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# RECONSIDERING WHITEHEAD WITH DEVAUX[1]

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*Summary*

This is an extensive book review of PHILIPPE DEVAUX, *La cosmologie de Whitehead: Tome I, L'Épistémologie whiteheadienne [Whitehead's Cosmology: Part I, Whiteheadian Epistemology]*, Louvain-la-Neuve, Les Éditions Chromatika, 2007, 340 pages. The book is edited by Thibaut Donck and Michel Weber, and contains a foreword by Paul Gochet. The extensiveness of the review is justified by the fact that Devaux's book offers the opportunity to reconsider and revise some outdated views on the place of Whitehead in the history of twentieth century philosophy, and on the relation between mathematical logic and speculative philosophy.[2]

## *Introduction*

Following his 1929 monograph on Samuel Alexander, Philippe Devaux (1902–1979) embarked on a study of Alfred North Whitehead. Only a few disconnected fragments of this study existed when Devaux, as a young and eager Belgian researcher, headed for Harvard University to join Whitehead's philosophical audience in the winter of 1930–1931. Despite the personal contact with Whitehead, and despite a first-hand acquaintance with Whitehead's thinking, his book on Whitehead was never completed. However, throughout his career as a professor (affiliated with the Universities of Liège and Brussels), as a translator (of Whitehead, Russell, and Popper), and as a writer (authoring, e.g., one of the first introductions in French to Russell's work), Devaux continued refining and extending his typescript. In fact, he was devoted to it even after a serious illness had put an end to his career in 1970, and until his death.

[1] A summary of this article is to appear as a book review in *Process Studies* journal.

[2] All quotations from Devaux's book are my translation. I thank my neighbour, novelist Peter-Paul Dirickx, for his linguistic support.

Thanks to Paul Gochet, spiritual heir of Devaux, and to the editing skills of Thibaut Donck and Michel Weber, and with support of the CNRL (Centre National de Recherche de Logique), the preface and the first eight chapters of the unfinished typescript of Devaux have now been published. Together with twenty-one more chapters which are awaiting publication, they form the first part of the book that Devaux had in mind. Its title, *Whitehead's Cosmology*, refers to Devaux's overarching project, but it should not lead the reader to expect a clear-cut exposition of the cosmology of *Process and Reality*. Even the subtitle, *Part I, Whiteheadian Epistemology*, is only an appropriate label to denote the more systematic chapters (III–VIII) and not the more historical preface and first two chapters, covering 195 of the 340 pages. The best characterization of the book is given by Paul Gochet in his Foreword:

> *Whitehead's Cosmology* by Philippe Devaux constitutes a historical testimony of exceptional interest, due to a scientifically educated philosopher who has personally known two of the main actors of the Anglo-Saxon philosophical renewal of the first half of the twentieth century: Russell and Whitehead. (vii)

In *Whitehead's Cosmology*, Philippe Devaux attempts to revive "the spiritual climate in the bosom of which Whitehead's thought has developed" (184), and for this reason the 2007 publication of a first chunk of his unfinished typescript could not have happened at a better moment. Indeed, the endeavour to put Whitehead's thought in its historical context is hot. E.g., it is an important part of the current activity generated by the *Chromatiques whiteheadiennes*, a Whitehead society centred around Michel Weber, and trying to cover the complete Whiteheadian spectrum in a series of lectures and publications (cf. `chromatika.org`). Also, the investigation into the emergence of Whitehead's philosophy in its British and American historical context is part of the mission statement of the recently launched *Whitehead Research Project* under the direction of Roland Faber (cf. `whitehead-research.org`).

## *Devaux meets Whitehead*

Devaux's Preface focuses on his personal experiences as an advanced fellow at Harvard University. Given "the opportunity to join in the United States the one whose philosophical odyssey constitutes the original theme of the work at hand: Alfred North Whitehead" (5), Devaux longed "to establish a direct contact with the man," a man "urged to respond to the challenges of a

new world." (25) Devaux considers "the issue of the adaptation" (8), namely, Whitehead's and his own adaptation to the challenging new world of Harvard University, by painting the multicoloured philosophical climate at Harvard during the inter-bellum. Topics here range from a "renaissance of realism" (10) to Clarence Irving Lewis's return to the pragmatism of Charles Sanders Peirce, and from the "polymorph patrimony of American Protestantism" (18) to a "new humanism" promoting "the primacy of man." (11)

Devaux first observed Whitehead when he addressed the students of the Philosophy Department during the 1930 opening of the academic year. He remarks that Whitehead looked "pale, severe, and seemingly grim-faced, with the air of an Old English country-gentleman, concentrated like Washington on a diplomatic mission" (35). This first encounter was followed by "frequent contacts, increasingly close, and increasingly friendly" (42). It is impossible to summarize Devaux's account of the fire-side chats at Whitehead's residence, and of the philosophy seminars which took place in his living room, but these frequent contacts made a lasting impression on Devaux. Among other things, they increased his awareness of "the unifying function of thought" (53), and of the non-substantial, fundamentally relational essence of all that exists. Such experiences also inspired him to ponder the following sketch of a philosopher, one that matched Whitehead's own:

> the philosopher is a man who forces himself to combine in one person the demands of the artist and of the mathematician, because he is at the same time, and to a large extent, open to the feeling of the particular and the universal, because he forces himself to grasp everything, and to understand everything: both harmony and tiny detail. (54–55)

*The Historical Context of Whitehead's Work*

Devaux's aim in chapters I and II of the book is "to broach one of the most demanding doctrines of our time," namely, Whitehead's philosophical system, by bringing to light "the conditions of its inception as a living thought," but at the same time, respecting "the plurality of sources which this thought tries to capture and integrate" (62). This aim obliges Devaux to go back in time, from Whitehead's speculative philosophical doctrines of his Harvard career (1924–1947), to his philosophy of science of his years in London (1910–1924), and even to the mathematics of his years at Cambridge (1880–1910). Devaux

> refuses to believe that the speculative philosophy, or if you prefer, the metaphysics of Whitehead, would be what it is if it had not been preceded by a philosophy of science, which in its turn is in line with one of the most daring endeavors of contemporary thought ..., mathematical logic. This order cannot be broken without endangering the intelligibility of Whitehead's philosophy. Every attempt ... to grasp the exact bearing of the Whiteheadian doctrine at the apex of its maturity ... will fail, ..., if ... one feels justified to silently ignore these two anterior moments: his philosophy of mathematics, and his philosophy of the natural sciences. (63–64)

This quote is an echo of the first sentence of Whitehead's preface in *Enquiry Concerning the Principles of Natural Knowledge* in which he points at the threefold root of his work: "the mathematical, the scientific, and the philosophical movements" (*PNK* v). However, this quote also points to a shortcoming of Devaux's study on Whitehead. Indeed, whereas Devaux clearly identifies the mathematical logic of Whitehead and Russell, and the British idealism-realism debate, as major sources of Whitehead's later philosophical endeavours, he does not sufficiently highlight the importance of the British reception of Einstein's theories of relativity.[3]

In relation to Whitehead's career as a mathematician, Devaux writes that "the first observation which cannot escape the historian of Whiteheadian philosophy is quite remarkable" (65), namely that "Whitehead's philosophical preoccupations did not become manifest until later, ... Whitehead, confronted with the problems of universal algebra and mathematical logic, only committed himself to satisfying the strictly technical requirements" (70–71) and that "for more than thirty years, he ... was happy to leave unsettled as many philosophical problems as possible" (75). This observation raises a question concerning Whitehead's status as a mathematician-philosopher. Notice that Devaux does not question the existence of mathematician-philosophers. On the contrary, he states,

> since all experience is being clarified when being mathematized, and since philosophy essentially consists in a systematic clarification of the totality of what we are thinking, where can one find a more ample and a more fertile field of investigation to offer to metaphysical speculation? Hence, nothing could prepare a more favorable climate for Whitehead's philosophical reflection than his actual

[3] See Desmet, R. "Whitehead and the British Reception of Einstein's Relativity," `www.ctr4process.org/publications/SeminarPapers/`.

> commitment to the austere scientific disciplines of algebra and formal logic .... (69)

The remarkable fact is not that mathematical and philosophical interests coexist in Whitehead, but rather that he "did not expose himself to the philosophical public prior to being almost sixty" (65). Here, "fifty" is perhaps more appropriate than Devaux's "almost sixty," especially in view of Whitehead's 1911 *Introduction to Mathematics*, which can be read as the Whiteheadian equivalent of Russell's *Introduction to Mathematical Philosophy*, not to mention Whitehead's 1915 decision to become a member of the London *Aristotelian Society*, a clear sign of exposing himself to the philosophical public. But, as Devaux highlights, in his first *Aristotelian Society* lecture, Whitehead modestly called himself "an amateur" (75). Nevertheless, the question remains: why did Whitehead not expose his philosophical ideas earlier in life, and in particular, during his collaboration with Russell in Cambridge?

A partial answer to this question, according to Devaux, is the fact that philosophy entails controversy, whereas Whitehead shied away from polemics, and was happy to leave it up to Russell to argue, for example, with Poincaré, first on the essence of geometry, and then on the function of logic. Devaux marvellously differentiates Whitehead from Russell in that the former

> leaves the most risky diplomatic missions up to his young and passionate colleague and collaborator, Bertrand Russell, a brilliant navigator in the crisscross of controversy. Russell takes good charge of making a lot of noise, and kicking-up a lot of dust. And above all, he has his way of thinking. Worthy of Alcibiades, he shamelessly burns, if needed, what he just admired, which, actually, does not make things easier. Whitehead ... is not in search of polemic, at no stage of his life at all. His dialectics, in order to progress, has no need to raise discussions with real adversaries, let alone imaginary, cooked-up stereotypes. (75–76)

Given this answer, and given the fact that "one does not simply switch from a complete lack of interest in philosophical issues to a constant and total concern," implying that Whitehead's "philosophical unrest" existed prior to its public appearance (165), Devaux makes plausible the possibility that it was a conscious choice made by Whitehead to keep his philosophical activity backstage, and to rely on Russell to go public. Of course, this only explains why Whitehead did not become a public mathematician-philosopher while still in Cambridge. It does not explain Whitehead's metamorphosis in London.

Following Russell, Devaux could have stated that Whitehead turned to speculative philosophy after his son Eric, member of the Royal Flying Corps during World War One, was killed in action over the Forêt de Gobain in 1918. However, Devaux refuses to identify "any extraordinary and absolutely decisive situation in Whitehead's life" because "in this totally even-tempered life, circumstances of this order completely fail" (165). Another explanation Devaux could here have invoked is the gradual divergence of outlook between Whitehead and Russell, rendering the latter inappropriate as a spokesman for the former. Regardless, Devaux invokes yet another historically interesting reason to understand why, later in life, Whitehead became a philosopher. According to Devaux, Whitehead lived "in a society where university institutions had turned scholars into professors, not only responsible for their scientific mission, but also for their role in the education of the young," and the educational responsibility of the English scholar included "a moral duty . . . to express his personal feelings, as an enlightened man, on the destiny of the human species, on the foundations of the highest values, and on many more things, divine and transcendental" (170–171). In such a society, "it frequently happens that a scholar, at the height of his researches, reunites the fruit of his meditations in philosophical synthesis" (169), and indeed, Devaux lists and discusses an impressive number of examples, in particular, physicist Oliver Lodge, naturalist Arthur Thomson, physiologist John Scott Haldane, biologist Conway Lloyd Morgan, as well as physicists Arthur Eddington and James Jeans.

In short, Devaux interprets Whitehead's early philosophical writings as a personal response to a general educational and moral duty imposed on all English scholars. Devaux's interpretation is interesting, even if it cannot be the sole explanation. His thesis of an educational motive for Whitehead's kick-off as a public philosopher, dovetails with the fact that Whitehead's London output also contains an impressive number of lectures on education. Also, by placing Whitehead within this particular British tradition, some other biographical details may gain relevance. For example, in 1912, Whitehead tried very hard (but in vain) to obtain a permanent appointment to the Goldsmid chair of Applied Mathematics and Mechanics, which William Kingdon Clifford and Karl Pearson had previously held at University College, London. Now, these two men can be added to Devaux's list of philosopher-scientists. In fact, Clifford's *The Common Sense of the Exact Sciences* and Pearson's *The Grammar of Science* were very popular in Whitehead's days. So, would it be wrong to say that Whitehead's application to succeed Pearson was part of his decision to follow in their footsteps, and become a philosopher-scientist himself?

Devaux's next question deals with the influence of philosophical movements on Whitehead, even prior to becoming a public philosopher, namely

those philosophical "transformations [to which] Whitehead was a silent witness, sometimes distracted, never indifferent" (77). In chapter II, Devaux first looks at the most important British movements in philosophy during the last quarter of the 19th century. He writes that

> two great movements of thought divide[d] the cultivated minds of this era. On the one hand, evolutionism in the philosophical format given to it by Herbert Spencer ... after the Darwinians, and at the same time as Thomas Huxley; on the other hand, neo-Hegelian idealism, of which [Thomas Hill] Green, [Eduard] Caird, [Francis Herbert] Bradley and [Bernard] Bosanquet were the major craftsmen in England from 1881 to 1900 approximately. (78)

Devaux touches upon many aspects of these movements, these thinkers, and their interaction, specifically, the development of naturalistic evolutionism into pragmatic evolutionism, the pessimism entailed by naturalistic evolutionism, the various Hegelian reactions to that pessimism, aggravated by two economic crises, as well as the influence of the writings of Hermann Lotze on F.C.S. Schiller's pragmatism. However, the Whitehead scholar might be a bit disappointed that Devaux does not give as much detail in respect to McTaggart as he does in relation to some other neo-Hegelian idealists. He states, "McTaggart could not exercise the same influence ... prior to the publication of *The Nature of Existence* (1921), the work that was so important in the history of British idealism" (79). This may be true in general, but in relation to Whitehead's case, it is not. Whitehead was an intimate friend of McTaggart almost from the very first day McTaggart came to Cambridge University, and they had almost daily chats, including philosophical conversations. Of course, Devaux died before Victor Lowe's biography, *Alfred North Whitehead: The Man and his Work* appeared, and this may be one of the reasons why he does not give McTaggart, and some of Whitehead's other Cambridge colleagues, for instance, James Ward, the place they deserve.

Devaux provides a treatment of a number of philosophers who were important in Whitehead's development, some of whom are largely neglected in more recent Whitehead literature, for example, Dawes Hicks, one of Whitehead's *Aristotelian Society* friends, next to Wildon Carr, Percy Nunn, and Lord Haldane. Devaux deals with Hicks in the context of a prelude to his account of the realist reaction to the idealist movement. This account is part of Devaux's chapter III, "The Renaissance of Realism and Whiteheadian Thought" (117) which commences with George Edward Moore's 1903 "The Refutation of Idealism." However, at the end of chapter II, an almost twenty page footnote contains an interesting and detailed digression to show that, in

order to deal with the conditions of the renaissance of realism in England, "one might evidently go further back in time," rather than taking the obvious 1903 starting point (97). Here, I cannot mention all philosophers which are treated by Devaux, but after dealing with Shadworth Hodson (co-founder of the *Aristotelian Society*) and Robert Adamson (predecessor of Alexander in Manchester), he gives a six-page exposé on Hicks. Hicks is now a largely forgotten figure, but one who is acknowledged by Whitehead in the following quote:

> in matters philosophic the obligations of an author to others usually arise from schools of debate rather than from schools of agreement. ... At the present moment England is fortunate in this respect. London, Oxford and Cambridge are within easy reach of each other, and provide a common school of debate which rivals schools of the ancient and medieval worlds. Accordingly I have heavy obligations to acknowledge to Bertrand Russell, Wildon Carr, F.C. Schiller, T.P. Nunn, Dawes Hicks, McTaggart, James Ward, and many others who, amid their divergences of opinion, are united in the candid zeal of their quest for truth. (*PNK* viii)

This quote justifies Devaux's detailed historical treatment of the British idealism-realism debate, a treatment reminding of Robin George Collingwood's writings, to which Devaux also refers (122–124). The affinity can be illustrated by citing an unpublished 1935 manuscript of Collingwood's, entitled *Realism and Idealism*,[4] in which he states, "the problem of modern realism is the problem of perception." In line with this aphorism, Devaux writes that for the neo-realists, in contradistinction to the post-Darwinian evolutionists and the neo-idealists, "the theory of knowledge would have to be drawn after the model necessitated by the *study of sense perception*" (129, original italics). Collingwood, in his manuscript, links his own view on perception, one which attempts to go beyond the idealism-realism divide, with Whitehead's view, by writing, "my view is in essentials pretty much the same as his." Devaux identifies "the 'logicization' of sense perception" as the apex of the neo-realist movement, especially Whitehead and Russell's application of the logic of *Principia Mathematica* to the problem of perception, "well before the 'Vienna Circle' existed, that uncompromising competitor of the Cambridge school" (131).

[4] Thanks to Prof. Dr. Guido Vanheeswijck of the University of Antwerp who was so kind to provide me a copy.

Devaux does not forget to give an account of the important impact of "Russell's *The Philosophy of Leibniz*, London, 1900 ... in the British philosophical milieu" (125), nor the important rejection by Moore and Russell of the idealist "dogma of the internality of relations," and their embrace of a "theory of the externality of relations" (136). However, in conjunction with the above, Devaux recurrently focuses on Russell's 1914 *Our Knowledge of the External World*, in which "the 'logicization' of the foundations of mathematics" is extended to perception and language, hence foreshadowing logical positivism. He states,

> today we know that following the path indicated by Russell in *Our Knowledge of the External World*, the majority of theoreticians of the Vienna Circle, whether we consider Rudolf Carnap or [Ludwig] Wittgenstein, Philip Frank or ... Moritz Schlick, to only mention the most important ones, has been inspired to a large extent by the directions contained in this work. (202)

Devaux clearly recognizes the important influence of Whitehead on Russell's logicism, as well as on the latter's *Our Knowledge of the External World*, an influence repeatedly acknowledged by Russell himself, especially in relation to Whitehead's method of extensive abstraction, that is, his method of applying the new logic of relations to the problem of perception. Devaux's recognition of the importance of the Whitehead-Russell interactions in these matters implies an open invitation to reconsider the relation between Whitehead's philosophical journey and the logical positivist adventure, for example, along the lines of Henry Leonard's essay "Logical Positivism and Speculative Philosophy" (203). For Devaux, this recognition implies that Whitehead's work can be seen as a culmination point of British neo-realism, despite the fact that Whitehead distances himself from the neo-realist externalism and the resulting "inclination towards logical atomism in Moore and Russell" (152). Devaux also provides an account of the role played by Alexander in the realist camp, and of his influence on Whitehead. Overall, Devaux's interpretation of Whitehead's work is that it is a climax of the British neo-realist movement. He writes that with respect to the history of such realism

> which started with total externality, and hesitatingly progressed towards Alexander's immanent-like theory of objectivity, Whitehead deliberately and progressively opposes a realism of immanence. However, when teaching it, this supreme resolution risks appearing less rich if one does not recall that it arises from a merely schematic theme, first due to Moore, picked-up and developed by Russell, and

> further amplified and orchestrated 'in grand fashion' by Alexander, prior to being crowned by the brilliant Whiteheadian contra-fugue. (149)

*Whitehead's Philosophy of Science*

Contrary to the majority of books on Whitehead's philosophy of science, the more systematic chapters of *Whitehead's Cosmology* do not start with an account of *An Enquiry Concerning the Principles of Natural Knowledge* (1919) or *The Concept of Nature* (1920), but rather with a treatment of two earlier Whitehead papers, "The Organization of Thought" (1916) and "The Anatomy of Some Scientific Ideas" (1917). Devaux places more emphasis on the role played by mathematical logic in Whitehead's work than on the influence of Einstein's theories of relativity. Devaux does not refer to Whitehead's "Space, Time, and Relativity" (1915), even though Whitehead clearly saw these three papers as jointly forming the nucleus of his philosophy of science. Whitehead not only alludes to this notion when including them in his 1917 collection of papers, *The Organization of Thought*, but also when re-including them in his 1929 collection *The Aims of Education*, as he states, "they are not to be constru[]ed as commentaries on my writings since that date. The converse relation is the true one" (*AE* vi).

Devaux's analysis of "The Organization of Thought" and "The Anatomy of Some Scientific Ideas" in chapters III and IV constitutes an excellent commentary on Whitehead's statement that "science is rooted in . . . commonsense thought," that commonsense thought "is the datum from which [science] starts, and to which it must recur" (*OT* 112). In Devaux's rich account of these works, science is an organization of thought that is characterized by systematic coherence, and hence, by its logical texture. But its success has led us to ignore the limitations of its scope, to exaggerate the exclusiveness of its method, and to wrongly attribute ontological priority and autonomy to its concepts. The vague flux of perceptions and emotions is first stabilized by commonsense thought and its natural languages, which is then rendered exact by scientific thought and its "conventional and symbolic language" (206). However, this does not justify science in discrediting common sense since, first, "scientific thought only differs from commonsense thought by the *degree* of theoretical rigour" (209), and second, scientific thought and its technical offspring are heavy influences on the evolution of commonsense thought. He writes, "today, nature as displayed by the spectacle of commonsense thought, is already overwhelmingly styled by the complex intervention of human ingenuity" (207–208). Last, the verification or falsification of scientific thought is necessarily mediated by commonsense thought. In other words, the theoretical world of scientific objects can only be put to the test

by recourse to the practical "world of commonsense things" (209). Even the most systematic of all natural sciences, namely, "mathematical physics" (222) "inevitably ... *rejoins* experience" (225), "because all verification of physics ultimately rests on the set-up of experiments" (226). And each experiment is an event, intended "to render transparent an intelligible complex of [scientific] objects," but at the same time happening "in a world of [commonsense] things." (227)

The latter sentence seems commonplace, namely, the idea that the theoretical world of science and the practical world of common sense meet in our experience. However, according to Whitehead, this experiential meeting is analyzed in an insufficient manner, even disregarded to the point of bifurcating nature into two diverging worlds. One formulation of this bifurcation is attributed to Jean Nicod, whose work is characterized by Devaux as a study "of sense perception and its epistemological conditions" (145). Nicod states, "we believe in laws which are founded only on experience although we do not know exactly what they mean in terms of experience" (*Foundations* 13). For example, we believe in the laws of general relativity because they are founded on experience. Devaux writes,

> the announcement of the deviation of rays of light in the famous observation which was supposed to contribute to the accreditation of the theory of relativity ... clearly showed that mathematical physics did not stop to provide empirical proof, as required from every scientific discipline. (225–226)

But do we know what these laws mean in terms of experience? According to Whitehead, Einstein failed to provide the answer to this question, and in *The Principle of Relativity*, Whitehead wrote, "Einstein, in my opinion, leaves the whole antecedent theory of measurement in confusion, when it is confronted with the actual conditions of our perceptual knowledge" (*PR* 83).

As Devaux highlights, when confronted with the request to formulate an antecedent theory of measurement in particular, and of perception in general, one might raise an objection. Particularly, he writes, "will we not soon be forced ... to subordinate the epistemological truth to the scientific truth, meaning, to prove what we are going to presuppose in science by means of the truths of science?" (233). Indeed, will we not be forced to give meaning to science by means of a *scientific* theory of perception, as in a vicious circle? However, according to Devaux, this is "a philosophical pseudo-problem," resting on the false presupposition that "truth is coextensive with science" (234). According to both Whitehead and Devaux, there is no pure and independent source of truth. For Devaux, "each truth depends on the interrelation of judgements, on their systematic links, on their function

in a hypothetical-deductive structure. Unconditional truth does not exist" (239). In this holistic account of knowledge, the pseudo-problem concerning foundation is translated into the requirement of the overall coherence of knowledge. Scientists escape from the latter requirement by ignoring the dependence of science on a larger background of knowledge. According to Whitehead, they only ask one question, namely, "has the doctrine a precise application to a variety of particular circumstances so as to determine the exact phenomena which should be then observed?" (*PR* 3). But Whitehead's philosophy of science offers no such escape route. Whitehead writes, "there are two gauges which every theory must pass. There is the broad gauge which tests its consonance with the general character of our direct experience, and there is the narrow gauge [of experiment] which is ... the habitual working gauge of science" (*PR* 4).

In chapter VII, "Epistemology and Mathematical Physics," Devaux endorses Whitehead's requirement that every theory has to pass the test of overall consonance with experience. Mathematical physics

> does not offer all guarantees with regard to its physical significance unless it satisfies the requirement of always being able to restore the [mathematical] entities at play into a kind of interpretative system which is coherent with a given experience, with a lived experience in all its meticulous complexity of actual becoming ... The *interpretability* always constitutes the primitive criterion of the value of a theory ... One has to *interpret* [a theory] in order for it to be pregnant of a proper *significance*. (284–285, 289)

Devaux gives the example of the concept of a mass point in Newtonian mechanics. This mathematical entity is "an ideal mass," whereas "all physical masses occupy a volume," but "the technique of integration" is an important step in arriving at "an interpretation of the differential equations" dealing with the mechanics of point masses (286). Devaux adds,

> when opposing the global character of the observational data to the infinitesimal crumbling of mathematical physics, one can draw attention to the fact that the latter character does not prevent the astronomer or the engineer to treat a body as a whole, and to predict its behaviour. (288)

This may be true, but Devaux fails to highlight that whereas the habitual interpretation of Newtonian mechanics allows for the habitual step of astronomers and engineers from the infinitesimal to the integral picture, Einstein's interpretation of his general theory of relativity does not account for

that step. His local curvature interpretation of space-time, resulting from his postulate of the *local* equivalence of the inertial frame-description and the gravitational field-description, does not allow for the geometrical assembly of the different infinitesimal pictures into a global picture, which is coherent with the actual conditions of our experience. To be sure, general relativity's "purely infinitesimal geometry," to employ Hermann Weyl's terminology, does allow for a mathematical integration into a globally non-uniform space-time, but the latter is at odds with the actual conditions of our perceptual knowledge, because "our experience requires and exhibits a ... uniformity of spatio-temporal relations" (*PR* v). For example, the global visualization of the deviation of a ray of starlight passing the sun, which illustrates Eddington's solar eclipse verification of general relativity, is the result of an integration of the local data (i.e. spots on photographic plates) in accordance with the actual conditions of our perceptual knowledge. But it is fundamentally at odds with the only, purely mathematical integration of these data allowed for by Einstein's interpretation. The path of light in the zero curved Euclidean visual picture is *not* the geodesic in the variably curved non-Euclidean mathematical picture. This lack of coherence between the commonsense interpretation of the practice of observation, and Einstein's interpretation of the scientific theory these observations are supposed to verify or falsify, prompted Whitehead to give "an alternative rendering of the theory of relativity" (*PR* v).

The fact that Whitehead's re-organization of the concepts of space, time, and matter, is quite different from Einstein's, should have prevented Devaux from drawing potentially misleading parallels between the two men. After giving the special relativistic example of Einstein's operational definition of simultaneity, Devaux links "Einstein's original memoirs" to "the guiding principle that Whitehead wanted to follow in his reconstruction of the various concepts at play in our systematic representation of nature" (297). "In outline," he says, this principle amounts to the fact that "we can economize on [a] concept [such as 'simultaneity'] among the primitive concepts of a theory" if we can derive it from concepts which generate "more extrinsic simplicity in the realm of sense experience" (296–297). This may be true, but it is misleading. Einstein's operational definition of simultaneity for distant events is part of his postulate of the constancy of the speed of light. It is "the clue by which Einstein guided himself" to special relativity (*ESP* 332), but it is rejected by Whitehead where he states, "I do, however, disbelieve in this invariant property of the velocity of light, for reasons which have been partly furnished by Einstein's own later researches" (*ESP* 334).

Devaux also writes that "the law of physical space and time has been subjected to the common destiny of all physical laws, and its formulation has become as revisable as the one expressing the gravitational relations" (300).

Again, this may be true, but it is misleading. Einstein's unification of the geometry of space-time and the physics of gravitation is part of his postulation of the local equivalence of the inertial frame-description and the gravitational field-description, namely, part of "the clue by which Einstein guided himself" to general relativity (*ESP* 332), but which is rejected by Whitehead. Whitehead maintains "the old division between physics and geometry," in stating that "physics is the science of the contingent relations of nature and geometry expresses its uniform relatedness" (*R* v–vi).

To avoid misunderstanding, let me add that Whitehead, while rejecting both the postulation that guided Einstein to his special theory as well as the postulation that guided Einstein to his general theory, did not reject the outcome of Einstein's search. Whitehead wrote, "it is no novelty to the history of science that factors of thought which guided genius to its goal should be subsequently discarded" (*ESP* 332). Hence, Whitehead's rejection of Einstein's Machian guiding principles does not necessarily invalidate Einstein's result. In fact, Whitehead only rejects Einstein's interpretation, not the formulae Einstein arrived at. Whitehead's alternative interpretation, namely, his re-interpretation of the concepts of space, time, and matter, aims to arrive at the same (or at least very similar) formulae while being coherent with the actual conditions of our perceptual knowledge, or in other words, while being consonant with the general character of our direct experience. Furthermore, Devaux's insufficient differentiation between Einstein's reorganization and Whitehead's reorganization of the basic concepts of mathematical physics, does not lead him to misrepresent Whitehead's aim and reorganization. In fact, Devaux's account of Whitehead's philosophy of science is a superior one.

A discussion of Whitehead's reorganization of the concepts of space, time, and matter, cannot fail to include Whitehead's rejection of the classical interpretation of these concepts. So, it should come as no surprise that Devaux, eager to put everything in its appropriate historical context, devotes chapters V and VI to a discussion of Whitehead's *Science and the Modern World*. In this 1925 book, Whitehead first paints the dominant historical current of "scientific materialism." Scientific materialism, which is the topic of Devaux's chapter V,

> presupposes the ultimate fact of an irreducible brute matter, or material, spread throughout space in a flux of configurations. In itself such a material is senseless, valueless, purposeless. It just does what it does do, following a fixed routine imposed by external relations which do not spring from the nature of its being. (*SMW* 17)

This dominant interpretation of Newtonian physics entails a bifurcation of nature in a world of primary qualities, namely, the scientific world of mathematical physics, and a world of secondary qualities: the commonsense world of our daily experience. Furthermore, it entails an unfortunate promotion of the scientific world to being real, and a corresponding degradation of the commonsense world to being apparent. Next, Whitehead links his rejection of the dominant historical current of scientific materialism, as well as his endeavor to arrive at an alternative interpretation, to a variety of historical counter-currents (Berkeley's idealism, the romantic reaction, etc.) and of 19th and 20th century scientific evolutions (Darwin's theory of evolution, Maxwell's theory of electromagnetism, Einstein's theory of relativity, etc.). This variety of counter-currents and scientific evolutions is the topic of Devaux's chapter VI.

In chapter V, entitled "Classical Mechanics and Cosmology," Devaux focuses on scientific materialism, and more specifically, on its major presupposition of simple location, which holds that nature is made of "stuff, or matter, or material ... which has the property of simple location in space and time, or, if you adopt the more modern ideas, in space-time" (*SMW* 49). According to Devaux, scientific materialism wants, but fails to avoid the issue of "the intrinsic nature of matter." It attributes "the indefinable relation of occupation" of space-time regions to its most "concrete elements" (265). Hence, bits of matter are essentially isolated, and in particular, isolated by simple location, or isolated by their occupation of different space-time regions. However, taking isolated bits of matter as the most concrete elements of nature is an instance of "the accidental error of mistaking the abstract for the concrete," an error Whitehead calls "the fallacy of misplaced concreteness" (*SMW* 51).

For Whitehead, as opposed to scientific materialism, the most concrete elements of nature are essentially related. Nonetheless, Whitehead holds "that by a process of constructive abstraction we can arrive at abstractions which are the simply-located bits of material" (*SMW* 58). Space-time is not the external relatedness, but an abstraction from the internal relatedness of the most concrete elements of nature. In other words, space-time is not an expression of isolation, but of essential relatedness. Also, bits of matter are not the most concrete elements of nature, but abstractions from the flux constituted by them. This being said, the Whiteheadian alternative is still vague. What are Whitehead's most concrete, essentially related elements? And what is the process of constructive abstraction, bridging the gap between concrete reality and scientific concept?

Chapters VI and VIII can be seen as providing preliminary answers to these questions. In chapter VI: "The Concrete and its Abstract Requirements," Devaux sheds some light on what Whitehead's most concrete elements are by focusing on the historical material contained in *Science and*

*the Modern World*. However, the notion of "event" is not yet introduced. This introduction is part of the unpublished chapters of Devaux's typescript, most likely chapter IX: "The Ether of Events." In chapter VIII: "Convergence and Simplicity," Devaux sheds some light on Whitehead's process of constructive abstraction, which Whitehead originally called "the principle of convergence to simplicity with diminution of extent" (*OT* 146) and later on, "the method of extensive abstraction" (*CN* 79). However, the notion of "extension" is not yet elaborated. This elaboration is also part of the unpublished chapters (chapter X on the relation of extension, chapter XI on the abstractive elements, etc.).

In chapter VIII, Whitehead and Russell's logic of relations reappears. This should come as no surprise. Solving the problem of bridging the gap between the world of commonsense thought and the world of scientific thought, central to Whitehead's philosophy of science, coincides with solving the problem of perception, central to the British movement of neo-realism. Whitehead's development of the method of extensive abstraction is one with his application of the logic of relations to the problem of perception. Hence, what Devaux considers as the apex of Whitehead's philosophy of science in the systematic chapters of *Whitehead's Cosmology*, merges with what he considers as the apex of British neo-realism in the historical chapters; and with this merger *Whitehead's Cosmology* comes to an end.

## *Conclusion*

Despite some minor shortcomings, *Whitehead's Cosmology* is an important scholarly contribution. Devaux's historical treatment of Whitehead offers suggestions for future research, and his explanation of Whitehead's transformation from mathematician to philosopher invites us to reconsider Whitehead's essays on education, as well as some biographical data. Devaux's postulation of a link between Whitehead's work and logical positivism implies a challenge to reconsider both. Furthermore, when dealing with *Science and the Modern World*, and more specifically, when describing the romantic counter-current (in order to highlight Whitehead's rejection of scientific materialism, and to introduce the Whiteheadian alternative), Devaux accurately observes,

> maybe it is true that the work of Wordsworth is a kind of Leibnizian poetry, which has managed to open all the windows with which all monads previously had been provided; and if so, future historians, who will no doubt one day investigate the romantic literary sources

> of Whitehead's thought, will do well to recall the precise indication which Whitehead himself left them. (278)

If one objects that this kind of research has already been done and published, since Alexander Patterson Cappon published three books on Wordsworth and Whitehead, respectively in 1982, 1983, and 1985, this can only reinforce my point. And so can the proposal to make a comparative analysis of Goethe's critique of Newton's optics, and Whitehead's critique of scientific materialism, yet another "romantic" suggestion arising from Devaux's book (251–252).

All in all, scholars should look forward to the publication of the remaining chapters of Devaux's manuscript. One might suggest, however, that the editors provide that second volume with a name index covering both volumes. This would be an indispensable instrument to profit fully from this historical and philosophical goldmine.

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