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**SCIENCE, CONCEPTS, AND  
THE SOCIAL ENVIRONMENT**

**Abstract:** *This paper will suggest that the work of Alfred North Whitehead (1861–1947) provides a fruitful resource for understanding the philosophical development and validity of scientific concepts through an analysis of their socio-historical location. The paper will address two key elements of Whitehead’s thought. One element is “the bifurcation of nature” and the paper traces the influence that this conceptual compromise has had on philosophy and science through its reinforcement of the division between the natural and the social sciences. The second element is the status of abstraction in thought and existence. The article will outline Whitehead’s argument that it is necessary to pay attention to the social environment which both enables and inhibits thought if historical epistemology is to develop novel yet analytically strong concepts.*

**Keywords:** *Whitehead; social environment; abstraction; science*

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**Věda, pojmy a sociální  
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**Abstrakt:** *V tomto článku se bude tvrdit, že dílo Alfreda Northa Whiteheada (1861–1947) poskytuje plodný zdroj pro porozumění filosofického vývoje a validity vědeckých pojmů pomocí analýzy jejich socio-historického umístění. Článek se bude zabývat dvěma klíčovými elementy Whiteheadova myšlení. Jedním elementem je “bifurkace přírody” a článek sleduje vliv, jenž tento pojmový kompromis má na filosofii a sociální vědy. Druhý element představuje status abstrakce v myšlení a bytí. Článek nastíní Whiteheadův argument, že je nezbytné věnovat pozornost sociálnímu prostředí, jež zároveň umožňuje a inhibuje myšlení, pokud má historická epistemologie schopna vyvinout nové, a přesto analyticky silné koncepty.*

**Klíčová slova:** *Whitehead; sociální prostředí; abstrakce; věda*

Alfred North Whitehead (1861–1947) started his career as a mathematician at Cambridge University in the late 19<sup>th</sup> century, he took up a post as a mathematical physicist at Imperial College, London, in 1910 and, at the age of 63 in 1924 accepted a chair in philosophy at Harvard University in the United States. His writings encompass texts on mathematics, relativity, the history of science and philosophy of science, education, and metaphysics. His work, therefore, offers a unique resource for thinking through the problems of historical epistemology as his writings cover the fields of theoretical and applied science, history, and philosophy. The challenge that he makes to contemporary thought is to refuse what he termed “the bifurcation of nature” which he outlines as the predominant tone of modern western thought. As will be discussed in more detail below, the bifurcation of nature is a specific and powerful view of the world and the place of human subjects within it; it divides existence into two fundamental realms. One realm is that of an inert, fixed natural world which is populated by self-identical objects and which science studies. The other realm is that of the perceptions, thoughts, meanings, volitions and intentions which is populated by cognisant human subjects and is studied by the social and cultural sciences. Modern philosophy, through its different schools, encompasses elements of both of these realms though there is a historical dividing line represented by the work of Kant.

Broadly speaking, this dividing line can be characterized as follows: prior to Kant’s critiques, writers such as Descartes and Hume attempted to outline the immediate and direct mode of access of individual subjects to the external world.<sup>1</sup> Most post-Kantians refuse the possibility of such a straight-forward engagement with reality and tacitly accept the central role that the mediating, organizing subject plays in assuring the objectivity of knowledge. In this way, the very possibility of metaphysics is denied, a position which was taken up forcefully in the 20<sup>th</sup> century. This post-Kantian, philosophical, linking of objective knowledge to the operations of the (human) subject complicates the inter-relation of reality and subjectivity and reinforces the disjunction between both the method and findings of science and those of philosophy in that the former retains its rights to speak directly and truthfully of reality (i.e. in pre-Kantian terms) whilst historical and social analyses always insist on the mediating if not prior role of the human subject in the production of knowledge.

<sup>1</sup> The point being made here is a broad one and it should be noted that there are exceptions. An important one is John Locke who Whitehead uses extensively to explicate his philosophy of organism. I am grateful to the anonymous reviewer who reminded me of this point.

One result of this intellectual settlement of modern thought is that attempts to locate scientific knowledge and scientific knowledge production within a cultural or historical milieu have tended to reduce such knowledge to mere social constructions, to epi-phenomena of a more basic, foundational societal or historical realm through their emphasis on the centrality of human thought, intentions and experience. This social location of science has difficulty accepting the claim of science that it enjoys a direct access to external reality and instead emphasizes the conceptual and practical priority which, it is claimed, must be afforded to social actors. This subsumes objective descriptions of reality to human descriptions of reality and is, therefore, ultimately open to the charge and dangers of relativism.

The counter-prevailing approach of the philosophy of science which insists on dislocating concepts from the environment within which they were developed runs the risk of missing out important elements of such concepts and the validity of their arguments by ignoring crucial aspects which enabled those concepts to arise and persist. By insisting on the irrelevance of the cultural and historical environment within which such concepts were produced, they develop an a-historical approach and, in a manner redolent to that of science and aspects of pre-Kantian philosophy, insist that the adequacy of their concepts can be judged directly and in abstraction from their historical locale. In a sense, concepts are to be treated as inert, fixed, and dead in a manner akin to that view of nature as comprising an external and quasi-eternal realm which is to be dispassionately uncovered by humans. The almost paradoxical danger is that the very construction of such concepts by located (social) humans is erased from the analysis as a mere irrelevance and concepts are granted an unwarranted purity and a rather peculiar a-temporal ontological status. As will be seen later on, Whitehead does not want to argue that such an approach is in and of itself mistaken. Rather, he insists that it is necessary to pay more attention to how such abstractions are constructed, what authority they claim and are sometimes surreptitiously granted, and whether such abstractions are deployed beyond their intended field thereby awarding themselves a more extensive validity than is justified.

The challenge for contemporary historical epistemology would seem to be to take seriously both the socio-historical context of scientific knowledge *and* its philosophical coherence. This article will suggest that the work of Whitehead offers a way of providing both of these elements. The crucial aspects of the argument will be his recasting of the notion of the social environment, his diagnosis of the conceptual under-pinnings of modern thought's adherence to the bifurcation of nature, his development of a non-

reductionist approach to the history of science and reason, and his specific argument regarding the status and role of abstractions.

### **A history of science and philosophy – the bifurcation of nature**

The demand that Whitehead sets himself in his book *Science and the Modern World*<sup>2</sup> is to outline a history of the development of the inter-related concepts of science and philosophy as they emerged in the post-Renaissance West. He traces the manner in which these concepts arose, became taken for granted and extended beyond their initial application in scientific research to form the background or “tone of thought”<sup>3</sup> which suffuses modern thinking: “the quiet growth of science has practically recoloured our mentality so that modes of thought which in former times were exceptional, are now broadly spread through the educated world”<sup>4</sup>. For him, these inter-related concepts which have led to the positing of self-sufficient yet inter-related objects is both the great achievement and the Achilles heel of modern science and modern thought for they have produced a wide-spread, uncritiqued view of the character of existence as based on the inter-relation of self-identical objects even whilst modern science denies such a version of substantiality.

The state of modern thought is that every single item in this general doctrine is denied, but the general conclusions from the doctrine as a whole are tenaciously retained. The result is a complete muddle in scientific thought, in philosophic cosmology, and in epistemology.<sup>5</sup>

Whitehead therefore sets out to identify the manner in which such specific scientific concepts took hold of Western conceptions of reality, in the most general sense. Importantly, however, his aim is not to deconstruct or explain away the concepts and achievements of science but to locate them within a more general philosophical, historical, and social environment. The efficacy and ability of scientific concepts to generate novel and important innovations is not to be denied but their dislocation from a more general development in thought and society is. Furthermore, Whitehead will insist

<sup>2</sup> Alfred N. WHITEHEAD, *Science and the Modern World*. Cambridge: Cambridge University Press 1932 (1926).

<sup>3</sup> *Ibid.*, p. 15.

<sup>4</sup> *Ibid.*, p. 2.

<sup>5</sup> Alfred N. WHITEHEAD, *Modes of Thought*. Cambridge: Cambridge University Press 1938. p. 180.

that more attention is paid both to the locale from which concepts and abstractions develop and from which they continue to derive their force. One of the most striking elements of his argument is that science was, initially at least, an inherently un- or anti-rationalist reaction to the over-weening rationalism of medieval scholastic philosophy and theology. “Galileo keeps harping on about how things happen, whereas his adversaries had a complete theory as to why things happen”.<sup>6</sup> Whitehead continues:

It is a great mistake to conceive this historical revolt as an appeal to reason. On the contrary, it was through and through an anti-intellectualist movement. It was the return to the contemplation of brute fact.<sup>7</sup>

The origins of modern science were, Whitehead argues, a “very necessary corrective to the unguarded rationalism of the Middle Ages”.<sup>8</sup> So, what characterizes the origins of modern science is a return to the conception of “brute fact” in place of attempts to produce theory-laden, rationalist accounts of existence to which such brute fact must accede. However, it is not quite so simple as this. For the animus of such a return is not self-explanatory, as if an analysis of nature is itself a natural thing or a part of human nature. Whitehead views the specificity (and success of modern science) as arising from its belief that:

Every detailed occurrence can be correlated with its antecedents in a perfectly definite manner, exemplifying general principles. Without this belief the incredible labours of scientists would be without hope. It is this instinctive conviction [...] which is the motive power of research: – that there is a secret, a secret that can be revealed.<sup>9</sup>

Such a belief, such a faith, is, for Whitehead, a legacy of a specific conception of the relation of God to existence and to nature which was developed in medieval theology. As opposed to a multi-theistic, impersonal or arbitrary version of deity, medieval Europe had produced a concept of a personal, involved and rational God. He describes such an entity in the following, intriguing, way:

<sup>6</sup> WHITEHEAD, *Science*, p. 10.

<sup>7</sup> *Ibid.*, p. 10.

<sup>8</sup> *Ibid.*, p. 12.

<sup>9</sup> *Ibid.*, p. 15.

The rationality of God, [was] conceived as with the personal energy of Jehovah and with the rationality of a Greek philosopher. Every detail was supervised and ordered: the search into nature could only result in the vindication of the faith in rationality.<sup>10</sup>

My explanation is that the faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology.<sup>11</sup>

The important point to be made here is that Whitehead does not envisage these theological roots of science as immediately undermining or vitiating its concepts. To locate the development of science and its methodological procedures within the legacy of medieval theology is not to explain them away or reduce them to ineffective social constructions, merely created out of the minds of humans and with no real reference to the external world. For, as will be seen, such a division, such an insistence that something must either be objectively true or socially conditioned, is an unfortunate outcome of the way in which certain scientific and philosophical concepts took hold and were extended beyond their initial purpose. So, the turn to the analysis of brute fact which marks out the origins of modern science was accompanied by a faith, albeit an unconscious one, in the possibility of uncovering the truth of the relations of the world beyond such immediate fact.

The concern that science demonstrated with brute fact entailed one important difference and the medieval theology from which, Whitehead maintains, modern science inherited a certain element of “faith”. This difference lies in the focus on the bruteness of the facticity to be analysed; this meant that it had to be taken on its own terms as embodying only itself rather than being only an instance of wider reasons which could be discovered prior to its analysis. As such, questions of teleology and purpose dropped out of the equation.

The rejection of purpose dates from Francis Bacon at the beginning of the seventeenth century. As a methodological device it is an unquestioned success so long as we confine attention to certain limited fields<sup>12</sup>.

<sup>10</sup> *Ibid.*, p. 15–16.

<sup>11</sup> *Ibid.*, p. 16.

<sup>12</sup> Alfred N. WHITEHEAD, *The Function of Reason*. Princeton, New Jersey: Princeton University Press 1929, p. 21.

This sums up neatly Whitehead's critical approach to the development of the concepts of science. The rejection of purpose is not, in itself, incorrect; indeed it facilitates a great advance. However, when its initial function as a purely methodological tool is forgotten and purpose is rejected *tout court* by science, this will, as shall be discussed below, create seemingly insurmountable problems. This insistence by Whitehead on the need to locate the development of the concepts of science within a historical frame and, therefore, within a wider milieu indicates not a rejection of the efficacy of the concepts of science but a need to pay attention to the limits of their application and extensions.

Whitehead elaborates this tension between the efficacy of scientific concepts and the need to recognize the limits of their warranted conceptual extension through his discussion of the work of Newton. Two key elements here are the doctrines of the transmission of light (and sound) and that of objects as self-sufficient, self-identical and as inhabiting an otherwise empty space. Importantly for Whitehead, Newton's thought and work did not arise out of nowhere but combined "ideas derived from Plato, Aristotle, and Epicurus, into a consistent scheme of thought which elucidates an incredible number of observed facts".<sup>13</sup> Furthermore: "The services to mankind rendered by the Newtonian System of Nature are incalculable"<sup>14</sup> (Whitehead, 1933: 200). However, the very success of Newton's system masks some problems which still linger both in modern thought more generally and in the understanding both of nature and scientific concepts thereof.

Systematic doctrines of light and sound as being something proceeding from the emitting bodies were definitely established, and in particular the connexion of light with colour was laid bare by Newton [...]What we see depends on the light entering the eye. Furthermore we do not even perceive what enters the eye. The things transmitted are waves or – as Newton thought – minute particles, and the things seen are colours. Locke met this difficulty by a theory of primary and secondary qualities. Namely, there are some attributes of the matter which we do perceive. These are the primary qualities, and there are other things which we perceive, such as colours, which are not attributes of matter, but are perceived by us as if they were such attributes.<sup>15</sup>

<sup>13</sup> Alfred N. WHITEHEAD, *Adventures of Ideas*. Cambridge: Cambridge University Press 1933, p. 200.

<sup>14</sup> *Ibid.*

<sup>15</sup> Alfred N. WHITEHEAD, *The Concept Of Nature*. Cambridge: Cambridge University Press 1964 (1920), p. 27.

The solution proposed to the problem that arose from Newton's discovery of the transmission of energy was to divide reality into two realms: that of the percipient mind and that of what was perceived by that mind. Worse, the relationship between these two realms was envisaged in terms of an efficient causality with external nature granted priority. Nature is thus bifurcated. On one side is the really real world of objects (made up of waves of energy, electrons, molecules, etc. which are never directly perceived but are held to constitute utter reality) which causes a distinct realm which is the world as it appears to the human mind. This world thereby has a less valid reality and is reduced to an epi-phenomenal, spectral world of non-objective colours, feelings and meanings.

The bifurcation theory is an attempt to exhibit natural science as an investigation of the cause of the fact of knowledge. Namely, it is an attempt to exhibit apparent nature as an effluent from the mind because of causal nature. The whole notion is partly based on the implicit assumption that the mind can only know that which it has itself produced.<sup>16</sup>

The emphasis on brute fact has quickly become an emphasis on a division between the realms of an unseen, objective external nature and the "psychic additions"<sup>17</sup> which the human mind enjoys but which are distinct from these; "in this theory colours are, after all, merely the furniture of the mind".<sup>18</sup>

The acceptance of the division of a real reality and human perceptions thereof may have, in present-day versions, shifted from the division of existence into primary and secondary qualities but, Whitehead argues, it is still present in contemporary thought and practice. It is evident in the establishment in the 19<sup>th</sup> and 20<sup>th</sup> century of distinct disciplines to deal with the natural world and the social world, the relegation of facticity to a realm of meaninglessness, and the celebration of that specific yet unpredictable world of human intentions, meaning and art. "After the close of the seventeenth century, science took charge of materialistic nature, and philosophy took charge of cogitating minds".<sup>19</sup> This is reflected not only in the strict separation of university disciplines and faculties but in the tension which dogs social and philosophical accounts of science. The former would seem to fall on that side of the bifurcation of nature which addresses the psychic

<sup>16</sup> *Ibid.*, p. 32–33.

<sup>17</sup> *Ibid.*, p. 29.

<sup>18</sup> WHITEHEAD, *Science*, p. 181.

<sup>19</sup> *Ibid.*, p. 180.

additions and role of the human mind as constitutive whilst the philosophical approach would emphasize the fixed, objective and external character of its concepts which can operate as timeless, self-identical and self-sufficient objects of study – although they were obviously created by human minds at some point. This latter division points to the complexity and messiness of the legacy of the bifurcation of nature and the insidious extent to which it haunts modern thought in that it is not simply a question of Newtonian or Lockean notions of the transmission of light or secondary qualities but is a deep-seated aspect of our conception of reality.

A second important and influential tranche of Newton's methodological approach is his conception of objects and simple location which Whitehead summarises as follows:

The concept of matter presupposed simple location. Each bit of matter was self-contained, localized within a certain region with a passive, static network of spatial relations, entwined in a uniform relational system from infinity to infinity.<sup>20</sup>

It was this scheme, this conception of reality, which enabled Newton to develop the notion of stresses which relate such objects, externally, and hence to the theory of gravity. Following from the insistence on brute fact which characterizes the rise of modern science and the associated rejection of any inherent purpose or meaning to such brute fact, nature came to be seen as fixed, static and inert. In a word, nature was conceptualized as “dead”.<sup>21</sup> Of course, this rather simplified notion of the object has been challenged and changed not only by recent social theorists but by more recent science as well.

The notion of empty space, the mere vehicle of spatial interconnections, has been eliminated from recent science. The whole spatial universe is a field of force. [...] The unexpected result has been the elimination of bits of matter, as the self-identical supports for physical properties.<sup>22</sup>

Yet, according to Whitehead, these new concepts of field and energy have not simply replaced the old philosophical and scientific concepts. “The presuppositions of yesterday's physics remain in the minds of physicists,

<sup>20</sup> WHITEHEAD, *Modes*, p. 188.

<sup>21</sup> Carolyn MERCHANT, *The Death of Nature. Women, Ecology and The Scientific Revolution*. London: Wildwood House 1983.

<sup>22</sup> WHITEHEAD, *Modes*, p. 186.

although their explicit doctrines taken in detail deny them”.<sup>23</sup> And, given the widespread influence of the bifurcation of nature, its remnants are not confined simply to physics laboratories. The notion of self-sufficient objects (and subjects) inhabit everyday legal, educational, economic, political areas of life and thought where land is argued over, pupils taught with textbooks, etc. Not only do we think in terms of objects and subjects but we believe we act in relation to objects and subjects: students, parents, and partners as opposed to lecture-halls, houses and presents. Such an everyday faith in the existence of objects and subjects permeates our language and our institutions and we do not notice or consider their reliance on a specific rendering of reality as informed by 17<sup>th</sup> and 18<sup>th</sup> century science and philosophy. Moreover, we retain these conceptions even in the face of contemporary science’s refusal of such a conception and its turn to questions of field, energy, relativity and process as constituting the fundamental “elements” of existence. Whitehead is not suggesting that philosophy and social science should merely learn the new concepts that have been developed by science and deploy them more widely. This would be to mistake the very constructedness of such concepts and the specificity of the role that they were originally designed to play, that is, to measure the inter-relation of certain items considered in abstraction from their immediate and particular milieu. At the same time, to ignore questions of relativity, process and the vector character of existence would be to refuse the possibility of developing our modes of thought beyond the limits imposed by the retention of out-dated scientific schemes. Whitehead, therefore, has a complex relation to the inter-relation of science and philosophy which neither ignores nor simply attempts to apply the “findings” of modern science. This inter-relation is best summed up in the title of his major philosophical work *Process and Reality*<sup>24</sup> which attempts to develop a metaphysics which incorporates elements of notions of relativity and the challenge that quantum mechanics has made to our understanding of reality without simply inserting modern science into philosophy. There is not space here to follow up this discussion but the work of Debaise,<sup>25</sup> Leclerc<sup>26</sup> and

<sup>23</sup> *Ibid.*, p. 179.

<sup>24</sup> Alfred N. WHITEHEAD, *Process and Reality. An Essay In Cosmology*. Gifford Lectures of 1927–1928. Corrected edition. GRIFFIN, D. – SHERBURNE, D. (eds.). New York: The Free Press 1978 (1929).

<sup>25</sup> Didier DEBAISE, *Un empirisme spéculative. Lecture de Procès et réalité de Whitehead*. Vrin: Paris 2006.

<sup>26</sup> Ivor LECLERC, *Whitehead’s Metaphysics. An Introductory Exposition*. London: George Allen and Unwin Ltd.: 1958.

Stengers<sup>27</sup> provide sustained accounts of Whitehead's novel metaphysical position. For the moment, only one element of this, and of its relation to contemporary science, will be taken up, that is, the question of the relation of matter, individuality and the environment.

The fundamental fact, according to the physics of the present day, is that the environment with its peculiarities seeps into the group-agitation that we term matter, and the group agitations extend their character to the environment.<sup>28</sup>

The reason that this particular aspect of Whitehead's work has been singled out for discussion is that it would seem to bear an important relation to questions of historical epistemology and will also give a flavour of the way in which Whitehead's metaphysics and his method of conceptual analysis can make a significant contribution to taking seriously the coherence and adequacy of concepts on their own terms whilst recognizing the environment and milieu within which they arise and continue to gain their sustenance. The key aspect of Whitehead's thought is conveyed by the term "social environment".

### **The question of the social environment**

The relation of the individual to society and the associated question of which has priority (the structure-agency question), as well as the position of an electron within its wider field, signal two diverse yet similar theoretical problems which run up against the question of the relation of a singularity to its environment. Any theory that holds that the environment can have a substantial influence on an individual plant, animal or crop so as to enable new characteristics to be developed in response to that environment and then immediately passed on to future generations is seen as going against the established scientific doctrine regarding the priority of the individual (or individual genes) over environmental factors. Lamarck's supposed adoption of such a principle is often seen as the reason why his theory was and is still inferior to that of Darwin (see Kupiec and Sonigo<sup>29</sup> for a critical evaluation of this "victory" of Darwinian theory).

<sup>27</sup> Isabelle STENGERS, *Penser Avec Whitehead. Une libre et sauvage creation de concepts*. Paris: Éditions de Seuil 2002.

<sup>28</sup> WHITEHEAD, *Modes*, p. 189.

<sup>29</sup> Jean-Jacques KUPIEC – Pierre SONIGO. *Ni Dieu ni gène. Pour une autre théorie de l'hérédité*. Paris: Éditions de Seuil 2000.

These matters take on a similar yet different hue when the question becomes one of the relation of the individual to its social environment. Here the danger lies in emphasizing the role of the social environment at the expense of the efficacy of the individual. In this respect, social analyses of science in their attempts to explain the financial, motivational, political or simply the generally social factors which contribute both to the discoveries of science and to their concepts can be seen as not so much explaining such discoveries or concepts as *explaining them away*. As Whitehead puts it: "Philosophy destroys its usefulness when it indulges in brilliant feats of explaining away. It is then trespassing with the wrong equipment upon the field of particular sciences".<sup>30</sup> The refusal of any autonomy to the concepts of science both underestimates their individuality and any possibility of their independence but also over-emphasizes both the role and power of social analysis itself. The humanly social takes utter priority. As Latour<sup>31</sup> has argued, such approaches make sociology into an über-science whose explanations take precedence over all others to the extent that society is seen as the productive field of all things that are experienced and known by humans. "Society had to produce everything arbitrarily including the cosmic order, biology, chemistry, and the laws of physics!"<sup>32</sup> Social analyses are expected to explain every-thing insofar as *all* things are rendered as only fully understandable within their social context.

The notion of the priority of the environment and of the social as either an ontological force or an epistemological guarantor have both fared badly as they tend either to an unwarranted essentialism or reductionism. Yet the opposing view that the individual object, as a self-sufficient entity, has an immediacy and internal consistency which indicates its separateness or protectedness from its environment is equally problematic for it assumes a strict separation of the individual from its wider location in its very definition of individuality. As discussed earlier, Whitehead is clear that such a notion of individuality is itself mistaken insofar as it expresses a specific concept of the Newtonian self-identical object which has its role in explaining some features of the world but should not be taken as a description of all of the world, in its diverse modes of potentiality and purpose. The abstract concept of the inter-relation of discrete objects externally related through forces

<sup>30</sup> WHITEHEAD, *Process*, p. 17.

<sup>31</sup> Bruno LATOUR, *We Have Never Been Modern*. Hemel Hempstead: Harvester Wheatsheaf 1993.

<sup>32</sup> *Ibid.*, p. 55.

(such as gravity) has been adopted as the universal description of the reality of everyday experience even when such concepts have become outdated. As such, the question of the relation of the individual to its environment clearly bears the marks and scars of the sedimentation of the bifurcation of nature into accepted modes of thought.

To attempt to avoid this bifurcation by denying or ignoring one of its poles is to miss the point. It is only by tracing the mode in which this bifurcation came to inhabit contemporary scientific, philosophical, sociological, and everyday modes of thought that its extent and influence can be realised. As Stengers<sup>33</sup> has stressed, such identifications should not immediately be followed by an attempt either to dismiss or reconcile this bifurcation. Instead, the aim is to provide novel ways of thinking, of producing concepts which manage to inherit the problems indicated by this apparent conceptual dichotomy but avoid the limiting demands that it makes on us to choose either the social or the natural (or even philosophical) realm as primary.

The theme of the bifurcation of nature is thus a diagnostic. [...] But to this diagnostic there does not respond a prognostic which affirms the necessity of a return to the unity which has been destroyed by the modern epoch.<sup>34</sup>

Instead the aim is to take seriously the legacy but also to attempt to provide ways of thinking which avoid the necessity of accepting its legitimacy; in a sense the demand is to think both poles together. The important point, for Whitehead, is not then simply to reject any attempt to describe the social aspect of science and its concepts but nor is it to attempt to build a compromise solution wherein the social and the individual concept are both granted a degree of efficacy. The problem lies in a different place to this.

The radical move that Whitehead makes and which enables an avoidance of one vital element of the critique of social explanations of science, namely that it reduces the “truths” of science to the production of mere humans, is to question why the notion of sociality has been and still is limited to the human realm. This may seem like a strange question. It seems obvious that sociality is indelibly linked to humanity. Yet, one of Whitehead’s aims is to ask us to question some of our deepest held assumptions of thought and to trace their development and claim to legitimacy. The link between sociality and humanity would seem to be such an assumption and is one

<sup>33</sup> STENGERS, *Penser*, p. 562–567.

<sup>34</sup> *Ibid.*, p. 564. My translation.

which derives from the very particular mode of existence which is envisaged as comprising the realm of the thinking human subject as opposed to a fixed, external, unthinking nature. The limiting of the social to the human realm and to the inter-actions of humans seems to be a legacy of the very distinction between existence conceived as comprised of objects which are to be known and those subjects which perceive the objects which punctuate such an existence (and is thus a replication of the bifurcation of nature). This division is itself an outcome of the tortuous imbrication of scientific and philosophical concepts which both founded and continue to haunt the modern era. Whitehead's radical solution to this problem, his manner of avoiding its premises, is to refuse to predicate sociality on the human and, instead, to widen its scope so that sociality and the social, thought of as a set of inter-relations, applies equally throughout existence. It is at this point that the recourse to metaphysics becomes necessary.

Every actual entity is in its nature essentially social; and this in two ways. First, the outlines of its own character are determined by the data which its environment provides for its process of feeling. Secondly, these data are not extrinsic to the entity; they constitute that display of the universe which is inherent in the entity.<sup>35</sup>

Without granting a prior definition of the social, but also avoiding the assumption that sociality is human-bound, Whitehead makes two important assertions here. One is that all existence ("actual entity" is his technical term for a unit of existence) is social insofar as its mode of existence is characterised by its relation to the environment which thereby helps to contribute to the process of its existence (as opposed to its being seen as having a fixed existence). Second, there is an utter inter-relation of the world and the individualized element of the world in that the latter is not of a different kind to the former, it is an aspect of the former. There is no resolute disjunction between the subject and object for the individual is a specific manifestation of an area of the universe. The social, then, is not based on humanity but expresses the manner in which the environment is individually rendered on a specific occasion. This inter-weaving of the environment with the subject is further explained by Whitehead:

<sup>35</sup> WHITEHEAD, *Process*, p. 203.

It follows that any general presupposition as to the character of the experiencing subject also implies a general presupposition as to the social environment providing the display for that subject.<sup>36</sup>

The implications of such a position are striking and manifold. Rather than positing brute facts or nature as inherently ordered and with a “secret”, fixed, framework which it is the task of science to uncover, Whitehead states that “the laws of nature are the outcome of the social environment”.<sup>37</sup> This is not to write off the laws of nature as ephemeral and it is not to deny the possibility of science. But it does avoid both the bifurcation of nature into discrete subjects and objects and also avoids the positing of the social, and of social or historical explanations, as reductive human affairs which somehow denigrate the validity of scientific concepts or dissolves them into solely human creations and constructions.

Stengers has emphasized the role of this specific conception of the social in Whitehead<sup>38</sup> and also provides an important discussion of some of the implications of his notion of the social environment beyond the purely metaphysical level. She argues that lack of attention to the manner in which the social environment infuses the individual occasion, thought or concept risks missing out on important elements which enable that occasion, thought or concept to come to be and to endure. As such, she takes Descartes to task for neglecting the complete role that the social environment plays in enabling him to follow his procedure of radical doubt and therefore to think that he thinks. This social environment is made up of, among other things, the words that he uses to formulate the reasons for rejecting the evidence of his senses (but it could also include the “stove” into which he retired in order to meditate). “Descartes’ doubt requires the specialist social environment that it sets out, very creatively, to judge”.<sup>39</sup> To what extent this lack of attention to the social environment vitiates or not Descartes’ method and his concepts thus becomes a question of empirical analysis. It becomes a solvable problem, one which could be undertaken by historical epistemology and which would require *both* philosophical analysis and elucidation of the historical social environment within which Descartes was situated. The introduction of the social environment does not, however, reduce Descartes’ concepts to a mere production or reflection of social, political or technological changes of his

<sup>36</sup> *Ibid.*, p. 203.

<sup>37</sup> *Ibid.*, p. 204.

<sup>38</sup> STENGER, *Penser*, p. 358–367.

<sup>39</sup> *Ibid.*, p. 293. My translation.

time (as attempts to introduce social elements into science or philosophy sometimes tend to do). Instead, Whitehead's elaboration of the inter-fusion of the social environment with individual subjects, thoughts, or concepts demonstrates the importance of paying attention to the manner in which abstractions are created and deployed. As will be seen in the next section, Whitehead develops a novel notion of the status and role of abstractions which ties together his critique of the bifurcation of nature and the inter-fusion of the individual and the environment.

### **Whitehead on abstractions**

"You cannot think without abstractions; accordingly, it is of the utmost importance to be vigilant in critically revising your *modes* of abstraction".<sup>40</sup> Abstractions are central to Whitehead's understanding of thought and, as will be seen, to his understanding of reality as well. Thinking is a matter of abstraction. It is a matter of isolating certain elements of reality in order to construct ways of thinking. What is crucial here is the phrase "ways of thinking" or, in Whitehead's own words "*modes* of abstraction". For this immediately indicates that thought is not a simple reflection of reality or an innocent category which is simply imposed upon that reality. The emphasis on the mode of abstraction designates that the construction of abstractions always occurs in a certain manner. There is a "how" to the construction of abstractions as well as a "what". This manner of the construction of abstractions will be informed by the social environment within which it is produced. That is, they will depend on both that which is identified as relevant for understanding and the wider factors which enable such an understanding to be developed. Not all the factors of the social environment will or can be taken up into that abstraction, for this would be simply to repeat what is already given in its entirety and would allow for no discrimination or novel thinking. Hence, "every abstraction neglects the influx of the factors omitted into the factors retained".<sup>41</sup> This does not negate or falsify the abstraction or make it "untrue". Questions of truth and falsehood are not relevant at this stage, these will come later when judgements are made utilising such an abstraction. For the moment, "an abstraction is nothing else than the omission of part of the truth. The abstraction is well founded

<sup>40</sup> WHITEHEAD, *Science*, p. 73.

<sup>41</sup> WHITEHEAD, *Modes*, p. 196.

when the conclusions drawn from it are not vitiated by the omitted truth".<sup>42</sup> Vitiating, the faultiness of an abstraction, becomes key. For all abstractions are developed in a specific milieu and for a specific purpose. They arise within a social environment (in Whitehead's specific sense of the term) and respond to a specific problem. In this way the "social" is doubly implicit within the constructions of abstractions but not in the usual understanding of its role. This certainly does not imply that the efficacy of such abstractions are reducible to a prior or over-arching social explanation which somehow dissolves them into mere (social) constructions. Rather, abstractions are the very tools of thought. There is neither the time nor space to do justice fully to Whitehead's complex understanding of the role and status of abstraction here. However, it should be pointed out that he does not reduce abstraction merely to a process of thought, though it is an important element of thought. Abstraction is also a genuine element of all existence, it is, in this sense, inevitable.<sup>43</sup>

Thus "objectification" itself is abstraction. [...] Abstraction expresses nature's mode of interaction and is not merely mental. When it abstracts, thought is merely conforming to nature – or rather, it is exhibiting itself as an element in nature.<sup>44</sup>

Whitehead clarifies his point with an example from science:

Undoubtedly molecules and electrons are abstractions... an electron is abstract because you cannot wipe out the whole structure of events and yet retain the electron in existence.<sup>45</sup>

The very notion of those entities which are supposed to comprise some of the most fundamental elements of reality is an abstraction. The concept of molecules is a specific attempt to isolate and understand certain features of reality at the expense of others. The notion of an oxygen molecule as a self-sufficient entity which somehow exists in some dislocated realm inhabited solely by other purified oxygen molecules is not how oxygen molecules really exist. They are always located somewhere and somehow: in water, in the air

<sup>42</sup> *Ibid.*, p. 189.

<sup>43</sup> I am grateful to the anonymous reviewer of this piece who emphasized this aspect of Whitehead's account.

<sup>44</sup> Alfred N. WHITEHEAD, *Symbolism. Its Meaning and Effect*. New York: The Free Press 1927, p. 25–6.

<sup>45</sup> WHITEHEAD, *Concept*, p. 171.

(either in relation to another molecule as  $O_2$ ) in the alcohol in a pint of English beer, French wine, or Czech Becherovka. There is no such thing as an abstract oxygen molecule, they are always somewhere and somewhere. Science, in its construction of the abstraction which makes it possible to conceive of oxygen molecules as discrete from their immediate locale, is a great advance. But it does not explain *more* of reality. It explains *less*.<sup>46</sup> However, this “less” is not then to be taken, immediately, as somehow disproving or denigrating that abstraction. For the power of that abstraction is evident in its ability to enable the synthesis of different forms of alcohol, of purified water, of pure oxygen and to combine these “artificially” with other elements. The mistake, and the danger, is when the abstract notion is taken as representing the real reality which underlies all existence, for this way leads back to the bifurcation of nature. Whitehead explains his point in terms of the development of mathematics and the notion of numbers as abstracted from reality:

In considering the relations of the number “five” to the number “three,” we are thinking of two groups of things, one with five members and the other with three members. But we are entirely abstracting from any consideration of any particular entities [...] which go to make up the membership of either of the two groups. [...] This is a very remarkable feat of abstraction. [...] But the first man [sic] who noticed the analogy between a group of fishes and a group of seven days made a notable advance in the history of human thought.<sup>47</sup>

Science deals in abstractions, as does social science, history, humanities, etc. The point is to be vigilant, to be aware that one is dealing with abstractions, to realise that these are not a simple reflection of some fundamental reality beneath our perceptions, and also not to fall into the associated trap of believing that one’s abstractions can be immediately deployed in another field, at least without major modifications; for this would be to misrecognize that abstractions are always constructed in relation to a specific social environment and have relevance and authority only in relation to that field.<sup>48</sup> One of the great mistakes of modern thought is precisely this adoption of the specific abstractions of science and their attempted applications in the fields of history, economics and analyses of the human world. This misunderstanding of the status of abstractions and their resolute ties to their sites of

<sup>46</sup> STENGERS, *Penser*, p. 52, 120.

<sup>47</sup> WHITEHEAD, *Science*, p. 26–27.

<sup>48</sup> Isabelle STENGERS, “A Constructivist Reading of *Process and Reality*.” *Theory, Culture and Society*, vol. 25, 2008, no. 4, p. 91–110.

production and hence to their social environment is what Whitehead refers to as the “fallacy of misplaced concreteness”<sup>49</sup> which he elsewhere describes as follows: “This fallacy consists in neglecting the degree of abstraction involved when an actual entity is considered merely so far as it exemplifies certain categories of thought”.<sup>50</sup> Whitehead’s demand of science, philosophy and historical epistemology is thus clear – to pay attention to the manner of construction of our abstractions, their social and historical milieux, and the aspect of existence which they were initially designed to explicate. In this way, the requirement of the philosophy of science that the validity of (scientific) concepts should be assessed in terms of the effectiveness of their abstraction can be met. But so can the demands of social and historical analyses of science which insist upon the importance of the specific conditions which enabled the production of such abstractions and concepts.

As has been stressed throughout this piece, such a demand does not entail disregarding the power of the abstractions of science and it is certainly not to reduce them to mere social constructions or historically specific manifestations which are always distorted or over-written by the foibles and fallacies of human nature. “The mere phrase that ‘physical science is an abstraction’, is a confession of philosophic failure”.<sup>51</sup> Whitehead, thereby, advocates a more rigorous form of analysis which takes science and its concepts seriously but also pays attention to their social environment. In doing so, he sets out the parameters for a more effective approach to historical epistemology which avoids a dislocated analysis of the history of ideas and proposes that greater attention is paid to the inter-weaving of abstractions and concepts with their social environment.

We are instinctively willing to believe that by due attention, more can be found in nature than that which is observed at first sight. But we will not be content with less.<sup>52</sup>

<sup>49</sup> WHITEHEAD, *Science*, p. 64, 72.

<sup>50</sup> WHITEHEAD, *Process*, p. 7–8.

<sup>51</sup> WHITEHEAD, *Adventures*, p. 186.

<sup>52</sup> WHITEHEAD, *Concept*, p. 29. Also see STENGERS, “A Constructivist Reading,” p. 99–100 for a fuller discussion of this.

## Conclusion

An interesting and neat account of Whitehead's approach toward the entanglement of historical, social, scientific, cultural, and other elements is provided by the following account:

It was my good fortune to be present at the meeting of the Royal Society in London when the Astronomer Royal for England announced that the photographic plates of the famous eclipse, as measured by his colleagues in Greenwich Observatory, had verified the prediction of Einstein that rays of light are bent as they pass in the neighbourhood of the sun. The whole atmosphere of tense interest was exactly that of the Greek drama: we were the chorus commenting on the decree of destiny as disclosed in the development of a supreme incident. There was a dramatic quality in the very staging:- the traditional ceremony, and in the background the picture of Newton to remind us that the greatest of scientific generalizations were now, after more than two centuries, to receive its first modification. Nor was the personal interest wanting: a great adventure in thought had at length come safe to shore.<sup>53</sup>

Here, there is an description of the diversity of elements which go to make up one element of the process of the construction of a scientific concept. Each plays a role and each contributes to the full description of such events. Of course, certain elements can and indeed are, necessarily, neglected when the desire is to concentrate on one aspect. In this sense, it is possible to introduce the equation  $E = mc^2$ , yet such an abstraction does not in and of itself explain either relativity or the manner of the construction of the concept. But nor do popular explanations such as "Space caught bending"<sup>54</sup> elicit the importance of the notion of relativity.

Whitehead's version of the occasion at the Royal Society, whilst by no means complete, does point to those factors which are all too easily neglected but through which the statement that  $E=mc^2$  came to make sense and to gain its effectivity. Not only is there the confirmation established by the "photographs" of deflection of light from its supposedly correct course as it passed through the plates, there is the requisite acceptance by competent authorities such as the Astronomer Royal and the members of the Royal Society (including Whitehead himself), and there is also the room wherein these "authorities" are gathered. The location of the declaration in the rooms

<sup>53</sup> WHITHEAD, *Science*, p. 12-13.

<sup>54</sup> WHITEHEAD, *Concept*, p. 174.

of the Royal Society, with its ceremony, and with the *knowledge* that Newton propounded his theories of light there previously, not only signalled by his picture on the wall but by the attendees' acquaintance with his work, and its limitations, constitute exactly that expertise which enables the members of the audience to either accept or deny the photographic plates as evidence. But, such a reading might be familiar to those who are conversant with recent developments in Science and Technology Studies, Actor-Network-Theory, and the work of Latour. What is of note in Whitehead's account is his introduction of the notion of Greek drama and its associated conception of fate as blind necessity (Ananke). What is dramatic about the presentation of these findings is not the way in which the ideas are presented, the sense of the importance of the occasion (although this was also a factor), nor the reading back into the proceedings, with hindsight, of the future implications and widespread acclaim that the confirmation of Einstein's theory of relativity would have. The real working of the Greek conception of fate, as Whitehead sees it, is the legacy that it gave both medieval theology and modern science, in terms of the unrelenting procession of the world, indifferent to the beliefs or intentions of humans.

The pilgrim fathers of the scientific imagination as it exists today, are the great tragedians of ancient Athens, Aeschylus, Sophocles, Euripedes. Their vision of fate, remorseless and indifferent, urging a tragic incident to its inevitable issue, is the vision possessed by science. Fate in Greek Tragedy becomes the order of nature in modern thought.<sup>55</sup>

It should also be noted that: "The essence of dramatic tragedy is not unhappiness. It resides in the solemnity of the remorseless working of things".<sup>56</sup> Whitehead's invaluable contribution is to provide a description of the development of *real* scientific concepts amidst and within concerns which might normally be unnoticed or dismissed as irrelevant and whose incorporation into an account of the development of the theory of relativity might smack of reductionism in that they would seem to discredit or taint the purity of its exposition and findings. Adopting Whitehead's analysis within historical epistemology would eschew such narrow interpretations. Instead, he insists that the relevance, power, and efficacy of a concept cannot be judged solely in terms of its social production nor in terms of its abstract coherence; the manner of its construction and its relationship to wider forms of thought,

<sup>55</sup> WHITEHEAD, *Science*, p. 12.

<sup>56</sup> *Ibid.*, p. 13.

such as that of the inheritance of the Greek concept of Fate, are all involved in the genesis and sustenance of the real concepts of science amidst their social environment. It is in this way that Whitehead offers historical epistemology a tool for thinking the social, historical, and philosophical validity of the concepts of science by taking into account *more* of reality, the inter-relation of individuality and the environment and the combining of apparently diverse elements and qualities to produce the facticity of the constructedness of thought.