Science*, 53 (1986), pp. 265-270.
13. Sperry, “Roger Sperry,” in: Weintraub, P. (ed.), *The Omni Interviews*. (New York: Ticknor & Fields, 1984). p. 201.
14. I do not mean that Morgan completely accepted Alexander’s view. There was disagreement among them. For example, Morgan disagreed with Alexander’s picture of four major stages of emergence; he had difficulties in accepting the first stage (the stage in which matter emerged out of space and time) and the last stage (the stage in which deity emerges out of consciousness).
15. Alexander, S., op. cit., pp. 46-7.
16. Morgan, C. Lloyd. *Emergent Evolution*. (London: William & Norgate, 1923), pp. 2-3
17. See, for example, Kim, Jaegwon, *Supervenience and Mind: Selected Philosophical Essays* (Cambridge: Cambridge University Press, 1993).
18. Searle, John R., *The Rediscovery of the Mind* (Cambridge: the MIT Press, 1992).
19. During my presentation, Professor Miura pointed out, on this distinction, that some human factors may be working here. I thank him for the helpful comment.
20. This distinction between constitutive and correlative supervenience is not my original idea. See, for example, Seager, W., *Metaphysics of Consciousness* (London and New York, Routledge, 1991). He cites as an example of correlative supervenience a case of “a micro-particle’s definite momentum supervening upon having a definite position” (p. 177).
21. Winch, Peter, “Eine Einstellung zur Seele” in: *Trying to Make Sense* (New York: Basil Blackwell, 1988). pp. 140-153.
22. Winch, Peter, op.cit., p. 150.

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