Emergent Evolution:

The Problem of Qualitative Novelty in the Evolutionary Process

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Abstract

This dissertation considers the history and philosophy of emergent evolution, and in particular the attempt to answer the question of the role of qualitative novelty in the evolutionary process. Chapter one examines the background to the theory of emergent evolution in the work of Charles Darwin. It is argued that Darwin's theory is neither tautologous nor revolutionary, and the application of Thomas Kuhn's theory of scientific revolution to the case of Darwinian evolution is criticized. Chapter two analyzes the work of the comparative psychologist Conwy Lloyd Morgan, and his views on qualitative novelty are compared with those of other major contemporaneous emergentist theorists: Samuel Alexander, C. D. Broad and Roy Wood Sellars. Chapter three discusses the history of emergent evolution as a philosophical trend, up to and including the emergent materialism of Mario Bunge. An alternative emergentist view of the level structure of reality based on the four levels of matter, life, society and mind is proposed in the conclusion.

Résumé

La présente dissertation analyse l'histoire et la philosophie de l'évolution émergente, et tente de répondre à la question du rôle de la nouveauté qualitative dans le processus évolutionnaire. Le premier chapitre examine la théorie de l'évolution de Charles Darwin, ce qui fournit la problématique pour la théorie de l'évolution émergente. On critique l'application de la théorie de la révolution scientifique de Thomas Kuhn au cas de Darwin, et la distinction est faite entre le débat scientifique concernant les facteurs de l'évolution et la question philosophique du mode de l'évolution. Dans le deuxième chapitre, la théorie émergentiste de Conwy Lloyd Morgan est comparée avec celles d'autres philosophes de l'émergentisme de sa période, en particulier Samuel Alexander, C. D. Broad et Roy Wood Sellars. Le troisième chapitre trace l'histoire de l'evolution émergentiste comme tendance philosophique, jusqu'à l'émergentisme matérialiste de Mario Bunge. En conclusion, on propose une analyse émergentiste de la structure de la réalité, comportant les quatre niveaux de matière, vie, société et pensée.

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Introduction

The goal of this dissertation is to trace the origin and development of the philosophy of emergent evolution, and in particular to present its analysis of the problem of qualitative novelty in the evolutionary process. The dissertation is organized into three chapters. In the first chapter, I examine the structure of Darwin's theory of evolution, and in particular discuss two kinds of debate surrounding it: (a) the scientific debate over the factors of evolution, and (b) the philosophical debate concerning what is termed the mode of evolution. The factors of evolution include natural selection, sexual selection, use-inheritance, organic selection, physiological selection, and a variety of other putative mechanisms for evolutionary change. The mode of evolution involves such philosophical questions as the continuity or discontinuity of the evolutionary process, the problem of quantitative vs. qualitative change and the ontological question of monism vs. dualism. Some relations between the scientific and the philosophical aspects of evolution are discussed.

Chapter one also sets out a model of the structure of Darwin's theory of evolution, which is then used in a discussion of two problems concerning Darwinian evolution: (a) is it tautological and (b) is it revolutionary? I argue in the negative for both questions (though recognizing the tremendous impact of the theory on science, philosophy, religion and culture). In particular, the applicability of Thomas Kuhn's theory of scientific revolution to Darwin's theory of evolution is criticized, for the following reasons: (1) it overemphasises the discontinuity between Darwin and his predecessors; (2) it overestimates the degree to which the Darwinian theory became a paradigm in the succeeding period; (3) it underestimates the importance of philosophical factors underlying debate over Darwinism; and (4) it underestimates the influence of Darwin's theory outside the immediate scientific field of biology. It is argued that Darwin's theory is best seen as a creative synthesis, involving elements of continuity and discontinuity with his general background and immediate predecessors, as well as the innovative element of natural selection.

In chapter two, the origin and early history of emergent evolution is analyzed. The comparative psychologist, Conwy Lloyd Morgan is identified as the founder of this theory. Lloyd Morgan's early work, centered on a neutral monist ontology for evolutionary philosophy, is discussed at some length, followed by an analysis of the background and influences on the development of his theory of emergent evolution. The general background is formed by the evolutionary theories of Darwin, Herbert Spencer, and G. J. Romanes, and the immediate influences are identified as J. S. Mill, G. H. Lewes, Henri Bergson, W. M. Marvin and E. G. Spaulding. Their views on novelty are discussed. Then, Lloyd Morgan's development of the theory of emergent evolution is analyzed as one of creative synthesis. The elements of his mature theory are reviewed, and his system is compared with the related systems of Samuel Alexander, C. D. Broad and Roy Wood Sellars.

Lloyd Morgan developed a philosophy of evolution which admitted qualitative change and the emergence of novelty, while respecting continuity in evolution and monism in ontology. This required a major modification of the Darwinian mode of evolution, which admitted only quantitative change. The following are identified as the core theses of emergent evolution:

1. The universality of evolution, including the subsidiary propositions that (i) there is an evolutionary process that runs through all of nature - the physical, chemical, organic, social and psychological domains; (ii) evolution is a multi-factor process, with different factors or combinations of factors producing

evolutionary advance in different domains; (iii) evolution is creative of new entities, properties and relations among those entities; and (iv) evolution is a continuous process, with major novelties marking points of change of direction, not gaps in the process.

2. The level structure of reality, including the subsidiary propositions that (i) reality is composed of entities which can be arranged in levels that are distinct and irreducible; (ii) higher levels include some things, properties or relations which do not occur in lower levels; (iii) higher levels depend on the lower levels for their raw material; and (iv) entities at different levels can interact, either directly or mediately.

3. The whole/part relationship, including the subsidiary propositions that (i) some wholes have properties that none of their parts have; (ii) in these cases, the novel properties of the whole cannot be predicted on the basis of the sole knowledge of the properties of the parts; (iii) the properties of the whole can be understood and explained in terms of those of the parts and some additional assumptions; and (iv) wholes at one level can be parts of wholes at other levels.

Chapter three discusses the history of emergent evolution as a philosophical trend. The views of a major philosophers and scientists influenced by emergentist ideas are presented. It is argued that emergent evolution was a philosophical trend during the period of the 1920s and early 1930s, was "eclipsed" by other developments in the philosophy of science in the period of the 1940s, and has "re-emerged" in the period from the mid 1950s to date. This development is summarized in the conclusion, and then an alternative proposal for an emergentist analysis of the level structure of reality is set out, involving the four levels of matter, life, society and mind. The bibliography provides a list of relevant articles and books on evolution and emergent evolution.

The following are considered as contributions of this dissertation: (1) the concepts (though not the terms) of mode of evolution and creative synthesis as applied to Darwin's theory; (2) the details of the critique of the application of Kuhn's theory of scientific revolution to the case of Darwinian evolution; (3) the historical survey and analysis of emergent evolution as a philosphical trend; and (4) the proposed level structure of reality based on the levels of matter, life, society and mind, as set out in the conclusion of the dissertation.

I wish to thank Prof. Mario Bunge whose philosophy of scientific materialism, with its emphasis on emergence, was what originally suggested the dissertation topic, and Prof. William Shea, who has encouraged my interest in the history and philosophy of science. Prof. Bunge has been a kind and patient advisor, and Prof. Shea has provided wise and helpful encouragement.

Chapter One: Darwin's Theory of Evolution

This chapter will discuss the scope of Darwin's work, the structure of his theory, and examine two claims about it: (a) that it is tautologous, and (b) that it is revolutionary. A middle ground between these two extreme claims will be found in the thesis of creative synthesis. The chapter will also discuss Darwin's views on the the philosophical concepts underlying the theory of evolution: the problems of evolutionary continuity and discontinuity, quantitative and qualitative change in the evolutionary process, as well the nature of mind and its relation to the body. These question forms part of the problematic that emergent evolution will attempt to answer. Darwin's theory of evolution is a major part of the immediate background to the development of Lloyd Morgan's philosophy of emergent evolution, and the examination of this background indicates the type of problems that Lloyd Morgan had to deal with.

(1) Darwin's Writings:

Darwin's theory, as expressed in the **Origin of Species**, is the result of nearly thirty years of preparatory work and considerations, and has resulted in a tremendous secondary literature, both scientific and philosophical.[1] Darwin's theoretical corpus forms a unified whole, dealing not only with the scientific

[1] The secondary literature on Darwin has grown to enormous size, and has resulted in a "tertiary" literature which examines and evaluates the commentaries on all aspects of Darwin's theory. Typical of such articles is A. la Vergata, "Images of Darwin: A Historiographic Overview", in the recently published **The Darwinian Heritage**, a massive, more than 1000 page volume which includes articles presented at the Charles Darwin Centenary Conference at the Florence Center for the History and Philosophy of Science, in 1982, edited by David Kohn. In what follows, I have based my reading primarily on the original works of Darwin, especially the **Origin of Species, Natural Selection** and the **Descent of Man**. Secondary material has included Stephen Jay Gould, **Every Since Darwin** (1977), Michael T. Ghiselin, **The Triumph of the Darwinian Method** (1969), and George Gaylord Simpson, **The Book of Darwin** (1982), and Howard Gruber, **Darwin on Man: A Psychological Study of Scientific Creativity** (1974).

question of the factors of evolution, but with philosophical problems concerning continuity, change and other related concepts.

Upon returning from the circumnavigation of the globe aboard the **HMS Beagle**, during the period 1838-46 Darwin looked after the publication of the scientific results, both zoological and geological of the expedition. He published his **Journal of Researches into the Geology and Natural History of the various Countries visited during the Voyage of the Beagle** (1839)[2], and three geological volumes on coral reefs, volcanic islands and South America.[3] He also edited the zoological and geological findings of the expedition.[4] During the succeeding period, 1851-58 Darwin worked on his four volume treatise on the barnacles, living and fossil in England and the rest of the world.[5]

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[2] This volume was the third volume of the **Narrative of the Voyages of H.M. Ships Adventure and Beagle**, edited by Captain Robert Fitzroy. The volume has had variant titles. In the second edition of 1845, "natural history" is mentioned before "geology". It is usually referred to by the short title **Journal of Researches**. A complete list of Darwin's writings, including translations is found in Freeman, R. B. (1976). **The Works of Charles Darwin: An Annotated Bibliographical Handlist.**

[3] **The Structure and Distribution of Coral Reefs** (1842); **Geological Observations on the Volcanic Islands visited during the Voyage of HMS Beagle, together with some brief notices of the geology of Australia and the Cape of Good Hope** (1844); **Geological Observations on South America** (1846)

[4] **The Zoology of the Voyage of HMS Beagle**, edited and superintended by Charles Darwin. This included 5 volumes issued in 19 parts from 1838-43. Vol. I: The **Fossil Mammalia**, by Richard Owen; vol. II: **Mammalia**, by George Robert Waterhouse; vol. 3: **Birds**, by John Gould; vol. 4: **Fish**, by F. Leonard Jenyus, and vol. 5: **Reptiles**, by Thomas Bell.

[5] **A Monograph on the sub-class Cirripedia, with figures of all the species. The Lepadidae; or penduculated cirripedes**, vol. 1 (1851); **A Monograph on the sub-class Cirripedia. The Balenidae (or sessiole cirripedes)**, vol. 2 (1854). **A Monograph of the fossil Lepididae, or pendiculated Cirripedes of Great Britain**, vol. 1 (1851); **A Monograph of the Fossil Balenidae and Verrucidae of Great Britain** (1854), and **Index to Volume II** (1858). Together with his volumes on corals and the volume on worms, this treatise on barnacles illustrates the interest Darwin had in small organisms, which in sufficient numbers and with sufficient time, produce large results: tiny corals build up large reefs and islands, worms produce the top soil upon which agriculture is based, and barnacles, if not regularly cleaned away, can destroy ocean going wood vessels. This point is noted in Stephen Jay Gould's **Ever Since Darwin** (1977)

But at the same time, he was working on the theory of evolution, or descent with modification as he originally termed it. A considerable mass of preparatory material has become available from the period 1837-59. These are: The notebooks of 1837 - 39 on problems of evolution, edited by Gavin de Beer under the title **Darwin's Notebooks on Transmutation of Species,**[6] and the notebooks of a more metaphysical and speculative type, edited by Howard Gruber and Paul Barrett under the title **Notebooks on Man, Mind and Materialism.**[7] Sandra Herbert has edited another notebook of the period, which precedes these two, to which the title **Red Notebook** has been given.[8]

In 1842, and again in 1844 Darwin wrote sketches of his theory, published in 1909 by his son as **The Foundations of the Origin of Species.**[9] Darwin in 1856 returned to the theoretical problem of evolution, and began a treatise on the subject. Work on this text was interrupted by the arrival of Wallace's letter containing his independently arrived at notion of struggle for existence and

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[6] There are four notebooks, Part I (July 1837 - February 1838), Part II (February to July 1838), Part III (July 15, 1838 - October 2, 1838), Part IV (October 1838 to July 10, 1839). De Beer also issued Part V - Addenda and Corrigenda, and Part VI - Pages Excised by Darwin. These were published in the **Bulletin of the British Museum (Natural History)**, during 1960-67.

[7] These include the **"M" Notebook** (July 15, 1838 - September 23, 1838), and the **"N" Notebook** (October 2, 1838 - April, 1839). Gruber and Barrett have also included Darwin's "Old and Useless Notes about the moral sense and some metaphysical points" (1837 and earlier) in their **Metaphysics, Materialism and the Evolution of Mind: Early Writings of Charles Darwin** (1974).

[8] Herbert dates the **Red Notebook** from June 1836 to April 1837, and argues that Darwin then divided his thought into three strands: (1) the **"A" Notebook** (as yet unpublished) , on geology (from July 1837 to February 1838), (2) The **"B", "C", "D" and "E" Notebooks** on the transmutation of species, issued by de Beer, and (3) the **"M" and "N" Notebooks** issued by Gruber and Bartlett. The **Red Notebook** therefore precedes the others and was begun by Darwin immediately upon his return from the voyage on the HMS Beagle. By July of 1838, he was working on his notebooks on geology, transmutation and metaphysics simultaneously. Cf. Herbert, Sandra (1980): "Introduction and Notes to the Red Notebook of Charles Darwin", **Bull. Br. Mus. nat. Hist. (hist. Ser.)**, pp. 14-17. Another of Darwin's notebooks, on ornithology, has been published by Nora Barlow in the same review.

[9] These sketches are referred to as the **Essay of 1842** and the **Essay of 1844.**

natural selection. Darwin then prepared a résumé of his views, based on parts of the **Essay of 1844**, which was presented jointly with a paper by Wallace at the 1858 meeting of the Linnean Society.[10] Immediately thereafter, Darwin began to work on what he called an "abstract" of his views, which appeared as the **Origin of Species** in 1859.[11] The work began in 1856 was left unfinished, though the first two chapters were published by Darwin as **Variation of Plants and Animals Under Domestication** in 1868. The 1856-58 work has been published under the title **Natural Selection**, edited by R. C. Stauffer in 1975.

Of works published during his lifetime, four constitute Darwin's main writings on evolution. These are: **Origin of Species by Means of Natural Selection, or the Preservation of the Favoured Races in the Struggle for Life** (1859), **The Variation of Animals and Plants under Domestication** (1868), **Descent of Man, and Selection in Relation to Sex** (1871) and **The Expression of Emotions in Man and Animals** (1872). Besides the major theoretical works, Darwin produced a series of volumes on botany and a book on the biology and ecology of worms.[12]

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[10] Collectively entitled **On the tendency of species to form varieties, and on the perpetuation of varieties and species by natural means of selection.** In the absence of both Darwin and Wallace, their articles were communicated by Sir Charles Lyell. Darwin's contribution included two parts - I: "Extract from an unpublished work on species... consisting of a portion of a chapter entitled "On the variation of organic beings in a state on nature; on the natural means of selection; on the comparison of domestic races and true species" and II: "Abstract of a letter to Asa Gray, Sept. 5, 1857"

[11] The work, in two books, appeared in six editions from 1859 to 1872. The original title was **On the Origin of Species**, but the word "On" was dropped as of the second edition of 1861. That edition included an historical sketch indicating some of the precursors of Darwin. The sixth edition of 1872 included an additional chapter VII in Book I replying to St. George Mivart's criticisms contained in the latter's **Genesis of Species** (1870). The sixth edition uses the term "evolution" as a noun for the first time. In the following footnotes, I will indicate references to Darwin's works without repeating his name each time.

[12] **On the Various Contrivances by which Orchids are fertilized by insects** (1862), **On The Movements and Habits of Climbing Plants** (1865), **Insectivorious Plants** (1875), **The Effects of Cross and Self-Fertilization in the Vegetable Kingdom** (1876), **The Different Forms of Flowers on**

Rather than being an avocational sidelight, the works on plants were part and parcel of Darwin's evolutionary thinking, particularly his notion of the continuity of life. He was particularly interested in those features of plants which they have in common with animals, such as sexual reproduction, and in some, the power of movement and the ability to capture and eat insect prey. Indeed, he concludes his **Power of Movement of Plants** with a section concerning the radicles of plants, which he considers to play the key role in movement. The concluding sentence of the book is: "It is hardly an exaggeration to say that the tip of the radicle thus endowed, and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals; the brain being seated within the anterior end of the body, receiving impressions from the sense-organs, and directing the several movements."[13]

George Gaylord Simpson says that Darwin's comparison of the radicle of the flower and the brain of lower animals, "need not be taken quite literally."[14] But Darwin was committed to the principle of continuity of life, as will be discussed in a later section. On this view, there is a continuous line of development from plants and especially animals to humans. This proposition can also be read in the converse: what exists in humans, must also exist, if only in a less developed or implicit form, in animals and plants as well. This obliges Darwin to adopt what

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Plants of the Same Species (1877), and **The Power of Movement in Plants** (1880).The volume on worms was entitled **The Formation of Vegetable Mould Through the Action of Worms** (1881) This was the last book written by Darwin and presented the results of nearly forty years of research on the habits and activities of earthworms.

13 Charles Darwin, **The Power of Movement in Plants**, p. 573

14 George Gaylord Simpson, **The Book of Darwin** (1982) , p. 171

may be called a "bio-psychist" point of view - the notion that some sort of mind or intelligence exists in all living things, becoming progressively more developed as evolution proceeds.[15]

In the concluding chapter of his book on worms, Darwin notes that though almost totally blind, completely deaf, and hardly able to smell, earthworms are nevertheless responsible for the production of the whole of the arable topsoil. Moreover, despite their lack of many sensory faculties, they "... apparently exhibit some degree of intelligence instead of a mere blind instinctive impulse, in their manner of plugging up the mouths of their burrows."[16] From humans through the monkeys and dogs, down to earthworms and even plants, Darwin saw mind at some degree of development as a correlate of physiological processes.[17]

In what follows, I have based my analysis of Darwin's theory of evolution principally on two sources: **The Origin of Species**, and **Natural Selection**. Since this latter was the source text from which the former was abstracted by Darwin, it often contains more detail and most importantly, references absent in the **Origin**. A systematic presentation of Darwin's theory of evolution will be attempted,

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[15] The belief that all things, including non-living ones, possess some element of mind (or psychic element) is panpsychism. There is no evidence that Darwin held such a view. The term "biopsychism" appears in Ernst Haeckel (1892) "Our Monism: The Principles of a Consistent, Unitary World-View", where he distinguishes among panpsychism, biopsychism and zoopsychism as three theories of the scope of the mental: biopsychism restricts the mental to biological organisms, and zoopsychism further restricts it to animals alone.

[16] Charles Darwin, **The Formation of Vegetable Mould Through the Action of Worms**, p. 374

[17] For more on this problem, see C. U. M. Smith:"Charles Darwin, the Origin of Consciousness, and Panpsychism" (1978)

different in certain respects from expositions such as those of A. R. Wallace,[18] G. J. Romanes,[19] and J. Huxley.[20]

(2) The Structure of Darwin's Theory

(a) The Basic Condition: Overpopulation and the Struggle for Existence

The observation with which Darwin habitually began his works on evolution is the existence of individual variations. The individual differences between progeny and their parents involve both unimportant and important parts. In general these variations are slight. "Sudden and considerable deviations" of structure, especially in the wild, are considered as monstrosities of no use to the species.[21] Darwin noted that wide-ranging, much diffused and common species vary most, as do species in larger genera as compared with those of smaller genera.[22]

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[18] One of the first attempts to summarize Darwin's theory in systematic form is Wallace's presentation in **Contributions to the Theory of Natural Selection** (1871). Wallace presents Darwin's theory as a series of three interconnected syllogisms as follows: (1) Rapid increase of population, combined with (2) stability of population over time, leads to (3) struggle for existence. This latter, combined with (4) heredity with variation, leads to (5) survival of the fittest or natural selection. Finally, (5), together with (6) change of external conditions, leads to (7) change of organic forms and origin of species. (p. 302)

[19] George Romanes, in **Darwin, and after Darwin, v.2: Post Darwinian Questions, Heredity and Utility** (1896), contrasts Wallace's neo-Darwinism, based on a single-factor analysis of Darwinism as presented in the above footnote, with Darwin's multi-factor theory, including the factors of natural selection, use-inheritance and sexual selection. Romanes notes that Wallace's treatment is a reduction of evolution to the factor of natural selection alone, and suggests the term "neo-Darwinism" to distinguish this view from Darwin's own, more complex theory.

[20] Julian Huxley, in his seminal work **Evolution: The Modern Synthesis** (1942)

[21] Charles Darwin, **Origin of Species**, ch. II, pp. 74-79

[22] **ibid**, ch. II, pp. , pp. 89-93

Darwin admitted "our ignorance of the cause of each particular variation,"[23] so that the overall result appeared as if due to chance. Nevertheless, Darwin did attempt to investigate some factors of variation, albeit "in a very dim and doubtful manner".[24] In the **Origin of Species**, the factors mentioned include the following: (1) Changed environmental conditions not only cause increase of variability, but in some cases may even determine the direction of the variation. (2) Use or disuse of parts causes the parts themselves to increase or diminish. (3) The variation of one part may be correlated with the variation of some other, not directly related part, and (5) There may be compensation of parts, where the growth of one part is balanced by the stunting of another. In addition, Darwin recognized spontaneous variation not related to the preceding causes, especially as concerns sexual parts, and other minor factors mentioned from time to time.[25]

Individual variation in itself furnishes only the context or conditions for the operation of further components of the Darwinian mechanism. Population increases geometrically, and if unchecked, the progeny of a single asexually

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[23] **ibid,** v.1, p. 190

[24] Charles Darwin, **Natural Selection,** p. 280

[25] Peter Vorzimmer in his **Charles Darwin: The Years of Controversy; The Origin of Species and its Critics, 1859-1882** (1970) discusses the problem of the factors of variation at some length Vorzimmer (p. 76) lists the following factors: (1) the indirect effect of the conditions of life; (2) the direct effect of the conditions of life; (3) Habit, use and disuse; (4) correlation and (5) compensation, or balance. Darwin's list of factors varies in the listings he provides 1842 and 1844 **Essays, Natural Selection, Origin of Species,** and **Variations of Plants and Animals.** For example, in the chapter "Laws of Variation" in **Natural Selection,** his list is as follows: (1) the immediate or direct action of external conditions, (2) acclimatization, (3) effects of use and disuse of structure, (4) correlation of growth, (5) compensation or balancement, and in addition the following remarks: (i) "a part normally developed in any species in an extraordinary degree or manner, in comparison with the same part in allied species, tends to be highly variable" (p. 307), (ii) "a part so little developed, as to be called rudimentary, tends to be highly variable" (p. 318), (iii) "distinct species present analogous variations; and a variation of one species often resembles the normal structures of an allied species" (p. 321). In the **Origin of Species,** a similar, but not quite identical list is given at the head of chapter 5 on laws of variation.

reproducing plant or of a pair of sexually reproducing organisms would exceed the means of support available for the species. Darwin notes that "Hence we may confidently assert that all plants and animals are tending to increase at a geometrical ratio - that all would rapidly stock every station in which they could exist - and that this geometrical tendency to increase must be checked by destruction at some period of life."

A struggle for life ensues. Checks to population increase include the amount of food available to the species, the predator-prey relationship, extremes of climate such as cold or drought, and epidemics. This struggle for life involves individuals within the same species, and individuals of different species. "All that we can do is to keep steadily in mind that each organic being is striving to increase in a geometric ratio; that each at some period of its life, during some season of the year, during each generation or at intervals, has to struggle for life and to suffer great destruction....The vigorous, the healthy, and the happy survive and multiply."[26]

Thus, the first part of Darwin's theory is characterized by individual differences among a population confronted by over-population and the struggle for existence.[27] Here, the action of the factors of variation on the population of individuals, producing individual differences, forms the circumstances upon which the further factor of overpopulation will act. Overpopulation is a cause leading to the struggle for existence as effect. This conflict is resolved through

[26] Charles Darwin, **Origin of Species**, pp. 118-119

[27] The importance of population thinking in Darwin's work has been stressed by Ernst Mayr. In the following section on the influences on Darwin, the role not only of Malthus, but of Comte as well, will be traced in the origin of this aspect of Darwin's thought.

natural selection. The general conditions (individual differences, struggle for life) upon which natural selection will act may be represented diagrammatically as follows:

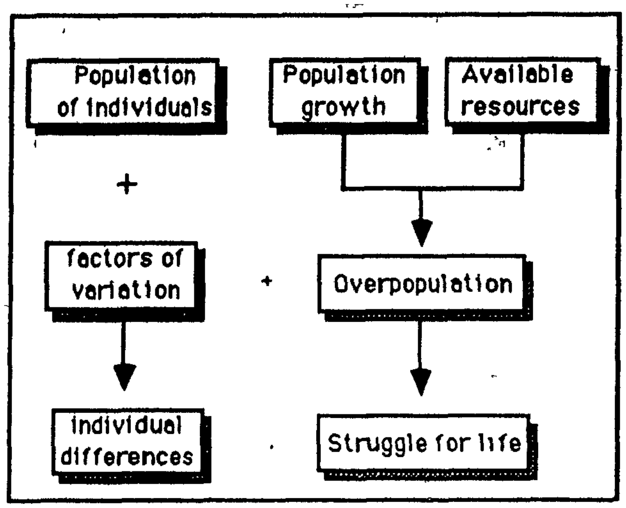

Diagram 1: Struggle for life

(b) The Main Mechanism: Natural Selection, Survival of the Fittest and Descent with Modification:

The mechanism by which the fittest survive is that of natural selection. "It may metaphorically be said that natural selection is daily and hourly scrutinizing, throughout the world, the slightest variations; rejecting those that are bad, preserving and adding up all that are good; silently and insensibly working, whenever and wherever opportunity offers, at the improvement of each organic being in relation to its organic and inorganic conditions of life."[28]

[28] Charles Darwin, **Origin of Species**, p. 126.

Natural selection is, of course, the main contribution of Darwin to the theory of evolution.[29] In his various presentations of the question, from 1842 forward, Darwin always considered natural selection on analogy to artificial selection. Darwin's point is that through artificial selection, within the limits set by external conditions and the laws of inheritance, development and variation, humans can select for characteristics and develop breeds which meet their needs and fancies. Here the selection involves the breeder explicitly choosing the animals or plants which will be allowed to reproduce, this selection being based on the selected organisms possessing the desired attribute to a slightly greater degree.

Having dealt with artificial selection of domesticated plants and animals, Darwin turns his attention next to the natural selection of plants and animals in the wild. The analogy holds, but with some modifications. Darwin states that variation is smaller in the state of nature, but selection more rigorous.[30] Man can select only for certain external characteristics, but nature can select for internal structures as well.[31] As Darwin notes in the **Origin**:

> All these results, as we shall more fully see in the next chapter, follow from the struggle for life. Owing to this struggle, variations, however slight and from

[29] See Camille Limoges, **La Sélection Naturelle; études sur la première constitution d'un concept, 1837-59** (1970) for a discussion of the genesis of the concept of natural selection. The same subject is also dealt with at length in Howard Gruber, **Darwin On Man**, part II.

[30] "Nature's variation far less, but selection far more rigid and scrutinizing", Charles Darwin, **Essay of 1842**, p.9.

[31] In an early formulation, Darwin says: "Let us now suppose a Being with penetration sufficient to perceive differences in the outer and innermost organization quite imperceptible to man, and with forethought extending over future centuries to watch with unerring care and select for any object the offspring of an organism produced under the foregoing circumstances; I can see no conceivable reason why he could not form a new race (or several were he to separate the stock of the original organism and work on several islands) adapted to new ends." Charles Darwin, **Essay of 1844**, p. 85. Note the attribution of natural selection to a Being possessing penetration, forethought and ends. This aspect of the presentation is dropped in later versions, the **Origin** in particular.

> whatever cause proceeding, if they be in any degree profitable to the individuals of a species, in their infinitely complex relations to other organic beings and to their physical conditions of life, will tend to the preservation of such individuals and will generally be inherited by their offspring. The offspring, also will thus have a better chance of surviving, for, of the many individuals of any species which are periodically born, but a small number can survive. I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection, in order to mark its relation to man's power of selection."[32]

The argument up to now has assumed a static environment for the species in question. Because of overpopulation, struggle for existence is the normal state of nature. Survival of the fittest is the outcome, with natural selection the mechanism operating to produce this result. This can be represented in the following diagram. Here, the non-dynamic condition is that of the factors of variation producing individual differences among the population. The dynamic condition, or catalyst, is overpopulation leading to the struggle for life. This conflictual situation is resolved through natural selection, which results in the survival of the fittest:

[32] Charles Darwin, Origin of Species, 6th ed, v.1, p. 99

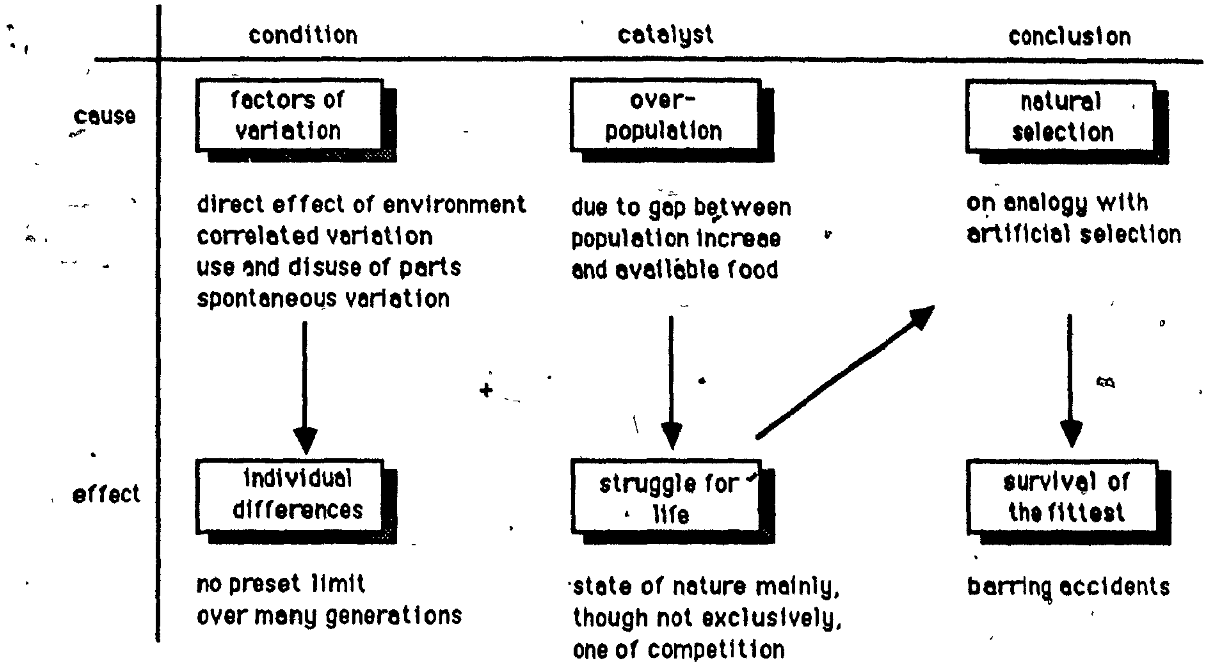

Diagram 2: Conditions, Catalysts and Causes leading to Survival of the Fittest

But the Darwinian theory as formulated above does not yet account for an historical process of change. This is done in Darwin's theory of descent with modification. The above model still assumes a stable environment, while the transmutationist dynamic model brings into play the variation of the environment as well. When the environment changes, the variability of the species within that milieu tends to increase. "We have good reason to believe, as shown in the first chapter, that changes in the conditions of life give a tendency to increased variability..."[33] However, changes in the physical environment and contiguous species do not bring about automatically the appropriate variety best fitted to them.[34] Moreover, though the environmental changes provoke a greater

[33] ibid, p. 123

[34] Here, Darwin's theory differs from that of Lamarck, where environmental change automatically (directly or indirectly) evokes the required changes in the members of a species. As a result, extinction is impossible. This is not the case in Darwin's theory.

variability of certain parts of the individuals, the direction of that change is (in general) not pre-determined. Rather, it is natural selection which acts upon the pool of available varieties, choosing those individuals whose variation "fits" the changes in the environment.

Natural selection may act in one of two directions. In the first, negative case, it leads to the extinction of groups of individuals unsuited for the change in environment. In this case, variation among the individuals in the population was such that none, or so small a number as to be unable to maintain the existence of the group, had the requisite characteristics to survive in the new milieu. In the second, positive case, there are a sufficient number of individuals with the appropriate variations to take advantage of the change in environment. In this case, characteristics not important in the old environment may be selected for in the new. This population will now differ from the parent population, or in Darwin's terms, will be said to have diverged from it.

Divergence leads to increasing differences between the characteristics of succeeding generations. In **Origin of Species**, Darwin states that the principle of divergence, or divergence of character, is analogous to the division of labor. Just as more commodities can be produced in a given time when laborers with different skills are used, so in nature, "the greatest amount of life can be supported by great diversification of structure..."[35] Elsewhere he says: "For in any country, a far greater number of individuals descended from the same parents can be supported, when greatly modified in different ways, in habits, constitution,

[35] **ibid**, v.1, p. 162. See also **Natural Selection**, p. 233 where the reference is explicitly made to Milne Edwards' doctrine of the division of labor in organic life.

and structure, so as to fill as many places, as possible, in the polity of nature, than when not at all or only slightly modified."[36] This can be extended, as Darwin then goes on to say, to the scale of the whole planet, where a greater number of different types of organisms can be supported when diversification is large than when it is slight.

In short, natural selection acting upon a varying population in circumstances of environmental change leads to what Darwin has called "descent with modification". In this model, heredity tends to pass on the average characteristics of the fit population, according to the blending model of heredity to which Darwin subscribed. The process may be summed up in the following diagram:

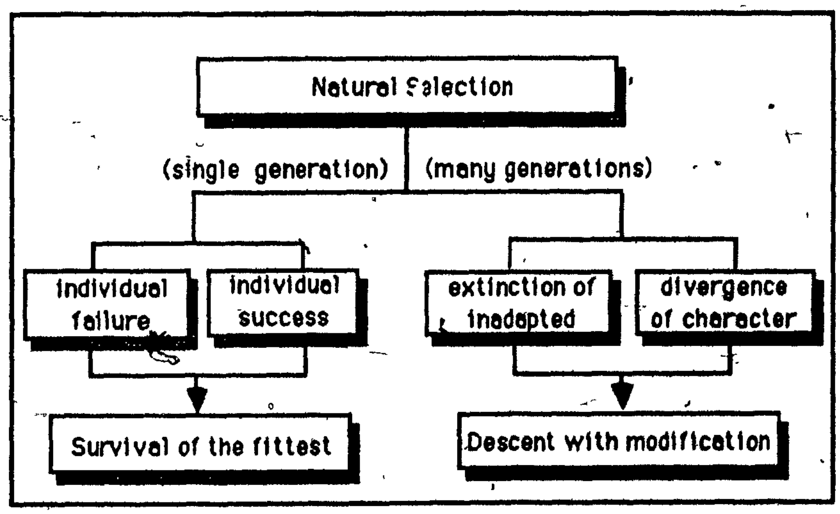

Diagram 3: Natural Selection, Survival of the Fittest and Descent with Modification

[36] Charles Darwin, Natural Selection, p. 228

This can best be analyzed in reference to the chart that Darwin includes in the **Origin of Species** to illustrate the principle of divergence. Indeed, this is the only chart or diagram in the whole work. Here, Darwin considers a hierarchy of divergences, from individual differences involving insignificant variations, to well marked varieties which may be considered as incipient species, through to new species and genera as the ultimate result of the whole process.[37] Time is for all practical purposes unlimited. Time in itself does not produce the divergence of character, but is important only insofar as "it gives a better chance to beneficial variations arising and of their being selected, accumulated and fixed."[38] In his diagram of divergence, Darwin assumes at least 10,000 generations for the production of distinct species and genera.

The image which Darwin uses is that of a branching tree.[39] This image is present in the **Notebooks**, and leads to the tree diagram which appears in both **Natural Selection** and **Origin of Species**, the latter two differing only in the direction (downwards or upwards) of the branching. Each initial root is considered as representing a species within a large genus. Twigs extending from each root are varieties, and Darwin follows the process through a large number of generations, with each of 10 levels representing a thousand generations. The following is a modified version of Darwin's diagram, intended, however, to illustrate the basic points he wished to make. The main modification is to

[37] **Ibid**, p. 167
[38] **Ibid**, p. 153
[39] "The relation of all past and present beings may be loosely compared with the growth of a few gigantic tress; that is if we suppose that from each of the innumerable twigs, innumerable buds are trying to sprout forth, and that the other buds, twigs and branches have the best chance of growing from getting more light. The buds and twigs may represent existing species, and all beneath their living extremities may represent extinct forms." Darwin, **Natural Selection**, p. 249

explicitly indicate the numbers of generation (x10,000) on the Y-axis, and the measure of the characteristic on the X-axis (in units):

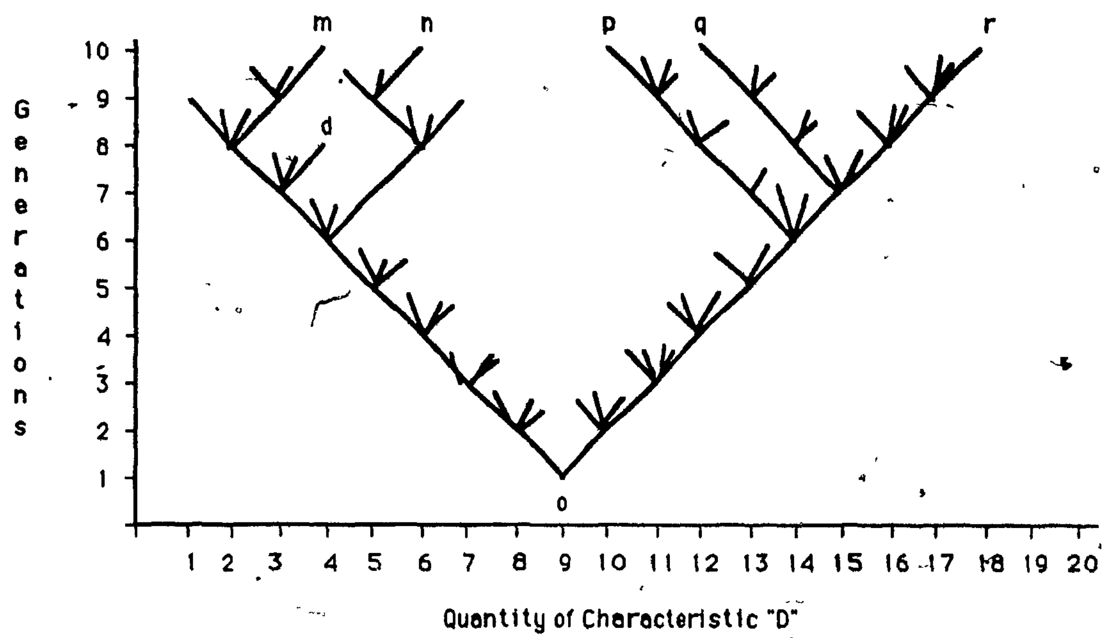

Diagram 4: The "Tree" of Life

In a model for the above diagram, the following assumptions are made: The quantity of characteristic D possessed by an individual x, is symbolized as D(x), and varies from 0 to 20. The progeny of an individual x are considered to vary from it, on the average, by no more than v(x), which is a small amount compared to D(x). The amount of characteristic D required by an organism x to survive is symbolized as R(x). We then consider the definition of species, varieties, genera and families, as well as survival and extinction of species. For Darwin, the basic categories are those of individuals and individual variation; varieties, species, genera and the other taxa are defined on their basis. In order to do this, assumptions must be made as to what constitutes a sufficient quantitative difference to classify two individuals a and b as well marked varieties of the same species, members of distinct species within the same genus, or members of different genera.

For example, organisms may be considered as part of the same species when they differ by no more than say, a_1 units of characteristic D; and well-marked varieties when, though part of the same species by the above criterion, they differ by at least $a'_1 < a_1$ units. The specifications of a_1 and a'_1 would be up to the competent taxonomists, and as will be apparent in the next section, depend on informed judgment. Two organisms of distinct species are said to be members of the same genus when they differ in the characteristic by no more than a_2; and of the same order, when the difference is greater than a_2 but less than a_3. Here it must be the case that $0 < a'_1 < a_1 < a_2 < a_3$. Now, if S(a,b) stands for 'a and b are in members of the same species', then $S(a,b) \equiv |D(a)-D(b)| \leq a_1$. In this case, The species w of which a and b are members is itself defined as the set of individuals having on the average d units of the defining characteristic: $w \equiv \{x \mid D(x)=d \pm \frac{a_1}{2}\}$. [40]

Similarly, if G(c,d) stands for 'c and d being members of the same genus', then $G(c,d) \equiv (x)(y)[(x \in c \,\&\, y \in d) \rightarrow (a_1 \leq |D(x)-D(y)| \leq a_2)]$.[41] Here, a genus is a set whose members are sets representing species.

[40] The concept of species as a derivative category is explicitly indicated here by having a species represented as a set of individuals. In this case, the members of the population have, on the average, d units of D, and members of the species may vary by as much as $a_1/2$ units.

[41] In this case, c and d being distinct species in a single genus is determined by the fact that the members of each species differ by more than a_1 units, but less than a_2 units, again respecting the notion that genera, like species, are conceptual categories derivative from the basic category of individuals.

At any given time it is assumed that a species is located in some environmental zone z, which requires of organisms living within it R(z) units of D. When all the members of a species (or a sufficiently large number to prevent the maintenance of the population) are lacking by b or more units of D, it is assumed that the species becomes extinct; otherwise, it survives. It might be difficult to determine a priori what types of organisms an environment would permit, but in practice, what is of interest in species evolution is the changed characteristics necessitated by shifts in the environment. Given a knowledge of the environment and its species before the change and the nature of the change (geographical, ecological or meteorological), it should not be impossible to predict the new requirements of various characteristics for members of species already living in that environment.

This model takes into account Darwin's notion that the basic ontological category is that of individuals, their differences, and populations of individuals. It allows for a consistent presentation of his theory, and one, it will be argued in a later section, that is not tautologous. The simplifying assumption, which Darwin himself implicitly makes is that there is only one characteristic to take into consideration; a more sophisticated analysis adequate for real taxonomy would require representing species evolution in a multi-dimensional state space for characteristics $d_1, \dots d_n$. In the next section, the conceptual model Darwin develops for the evolution of species will be considered in greater detail as concerns its philosophical aspects.

(c) The Conceptual Model: Natural System of Classification and Evolution of Species.

The above analysis of Darwin's theory has not yet broached the most controversial and important part: the theory of the evolution of species, or, in the terms Darwin first used to express it, the transmutation of species.[42] It is only at this juncture that the concepts of species and higher taxonomic orders can be fully analyzed.

Note that varieties, species, genera and families are defined by the organisms that make them up. This is clearly intended in Darwin's system, where the basic category is that of individuals. A species is located on the tree at the point corresponding to the average quantity of characteristic D manifested by its members. The principle of divergence sums up Darwin's view of how change occurs.[43] Slight changes lead to varieties, in particular, what he calls "well marked varieties", or "incipient species": "...varieties are species in the process of formation, or are, as I have called them, incipient species"[44], and further change, still of a quantitative sort only, leads to new species.

Referring to the diagram of the "tree of life", a taxonomist at generation 10 (x10,000) would classify species m and n in one genus, and species p, q and r in

[42] The term evolution originally meant the unfolding of the latent potentialities, in the preformationist sense; it only came to signify the transmutation of species after the publication of Darwin's **Origin of Species**, and is due to Herbert Spencer. See Bowler, Peter J.:"The Changing Meaning of 'Evolution'".(1975) **J. Hist. Ideas** 36: 95-114

[43] As is well known, this principle does not occur in the 1842 and 1844 **Essays**, and is mentioned for the first time in **Natural Selection**.

[44] Charles Darwin, **Origin of Species**, v.1, pp. 158-159

another, since all members within each group are at least a_1 (here represented arbitrarily by two) or more units apart and less than a_2 (here represented by five) units apart. The two genera are in the same order, since less than a_3 (here represented by ten) units separate their members. However, without knowing the whole historical record, it would be difficult to trace the all the members of these two new genera back to the common ancestry of species o at generation 1.

But the point which Darwin is making is that classification is a conceptual activity, and some conventions must be adopted which are not provided by nature itself. What nature provides are individuals; taxonomists establish the criteria for the rest - varieties, species, genera, families and so forth.[45] Nature here is proceeding in a strictly quantitative manner - the qualitative distinctions, though based on real distinctions in nature - are ultimately the product of human conceptualization and desire for classification.

Returning to the analogy of the tree, variation provides the raw material upon which natural selection operates. The "pruning" of segments of the tree represents extinction, and the extension of segments of the tree represents radiation of varieties into new places in the "polity of nature."[46] Perhaps the strongest statement of Darwin's view of species change occurs in **Natural**

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[45] The problem of the status of "species" is the subject of considerable debate in the literature, as evidenced by the discussion in a recent issue of **Biology and Philosophy** on the problem. See Michael T. Ghiselin, "Species Concepts, Individuality, and Objectivity" (1987), as well as the reply by Ernst Mayr, "The Ontological Status of Species: Scientific Progress and Philosophical Terminology" (1987). The problem of the status of species was also the subject of a long lasting debate in the pages of **J. Syst. Bio** over the last several decades.

[46] Charles Darwin, **Natural Selection**, p. 238

Selection "...species are only strongly marked varieties with the intermediate gradations lost."[47]

This is really the heart of Darwin's view of change - it is quantitative only, not qualitative, and it occurs slowly, over many generations, producing a cumulative effect. Moreover, it is noticeable because intermediate gradations become extinct, and this heightens the visible effect of divergence. Imagine a world where no extinction occurred, and all other Darwinian processes continued. Such a world would contain a continuous spectrum of species so close to each other that major types would not stand out. With the intermediary types eliminated, the survivors are distinct, and the taxonomist classifies them as different species.

Darwin refers once more to his graphic on descent with modification in chapter 14 of book ii of the **Origin of Species**, the chapter dealing with classification. Darwin first notes that the classification of organic beings into a hierarchy of groups based on degrees of resemblance is "not arbitrary like the grouping of the stars in constellations". Rather, it is based on descent with modification:

> All the foregoing rules and aids and difficulties in classification may be explained, if I do not greatly deceive myself, on the view that the Natural System is founded on descent with modification; - that the characters which naturalists consider as showing true affinity between any two or more species are those which have been inherited from a common parent, all true classification being genealogical; - that community of descent is the hidden bond which naturalists have been unconsciously seeking, and not some unknown plan of creation, or the

[47] **ibid**, p. 280. This contrasts with T. H. Huxley who was more concerned with the impossibility of interbreeding as a physiological criteria for distinct species.

enunciation of general propositions, and the mere putting together and separating objects more or less alike.[48]

There are two elements here: (1) the basis for the natural classification, which is community of descent, an objective, natural and quantitative process; and (2) the classification schema of the naturalist, which is the qualitative element, and as a product of the mind, arbitrary except for the constraint imposed by the preceding condition. Darwin states: "Thus, the natural system is genealogical in its arrangement, like a pedigree: but the amount of modification which the different groups have undergone has to be expressed by ranking them under different so-called genera, sub-families, families, sections, orders and classes."[49] The problem here is to express the quantitative amount of variation groups of individuals have undergone in the course of evolution by taxonomic categories.

Species are not explicitly mentioned in the list but Darwin's discussions elsewhere of the problems of defining species is consistent with this interpretation. In chapter two of book one of the **Origin of Species**, after noting that well marked varieties can be considered as incipient species, Darwin goes on to say that species themselves are names that are arbitrarily given for the sake of convenience:

From these remarks it will be seen that I look at the term species as one arbitrarily given, for the sake of convenience, to a set of individuals closely resembling each other, and that it does not essentially differ from the term variety, which is given to less distinct and more fluctuating forms. The term variety, again, in comparison

[48] Charles Darwin, **Origin of Species**, v.ii, p. 221
[49] **ibid**, v.ii, p. 223

> with mere individual differences, is also applied arbitrarily, for convenience sake.[50]

The conventional or arbitrary character of the definition of species means that they are an artifact of the naturalist's craft; a useful and indeed necessary artifact, but an artifact nonetheless:

> Hence, in determining whether a form should be ranked as a species or a variety, the opinion of naturalists having sound judgment and wide experience seems the only guide to follow. We must, however, in many cases, decide by a majority of naturalists, for few well-marked varieties can be named which have not been ranked as species by at least some competent judges.[51]

The nominalist trend of Darwin's thought is reiterated in the conclusion to the **Origin of Species**. Here it is clear that Darwin's basic ontology includes individuals and individual differences only; classification into varieties, species and other orders is based on quantitative differences which are judged by naturalists to be sufficiently large as to merit distinct rankings:

> Hereafter we shall be compelled to acknowledge that the only distinction between species and well-marked varieties is, that the latter are known, or believed, to be connected at the present day by intermediate gradations, whereas species were formerly thus connected... In short, we shall have to treat species in the same manner as those naturalists treat genera who admit that genera are merely artificial combinations made for convenience. This may not be a cheering prospect; but we shall at least be freed from the vain search for the undiscovered and undiscoverable essence of the term species.[52].

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[50] **ibid**, v.1, pp. 88-89
[51] **ibid**, v. 1, p. 80
[52] **ibid**, v. ii, p. 311. The influence of Comte's derision of the metaphysical search for essences and natures is also clear in the following quote, a point which will be further developed in the section on the historical influences on Darwin's thought.

Darwin has argued that a natural system of classification is based on descent with modification, along with the criteria for classification of taxonomists. Similarly, descent with modification forms the basis for the analysis of the evolution of species. Here, considerations from geology and paleontology are required in order to situate fossil remains in temporal succession. Species being derivative categories, their evolution is part of a conceptual model, to be distinguished from the real and underlying process of descent with modification. The conceptual model for classification and evolution can be represented by the following graphic:

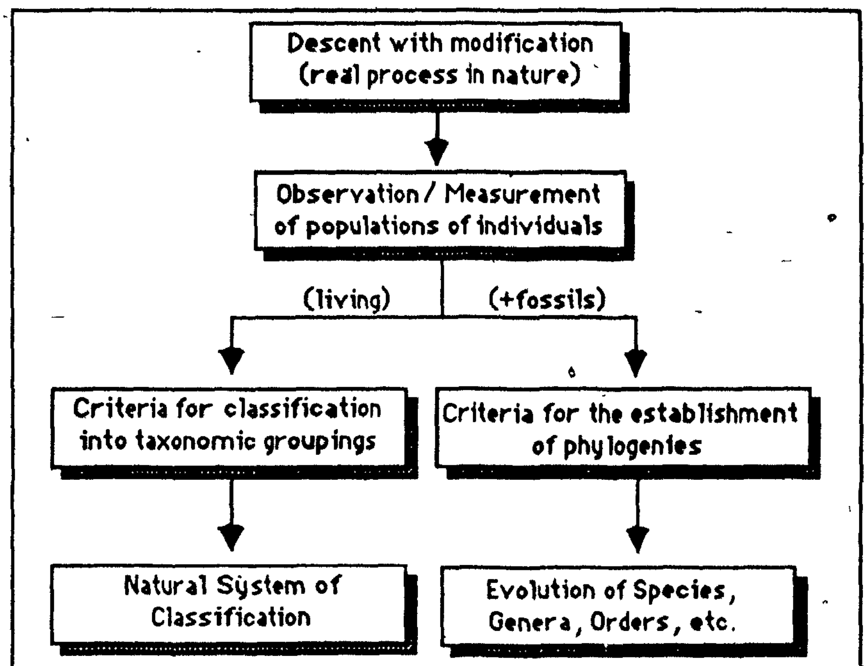

Diagram 5: Conceptual Model: Natural System of Classification and Evolution of Species.

On this reading, evolution of species, a terminology used by Darwin only in later editions of the **Origin of Species**, is used to express the result of combining the quantitative change involved in descent with modification (of later populations with respect to parent populations), with qualitative considerations (in particular, the designation of taxa) introduced through the taxonomist's analysis. The natural system of classification has a real basis in community of descent, but the categories in which it is expressed are due to the mind of the naturalist.

(d) The Supplementary Model: Sexual Selection, Use-Inheritance and Complex Parts:

Natural selection is not the only factor of evolution, though it is the chief one. In addition, playing a secondary but important role is the factor of sexual selection. Sexual selection involving male combat or female choice results in certain features being selected for - large antlers or colorful feathers, and these become part of the mix of characteristics constituting the species.

Darwin also explained the origin of complex parts, such as the eye. In the **Origin of Species**, this is treated in the chapter dealing with difficulties of the theory, for, as Darwin notes, if he cannot explain complex organs through natural selection, then his theory is incomplete. Darwin offered two elements of a response. In the first place, correlation of growth might result in combined development of parts into some complex organ. Secondly, transitional stages might be selected for where the function at the intermediary stages is different from the present function, but was nevertheless useful for the organism. In **Natural Selection**, Darwin says: "In considering the possibility of transitions of an organ from one state to another, we should bear in mind that a part having a nearly similar structure may perform in the same individual or in two individuals functions wholly different."[53]

Darwin accepted that characters acquired during the life of an individual could be transmitted to its progeny. Unlike Lamarck, however, he rejected the notion that in the higher animals this was mediated by an act of willing. Rather, he sought a physiological mechanism of inheritance capable of producing such a result. The theory of pangenesis was intended as a mechanism to explain use-inheritance. According to this theory, gemmules from each bodily organ and structure congregate in the sexual organs, to be passed on through procreation and possibly activated in progeny. Those gemmules not activated in the immediate succeeding generation may be passed on to the grand children, and if activated, explain atavism.

> Thus, an organism does not generate its kind as a whole, but each separate unit generates its kind... When a cell or unit is from some cause modified, the gemmules derived from it will be in like manner modified... Inheritance must be looked at as merely a form of growth, like the self-division of a lowly-organized uni-cellular organism... An organic being is a microcosm - a little universe, formed of a host of self-propagating organisms, inconceivably minute and numerous as the stars in heaven.[54]

The theory of pangenesis is an interesting case of Darwin's use of an hypothetical mode of reasoning. In his letters, he was quite concerned about the status of the hypothesis, and went so far as to call it a "working hypothesis". He maintained it because it allowed him to include a large number of facts of heredity

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[53] Charles Darwin, **Natural Selection**, (8.35), p. 354. See also the article by Steven Jay Gould "Ten Percent of a Wing" in **Natural History** for 1987.

[54] Charles Darwin, **Variation of Plants and Animals**, v.ii, pp. 398-399.

under a general hypothesis. The subsequent demonstration that the theory of pangenesis is false (along with the theory of blending inheritance) is an example of a part of Darwin's theory that has been refuted.[55]

According to Darwin, changes in species occur not only because of natural selection, but through the secondary mechanisms of sexual selection, the preservation of intermediary stages (under the control of natural selection), and use-inheritance coupled with pangenesis. As a result, a model of the main secondary factors of Darwin's theory looks as follows:

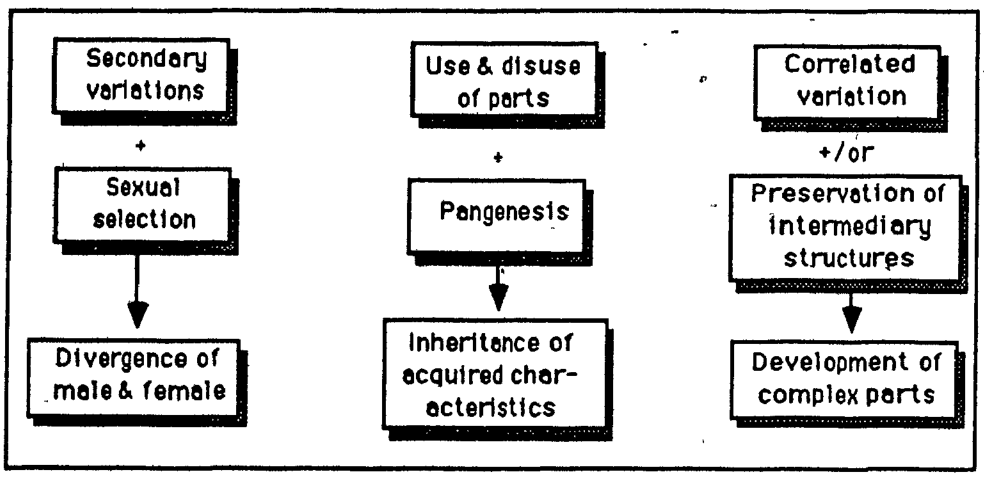


Diagram 6: Supplementary Factors: Sexual Selection, Use-Inheritance and Complex Parts

From what precedes it is clear that Darwin uses a certain number of analogies, specifically, the analogy between (1) variation under domestication and variation in the wild, (2) artificial selection and natural selection, (3) natural

55 Hugo de Vries limited the concept of pangenesis to an influence of the cell body on the cell nucleus in his **Intracellular Pangenesis,** while August Weismann rejected the theory completely and replaced it with his view of the "immortality of the germplasm".

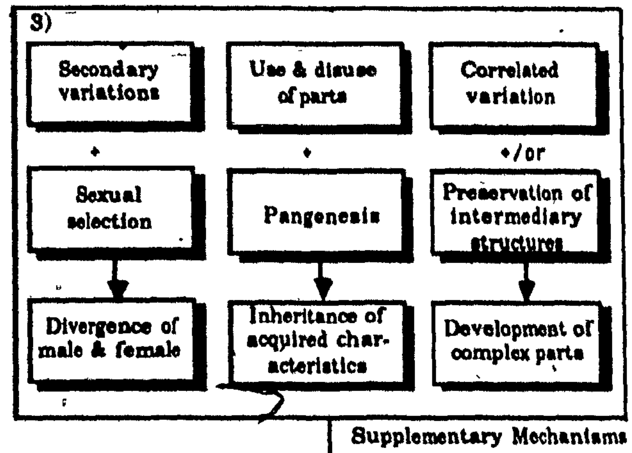
Model of Darwin's Theory of Evolution:

1) Basic conditions of over-population and struggle for existence.

2) Main mechanism of natural selection, leading to the survival of the fittest and descent with modification.

3) Supplementary mechanisms of sexual selection, use-inheritance and preservation of intermediary stages.

4) Conceptual model: natural system of classification and evolution of species.



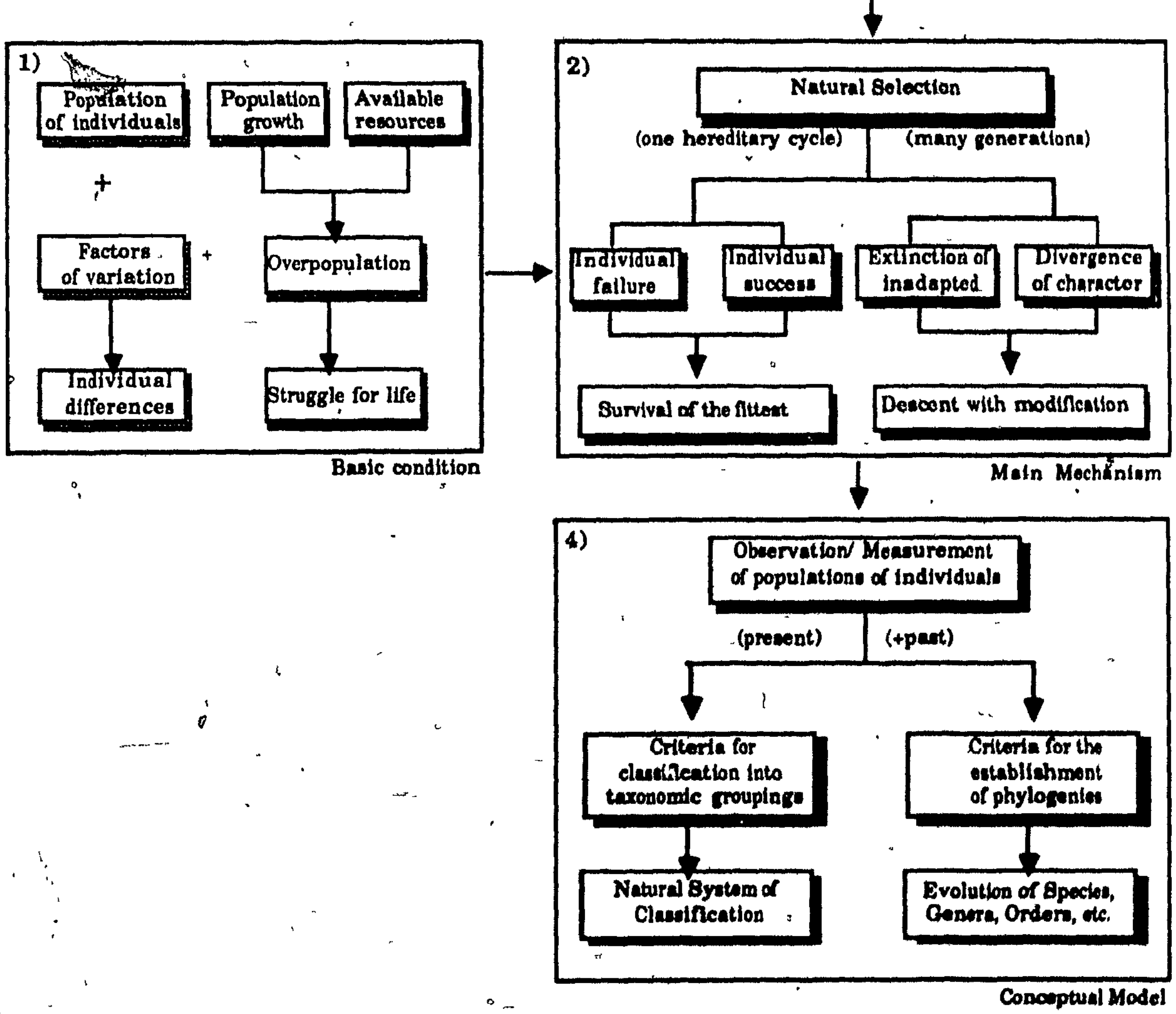


Diagram 7: Model of Darwin's System of Evolution

selection and sexual selection, and (4) change in varieties and change in species. His argument is typically that if the first of each pair is accepted, then analogous reasoning leads us to accept the second. The model of Darwin's theory can be summed up in the chart (overleaf).

(3) Is Natural Selection Tautological?

It should be noted that in this reading of Darwin, natural selection and struggle for life are not logically identical. The difference lies in their status as cause or effect in the Darwinian system. The struggle for life is the result of over-population, itself the consequence of the geometric increase of population and the arithmetic increase of food supplies. Natural selection functions in this model as the cause leading to the survival of the fittest. Again, the survival of the fittest is the result of the operation of natural selection upon the population, given the struggle among its members for life, and the individual differences among them which favor some and disadvantage others. Thus, there are three distinct terms - struggle for life (resulting from overpopulation as cause), natural selection (a causal factor) and survival of the fittest (the resultant or effect which follows from natural selection acting on a population of distinct individuals).

An important philosophical problem at this juncture is that of the tautological status of natural selection.[56] The proposition that natural selection is tautological has been defended by Norman Macbeth and Karl Popper. Macbeth

[56] This question has also been discussed at length in Elliott Sober's **The Nature of Selection** (1984).

argues that Darwin identified natural selection and differential mortality, following in this his reading of G. J. Simpson.[57] Macbeth then argues:

> If we say that evolution is accomplished largely by natural selection and that natural selection consists of differential reproduction, what have we done? Differential reproduction means that some species multiply by leaving more offspring than one-for-one, while others leave one-for-one, while others leave less than one-for-one and dwindle or die out. Thus we have a Question: Why do some multiply, while others remain stable, dwindle, or die out? To which is offered as Answer: Because some multiply, while others remain stable, dwindle or die out. The two sides of the equation are the same. We have a tautology. The definition is meaningless.[58]

Macbeth quotes C. H. Waddington on the same point. The essential of Waddington's claim is contained in this excerpt:

> Natural selection, which was at first considered as though it were a hypothesis that was in need of experimental or observational confirmation, turns out on closer inspection to be a tautology, a statement of an inevitable although previously unrecognized relation. It states that the fittest individuals in a population (defined as those which leave most offspring) will leave most offsp ing. Once the statement is made, its truth is apparent.[59]

Karl Popper, in some of his earlier writings, also argued that Darwinian natural selection is tautological, and hence meaningless. In **Objective Knowledge**, he stated:

> Quite apart from evolutionary philosophies, the trouble about evolutionary theory is its tautological, or almost tautological, character: the difficulty is that Darwinism and natural selection, though extremely important, explain evolution by 'the survival of the fittest' (a term due to Herbert Spencer). Yet there does not seem to be

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[57] Norman Macbeth, **Darwin Retried: An Appeal to Reason** (1971), pp. 40 and 54.
[58] ibid, p. 47
[59] C. H. Waddington, **Evolutionary Adaptation** (1960) p. 395. Quoted in Norman Macbeth, op. cit. p. 47

> much difference, if any, between the assertion 'those that survive are the fittest' and the tautology 'those that survive are those that survive'. For we have, I am afraid, no other criterion of fitness than actual survival, so that we conclude from the fact that some organisms have survived that they were the fittest, or those best adapted to the conditions of life.[60]

The goal of this section is to use the analysis of Darwin's theory developed in the preceding section to reply to the above and related charges that Darwin's theory is tautologous. The claim that Darwinism is tautological can be reformulated as two distinct statements:

1. The evidential version: There is no empirical means of determining which specimens in a species are the fittest. Evidence that some rather than others were the fittest is given only by their survival and greater differential reproduction, which is merely to say "the survival of the survivors". This is clearly tautologous.

2. The definitional version: There is no theoretical means of distinguishing between evolution and natural selection. The claim that natural selection is a real cause is merely definitional, since once evolution has been shown to occur, the theory merely declares that this was so due to natural selection.

My claim is that the evidential version rests on a confusion between cause and effect, and that the definitional version rests on a confusion between process and factor. Both neglect to examine in detail the structure of Darwin's theory.

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[60] Karl Popper, **Objective Knowledge: An Evolutionary Approach** (1971), p. 242. The paragraph quoted is from the article "Of Clouds and Clocks" which originally appeared in 1965. I will return later in this section to Popper's subsequent rectification of this claim.

The confounding of natural selection and survival of the fittest has a long paternity; indeed, it goes back to Darwin himself, who, in trying to relate his theory to that of Spencer states the following in the **Origin of Species**:

> I have called this principle, by which each slight variation, if useful, is preserved, by the term Natural Selection, in order to mark its relation to man's power of selection. But the expression often used by Mr. Herbert Spencer of the Survival of the Fittest is more accurate, and is sometimes equally convenient.[61]

In the model of Darwin's theory in the preceding section, I have reserved the term "natural selection" for the causal factor which, when acting upon a population in a state of competition for scarce resources, results in the survival of the fittest. In this sense, the term "survival of the fittest" refers to the effect. This, I believe, is consistent with the spirit of Darwin's **Origin**, which is based on cause and effect relationships, though it clearly runs foul of the letter of the above quote. I have opted for the spirit of the work over the letter of the text, because it avoids the circular definition charge brought against Darwin in a way which is consistent with his theory.

But even the theoretical distinction between natural selection as cause and survival of the fittest as effect does not suffice if ultimately there is no practical criterion for distinguishing the two. Again, the argument in the preceding section, that "fit" does give an independent criterion, when "fit" is interpreted as the correlation between (a) the characteristics possessed by an organism which are useful for certain functions and (b) the requirements of the environment which must be satisfied by those functions .

[61] Charles Darwin, **Origin of Species**, pp. 99-100.

The definitional version of the tautology charge is based on the confusion of evolution as a process with natural selection as a factor. Evolution is more general than natural selection; it is an objective process for which Darwin postulated natural selection as the chief factor. But for Darwin, natural selection, though the chief factor of evolution, is not the only factor. He attaches considerable importance to sexual selection and use-inheritance, as well as the preservation of intermediary structures through change of function. Moreover, the importance attached to these secondary factors increases with the later editions of the **Origin of Species**. The identity "evolution = natural selection", besides violating the distinction between process and factor, involves a misreading of Darwin. Indeed, Popper has recognized his own error in this regard.

In his article "Natural Selection and the Emergence of Mind" (1977), Popper reconsiders his above point of view, and states: "The fact that the theory of natural selection is difficult to test has led some people, anti-Darwinists and even some great Darwinists, to claim that it is a tautology."[62] He then goes on to state that he himself held that view, and admitted at most that evolution by natural selection was a "metaphysical research program."[63] The key to this change of mind, which Popper qualifies as a "recantation" is that the proposition that evolution occurs only by natural selection can be refuted, and indeed is, since natural selection is not the only factor of evolution, and some evolutionary change occurs as the result of other factors, such as sexual selection.

[62] Karl Popper. "Natural Selection and the Emergence of Mind" (1977), p. 344
[63] In his autobiography in the **Philosophy of Karl Popper** (1974), ed. P. A. Schilpp.

(4) Is Darwin's Theory Revolutionary?

(a) Kuhn and Darwin

At the other extreme is the claim that Darwin's theory of natural selection constitutes a scientific revolution, marking a discontinuity in the development of biological thought. This claim is made by Thomas Kuhn. Kuhn first presented his theory of scientific change in his **Structure of Scientific Revolutions** (1962), and made some modifications in a postscript of 1966. Kuhn's theory involves the factors of normal science, problem or puzzle solving, the discovery of anomalies leading to a period of crisis, a paradigm shift with its accompanying scientific revolution, the consolidation of the new paradigm and the development of a new normal science, opening up the whole cycle.

In greater detail, Kuhn argues: (1) Normal science is oriented to puzzle solving, and not the production of novelty. The puzzle solving activity is guided by a dominant paradigm, an agreed upon and well-established set of rules or way of doing things. (2) In the course of normal science some problems arise that are recalcitrant to the paradigm, anomalies which cannot be solved by it. (3) This leads to a crisis, the search for new rules and a new paradigm capable of solving the anomaly; there is a breakdown of the normal puzzle solving activity. (4) With the transition from a normal to an extraordinary period of research, a new paradigm arises, one capable of solving the anomaly. (5) This new paradigm is consolidated in the text-books of the following period of normal science based on it, and transmitted to the practitioners in the field. (6) Formed in the new schools, with new concepts, rules and tradition, scientists lose contact with the old paradigm; there is an gulf between old and new paradigms expressed through the "incommensurability" of the theories and the "revolution in world view". (7) The new science is nonetheless progressive with respect to the old, since it can solve a greater quantity of problems, i.e. more puzzles. The process can be visualized by the following flow chart:

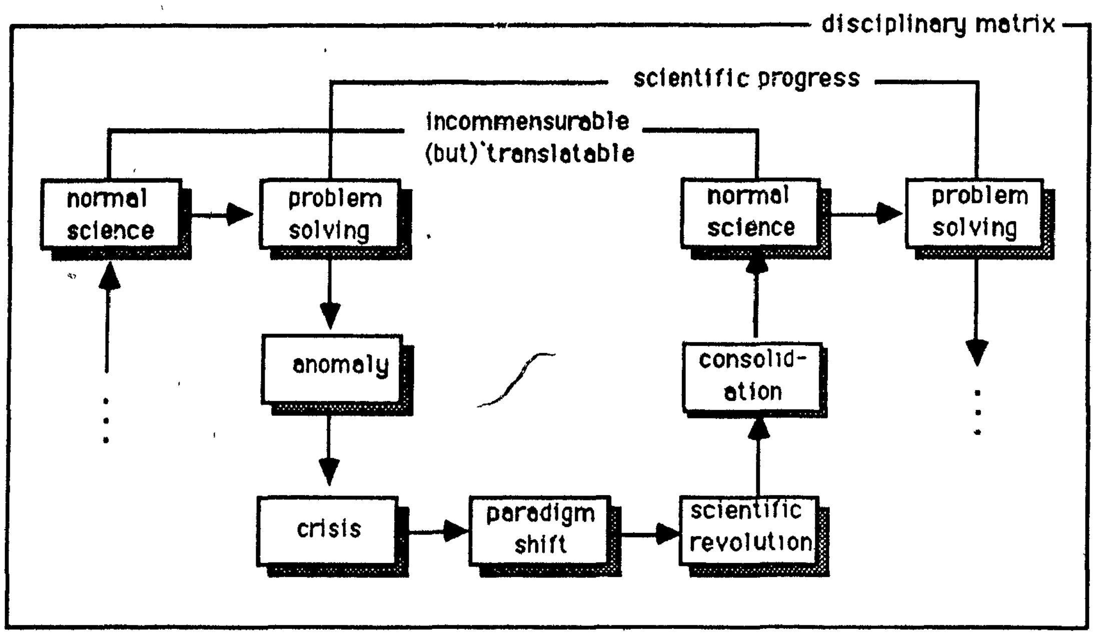

Diagram 8: Structure of Kuhn's Theory of Scientific Revolution

Kuhn has a number of subsidiary theses of some interest:

(1) In the first edition of his book, he stated that the normal sciences of two succeeding periods, that is to say, periods separated by a scientific revolution, are incommensurable. In the second edition of his book, he weakened this thesis by noting that it is the task of historians of science to translate between the two theories and re-establish communication, at least for comparative purposes.

(2) Science progresses over time - during normal periods, progress is due to more and more problems being solved, and during revolutionary periods, it is due to the substitution of a new paradigm for an old one, which allows more problems to be posed and later solved in the following period of normal science. Problem solving is thus a quantitative measure of scientific progress.

(3) Following Margaret Masterman's article identifying no less than 21 different senses of paradigm in his book[64], Kuhn acknowledged two distinct meanings of paradigm - the narrow sense of a shared set of assumptions among the practitioners of a science during its normal period of development, and a wider sense of disciplinary matrix, the shared values, methods and axioms that carry over paradigm shifts. The whole Kuhnian process of scientific revolution and progress occurs within a disciplinary matrix, which is represented as the surrounding box in the above diagram.

(4) Kuhn introduces what has been called the concept of "micro-revolutions"[65] in the "Postscript" when he remarks that a revolution may be no more than a "special sort of change involving a certain sort of reconstruction of group commitments" in specialized communities of scientists "consisting perhaps of fewer than twenty-five people".[66] As Newton-Smith has noted, this is a

64 Margaret Masterman, "The Nature of a Paradigm" (1970), in Lakatos and Musgrave, eds. : **Criticism and the Growth of Knowledge**.
65 Alan Musgrave in "Kuhn's Second Thoughts" (1971), refers to Kuhn's "new emphasis on the micro-community structure of science". reprinted in Gutting (ed.) **Paradigms and Revolutions** (1980) , p. 41. I will later introduce the term "macro-revolution" to designate the major revolutions of Copernicus, Newton, Einstein and Darwin, with special reference to the latter for the purposes of this discussion.
66 T. S. Kuhn, "Postscript" (1969). p. 181

watering down of the "revolutionary" Kuhn to a "social-democratic" Kuhn.[67] Such a modification trivializes the thesis of scientific revolutions, but is of no concern for the present purposes, since Kuhn maintains the view that Darwin's contribution is not of this type, but rather is what might be called a "first-edition" revolution.

The Kuhnian model can easily be applied to Darwinian evolution, though Kuhn himself does not do so in detail. But in principle, he admits Darwin's theory of evolution as a major scientific revolution, referring to "major revolutions such as those associated with Copernicus, Newton, Darwin or Einstein."[68] So, for Kuhn, his model, in the strong sense, should be applicable.

The question is whether the application does justice to the historical facts and theoretical problems raised by Darwin's work. A Kuhnian reading of Darwin might go as follows: (1) Previous to Darwin, normal science was creationist biology, summed up in the theory of natural theology - God created each creature perfectly adapted to its role and milieu, with man the highest and noblest of his

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[67] in W. H. Newton-Smith, **The Rationality of Science** (1981). See in particular chapter 5, entitled "T. S. Kuhn: From Revolutionary to Social-Democrat".

[68] T. S. Kuhn in "Postscript" (1969), p. 180. Again, Kuhn says in the introduction to the collection of his essays **The Essential Tension** (1977): "Some revolutions are large, like those associated with the names of Copernicus, Newton or Darwin, but most are much smaller, like the discovery of oxygen or the planet Uranus" (p. xvii)In the article "The Essential Tension: Tradition and Innovation in Scientific Research" (1959), he states, referring to the draft of **The Structure of Scientific Revolutions** he was then working on: "I am elsewhere studying these points more historically, with emphasis on the importance to scientific development of "revolutions". These are episodes - exemplified in their most extreme and readily recognized forms by the advent of Copernicanism, Darwinism, or Einsteinism - in which a scientific community abandons one time-honored way of regarding the world and of pursuing science in favor of another, usually incompatible, approach to the discipline", in **The Essential Tension**: p. 226. So Darwinism is not only an example of a scientific revolution, it is one of the three or four major ones that Kuhn recognizes.

creations. This was certainly the point of view of the eight eminent scientists who contributed to the collective work known as the **Bridgewater Treatises** in the first third of the 19th Century.[69] (2) But there were anomalies - for example, vestigial organs which had no apparent use, parasitic animals which manifested no perfection or nobleness of purpose, and the extinction of species as shown in the fossil record, to name just three. (3) The old normal science could not resolve these anomalies, and enter Darwin: species are not created ad aeternum by the Lord, but are evolved, and may become extinct, chiefly through the medium of natural selection. (4) This lead to a new paradigm, which was consolidated in standard texts, and passed on to the next generation as normal science. (5) The natural theology of the Bridgewater scientists and Darwinian evolution are incommensurable theories, though it is the task of the historian of biology to compare and contrast them in rational terms. (6) Biology has progressed from natural theology to natural selection, and post-Darwinian evolutionists are engaged in the task of applying the now standard paradigm to solving new problems. (7) Evolution has become a shared world view within the biological disciplinary matrix.

[69] The Right Honourable and Reverend Francis Henry, Earl of Bridgewater, died in February of 1829 and left the sum of 8000£ sterling to be divided among eight authors for the purpose of publishing a series of volumes "On the Power, Wisdom and Goodness of God, as manifested in the creation" and illustrated by arguments from all branches of natural philosophy. The following volumes were published in this series: Rev. Thomas Chalmers: **On the Power, Wisdom and Goodness of God as Manifested in the Adaptation of External Nature to the Moral and Intellectual Constitution of Man**; John Kidd, MD, **On the Adaptation of External Nature to the Physical Constitution of Man**; ~~Rev.~~ William Whewell: **Astronomy and General Physics Considered with Reference to Natural Theology**; Sir Charles Bell: **The Hand: Its Mechanism and Vital Endowments as Evincing Design**; Peter Mark Roget, MD, **On Animal and Vegetable Physiology**, Rev. William Buckland: **On Geology and Minerology**, Rev. William Kirby, **On the History, Habits and Instincts of Animals**, and William Prout, MD: **Chemistry, Metereology, and the Function of Digestion, Considered with Reference to Natural Theology**.

This reconstruction of a Kuhnian explanation of Darwinian evolution is admittedly speculative, since Kuhn does not provide one himself. Other attempts in the literature to apply Kuhn's theory of scientific revolution to Darwinian evolution are Michael E. Ruse, "The Revolution in Biology" (1970)[70], Ernst Mayr, in "The Nature of the Darwinian Revolution" (1971, revised 1976)[71] and John C. Greene, "The Kuhnian Paradigm and the Darwinian Revolution in Natural History" (1971)[72] reprinted in his **Science, Ideology and World View** (1981).

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70 Michael Ruse identifies two paradigms during the first third of the 19th century: the biblical paradigm of "consult the Bible", and the naturalist one of "consult the book of nature", this latter especially associated with Lyell's uniformatarianism. The crisis leading to Darwin's scientific revolution is not a crisis within the old paradigm (as Kuhn requires), but rather comes about as the result of an attempt to combine rules from both paradigms. Specifically, Ruse identifies the crisis as the attempt to explain fossil remains by successive floods, a fatal concession by the old paradigm to the methods of the new one. Darwin's contribution is not the production of an adequate theory of evolution (as Kuhn supposes), but rather the complete rejection of the Biblical paradigm, along with its associated teleology, in favor of a strictly mechanistic system of rules for biology. Moreover, the facts in the debate were common to both paradigms, and not theory-dependent, as Kuhn requires. Finally, for Ruse, Darwin's revolution, involving rule change, is a revolution of a "special type", which occurs infrequently, in contra-distinction to the more run of the mill paradigm shifts in science. Here, Ruse approximates Kuhn's view of "mega-revolutions".

71 Ernst Mayr criticizes the simplifying assumptions in Kuhn's concept of a paradigm. Mayr argues that the Darwinian revolution required the replacement of a whole series of scientific and metascientific "credos". The scientific changes were: (1) the extension of the age of the earth from several thousands to several millions; (2) refutation of the catastrophist principle and of the steady-state world views, and (3) refutation of the concept of an automatic upward evolution, and specifically Lamarck's progressionism. The metascientific credos that were replaced included: (4) the principle of creationism, along with its associated teleology; (5) essentialist and nominalist views (replaced by "population thinking"), and (6) the principle of anthropocentrism Mayr then goes on to say that Darwin's revolution had "a far greater relevance outside of science than any of the revolutions in the physical sciences", including those of Einstein, Heisenberg, or Copernicus. This is because it touched problems concerning ethics and religion. Mayr therefore criticizes Kuhn for underestimating the complexity of the Darwinian revolution, and its impact .It is not clear, however, how Mayr arrives at his contrast between the contributions of Darwin and those of Einstein, Heisenberg and Copernicus, which also had ethical and religious implications.

72 John Greene provides a more complex and historically complete presentation of Darwin's immediate context than the Kuhnian view allows. Preceding Darwin were a number of competing paradigms: (a) the static Linnean paradigm, including the work of Ray and Tournefort, later modified by Cuvier to include a more dynamic element of successive creations; (b) the transformationist Buffonian paradigm, leading up to the unsuccessful Lamarckian revolution; (c) the "naturphilosophie" paradigm of Goethe, Oken and others based on the principle of pure form, creative nature and spontaneous generation, and (d) the Darwinian paradigm, preceded by Lyell's uniformitarian principle. Darwinism does represent a radical break in tradition, but one

The Kuhnian story as sketched above reads well, but it is argued here that it does not fully stand up to the historical record or the history of ideas: (1) In the first place, it **overemphasises** the discontinuity between Darwin and his predecessors; (2) secondly it **overestimates** the degree to which Darwinian theory became a paradigm in the succeeding period; (3) thirdly it **underestimates** the importance of philosophical factors and diversity underlying scientific theories and debates and (4) it **underestimates** the influence of Darwin's theory outside the immediate scientific field of biology. Each of these four points will be discussed in the following sub-sections.

(b) The Influences on Darwin

The claim in this section is that Darwin's theory can best be understood, not as a Kuhnian scientific revolution, involving a radical break and consequent incommensurability with preceding theories, but as a creative synthesis, involving both elements of continuity and an element of discontinuity with the history of scientific ideas that preceded him. Two elements are distinguished in the background to Darwin: the general background, comprising the established theories and interpretations of biology from previous centuries, and the

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that was not anomaly-driven. Darwin did not invent the idea of the transmutation of species, but rather proposed a theory of the mechanism by which it could be said to occur. It is only with respect to this latter that he was revolutionary. The theory of natural selection played a major role in convincing scientists to accept the theory of evolution, though many who did paradoxically did not adopt natural selection as the mechanism, a trend reinforced by the rebuttal of Darwin's theory of heredity. Greene notes "In fact, it could be argued that nothing approaching a "Darwinian" paradigm became established until the 1930s, and then only in a very loose sense" (p. 53). Greene's view is similar in this respect to that developed in this text.

immediate background, involving authors contemporaneous with Darwin or belonging to the previous generation at most.

The following are proposed as the key elements of the general background to Darwin: (1) Natural theology and the principles of special creation, design, and the fixity of species, (2) the natural classification of species of Linnaeus, and (3) the principle of the continuity of life, an important element in the chain of being, present from Aristotle to Leibnitz Each of the three elements will be discussed in terms of Darwin's relation to them, which is not one of total discontinuity or rejection.

Natural theology was (almost) universally recognized as the foundation of science in England from Newton to the time of Darwin.[73] Hume was one of the few to formulate philosophical critiques, and this was published only posthumously.[74] The culminating high point of the trend occurred with the publication of the

[73] The systematic presentation of arguments for natural theology was inaugurated with the Boyle lectures, begun in 1692 and had roots both in physics and biology. Newton himself aided Richard Bentley in the preparation of the first lectrues of that series, **The Folly and Unreasonableness of Atheism** (1692), as can be seen from his four letters to Bentley (in **Isaac Newton's Papers and Letters on Natural Philosophy**, ed. I. Bernard Cohen, pp. 279-313). William Derham's **Physico-Theology: or, A Demonstration of the being and attributes of God, from the works of creation** was the 1713 lecture, followed three years later by the same asuthors' **Astro-Theology**, showing how the wonders of the heavens demonstrate the goodness and existence of God. John Ray's (1691) **Wisdom of God in Creation** leads directly to William Paley's **Natural Theology: or, Evidences of the Existence and Attributes of the Deity; collected from the appearances of Nature** (1802), and thence to the Bridgewater Treatises.

[74] In his **Dialogues Concerning Natural Religion** (1779), published three years after his death, despite the fact that the text was completed some quarter of a century earlier (1751-55). In the dialogues, it is Philo who formulates a critique of natural theology from a skeptical point of view, arguing that one cannot infer back from the multiple phenomena of the world to a single creator, from imperfect creations to a perfect creator, or from finite effects to an infinite cause. This presupposes that Philo does indeed speak for Hume, despite the disclaimer of sorts at the conclusion of the **Dialogue** (as Kemp Smith argues in his introduction). Kant, in his third critique, also criticizes the deduction of the goodness and existence of God from natural phenomena, and prefers an ethico-theology to a physico-theology.

Bridgewater Treatises in 1830-32, just as Lyell was beginning to bring out his **Principles of Geology**. In Cartesian science God is active only at the origin of the world, after which matter develops uniquely by its own (God-given) laws of motion. In contrast with this point of view, Newton had reserved a more active role for God. God not only creates the world, but intervenes in it, to set the planets in their motions about the sun and to correct their orbits to avoid any catastrophic collisions. Despite Leibniz' criticism that this implied God to be a "poor watchmaker,"[75] by requiring divine intervention to repair the system of the world, the Newtonian model of occasional divine intercession was maintained.

In biology, this took the form of a two fold claim: God created the individual species in special acts of creation and so arranged their environment that each was adapted to it, there to prosper and multiply. Because of this perfect adaptation, the result of divine design, species were fixed and did not change. Darwin's attitude to this part of his general background is the most negative of all. Although he is willing to admit the initial creative act of a deity to form the cosmos, thereafter he proceeds entirely according to natural causes, a return to Descartes' view, without, however, the dualistic metaphysics of this latter. His rejection of special creation is total and implacable. Natural selection is to replace special creation; the two are opposed and a concession to the latter is entirely corrosive of the former. The influence of Comte is the clearest here, a point to which I will return later. Darwin sees himself as bringing biology from its theological to its positive stage, and his rejection of natural theology is radical.

[75] in the **Leibniz-Clarke correspondence** of 1715-1716.

Nonetheless, Darwin is less critical of the other elements of his general background. Linnaeus had established a modern system of the classification of species, based on an examination of their essential characteristics, including for plants, their reproductive system. Darwin clearly situates himself in this tradition when he affirms his belief in the establishment of a natural system of classification in the **Origin of Species**; but rather than carrying out such a plan in practice, he merely indicates the possibility and the necessity of such a conceptual taxonomic system.[76]

Thirdly, there was the principle of the continuity of nature, present in the works of Aristotle[77] and Leibniz[78], to name but two. Here Darwin is the most

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76 Moreover, unwittingly, he shares a further theoretical point with Linnaeus: the acceptance of the transmutation of species. As modern research has shown, Linnaeus had a more sophisticated view on orders, genera and species that a "fixity of species" approach would indicate. The initial members of an order were created by divine fiat, and males of one order combined with females of another to form the genera according to a divine plan. Thereafter, species were formed according to natural processes of sexual union, and indeed, Linnaeus thought he had empirical evidence for the natural transmutation of species. Darwin, however, extends the transformist principle to all levels of taxonomy - not only species, but genera, orders, and the higher taxa. Note, however, that this formulation of Linnaeus was confined to texts not readily available; for the general scientific community, his views were those of the fixity of species expressed in his **System of Nature** (On this, see Gunnar Eriksson, "Linnaeus as Biologist" (1983). in **Linnaeus: The Man and his Work**, ed. T. Frängsmyr)

77 Aristotle formulates the principle of continuity as follows: "Nature proceeds little by little from things lifeless to animal life in such a way that it is impossible to determine the exact line of demarcation, nor on which side thereof an intermediate form should lie. Thus, next after lifeless things in the upward scale comes the plant, and of plants one will differ from another as to its amount of apparent vitality; and, in a word, the whole genus of plants, whilst it is devoid of life as compared with the animal, is endowed the life as compared with other corporeal entities. Indeed, as we just remarked, there is observed in plants a continuous scale of ascent towards the animal. So, in the sea, there are certain objects concerning which one would be at a loss to determine whether they be animal or vegetable..." [Aristotle, **History of Animals**, Bk. VIII, ch. 1, 588b4-14].

78 Leibniz' comments "..Nothing is accomplished all at once, and it is one of my great maxims, and one of the most verified, that nature makes no leaps: a maxim which I called the Law of Continuity..."(Leibniz, preface to **New Essays on the Understanding**) In the biological application of the above principle of continuity leaps are therefore excluded from nature, though Leibniz

faithful to his general background: he adopts the principle of "natura non facit saltum" as a principle of his system. The notion of continuity is intimately linked with that of gradualism: nature proceeds by small, indeed infinitesimal steps to continually produce varieties. The impression of gaps between species is due to two external phenomena: the extinction of intermediary species, and the inadequacies of the fossil record. A comparison between Darwin's statements and those of Aristotle and Leibniz in the above footnote demonstrate the affinity of views. Of course, on wider issues they differ: Aristotle identifies the source of human, animal and plant life in three grades or types of soul, while Leibniz argues for a pre-established harmony where physical causation does not exist and

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admits that gaps do appear to exist. But these apparent leaps are so only because we are limited in our experience to the species existing in our world; intermediate forms may exist on other worlds we have no knowledge of. This appearance of leaps, or gaps, is considered as aesthetically pleasing and illustrative of the goodness of nature towards man, her highest creation on this planet: "...Everything goes by degrees in nature, and nothing by leaps, and this rule regarding changes is part of my law of continuity. But the beauty of nature, which desires distinct perceptions, demands the appearance of leaps, and so to speak musical cadences in phenomena, and takes pleasure in mixing the species. Thus although there may be in some other world mediate species between man and beast (according as we understand these words), and although there may be somewhere rational animals surpassing us, nature has found it good to keep them away from us, in order to give us without contradiction the superiority we have in our globe [from "On the Degrees of Assent", p. 552] where species form a static chain of being.[79] But all accept the principle of continuity as applicable to organic nature.

Turning to the immediate influences on Darwin, authors contemporaneous with him or belonging to the immediately preceding generation, six major figures can be identified in what is termed the specific background to Darwin: (1) Lyell and the uniformitarian principle, (2) Malthus and the principle of population, (3) Wallace and the notion of divergence of character, (4) Lamarck and his theory of the generation of classes and species, (5) Comte's critique of the theological stage of knowledge, and (6) Milne-Edwards views on the biological division of labor. These influences manifest themselves at key places in the foundations and structure of Darwin's theory of evolution.

[79] Leibniz comments "..Nothing is accomplished all at once, and it is one of my great maxims, and one of the most verified, that nature makes no leaps: a maxim which I called the Law of Continuity..."(Leibniz, preface to **New Essays on the Understanding**) In the biological application of the above principle of continuity leaps are therefore excluded from nature, though Leibniz admits that gaps do appear to exist. But these apparent leaps are so only because we are limited in our experience to the species existing in our world; intermediate forms may exist on other worlds we have no knowledge of. This appearance of leaps, or gaps, is considered as aesthetically pleasing and illustrative of the goodness of nature towards man, her highest creation on this planet: "...Everything goes by degrees in nature, and nothing by leaps, and this rule regarding changes is part of my law of continuity. But the beauty of nature, which desires distinct perceptions, demands the appearance of leaps, and so to speak musical cadences in phenomena, and takes pleasure in mixing the species. Thus although there may be in some other world mediate species between man and beast (according as we understand these words), and although there may be somewhere rational animals surpassing us, nature has found it good to keep them away from us, in order to give us without contradiction the superiority we have in our globe [from "On the Degrees of Assent", p. 552]. See François Duscheneau, **La Physiologie des Lumières: empirisme, modèles et théories** (1982), chapter 3 for a discussion of Leibniz's biological conception of teleology and organism.

Darwin's was not the first theory of evolution, being preceded by some 50 years by Lamarck's. theory of biological transformationism.[80] Darwin and Lamarck share quite a number of assumptions - the gradualism of change, the uniformity of nature, the transmutation of species, evolution as a branching process, biological functions as a product of material organization, and in particular, mind as a function of brain[81], use-inheritance and species evolution as a response to changes in the environment, habit and intelligence as inversely related, to name the major ones. These theories seem commensurable, the main difference being the fact that Darwin rejects Lamarck's progressionism and principle of perfection, admits species extinction as well as species evolution, and postulates the mechanism of natural selection in contrast to the latter's direct effects of the environment, as the main factor of evolution.

Much has been made of the differences between Darwin and Lamarck, and Darwin himself formulates a negative evaluation in his later writings, especially

[80] See J. B. Lamarck, **Philosophie Zoologique** (1809). Lamarck argues that evolution is a two level process. The major level is one of continuous evolution from the less advanced to the more advanced through the progressive and gradual modification by nature of the internal organs and nervous system of animals. This leads to man, the highest life form; from this latter point of view, the preceding organisms can be seen as degenerate forms of the ultimate product. Secondly, there is local species modifications, discontinuous in character, due to changes in the environment which require modified functions in the animals inhabiting it. The modification of needs leads to use or disuse of certain organs, and these modifications in organic structures are passed on through heredity, modifying the species as a whole. In Lamarck's theory, not only species, but all higher taxa evolve; moreover, he believes that no species can become extinct, since by use-inheritance they will inevitably adapt to changed circumstances. In the introductory volume of **Histoire des Animaux sans Vertèbres** (1815) Lamarck makes more explicit the materialist ontology already present in the previous work. He sets out a number of principles, according to which all phenomena which can be observed are physical, all change is due to mechanical causes and laws of nature, and all vital functions are physical and due to the organization of the body of the organism..

[81] In particular, mind is a function of the organization of the brain: Animals with no unified brain mass but merely separate nuclei have only the power of movement. Those with a central brain but no distinguished cerebral hemispheres have as well feelings and emotions. And finally, those with cerebral hemispheres and a granulated cortex can think.

his **Autobiography**. But references to Lamarck abound in Darwin's **Notebooks**, indicating that he was reading **Philosophie Zoologique** at the time he was working on his own theory of evolution.[82] Moreover, Darwin had been introduced to Lamarck's views even earlier - through one of his university professors during his undergraduate studies, and again through volume 3 of Lyell's **Principles of Geology**. There, Lyell gives a detailed exposition of Lamarck's theory. Though he rejects Lamarck's conclusion of transmutation of species due to his view that species variation is limited, Lyell nonetheless presented at the same time an accurate and even sympathetic reading of Lamarck. Darwin received this volume while on his sea voyage aboard the H. M. S. Beagle; it was one of a handful of volumes he took with him or had sent to him. The influence of such repeated exposure to Lamarck is certainly greater than what Darwin later admitted, and this can be seen in the similarity of many of their views. Even if independently derived, Darwin's shared assumptions with Lamarck were most likely reinforced by his contacts with the latter's works.

A second French source upon Darwin was Auguste Comte. Darwin read and commented on a English review of Comte's **Philosophie Positive** during the time he was working on his evolutionary notebooks. The influence of Comte can be seen in the M Notebook as follows:

> ...Now it is not a little remarkable that the fixed laws of nature should be / universally / thought to be the will of a superior being, whose natures can only be rudely traced out. When one sees / this, one suspects that our will may / arise from

[82] For example, Darwin says in his **N Notebook** (1838) paragraph 90, p. 87: "Lamarck in **Philosop. Zoolog**/p. 284, Vol. II/ gives explanation and instance of starting identical with mine - Lamarck, Vol. II, p. 319. Habits more prevalent in proportion to intelligence less -" Such a favourable mention has disappeared in later works, such as Darwin's **Autobiography**, though it clearly indicates the influence of Lamarck on the young Darwin.

/ as fixed laws of organization. - M. le Comte argues against all contrivance - it is what my views tend to.[83]

The following quote more clearly than any other indicates the profound influence of Comte on Darwin's whole view of biology: "M. le Comte's idea of theological state of science, grand idea: as before having analogy to guide one to conclusion that any one fact was connected with law. - as soon as any enquiry commenced, for instance probably such a thing as thunder would be placed to the will of God. Zoology itself is now purely theological."[84] Given all of Darwin's collateral and subsequent writings, it is clear that Darwin means to transform zoology from its theological to its positive stage.

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[83] Charles Darwin, M **Notebook** (1838), #69, in Howard E. Gruber, ed. (1974), **Metaphysics, Materialism and the Evolution of Mind: Early Writings of Charles Darwin**, p. 18. The text begins: "...as first caused by will of Gods. /or God/ secondly that these are replaced by metaphysical abstractions, such as plastic virtue, etc. (Very true, no doubt savage attribute thunder and lightning to Gods anger. - (∴ more poetry in that state of mind: The Chilena says the mountains are as God made them. - next stp plastic «virtue» natures accounting for fossils) & lastly the tracing facts to laws without any attempt to know their nature. Reviewer considers this profoundly true - How is it with children ". Despite the absence of the part of the first line, which was cut out by Darwin and presumably used elsewhere, Darwin is clearly reading a review of Comte's three stages of thought - the theological, metaphysical and positive. Darwin's assent to the latter stage is evident in the last line of the second paragraph of the quote Paul Barrett in his **Metaphysics, Materialism and the Evolution of Mind: The Early Writings of Charles Darwin**, states that the review in question appeared in the **Edinburgh Review** for July 1838. The reviewer of Comte's **Cours de Philosophie Positive** (1830-35) quotes textually from Comte on the three stages of the evolution of thought on page 280.

[84] Charles Darwin, N **Notebook** (1838), #12, p. 72 of Gruber (ed.) op cit. Note that this comment follows directly upon a comment at page 11 of the same notebook reminding Darwin to continue his study of Malthus, another major influence upon his thinking. Darwin returns to Comte's theory at M:135-36, pp. 31-32. In the notes to Macculloch's book **Proofs and Illustrations of the Attributes of God**, transcribed by Gruber as "Essay on Theology and Natural Selection" and attributed by him to 1838 as well, Darwin clearly rejects any theological explanation of the cause of species: "The explanation of types of structure in classes - as resulting from the will of the deity, to create animals on certain plans, -is no explanation - it has not the character of a physical law /& is therefore utterly useless. - it foretells nothing/ because we know nothing of the will of the Deity, how it acts & whether constant or inconstant like that of man. - the cause given we know not the effect." [at page 5, pp. 157-158 in Gruber (ed.) op cit.] The rejection of supernatural agency and theological explanation is a constant feature of Darwin's further writings.

A third French influence on Darwin is that of Henri Milne-Edward. Here the influence concerns one of the major theses of Darwin's theory of natural selection, that of divergence of character. In the **Origin of Species**, the influence is not apparent because of the lack of footnotes and other scholarly references, but in **Natural Selection**, Darwin is explicit in indicating his debt to Milne-Edward:

> The view that the greatest number of organic beings (or more strictly the greatest amount of life) can be supported,on any area, by the greatest amount of their diversification is, perhaps, most plainly seen by taking an imaginary case. The doctrine is in fact that of the "division of labour", so admirably propounded by Milne Edwards, who argues that a stomach will digest better, if it does not as in many of the lowest animals, serve at the same time as a respiratory organ; that a stomach will get more nutriment out of vegetable or animal matter, if adapted to digest either separately instead of both. It is obvious that more descendents from a carnivorous animal could be supported in any country: if some were adapted, by long continued modification through natural selection, to hunt small prey, and others large prey living either on plains or in forests, in burrows, or on trees or in the water. So with the descendants of a vegetable feeder more could be supported, if some were adapted to feed on tender grass and others on leaves of trees or on aquatic plants and others on bark, roots, hard seeds or fruit.[85]

Darwin's reading of Milne-Edward during the mid 1850s is a major influence in extending the concept of natural selection in its creative sense, through the subsidiary factor of divergence of character.[86] The incorporation of Milne-Edwards views on the biological division of labor into Darwin's theory of natural selection is evident in the following quote:

> This same naturalist [Milne-Edwards], as well as others often insist on the advantages of a division of physiological labour; for instance that a surface will digest better if it has not at the same time to act as lungs, or that a stomach will

[85] Charles Darwin, **Natural Selection** (1856-58)., pp.233-234. The editors of the volume give the references to Milne Edwards writings as: **Introduction à la Zoologie générale**, p. 35, 55-57 and "Organisation" in Dict. class. hist nat. 12, Paris 1827, pp. 332-44

[86] The element of divergence of character was absent from Darwin's 1842 and 1844 **Essays**, though present in Wallace's 1855 paper.

> digest vegetable matter more effectually, if it has not, also, to digest flesh...Owing to this advantage from division of labour natural selection will always tend, where habits permit, to specialize organs.[87]

But Darwin rejected Milne-Edwards' opposition to evolution, and he comments on this problem as follows, showing that the same concept (division of labor) can be used in both an evolutionary and non-evolutionary context:

> Finally it seems to me highly important to bear in mind that he who believes that each species has been independently created, can only say that it has so pleased the Creator never or most rarely to introduce a new organ. Or he may mask his ignorance, & say with Milne Edwards that the "law of economy" is almost as paramount in nature, as the law of "the diversity of products." But on our theory of gradual modifications through natural selection, the law of economy is only the law of descent, the canon "Natura non facit saltum" becomes scientifically explicable.[88]

Among the English theoreticians, Lyell, Malthus and Wallace had the greatest influence on Darwin. Lyell's thesis of uniformitarianism[89], according to which past causes are the same as causes presently acting, was interpreted by Darwin in a sense even more radical than that of his mentor. The principle of uniformity was essential in Lyell's transformation of geology into a natural science, radically rejecting any need to explain or include biblical miracles such as the Flood. But Lyell did accept divine intervention for the creation of species, and believed that species variation in nature always respected definite and small limits. Darwin applies the principle of uniformity universally, to the origin of species as well, allowing the only possible exception to uniformatism to be the

[87] Charles Darwin, **Natural Selection**, p. 355
[88] ibid, p. 374
[89] So named by William Whewell in book II of his **History of the Inductive Sciences**. To Whewell is also due the term "catastrophism" to designate the opposite view.

ultimate origin of the cosmos. But this is a problem outside of biology, and within biology, Darwin is completely uniformitarian, more Lyellian than Lyell himself.

Malthus is universally recognized as an influence on Darwin; indeed, he is often considered (along with Lyell) as the chief influence on Darwin. Darwin's reading of the Malthus' **Principles of Population** in 1838 is credited with having been the catalyst and the model for the concept of natural selection. It is undeniable that Darwin accepted Malthus' argument that population increases more rapidly than available food resources, resulting in overpopulation and a struggle for life, and that this dynamic notion is essential to the theory of natural selection.

But the role given to Malthus' postulate, though essential, seems to me to have been overstated by many commentators. In particular, by elevating Malthus' principle to a special status, such commentators neglect the role of other key influences, in particular the French influences of Lamarck, Comte and Milne-Edward. Darwin becomes an "all-English" champion. Such a view is short-sighted and neglects the evident textual references to key ideas in Darwin's methodology and theory which have been traced to the above sources. Malthus uses the notion of over-population to argue against social equality in his theory of political-economy, and combines this with a creationist view of species origin. Darwin uses the principle of over-population to buttress his concept of struggle for life, but disagrees entirely with the fixity of species view which Malthus defends. Malthus is certainly a major influence, but not the main.

Finally, there is the influence of Wallace. Some debate exists as to the role of Wallace in Darwin's development of his theory. Many commentators see Wallace as an independent "co-discoverer" of natural selection, whose sole effect was to spur Darwin to publication. At least one commentator argues to the contrary that Darwin took the notion of divergence of character from Wallace without acknowledgement, and that Wallace, rather than Darwin, is the "true" inventor of the modern theory of evolution.[90] But if Darwin took the idea of divergence of character from Wallace, then he also took it from Milne-Edwards, and here the acknowledgment is clear and explicit in **Natural Selection**.[91]

While the views of Darwin and Wallace converged in the period of 1856-59, they diverged thereafter. In the theory of evolution, Wallace became more Darwinian than Darwin, arguing that natural selection is not only the chief factor of evolution, but the sole one. At the same time, Wallace defended the existence of the spirit world and supernatural forces, which he held to be the source of qualitative novelty in the evolutionary process, offending Darwin's methodological Comtism.

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[90] This is argued in Arnold C. Brackman, **A Delicate Arrangement: The Strange Case of Charles Darwin and Alfred Russell Wallace** (1980).. Brackman notes the clear formulation of divergence of character in the essay of Wallace, available publicly before the letter of 1857 to Darwin: "On the Law Which Has Regulated the Introduction of New Species" (1855). This essay is not included in the book **Evolution by Natural Selelction** (1958), ed. Gavin de Beer, where de Beer reproduces pre-**Origin** statements of natural selection: specifically, Darwin's 1842 and 1844 essays, and the 1858 joint presentation of Wallace's and Russell's views to the Linnean Society. Note, however, that it is a step from underestimating Wallace to overestimating him, as Brackman does, in trying to show that Darwin "borrowed" his theory of natural selection, without reference, from Wallace. On the view of "creative synthesis" to be developed in a following section, the influence of Wallace can be recognized, without belittling Darwin's own innovative and decisive contribution: a multi-factor theory of evolution, with natural selection (including the aspect of divergence of character) as the chief, but not the sole factor.

[91] The **Origin of Species** was a "synopsis" of **Natural Selection**, prepared rapidly for press in 1858 and contains no footnotes.

There are then six major influences on Darwin's theory of evolution - Lamarck, Comte, Milne-Edward, Lyell, Malthus and Wallace. The advantage of such a multi-influence approach is that the influence of each can be recognized without exaggerating its effect, while at the same time Darwin is more accurately situated as a product of his immediate background. Darwin's achievement is to have combined these, and probably other influences, in a coherent theory to which he added his own contribution of selection, both natural and sexual. In so doing, he rejected the limitation on species variation held by Lyell, Malthus, Comte and Milne-Edward, the progressionist view of transmutation of Lamarck, and Wallace's single-factor theory. It is just as important to consider what Darwin rejected, as what he accepted. Moreover, these main influences formed a very disparate group - a geologist, political economist, two biologists, a naturalist and a philosopher, and to see a relation among certain of their key theses was a mark of Darwin's originality.

Influence and text	Theses accepted	Theses rejected
Lyell, Principles of Geology (1832-36)	uniformity of nature, changes in past same as changes in present, denial of catastrophism	limitation on species variation
Malthus, Principle of Population (1798,1802)	population growth outstrips food resources, leading to population decline	limitation on species variation
Comte, Système de Philosophie Positive (1830-42)	three stages of evolution of knowledge: theological, metaphysical, positive	limitation on species variation
Lamarck, Philosophie Zoologique (1809)	transmutation of species via natural causes, evolution as branching process biological functions result of organization of matter	progress as inherent to evolution, direct effect of environment on organism as chief factor of change
Milne-Edward, Intro. à la Zoologie Générale (1844)	division of labour allows greater quantity and diversity of life in the same geographic area	limitation on species variation
Wallace, letter of 1858 and other writings	divergence of character explicitly formulated	evolution as single-factor theory

Darwin's contribution was, of course, the notion of natural selection. Artificial selection, as practiced by breeders and horticulturists was a well-known phenomenum. Darwin's main analogy was that nature selects in the production of wild species just as man selects in the production of domesticated species. Moreover, the analogy could be extended to sexual selection, where selection of males in mock combat and female choice based on ornamentation play a role in species evolution. This strong analogy of selection distinguishes Darwin's theory of evolution from the partially overlapping views of Wallace, where it is absent.

Finally, there is the structure of Darwin's theory, essentially involving as it does the notion of analogy: (a) the analogy between natural selection and artificial selection, and (b) the analogy between natural selection and sexual selection.[92] The use of analogy was itself a grounded theoretical move, in the work of John Herschell in particular.

Herschell distinguishes between the discovery of the explanation for a phenomenum in its immediate producing cause, and the inclusion of one whose explanation or vera causa is not known, under a more general law, along with other analogous phenomena. The hope then is that a more advanced state of

92 Analogy is distinguished from metaphor. R. M. Young in **Darwin's Metaphor** (1986) has described natural selection (or nature selecting) as a metaphor, almost a literary allusion. But it is clear that Darwin meant more than that. He felt that there was a strong analogy between the production of varieties by breeders ands the production of species in nature. Analogy takes the form a:b as c:d. Here 'a' stands for breeds and 'b' for breeders, 'c' for species and 'd' for nature. It is a strong analogy because there are close internal links between a and c.

knowledge, the true cause (or "adequate proximate cause") will be discovered. The more causes that have been determined and the more phenomena that are known, the greater the chance of success will be. So he admits two procedures, the determination of vera cause, and the subsumption of analogies under general principles; this second hopefully leading later to the first, but both scientific:

> Here, then, we see, the great importance of possessing a stock of analogous instances or phenomena with that under consideration, the explanation of one among which may naturally be expected to lead to that of all the rest. If the analogy of two phenomena be very close and striking, while at the same time, the cause of one is very obvious, it becomes scarcely possible to refuse to admit the action of an analogous cause in the other, though not so obvious in itself.[93]

This is exactly what Darwin was continually doing in his **Origin of Species.** He does not know the cause of individual variation, but he classes the various phenomena under a general principle; and he bases his major argument for a mechanism of evolution on the analogy between natural selection and artificial selection.

Thus, there is a three part theoretical reconstruction of the production of Darwin's theory of evolution: (1) A relationship of critical selection/rejection of key elements in the general theoretical background of biology, (2) A similar process with respect to Lyell, Malthus, Comte, Lamarck, and Milne-Edward, with elements of both continuity and discontinuity with them. (3) The addition of an innovative element around the concept of selection, and the synthesis of the retained theses and the new ones into a coherent theory capable of explaining a large body of biological data and providing a foundation for natural history and

[93] J. F. W. Herschel, **A Preliminary Discourse on the Study of Natural Philosophy** 1833), p. 149

comparative anatomy, morphology and physiology. This is the element of novelty in Darwin's contribution. I will analyze the question of creative synthesis in greater detail at the end of this chapter. The element of continuity between Darwin and his predecessors is one of the points which is underestimated in the application of Kuhn's theory to Darwin.

The problem of the Kuhnian model becomes even more apparent in examining the subsequent 19th Century history of Darwinian evolution. This brings up the second difficulty with the application of Kuhn's theory to Darwinian evolution: the problem of the status of Darwinism as a paradigm in the post-Darwinian period.

(c) The Factors of Evolution

Just as the influences upon Darwin were multiple, so were the reactions to his theory many and varied. A careful examination of the theoretical writings in the period 1859-1899 reveals that though Darwin's theory was the main point of reference, even supporters only defended parts of it, and many made important additions and modifications in their own versions. Indeed, if one is to be very strict in interpretation, the only Darwinian was Darwin himself.

Following the publication of the **Origin of Species**, the following types of theories of evolution were propounded by other authors:[94]

[94] The debate over natural selection and theories of evolution was especially marked in the review and periodical literature. A survey of **Nature**, from its first publication in 1869 through to the end of the 19th century, shows the extent of this debate, which included the related question of the origin

1. Theories recognizing natural selection as the only factor of evolution: This includes Alfred Wallace's writings[95], and those of August Waismann[96]. Both T. H. Huxley[97] and Asa Gray[98], though differing on their philosophical interpretations (the former agnostic and mechanistic, the latter deistic and teleological), in practice defended evolution as a single factor theory (natural selection). While both Wallace and Waismann rejected the existence of other factors, Huxley and Gray did not explicitly do so, limiting themselves to a defense of evolution based on natural selection.

2. Theories recognizing the Darwinian factors and postulating an additional one: This included George Romanes,[99] C. Lloyd Morgan,[100] and Joseph

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of life.The debate was also intense in the pages of **Contemporary Review**, **The Nineteenth Century**, and **Fortnightly Review**. In the United States, it was mainly in the pages of **Popular Scientific Monthly**, edited by Youman's a supporter of Spencer, and to a lesser extent in Science. In England, the **Metaphysical Club** was the center for many discussions on the questions related to evolution.

[95] See his **Contributions to the Theory of Natural Selection: A Series of Essays** (1871) and **Darwinism: An Exposition of the Theory of Natural Selection with some of its Implications** (1889) Wallace, as pointed out by Romanes in great detail, is not a strict Darwinian, but rather a neo-Darwinian, reducing evolution to single-factor process, where Darwin held to a multi-factor view.

[96] for example, in his **The Germ-Plasm: A Theory of Heredity** (1893), Waismann rejects Darwin's theory of pangesis, arguing for the continuity of the germplasm independently of body modifications during the life of the organism. This undercut the ground for use-inheritance, and reinforced Wallace and others in their single-factor reading of Darwin.

[97] See his **Collected Essays** (1893-94), in particular **Darwiniana** (v.2). Huxley was the foremost defender of Darwin's evolution by natural selection, but had nothing, whether for or against, to say about sexual selection or use-inheritance.

[98] Asa Gray, **Darwiniana** (1876).

[99] George Romanes, **Darwin and After Darwin: An Exposition of the Darwinian Theory and Discussion of Post-Darwinian Questions**, ed. by C. Lloyd Morgan (1892-97), 3 vols. See in particular **Post Darwinian Questions: Isolation and Physiological Selection** (v.3)

[100] Lloyd Modrgan in his **Animal Intelligence** (1893), where he argues for what later (with Baldwin and Osborne) was to be called "organic selection", a combination of Darwinian selection and Lamarckian use-inheritance to explain the survival of not yet useful intermediary structures.

le Conte.[101] Romanes, after defending Darwin's three factors of evolution - natural selection, sexual selection and use-inheritance, added that in order to explain evolutionary novelty, a further factor of physiological selection was required. This factor involved reproductive isolation as a means by which varieties could be cut off from each other and develop into separate species. Lloyd Morgan, along with Baldwin and Osborne, postulated a combination of use-inheritance and natural selection as a means for intermediary structures to be preserved. Le Conte admitted three groups of factors of evolution: (a) the Lamarckian factors of (1) the effect of the physical environment, and (2) the effects of increased use or disuse of organs which are transmitted through heredity to offspring; (b) the Darwinian factors of (3) natural selection, and (4) sexual selection, and (c) in addition a fifth factor, called by Le Conte the "rational factor", operant only with man, according to which man shapes, in part, his own evolution through his conscious effort.

3. <u>Theories which recognized natural selection as a subordinate factor</u>: Typical of such theories is that of Herbert Spencer.[102] The prime factor of evolution for Spencer was the von-Baerrian factor of the transformation of the homogeneous into the heterogeneous, followed by Lamarckian use-inheritance. Only then did he recognize Darwinian natural selection as a tertiary factor, with a limited domain of application in the biological realm.

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[101] Joseph Le Conte in his **Evolution: Its Nature, its Evidences and its Relation to Religious Thought** (1891, second edition). Le Conte, who studied under Agassiz, but accepted evolution, defined it in three parts as "(1) continuous progressive change, (2) according to certain laws, (3) and by means of resident forces." (p. 8) This was different from Darwin's non-progressionist view of evolution, but clearly excluded non-natural entities in the reference to "resident" forces.

[102] Herbert Spencer **Principles of Biology**, vols. 2-3 of his **System of Synthetic Philosophy** (1893-1902), 10 vols. See also "The Inadequacy of Natural Selection", **Contemp. Rev.** 63: 153-166, 439-456

(4) Theories which rejected natural selection as a factor of evolution: These include St. George Mivart,[103] Th. Eimer[104] and others. Though accepting evolution, they did not believe it due in any measure to natural selection, and instead postulated an inner force responsible for species transformations.

There was thus a welter of neo-Darwinian theories, partly Darwinian theories and non- or anti-Darwinian theories. It certainly seems that Darwin's theory, at least for the first three types, was a point of reference, but not a paradigm in the Kuhnian sense. Darwin's theory of evolution chiefly, though not exclusively, through natural selection had a lasting impact, not because his own particular theory was accepted as a paradigm, but because after the publication of the **Origin of Species**, it became generally accepted that a scientific case could be made for evolution as a basic process underlying organic nature. A debate then ensued over the factors of evolution, in which Darwin's own view was not fully dominant as one would expect a paradigm to be. It is in this sense that I judge Kuhn's claim for a Darwinian revolution to be overstated insofar as the factors of evolution are concerned.

(d) The Mode of Evolution

The term mode of evolution was introduced by George Gaylord Simpson.[105]

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[103] St. George Mivart, **Genesis of Species** (1871)
[104] T. H. Eimer in his **Orthogenesis**
[105] in his **Mode and Tempo of Evolution** (1944) an important work of the period of the modern synthesis, Simpson argues for three main modes of evolution - speciation, phyletic evolution and quantum evolution. Speciation involves "the local differentiation of two or more groups within a more widespread population" (p.199); phyletic evolution involves "the sustained (but not necessarily rectilinear) shift of the average characters of populations" (p. 202); while quantum

In what follows, I use the term in a special sense, to cover debate over the relation between quantity and quality and the problem of continuity and discontinuity in the evolutionary process. Philosophical preferences at this, often non-explicit level, go part of the way in explaining differences at the scientific level.

Darwin very clearly puts the emphasis on quantitative to the exclusion of qualitative change. In his **Notebooks**, Darwin states that for him, change in the organic sphere is a matter of quantity and not of kind,[106] and again in the **Origin of Species**, he stresses that "natura non facit saltum,"[107] repeating on at least seven occasions this Latin injunction also found in Leibnitz' monadology. Statements emphasizing the precedence of quantitative change over change in kind occur in other works as well, such as **Descent of Man.**[108] As A. O. Lovejoy has shown, "natura non facit saltum" is shorthand for two component ideas in the "Great Chain of Being" - the principles of plenitude and continuity. The background in mathematics is the theory of infinitesimals, with change said to occur in minute, minimal steps.

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evolution refers to "the relatively rapid shift of a biotic population in disequilibrium to an equilibrium distinctly unlike an ancestral condition" (p. 206). The three sorts of modes of evolution are related to differing tempos, or paces of evolution, as the title suggests. Simpson's views will be discussed in chapter three of the thesis. It suffices here to say that the term "mode of evolution" is used in a more abstract sense to designate the underlying philosophical considerations in a given theory of evolution.

106 "The difference (in) intellect of man and animals not as great as between living things without thoughts (plants) and living things with thoughts (animal). **Notebook B**, para. 214, p. 186 of Gruber (ed.).

107 In the first edition, the phrase in question appears on pages 171, 194, 206, 210, 243, 460 and 471, as indicated in Paul H. Barrett, et al, eds . **A Concordance to Darwin's Origin of Species, first edition** (1981), pp. 639-640.

108 "Nevertheless, the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind", from **Descent of Man**, vo. 1, p. 170

Darwin was especially opposed to saltationist ideas - the notion that qualitative change could occur in single leaps, and argued that such biological novelties would be monstrous mutants, "sports" in the terminology of the time, which could not survive. Yet Huxley and Lyell were initially at any rate, not of the same opinion. In his **Times** review of Darwin's Origin, Huxley stated "And Mr. Darwin's position might, we think, have been even stronger than it is if he had not embarrassed himself with the aphorism "Natura non facit saltum" which turns up so often in his pages. We believe, as we have said above, that Nature does make jumps now and then, and a recognition of the fact is of no small importance in disposing of many minor objections to the doctrine of transmutation."[109] But by the mid 1870s, influenced by Cope's genealogy of the horse which showed a series of slight changes over long periods of time, Huxley went over to quantitative gradualism.[110]

Lyell, whose **Geological Evidences of the Antiquity of Man**, which appeared in 1863 and was the first book-length treatment of the evolution of man, also had his reservations. In the conclusion to the first and second editions, he says: "If in conformity with the theory of progression, we believe mankind to have risen slowly from a rude and humble starting-point, such leaps may have successively introduced not only brighter and higher forms of grades of intelligence, but at a much remoter period may have cleared at one bound the space which separated the highest stage of unprogressive intelligence of the inferior animals from the first and lowest form of improvable reason manifested by Man."[111] By the fourth

109 T. H. Huxley, "Origin of Species" (1860), in **Collected Essays**, vol. 1 **Darwiniana**, p. 77
110 T. H. Huxley, **Lectures on Evolution** (1876).
111 Charles Lyell, **The Antiquity of Man** (1861, first edition)., p. 505

edition, 1873, this and other similar paragraphs had been cut, though there is still one reference to "conjecturing whether the successive steps in advance, by which a progressive scheme has been developed, may not admit of occasional strides constituting apparent breaks in an otherwise continuous series of psychical changes."[112] The terminology is more cautious and less overt, though in his recently published **Journals**, we can see Lyell struggling with the problems of gradualism and saltationism.

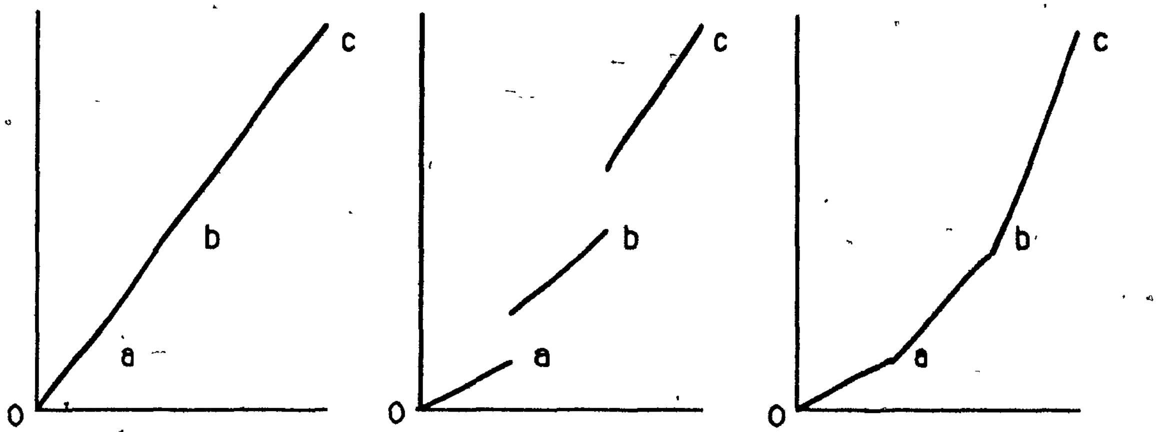
So strong was the Darwinian preference for quantitative change to the exclusion of change in kind, that when Wallace posed the very good question of the origin of qualitative novelty in the evolutionary process, he had to go outside the bounds of Darwinism to postulate a supernatural origin. The desire to break out of emphasis on exclusively gradual, continuous quantitative change, while still keeping within naturalistic bounds, was the basic problem that Lloyd Morgan faced in his development of emergent evolution. It required, in my opinion, a creative synthesis going beyond Darwinism. The problem of gradualism, and non-gradualist alternatives has recurred a number of times in the history of evolutionary theory, and the following table gives an indication of some of the major episodes of this debate:

112 ibid, 4th edition, p. 546

theory of change	main defenders	period of time/status
gradualism	Darwin, Romanes	last half of 19th century (dominant)
saltationism	possibility initially entertained by Huxley, Lyell (Darwinians); defended by Mivart, Argyll (anti-Darwinians)	last half of 19th century (minority)
mutationism	evolution by genetic mutations, de Vries and T.C. Morgan	first third of 20th century (dominant)
emergentism	creative evolution (Bergson) emergent evolution (Lloyd Morgan, Alexander),	first third of 20th century (NB: mainly philosophical, but some scientific defenders)
gradualism (restored)	main-stream of modern synthesis (especially Mayr)	2nd half of 20th century (dominant)
macro-mutationism	saltationist views by dissidents from gradualist wing of modern synthesis (Goldschmidt, Rensch)	1940s (minority)
punctuationism	evolution characterized by long periods of stasis and rapid spurts of speciation (Gould, Eldridge,Stanley)	1970s to date (minority, influential)

Darwin clearly associated quantitative change and continuous change as positive values for his theory. The problem of continuity and discontinuity in evolution is the second aspect of the mode of evolution which I would like to discuss. It was an almost universally shared view that evolution is continuous - special creation, its opposite, being quite discontinuous, with catastrophic breaks at various points. Typically, Darwin excludes discontinuous change, though at least one variety of it is consistent with an overall continuous evolution. This point is brought up by Wallace, who as we have seen posed the good question - how do significant qualitative novelties arise in the evolutionary process, but in my opinion gave the wrong answer - through the intervention of the supernatural spirit world.[113]

Wallace's view does not involve a discontinuity in what we may call the graph of evolution, but rather a change in direction of a connected line. This may be illustrated as follows:



(A) Graph is continuous at all points

(B) Graph is discontinuous at a and b

(C) Graph is continuous at all points, but its derivative is discontinuous at a and b

Note: 0 to a represents pre-animal life
a to b represents animal life
b to c represents mental life

X axis represents time
Y axis represents qualities

Diagram 9: Continuity and Discontinuity in Evolution

113 Wallace's interest in spiritualism (table rapping, mediums, spirit-photographs and the like) was a well developed one, as indicated in the series of articles he published devoted to this problem: "A Defence of Modern Spiritualism" (1874), in two parts. The articles appeared in the **Fortnightly Review**. An interesting critique from an unsympathetic source is contained in F. Engels' "Natural Science in the Spirit World", in his **Dialectics of Nature** (published 1933).

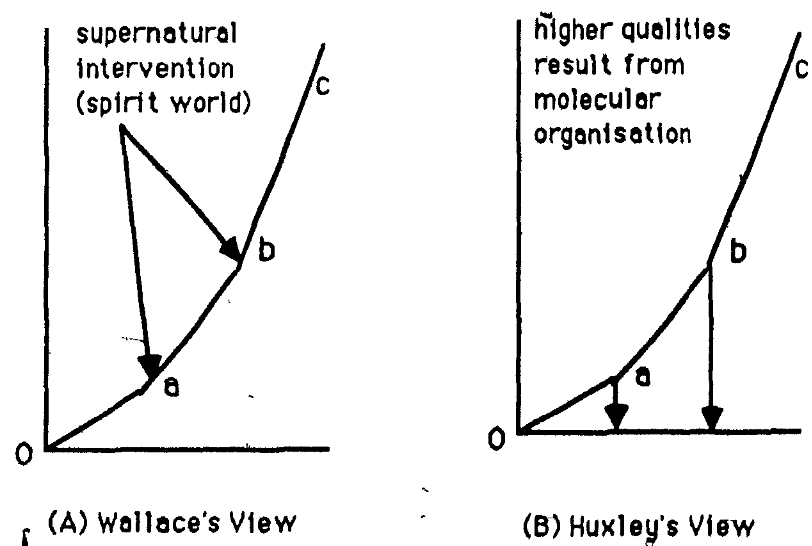
Here I would like to argue that a graph for evolution like that in (A) which is continuous in its derivative as well, applies to Darwin - change occurs by minute additions, there are no "turning points" where new qualities arise in any significant way. Thus, on the problem of mind, Darwin was a bio-psychist (or at the very least a zoo-psychist). He held that glimmerings of mind must exist at all stages in the animal evolutionary process - and indeed, he thought worms to be quite intelligent, and wrote a half-dozen books on "animal-like" activities of plants - sexual reproduction, insectivorous nutrition, climbing plants and so on.

A curve as in (B) which is discontinuous at point a, must be ruled out in an evolutionary theory, for the break can only be mysterious and a throw back to special creation. But Wallace's idea seems to suggest a representation as in (C) - the graph itself is continuous, but its first derivative is discontinuous at points a and b. This would correspond to the points of emergence of life and mind, except that for Wallace, the turns at a and b were due to supernatural intervention, whereas the emergentist point of view would see them as natural result of the increase in complexity of organization.

Darwin and the other Darwinians rejected such an approach. Huxley, for example,argued that the appearance of life and mind must be explained naturally, not supernaturally. His argument was analogical: (1) In chemical formation, the example given being that of the formation of water from hydrogen and oxygen, the new properties of water must ultimately "result from the component elements of the water", no non-material substance of "aqueosity" is needed.[114] (2) Similarly, living matter (protoplasm) is formed by the biochemical combination of carbon, hydrogen, oxygen, and nitrogen; no vital principle is required, just as previously no "aqueous" principle was needed. Vital action is therefore the result of the "molecular forces of the protoplasm which displays it" (ibid). Finally, (3) the argument is extended to mind itself:

> And if so, it must be true, in the same sense and to the same extent, that the thoughts to which I am now giving utterance, and your thoughts regarding them, are the expression of molecular changes in the matter of life which is the source of our other vital phenomena.[115]

This model is a reductionist one, though that terminology is not used. It may graphically represented in contrast with Wallace's view as follows:



Note: X-axis represents increase b complexity of organisation overtime
Y-axis represents qualites of inanimate, animate and humanlife

Diagram 10: Wallace and Huxley on Evolution

[114] T. H. Huxley, "On the Physical Basis of Life" (1868)., pp. 151-152
[115] ibid p. 154

No consideration is yet given that properties of complex molecules may be different from those of any of the atomic components, or that properties of systems of brain cells may be different from those of any of the individual cells. Such a view, however, was tentatively formulated by G. H. Lewes, as will be shown in the next chapter; and as well was sketched out by Joseph Le Conte.[116]

Le Conte, as was noted earlier, defended a multi-factor theory of evolution, including Lamarckian, Darwinian and rational factors. His consideration of the problem of qualitative novelty initially arose in a context somewhat removed from that of evolution: the problem of the conservation of energy. His ideas appear in an appendix to a volume by Balfour Stewart, **The Conservation of Energy** (1874). Le Conte's essay was titled "Correlation of the Vital with Chemical and Physical Forces".[117] Le Conte accepts the conservation of matter and the conservation of force as axiomatic to modern science.[118] The creation or destruction of matter is a question outside the domain of science, ultimately a matter of religion. But the interconvertability of the forms of force is a major concern of science. Le Conte identifies "four planes of material existence", and notes that these "may be represented as raised one above another."[119] The four planes are (1) the plane of elementary existence, consisting of the chemical elements, (2) the plane of chemical compounds, called the mineral kingdom, (3) the plane of vegetable

[116] Discussion of Lewes will be deferred to the next chapter, since he was one of the major influences on Lloyd Morgan's development of emergent evolution.

[117] There was a second appendix by Alexander Bain: "Correlation of Nervous and Mental Forces". The volume was part of the **International Scientific Series**.

[118] He notes that this should more correctly be termed the conservation of energy, with energy considered as actaive or working force.

[119] Joseph le Conte, "Correlation of the Vital with Chemical and Physical Forces" (1874), p. 173

existence, and (4) the plane of animal existence. He notes that there might be a fifth plane as well:

> I might add still another plane and another force, viz., the human plane, on which operate, in addition to all the lower forces, also free-will and reason. I do not speak of these, only because they lie beyond the present kin of inductive science.[120]

Le Conte develops a number of principles linking the forces among these four levels: (1) There is a special force whose function is to "raise matter from each plane to the plane above, and to execute movements on the latter."[121] These special forces are chemical affinity, which raises matter from the elemental to the vital plane, vegetative life-force, which raises matter from the 2nd to the 3rd planes, and animal life-force, which raises matter from the animal to the human plane; (2) It is not possible for nature to pass from a lower plane to one two levels higher than it without first passing through the intermediary plane; (3) Vital force is produced by chemical decomposition, "transformed nascent affinity" as he terms it; there is no mysterious or supernatural origin to its various forms (vegetable, animal and human). The example given by Le Conte is the utilization by organisms of carbon, hydrogen, oxygen and nitrogen contained in carbonic acid, water and ammonia. Sunlight, in the presence of chlorophyll or bioplasm, decomposes these compounds ingested by the organism in its food, and the organism then can use the required elements in "nascent condition to form organic matter":

120 ibid, p. 194. By the time of his major volume on evolution, some 15 years later, this fifth plane of existence is recognized.
121 ibid, p. 174

> It would seem in this case, therefore, that physical force (light) is changed into nascent chemical force, and this nascent chemical force, under the peculiar conditions present, forms organic matter, and reappears as vital force.[122]

There are two errors Le Conte wishes to avoid: conflating two related, but not identical forces (by making a reductionist identification of vitality and chemical affinity), and divorcing two different, but related forces (by seeking a supernatural source for vital force). Each forces arise from the previous one in a step by step process:

> With each elevation, there is a peculiar force added to the already existing, and a peculiar group of phenomena is the result. As matter only rises step by step from plane to plane, and never two steps at a time, so also force, in its transformation into higher forms of force, rises only step by step. Physical force does not become vital except through chemical force, and chemical force does not become will except through vital force.[123]

On Le Conte's view, the higher forces arise from the lower, but not through a gradual transition. He notes that the metaphor is not one of a gradually inclined plane, but of "successive planes raised one above the other... not ...[a]...sliding scale, but suddenly": "In the ascensive scale of forces, in the evolution of the higher forces from the lower, there are places of rapid, paroxysmal change."[124] Le Conte here combines elements of emergentism (higher planes arise from lower ones, but are not identical to them) with saltationism (the higher planes are not continuous, but involve leaps).

122 ibid, p. 177
123 ibid, p. 195
124 ibid, p. 195

Le Conte develops his train of thought in his **Evolution: Its Nature, Its Evidences, and its Relation to Religious Thought** (1888, 2nd edition 1891). Like Asa Gray, he attempts a reconciliation of evolution and theology, the philosophical discussion of which takes up the last third of the book. The fifth plane of conscious and rational thought, only hinted at in the earlier article, has been fully admitted in his level structure of reality. The evolutionary dimension of the appearance of higher forces is summarized as follows:

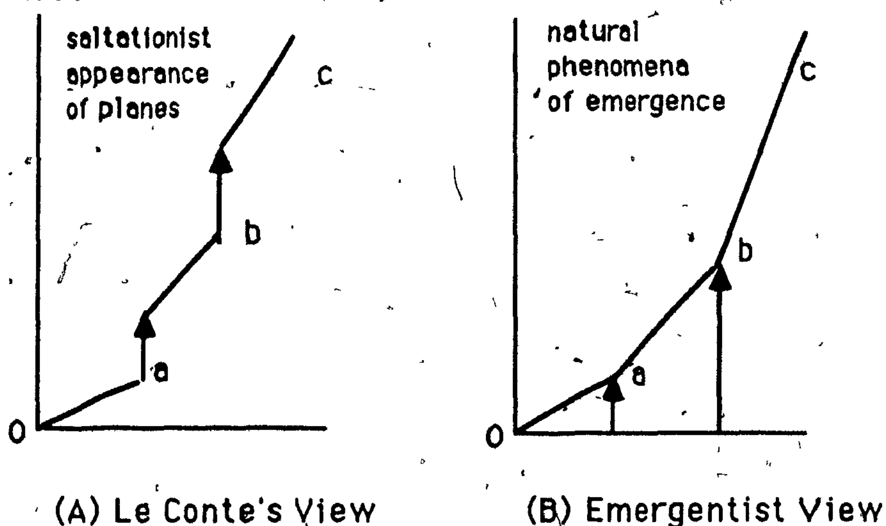
> In the history of the evolution of the cosmos, the forces of Nature have appeared suddenly when conditions became favorable. There was a time in the history of the earth when only physical forces existed, chemical affinity being held in abeyance by the intensity of the heat. [All chemical compounds are dissociated by sufficient heat]. By gradual cooling, chemical affinity at a certain stage came into being - was born, a new form of force, with new and peculiar phenomena, though doubtless derived from the preceding. Ages upon ages passed away until the time was ripe and conditions were favorable, and life appeared - a new and higher form of force, producing a still more peculiar group of phenomena, but still, as I believe, derived from the preceding. Ages upon ages passed away, during which this life-force took on higher and higher forms - in the highest foreshadowing and simulating reason itself - until finally, when the time was fully ripe and conditions were exceptionally favorable, spirit, self-consciousness, self-determining, rational and moral, appeared - a new and still higher form of force, but still, as I am persuaded, derived from the preceding.[125]

The acceptance of qualitative novelty in the evolutionary process and the related unpredictability of the novel is clearly expressed: "....[W]ith every new form of force, with every new birth of the universal energy into a higher plane, there appear new, unexpected, and previous to experience, wholly unimaginable properties and powers."[126] At the rational, fifth plane of existence, Le Conte considers that among the new properties is that of the immortality of the soul,

[125] Joseph Le Conte, **Evolution: Its Nature, Its Evidences, and its Relation to Religious Thought** (1891), p. 316
[126] ibid, p. 318

leading on to a reconciliation of evolution and religion: "As the organic embryo at birth reaches independent material or temporal life, even so spirit embryo by birth attains independent spiritual or eternal life."[127]

Le Conte's view shares with Wallace the acceptance of qualitative novelty in the evolutionary process, but differs in that he does not posit a supernatural source for the appearance of new planes of existence. His view, however, differs from an emergentist point of view in the holding that new planes arise through saltationist, discontinuous leaps (see the diagram below for a contrasting representation of the two models).[128]



The x-axis represents time and increase of complexity of organization
The y axis represents the appearance of new qualities

Diagram 11: Le Conte and Emergentism on Evolution

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127 ibid, p. 319

128 The problem of the relation between science and religion, mind and matter, transience and immortality are problems that will arise in Lloyd Morgan's and Samuel Alexander's systems, as will be discussed in the following two chapters. Note as well the similarity between the graphic for the representation of an emergentist view and the graphic for Huxley's system. The difference, a significant one, is the direction of the arrows at each new level. For Huxley, qualitative novelty will utltimately be reduced to quantitative organisation (represented by downward arrows at points a and b), while for emergentists, complexity of organisation gives rise to irreducible qualitiative novelty (represented by upward arrows to points b and c)

Consideration of these philosophic aspects of continuity and discontinuity, and quantitative and qualitative change (what has been called the mode of evolution) is essential to understanding the general context of debate over the theory of evolution. Kuhn's model, though itself an effort in the philosophy of science, neglects or under-rates such considerations in the debate over evolution.

(e) The Scope of Evolution

Thus far we have seen the concept of evolution deployed in the biological domain and certain of the metaphysical presuppositions for it. But Darwin's contribution extended to related domains as well, specifically, the problem of the evolutionary status of mind and ethics. This section will also briefly examine the development of some general philosophies of evolution in the last third of the 19th Century.

(i) Mind and matter

In his **M and N Notebooks** and other personal writings of the 1836-38 period, Darwin had set out what he considered a "materialist" view of mind. In his marginal notes to John Abercrombie's **Inquiries** (1839), Darwin says:"...By materialism I mean merely the intimate connection of kind of thought with form of brain - like kind of attraction with nature of element."[129] In his **M Notebook**,

[129] in E. Manier, **The Young Darwin and His Cultural Circle** (1978), pp. 223-224.

Darwin refers to materialism on a number of occasions: "It is an argument for materialism that cold water brings on suddenly in head, a frame of mind analogous to those of feelings which may be considered as truly spiritual."[130] Again, "To avoid saying how far I believe in materialism, say only that emotions, instincts, degrees of talent, which are hereditary are so because brain of child resembles parent stock (and phrenologists state that brain alters)."[131] And finally, in the **C Notebook**: "Thought (or desires more properly) being hereditary it is difficult to imagine it anything but structure of brain hereditary, analogy points to this - love of the deity effect of organization, oh you materialist."[132]

For Darwin, being a materialist meant that mind was a product of the organization of the brain. Here, structure brings about function. This is more than a functionalist point of view, where one is concerned only with similar functions, though the underlying structures may be different. Again, it differs from the structuralist view, which looks for similar or isomorphic structures independently of possibly different functions subserved by each. It is a structural-functional point of view, taking the specific form that brain as a structure produces mind, and mind as a function is the product of brain.[133]

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130 in Paul Barrett, ed., **Metaphysics, Materialism and the Evolution of Mind** (1976), M. 19, p. 9.
131 ibid, M. 57, p. 16
132 ibid, C.166, p. 190
133 Stephen Jay Gould in his "Darwin's Delay" (1977) goes so far as to suggest that Darwin's materialism was the reason for his delay of some two decades (from the mid 1830s to 1859) in publishing his theory of evolution. I believe that this is exaggerated, for the following reasons: (1) Darwin's theory was not yet full blown in 1838 despite his having hit upon the concept of 'natural selection'. In particular, the problem of divergence of character was not worked out until the mid 1850s, most likely influenced by Wallace on this point. Part of the delay, then, was in order to flesh out the theory beyond the mere concept of natural selection (2) Darwin typically published his novel results only when at least one other scientist had come to the same conclusion: his first statement of evolution by natural selection was prompted by Wallace's arriving independently at the same conclusion and being ready to publish; Darwin's work on human evolution in **Descent of Man** was

In his public writings, Darwin was not exclusively concerned with the biological domain of the transmutation of species. Darwin's major public contribution to the scientific study on mind was his **Expressions of Emotions in Man and Animals**, and this work in comparative psychology was continued by Romanes, who developed on the notion of the evolution of mind in his **Mental Evolution in Man** (1888).[134] So at least in the extension of evolution to psychology, Darwin had a direct if secondary, role to play. Darwin's clearest expression of his mature philosophical point of view on the origin of mind was stated in a letter to George Romanes in February of 1880, where he speculated as to the role of pleasure and pain in the development of mind.

> I have been accustomed to look at the coming in of the sense of pleasure and pain as one of the most important steps in the development of mind, and I should think it ought to be prominent in your table. The sort of progress which I have imagined is that a stimulus produced some effect at the point affected, and that the effect radiated at first in all directions, and then that certain definite advantageous lines of transmission were acquired, inducing define reactions in certain lines. Such transmission afterwards became associated in some unknown way with pleasure and pain. These sensations led at first to all sorts of violent action, such as the wriggling of a worm, which was of some use. All the organs of sense would be at the same time excited. Afterwards, definite lines of action would be found to be the most useful, and so would be practiced.[135]

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pubished after Lyell, Huxley and Haeckel had already published evidence for or substantially the same conclusions; and **Darwin's Expression of Emotions in Man and Animals** belatedly treats of the mind/brain relation, though in more positivistic terms (influence of Comte) than in the early Notebooks, once collaborators such as Romanes were available. Darwin's delay at the personal level might have been based on the desire "not to go it alone"; he does seem to have waited on at least three major occasions for supporters ready to publish in his defence.

134 This was the concluding volume to Romanes' series on animal and human intelligence and mind inaugurated with **Animal Intelligence** (1883) and **Mental Evolution in Animals** (1888).

135 Charles Darwin, letter to George Romanes of February 1880, in More Life and Letters, vol. 2, pp. 51-52. He then adds a final sentence to the above paragraph "But it is of no use my giving you my crude notions."

The mind/matter problem was more explicitly presented and debated by other 19th century evolutionists, and their views may be categorized as follows:

(1) Monistic positions admitting one substance, of which matter and spirit are aspects (depending on one's point of view) were defended by Huxley,[136] Romanes,[137] Lloyd Morgan,[138] and Spencer.[139] Monism had the advantage of admitting that part of materialism considered confirmed by science - that mind is a product of brain or at least depends upon it- while avoiding a radical break with mainstream opinion. Huxley's version of the mind/brain relationship was the greatest departure from the mean for this group, since he held that mind was an epiphenomenum of brain, caused by it but not reacting upon it. For the others, there was no causality at all, just a "mysterious" correspondence of mental and cerebral states.

(2) Wallace, alone of the group of English evolutionists, defended a dualism of the natural and the supernatural. He had two major arguments for his claim: (a) He argued that mental faculties such as mathematics and music had no survival value and so could not have been developed by natural selection. Therefore, since they cannot have a natural origin, they must have a supernatural one; hence, his belief that an intervention from the spirit world had

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136 T. H. Huxley, "On the Physical Basis of Life" (1868), **Collected Essays** 1: 160. See also T. H. Huxley "On the Hypothesis that Animals are Automata, and Its History" (1874), where Huxley develops his view of mind as an epiphenomenum of the brain.

137 George Romanes, **Mind and Motion and Monism** (1895), ed. C. Lloyd Morgan, p. 73. The essay "Monism" is preceded by an article entitle "Mind and Motion" originally published in 1885

138 C. Lloyd Morgan **The Springs of Conduct: An Essay in Evolution** (1885), pp. 208-209.

139 Herbert Spencer, **First Principles**, p. 550

brought about this radical shift in evolution. (b) Wallace believed that life was the cause of organization, and not vice versa. Proceeding from the fact that microscopes (of the time) did not reveal structure in the rhizopoda (the taxonomic group then defined as including amoebas and foraminifera), Wallace held that "life is the cause and not the consequence of organization."[140] For Wallace, "...life must be antecedent to organization, and can only be conceived as indissolubly connected with spirit and with thought, and with the cause of the directive energy everywhere manifested in the growth of living things."[141]

(ii) Society and Ethics

A second area where Darwin had an influence in extending the scope of evolution involved social and moral evolution in human societies. In the **Descent of Man**, Darwin makes good on his promise to "throw light on the origin of man." Following the publication of Huxley's enthusiastic **Man's Place in Nature** in 1862, and Lyell's slightly more cautious **The Antiquity of Man**, the **Descent of Man** established evolution in the field of anthropology as well. In the **Descent of Man**, Darwin also extends the concept of evolution and natural selection to morals and society, arguing that the social instincts of animals evolve into moral qualities in man, and that natural selection has operated to favour tribes with a high proportion of moral members. At the same time, he sounds a note of concern for modern society, where it seems that social protection is encouraging the weak who otherwise would be eliminated by natural selection.

140 Alfred Russel Wallace **The World of Life** (1911), p. 8. Wallace is quoting a reference by Huxley to Hunter contained in Huxley's **Introduction to the Classification of Animals** (1869), p. 10
141 ibid, p. 9

Darwin 's contribution to an extension of the scope of evolution to the study of society and morals can be considered as at best ambiguous. Darwin develops his ideas in chapters 4 and 5 of **Descent of Man**. In chapter four, Darwin presents his case for the existence of social instincts aiming at the common good in man. Man is a social animal, inheriting from his animal past "a tendency to be faithful to his comrades, and obedient to the leader of his tribe", as well as a tendency to "defend, in concert with others, his fellow men," and "to aid them in any way which did not too greatly interfere with his own welfare or his own strong desires."[142] Combined with "instinctive sympathy" which causes men to seek the approbation and avoid the disapprobation of their peers, this leads to the development of moral values, in the service of the general good. This latter is defined as "the rearing of the greatest number of individuals in full vigor and health, with all their faculties perfect, under the conditions to which they are subjected", and is distinguished in this biological reading from the related, but distinct notion of the general happiness of the species. Darwin presents a humanistic, optimistic view of moral evolution, that modern man, with the exception of barbarians, must with Kant value the "dignity of humanity" above his own selfish desires, and witness the higher, social instincts, with their derived virtues, win out in the struggle with the lower, individual impulses. He concludes:

> Looking to future generations, there is no cause to fear that the social instincts will grow weaker, and we may expect that virtuous habits will grow stronger, becoming perhaps fixed by inheritance. In this case the struggle between our higher and lower impulses will be less severe, and virtue will be triumphant.[143]

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[142] Charles Darwin,**Descent of Man** (1871), p. 149
[143] ibid, p. 169

This discussion is carried forward into chapter 5, where it is brought in line with Darwin's theory of natural selection. Although a high standard of morality may give no benefit to any one member of a tribe or other social group, and indeed may be destructive as in the case of sacrificing one's life for the sake of another, the matter is different when examined from the point of view not of the individual, but of the collectivity.

> A tribe including many members who, from possessing in a high degree the spirit of patriotism, fidelity, obedience, courage, and sympathy, were always ready to aid one another, and to sacrifice themselves for the common good, would be victorious over most other tribes; and this would be natural selection. At all times throughout the world tribes have supplanted other tribes; and as morality is one important element in their success, the standard of morality and the number of well-endowed men will thus everywhere tend to rise and increase.[144]

A decidedly less optimistic note is sounded when Darwin discusses the application of natural selection in civilized countries. Darwin cites a series of measures that society takes to protect "the imbecile, the maimed and the sick", so that the weak, rather than being eliminated through natural selection, are now being preserved and propagating their kind through social protection. Through conscription and war, healthy and vigorous young men are placed in circumstances of corruption and death, while the feebler remain at home to marry and reproduce. While holding out the possibility of evolutionary ethics of a cooperative sort, Darwin seems here to view the application of natural selection to social development in a less optimistic sense.

[144] ibid, p. 179

The debate over the application of evolution by natural selection to ethics and society is reflected in such works as Walter Bagehot's **Physics and Politics** (1873), subtitled "Or Thoughts on the Application of the Principles of 'Natural Selection' and 'Inheritance' to Political Society". Bagehot does not defend a strict Darwinian point of view; and limits Darwinian factors of conflict and isolation to the early phase of human history; once nations appear on the scene, factors of cooperation, imitation and discussion become essential conditions for further progress. The application of evolution to society was continued in a more competitive sense by Spencer and Haeckel, and eventually issued in the trend known as "social Darwinism".

Samuel Alexander in his **Moral Order and Progress: an Analysis of Ethical Conceptions** (1889) attempted to apply the concept of natural selection in a more straightforward way to ethical considerations. Moral ideals develop as natural species do. Just as natural selection selects and preserves favorable variations in the context of a struggle for existence so are good ideals developed in a struggle against bad or evil ones. Alexander, however, does not go beyond a metaphorical treatment of the similarity of biological species and ethical ideals, a point criticized by Lloyd Morgan in a review of the work in **Nature**.[145]

A complete rejection of the application of Darwinism to ethics came from an unexpected corner: T. H. Huxley, in his **Romanes' Lecture** of 1893 The process of evolution is characterized by competition and the overcoming of the weak by the strong; ethics, on the other hand, esteems just those fragile values which 'cosmic

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145 in **Nature**, June 20, 1889, p. 169

evolution' rejects. "Let us understand, once for all, that the ethical progress of society depends, not on imitating the cosmic process, still less in running away from it, but in combating it".[146] Huxley recognized only one factor of evolution, the competitive one of survival of the fittest, and could not accommodate ethics in this restricted framework.[147]

Henry Drummond, in **The Ascent of Man** (1894) reached a different conclusion: By adding "cooperation" as the "missing factor in current theories" of evolution, operative at the social and ethical level, he was able to integrate ethics and evolution to his satisfaction. Biological evolution is characterized by competition and struggle for existence, but social evolution by cooperation and the new factor of struggle for the existence of others.[148]

A similar strategy was taken by the Russian 'anarchist prince', Petr Kropotkin, in his **Mutual Aid: A Factor of Evolution** (1902). The chapters of the book had appeared earlier, from 1890-96 in **The Nineteenth Century**, a monthly intellectual review which along with **The Fortnightly Review** and **Contemporary Review**, highlighted the debates over the scientific, social and ethical dimensions of evolutionary theory. Kropotkin was directly replying to Huxley, and like Drummond, argued that a factor of cooperation ("mutual aid") operant at the

146 T. H. Huxley, "Evolution and Ethics" (1893), p. 82

147 But see his grandson's Julian Huxley's revised treatment of the subject, in his "Evolutionary Ethics" (1943), delivered as Romanes' lectures 50 years later. A different conclusion is reached based on emergentist concepts - I discuss this in chapter 5 of this dissertation.

148 Some authors have seen an emergentist notion in this, though the problematic seems to be more Spencerian insofar as different realms of evolution are recognized. with non-Darwinian factors at work at the higher ones. See Robert Reid, **Evolutionary Theory: The Unfinished Synthesis** (1985), ch. 7 for an analysis of Drummond as an early emergentist.

social level would forestall the contradiction between cosmic evolution and ethical progress.[149]

There are thus two alternative views of evolution and society, a restricted view and an enlarged view. On the restricted view, social evolution is a continuation of the struggle for existence (social Darwinism). For the enlarged view, social evolution admits a further factor of cooperation (Bagehot, others). Similarly, there are two opposed views of the relation between evolution and ethics, a compatabilist and an incompatabilist view. For the incompatabilists (Huxley) ethics is opposed to evolution, since this latter is seen as conflictual and based solely on the egotistic struggle for individual existence, thus excluding any altruism or cooperative morality. For the compatabilists, ethics is a continuation of evolution, admitting a further factor of mutual aid (Kropotkin, Drummond).

In both cases, there is a relation between the question of the factors of evolution and the extension of evolution to the social and ethical domains. If one has a single factor view of evolution, with natural selection the sole factor, and extends this to society, then social Darwinism seems to be the inevitable outcome (e.g. Haeckel).[150] Again, if one has a single factor view of evolution, and wishes to avoid the obvious ethical implications of the extension of struggle for survival to the field of morals, a move such as Huxley's seems the only alternative, though

149 Ashley Montagu in his 1955 reprint of Kropotkin's work, includes Huxley's "The Struggle for Existence in Human Societies" (1888), which prompted Kropotkin's reply. Kropotkin returned to the problem of the evolution of ethics in his posthumously published **Ethics: Origin and Development** (1924). A second volume, to deal with a positive presentation of a realistic ethics, was not completed at the time of his death.

150 This does not, however, apply to Wallace, who was a single factor theorist in biology and a socialist in social theory. But then Wallace admitted a second factor, albeit a supernatural one. Haeckel's case is more interesting. He was both a strict single factor Darwinian in evolutionary theory and a social Darwinian in social theory.

here the price is a high one: ethics and evolution are seen as opposed, and the ethical domain is excluded from evolutionary considerations. The relation between a multi-factor theory in biology and what has been called here an enlarged view of social evolution and a compatabilist view of evolutionary ethics is not an automatic one. But it does appear that a multi-factor theory affords the possibility of developing an "enlarged" view of social evolution and a "compatabilist" view of evolution and ethics, while a single-factor theory seems to lead more appropriately to restricted and incompatabilist views.

(iii) Philosophies of Evolution

Finally, Darwin's development of a coherent, cogent theory of biological evolution reacted back onto the intellectual climate of his times. Just as previous writings by Spencer, Baden Powell and Chambers had prepared the terrain for his work, the **Origin of Species** now popularized the notion of evolution in areas beyond its immediate biological home. One has only to examine the publishing history of Spencer's **System of Synthetic Philosophy** (10 volumes, 1855-1893) to see how 1859 was a watershed year. Prior to that time, Spencer had published a number of articles on evolution,[151] and had issued his **Principles of Psychology** in

151 Notably "The Development Hypothesis" in 1852, "Progress: Its Laws and Cause" in 1857 and "Transcendental Physiology" of that same year. In "The Development Hypothesis" Spencer argues for the plausibility of the evolution of species in general terms reminiscent of Lamarck: given new conditions, animals begin to adapt themselves to these new conditions, and over a very long period of time, continuous change of circumstances can generate modifications of species so great as to produce new ones. At other times, his argument is analogical: just a single cell develops into a man in the course of a lifetime, so a single cell may give origin to the human race over millions of years. In "Progress: Its Laws and Causes" Spencer develops the embryological analogy, and drawing from Von Baer's theory, formulates his principle of the transformation of the homogeneous into the heterogeneous, in which Spencer finds the essential characteristic of progress. In "Transcendental Physiology" (1857), he bases the transformation of the homogeneous

1855. It was only after the publication of the **Origin of Species**, however, that Spencer decided upon the plan for a series of volumes unified around the concept of evolution. As a result, **First Principles**, the logical starting point of the series, was published only in 1862, seven years after the **Principles of Psychology**, which then was then included as part II of the over-all work. Spencer, though not a Darwinian as concerns the factors of evolution, shared in the interest that Darwin had created for the concept of evolution. In turn, Spencer extended the scope of evolution to encompass the three areas of the inorganic, the organic and the super-organic, this latter term being used by Spencer to denote the psychological and social.

In the period from 1859 to 1899 a number of other works appeared with general philosophies of evolution: These include Fiske's **Cosmic Evolution**, based on Spencerian principles, and Haeckel's writings, inspired by Darwin. With the founding of **The Monist** in 1890 by Paul Carus, as the first English review devoted to the philosophy of science, Lloyd Morgan began a series of articles on the philosophy of evolution, combining theses of Darwin, Spencer, Romanes and Huxley.

Thus we have two mechanisms of extension of the scope of evolution that may be referred to Darwin: (1) extensions directly due to his initiative, or that of his colleagues, specifically the extension to mind, morals and society and (2) extensions due to Spencer and his followers, who though not strictly Darwinian,

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into the heterogeneous on the underlying instability of the homogeneous. So by 1857 the basic features of his distinct, non-Darwinian view of evolution were established.

nevertheless profited from the favorable climate Darwin's work created. This extension of the scope of evolution to other areas of science transcends the disciplinary matrix which Kuhn would set as a boundary.

The philosophical problems associated with Darwinism have been excluded in Kuhn's notion of a Darwinian scientific revolution. Three such problems have been discussed above: the problem of materialism in ontology, the problem of evolutionary ethics, and the question of social evolution. Though Kuhn in his appendix to the second edition of his **Structure of Scientific Revolutions** admits the relevance of metaphysical considerations in the course of scientific revolutions, he does not explicitly work out the implications. Though the problems of social evolution, evolutionary ethics and the mind/brain problem were not the focus of 19th century debate over Darwinism (indeed, Darwin's metaphysical opinions only became known with the publication of his **Notebooks** in the period from 1959 on), nonetheless they are an important component in any philosophy of science appreciation of Darwin's impact and influence.

(5) Darwin's Creative Synthesis

The Kuhnian model of the origin of Darwinism has been criticized in the previous sections; here, I turn to an alternative explanation, which I term "creative synthesis". The term creative synthesis is used in order to express the two main components of a theoretical development such as Darwin's: an innovative element which marks a new point of departure in biology (the "creative" aspect), and an element of continuity with previous sources and the incorporation of ideas from others (the "synthetic" element) My contention, for the moment, is that this model of creative synthesis is adequate to the case of Darwin. But I develop the theory of creative synthesis in a general way, since I intend to use it again in chapter two when discussing Lloyd Morgan's work on emergent evolution.

In discussing the background to Darwin, two parts were distinguished: the general background, consisting of older theories which dominated the subject, and immediate sources, authors contemporaneous or one generation removed whom Darwin read and who influenced him. The effect of Darwin's innovation was to provide a new foundation for biology, unifying its diverse domains of anatomy, physiology, morphology and taxonomy. This development had repercussions in other domains of science, philosophy, religion and culture as well.

I therefore distinguish the following areas of the knowledge context of biology: (1) science, of which biology is a part and from which it draws required complimentary or subsidiary knowledge. This includes factual knowledge from chemistry, physics and formal techniques from mathematics and logic; (2) philosophy, which enters into the foundations and interpretation of biology; (3) religion, which via natural theology argues for an intimate relation between science and the divine; and (4) the other intellectual products of society which form the most general, cultural backdrop of a scientific discipline. My calling these admittedly disparate domains by the common term "knowledge", involves no more than saying that they share a common form, that of constituting systems of beliefs held by groups of people, and which develop in rational ways over time.

Darwin as a scientist found himself in a particular knowledge context. His discipline, that of biology, was dominated by a complex of scientific, philosophical, religious and cultural factors (the general background) that expressed themselves most clearly in the three elements of natural theology and the fixity of species (Ray, Paley), continuity and the chain of being (Leibnitz and others), and the natural system of classification (Linnaeus in particular).

To this must be added the immediate sources who influenced Darwin: the major immediate influences have been identified as Lyell (principle of uniformity), Malthus (principle of population and competition), Comte (theory of the three stages in the evolution of knowledge), Lamarck (the first theory of evolution), Milne-Edwards (the biological division of labor); and Wallace (the principle of divergence of character). Darwin undertook a critical analysis of these (and other) influences, a process which can be seen at work in his **Notebooks** and early drafts on evolution. He accepted certain theses and modified them, and rejected others. Certainly Lyell, Malthus, Wallace, Lamarck, Comte and Milne-Edwards were a mixed bag, and what I call a critical analysis was needed to find a consistent set of theses among their contradictory and often disparate theories. At the same time, Darwin was comparing and contrasting these immediate sources with his general background.

Along with this on-going process of critical analysis of his immediate sources and general background, Darwin was working on his innovative element - the concept of selection applied in the theories of natural selection and sexual selection. The period of development of this innovative element extended over some period of time, from 1838 to 1859. At the same time, he was comparing his new theory with evidence, at first to convince himself of its basis in reality, and then to convince others by amassing the largest evidence class for his theory as possible. Darwin's observations during his sea voyage, and his researches on barnacles, flowers and worms furnish an evidence class or factual basis for his theory. As well, he was working on drafts of his theory (1842, 1844, 1856-58), structuring the elements into a coherent presentation. The theory was not simply derived by inductive generalization from the evidence class, but involved a formal structure where analogy played an important, indeed crucial role.

These three components: the innovate element, the evidence class and the formal structure were combined by Darwin in his creative synthesis. The result was a new theory: the theory of descent with modification chiefly, but not solely, through the agency of natural selection. This new theory, as has been argued in the sections on the factors of evolution, did not become a dominant paradigm, but rather a focus of debate within the discipline. At the same time, it legitimated evolution as a conceptual basis for biology, and was extended to other domains in science, and into philosophy, religion, culture and ideology as well.[152] It is here that it had its most apparent public effect, in mobilizing a tremendous number of commentators at the the most general level of the knowledge context. A suggested graphic for this process is the following:

152 These three aspects of the influence of Darwinism on biology, science and the other knowledge fields are indicated by the three arrows leading from the box labeled "new theory". Similarly, the three types of influence on Darwin, such as those of Lamarck in biology, Lyell in the related scientific field of geology, and natural theology more generally, are also indicated by the three arrows leading to the box labeled "immediate influences".

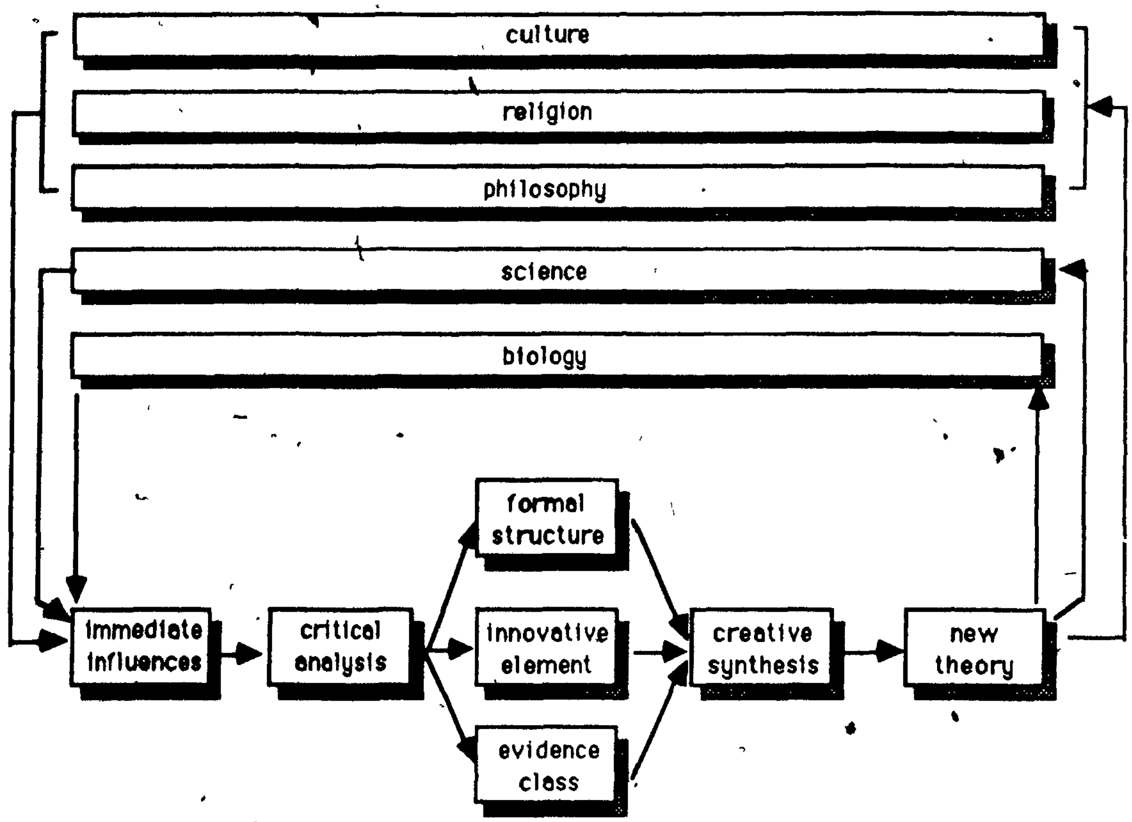

Diagram 12: Creative Synthesis of a Novel Theory

Within the new theory, the innovative element (that of natural selection) plays a central role. It is the core of the theory, with the other elements (sexual selection, use-inheritance, pangenesis, etc.) surrounding it. This distinguishes Darwin's theory from predecessors (such as Wells, Matthews and others) who hit upon similar ideas, but did not build full fledged evolutionary theories on its basis.

The view of Darwinism here defended is quite different from that proposed by the Kuhnian model. This is not to deny, however, that Darwinism formed a trend of thought with a tremendous influence. The Darwinian trend included all those who accepted natural selection as a major factor of biological evolution.[153] There were internal disagreements within the trend as to the exact role of natural selection, specifically whether it sufficed as sole factor (Wallace), was the chief but not the only factor (Darwin), or whether it had to be supplemented by other factors (Romanes).

Darwin was not only the point of reference for this trend in matters scientific, he also exerted a strong, though implicit, philosophical influence. For those trained in the Darwinian trend (as was Lloyd Morgan, who studied with T. H. Huxley and was a colleague of Romanes) evolution was a continuous process characterized by gradual, quantitative change within a monistic framework.[154] The examination of Lloyd Morgan's development shows the considerable difficulty involved in making the transition to a theory which would incorporate qualitative novelty while keeping to the theses of continuity and monism. This is the subject for the next chapter.

153 In this sense, Spencer is at most a peripheral Darwinian, since he admitted natural selection only as a tertiary factor of biological evolution.

154 In this respect, Wallace was a "heretic" to the trend at the philosophical level. Le Conte comes the closest to an emergentist view, adopting, however, a saltationist model of the transition from one plane to another.

Chapter Two: The Founders of Emergent Evolution

Emergent evolution was a product of the first decades of the 20th Century, and although not the exclusive property of any one thinker, the comparative psychologist Conwy Lloyd Morgan is certainly the key or central figure of the movement. Lloyd Morgan was a pupil of Huxley and a colleague of Romanes. He was a neo-Darwinian as concerns biological evolution, and was influenced by Spencer's philosophy of evolution. His work can be divided into three periods - (1) the pre-emergentist writings before 1913, characterized by an attempt to come to grips with the problem of novelty within the neutral monist framework, (2) the period 1913-15 when, as the result of a process which will be analyzed as one of creative synthesis, he put forward the basic theses of emergent evolution, and (3) his writings after 1915 when he systematically developed and defended emergent evolution[1] This discussion of Lloyd Morgan's work will conclude with an evaluation and critique of his philosophy, and then will examine the theories of

[1]Very little has been written in depth about Lloyd Morgan's philosophy. Doctoral dissertations devoted exclusively to him of which I am familiar include Harold Jameson Ralston, **The Concept of Purpose in the Philosophy of C. Lloyd Morgan** (1930· State University of Iowa), and Pat S Schievella, **The Philosophy of Conway Lloyd Morgan** (1967: Columbia University). Ralston's volume was issued as a book (available only through the U. of Iowa library) entitled **Emergent Evolution and Purpose** (1933) and subtitled with the original dissertation title. Neither author deals with the development of Lloyd Morgan's thought, and in particular, do not examine in detail his work before **Emergent Evolution** (1922) or the external influences that aided him in his development of emergent evolution as a philosophy Ralston's volume is especially concerned with the problem of teleology and its relation to emergence, but includes a resume of (then) contemporary emergentist theorists besides Lloyd Morgan Schievella's is exclusively devoted to Lloyd Morgan, with a concluding chapter of general criticism. The following two dissertations also deal with Lloyd Morgan or emergent evolution Garrit T. Vander Lugt, **Emergent Evolution: A Critical Analysis** (Univ of Michigan, 1928), and Paul Arthur Reynolds, **Emergent Evolution and the Nature of Mind - A Monograph Based on a Study of the Philosophy of C. Lloyd Morgan** (Cornell Univ , 1930) Dissertations dealing with aspects of emergent evolution (causality and values) or dealing with Lloyd Morgan among others are Cornelia G Lebowtillier, **Religious Values in the Philosophy of Emergent Evolution** (Columbia Univ, 1937), William Y. Fung, **The Theory of Values in Emergent Evolution** (NY Univ, 1944);Helen Lorena McArthur, **Causality in Emergent Evolution** (Univ of Toronto, 1958), Lawrence Leroy Habermehl, **Value in the Evolutionary World Views of Samuel Alexander, C. Lloyd Morgan and Pierre Teilhard de Chardin** (Boston Univ. 1967)

three other major emergentist philosophers influenced by Lloyd Morgan: Samuel Alexander, C. D. Broad and Roy Wood Sellars.

(1) Lloyd Morgan's Formative Period:

The period from 1885 to 1912 is a period characterized by Lloyd Morgan's search to work out the problem of creativity or novelty in evolution within the Darwinian tradition. As shown in the previous chapter, the Darwinism involves two key propositions: (1) the scientific conclusion that natural selection is the chief, though not necessarily the sole factor of evolution, and (2) the philosophical proposition that evolution is continuous and quantitative.

Lloyd Morgan's writings in this period include **Springs of Conduct: An Essay in Evolution** (1885), his first writing on evolutionary theory, followed by a series of books on comparative psychology: **Animal Life and Intelligence** (1891), **An Introduction to Comparative Psychology** (1894, second edition 1903), **Habit and Instinct** (1896), **Animal Behavior** (1900) and **Comparative Biology** (1905). His volume **The Interpretation of Nature** (1905) is an effort at developing a philosophy of science. During this period he also produced a textbook entitled **Psychology for Teachers** (1894), and edited the posthumous works of Romanes, serving as editor for his **Matter and Motion and Monism** (1895), as well as the three volumes of **Darwin and After Darwin** (1892-97) and a volume of Romanes' **Essays** (1897).

During the period under question, Lloyd Morgan also contributed a series of articles to **The Monist.** During its first decade of publication (the 1890s) he was one of its most frequent contributors, after its editor Paul Carus. These articles, to be analyzed shortly, are based on a Spencerian view of evolution. At the end of the 1890s, Lloyd Morgan was a contributor to Baldwin's **Dictionary of Philosophy and Psychology**, co-authoring (among others) the article on organic selection, his attempt to grapple with the problem of the factors of evolution.

(i) Neutral Monism and the Terminology of Novelty

A monistic ontology was shared by Huxley, Spencer and Romanes, all important influences on Lloyd Morgan. In particular, the influence of Romanes' monism can be seen in Lloyd Morgan's **Springs of Conduct: An Essay on Evolution** (1885). The motivation is a familiar one in 19th Century Victorian thought, an attempt to avoid the twin "excesses" of materialism and idealism, while retaining elements of each. On this view, materialism has a practical advantage as concerns the interpretation of scientific investigation, since it avoids a spiritual substance whose interaction with matter is difficult, if not impossible, to explain. Idealism has a speculative advantage, since it recognizes the fact of consciousness as basic, in accord with intuitive feelings. A materialist viewpoint is useful in physiology, an idealist one in psychology. Monism combines the two, and according to Lloyd Morgan, is the only philosophy capable of "rendering conceivable the concomitant evolution of mind and body":

> The parallelism between neurosis and psychosis is merged in identity. They are not parallel series which run side by side, but one series which we regard under different aspects. To use the old philosophical phraseology, there are not two substances, a substance of matter and a substance of mind, but one substance, the substance of being.[2]

[2] C. Lloyd Morgan, **The Springs of Conduct: An Essay in Evolution** (1885), pp. 208-209.

In **Springs of Conduct** the point of departure is Huxley's old problem of the relation between neuroses, the technical term for brain states or processes, and psychoses, the corresponding mental states or processes. Like Romanes, Lloyd Morgan rejects Huxley's epiphenomenalism as inconsistent with an evolutionary point of view: if mind does not interact or influence brain, why would it have been selected for by evolution? Lloyd Morgan adopts Alexander Bain's distinction between the brain as organ of consciousness and the whole body as the organ of mind, and considers W. K. Clifford's mind-stuff hypothesis for a moment, before returning to the neutral monist fold[3]. He also mentions G. H. Lewes on a number of occasions: the comparison of the mental and the physical as concave to convex derives from Lewes.[4]

In his exposition of a monistic view on the mind/brain problem, Lloyd Morgan makes the distinction between psychoses proper and what he terms hypopsychoses. These latter are defined as "submerged feelings which correspond on the subjective side to neuroses, but which do not see the light and emerge in consciousness"[5]. Mind is "the sum total of psychoses and hypopsychoses", i.e. of submerged feelings and feelings which have emerged into consciousness. This penchant for coining new terms will continue in Lloyd Morgan's later writings, up to the period of the crystallization of the emergence theory in the mid 1910s. His problem is to explain qualitative novelty within the

[3] Alexander Bain develops this argument in his **Mind and Body: The Theories of their Relation**, while Clifford argues for "mind-dust" as the basic substance of both mind and matter in his **Body and Mind, with Other Essays.**

[4] An indication of the influence of Lewes on Lloyd Morgan's thinking can be seen by examining the title quotes he includes for each part, chapter and section of the book. Of the 17 persons quoted in this context, Lewes appears most often, with 7 quotes, out of a total of 34 quotes for all authors.

[5] C. Lloyd Morgan, **The Springs of Conduct: An Essay in Evolution**, p.190

neutral monist tradition. It will be argued that Lloyd Morgan is unable to do this in strict adherence to the views of Darwin, Huxley, Wallace, Romanes or Spencer, and is continually searching for new concepts to get around the impasse.

In **Animal Life and Consciousness** (1891), Lloyd Morgan once again addresses the problem of novelty. He does so in the context of a discussion of what may be called "Wallace's dilemma": the solution of the mind/body problem requires a choice between panpsychism and supernaturalism. Wallace had argued that either all matter is conscious or that consciousness is introduced into matter from without. If one rejects panpsychism (as Wallace did), then the only other possibility is the existence of conscious force outside of and independent of matter. This is Wallace's spirit world, infuses certain sorts of matter with mind.

Lloyd Morgan proceeds to get around the horns of this dilemma as follows: He accepts the proposition that evolution is a continuous process proceeding in a natural way, without any supernatural principle required. There should thus be an evolution from unconscious life to conscious life without the admission of a psychic substance. Though such a position excludes Wallace's supernaturalism, without further qualification it leads back to the other horn of Wallace's dilemma: panpsychism. According to the double aspect monistic ontology Lloyd Morgan accepts, it is not possible to deny some psychic aspect in lower organisms. Lloyd Morgan is aware of the difficulty of having lower organisms, or inanimate matter, endowed with the same sort of consciousness as humans. Quite simply, such a position is untenable, contradicting both common sense and scientific knowledge. What follows is his attempt to maintain an overall neutral monism, without falling into the extreme of panpsychism. He attempts to get around this problem by introducing concepts to describe lower stages of consciousness.[6]

The physical side of the process poses no difficulty for Lloyd Morgan: complex neuroses are evolved from less complex ones, less complex ones from simple ones, and simple ones "from organic modes of motion which can no longer be called neuroses at all."[7] When a similar mode of reasoning is applied to psychoses, the problem arises that the last two steps do not seem to correspond to anything below the level of psychoses. As a solution, he introduces the concepts of kinesis and meta-kinesis. All physical processes, including the physiological, are explicable in terms of energy, and for this the term "kinesis" is used. The term "meta-kinesis" is then defined to apply to the concomitant mental manifestations of kinesis.

> According to the monistic hypothesis, every mode of kinesis has its concomitant mode of meta-kinesis, and when the kinetic manifestations assume the form of the molecular processes in the human brain, the metakinetic manifestations assume the form of human consciousness.[8]

There are metakinetic manifestations or aspects of all things, including inanimate objects. But the kinesis of the inanimate object being less than that of

[6] Wallace reviewed Lloyd Morgan's **Animal Life and Intelligence** (1890) for **Nature** in a five page article in 1891. The review is generally favorable, but not unexpectedly, Wallace objects to Lloyd Morgan's monism, and the relation he draws between psychosis and neurosis. "If this means anything, it means, what has been stated in simpler but equally exact and more intelligible language, that all force is will-power. But it goes further, and implies that there can be no mind like that of man, or superior to it, without a brain formed of similar materials and similarly organized as the brain of man. This necessary connection, and even identity, of the two is, however, what is not proved, and not even, in my opinion, shown to be probable." (**Nature**, Feb. 12, 1891, p. 341)

[7] Lloyd Morgan, **Animal Life and Intelligence**, p. 466

[8] ibid, p. 467

the human brain, the metakinesis does not attain the form of mind or consciousness. What form it does attain, Lloyd Morgan does not tell us. Presumably, we cannot reproduce primitive states of metakinesis in our own developed metakinetic minds In discussing the limitations to his view, Lloyd Morgan notes the following:

> First, we can know directly only [one] product of metakinetic evolution - that revealed in our own consciousness. Secondly, the process of metakinetic evolution must be reached, if reached at all, indirectly through a study of kinetic evolution. Thirdly, we have no right to infer a consciousness unless the mode of kinesis is analogous to that which is involved in neural processes. And fourthly, the closer the kinetic resemblance we observe, the closer the meta-kinetic resemblance that we infer.[9].

Lloyd Morgan considers that the kinesis/metakinesis distinction is more tractable and less mysterious than the matter/spirit distinction:

> According to this view, the two distinct phenomenal orders, the kinetic and the metakinetic, are distinct only as being different phenomenal manifestations of the same noumenal series. Matter, the unknown substance of kinetic manifestations, disappears as unnecessary; spirit, the unknown substance of metakinetic manifestations, also disappears; both are merged in the unknown substance of being - unknown, that is to say, in itself and apart from its objective and subjective manifestations.[10].

The whole system is summed up in the following quotation, where the Kantian-Spencerian influence is clear:

> I make, therefore, the following assumptions: First that there is a noumenal system of "things in themselves" of which all phenomena, whether kinetic or metakinetic,

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[9] ibid, p. 480. Note that Lloyd Morgan's position here is close to his "canon" of not postulating mind where other and simpler explanations (say in terms of reflex behavior) are available. We observe the kinetic, but we infer the metakinetic, with the exception of the introspection of our own, individual, consciousness.

[10] Lloyd Morgan, **Animal Life and Intelligence**, p.468

> are manifestations. Secondly, that whenever in the curve of noumenal sequences kinetic manifestations (convexities) appear, there appear also concomitant metakinetic manifestations (concavities). Thirdly, that when kinetic manifestations assume the integrated and coordinated complexity of the nerve processes in the certain ganglia of the human brain, the metakinetic manifestations assume the integrated and coordinated complexity of human consciousness. Fourthly, that what is called "mental evolution" is the metakinetic aspect of what is called brain or inter-neural evolution[11]

The terminology is further extended in the article "Mental Evolution" (1890) where Lloyd Morgan introduces the concept of infraconsciousness to refer to pre-conscious mental states. This term covers the area of metakinesis below that of consciousness, when psychoses (in the older terminology) have not yet "emerged" into consciousness:

> The material structure has been evolved from lower forms of matter: the organic modes of energy (in virtue of which he lives) from lower forms of energy; the mental states (in virtue of which he is conscious), from - what? I suggest in continuation and conclusion of this sentence - from lower forms of infra-consciousness; that is to say, of what is the same order of existence of consciousness, but has not yet risen to the level of consciousness.[12]

The following diagram is based on that given by Lloyd Morgan and illustrates his use of the terms kinesis/metakinesis, and neurosis/psychosis. The lower left hand of the diagram corresponds to an early stage of ontogenetic development, when the ovum has not yet developed a nervous system. The mental states concomitant with that primitive physiological condition are referred to as metakinetic or infraconscious. The the upper right hand of the diagram represents a fully developed individual, with mental states (psychoses) corresponding to brain states (neuroses). Here the individual has achieved

[11] ibid, p. 470
[12] Lloyd Morgan, "Mental Evolution" (1892), p. 172

consciousness. Point 'a' is the midpoint of the curve of development, representing the moment when infraconsciousness first becomes consciousness.

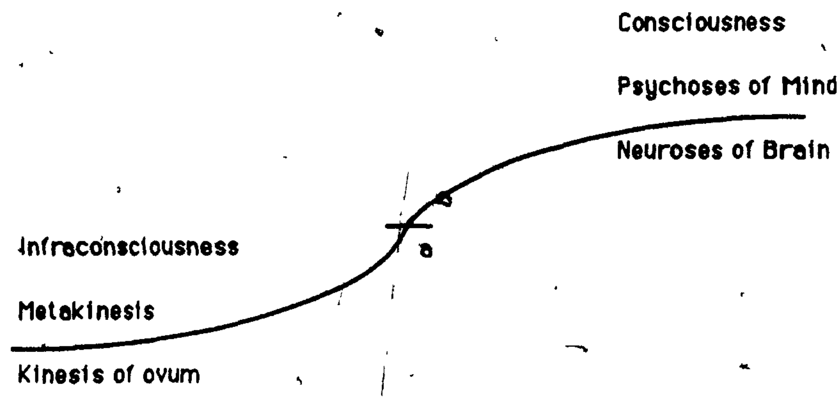

Diagram 1: Lloyd Morgan on Ontogenetic Development

Lloyd Morgan notes that it is frequent in science to say that at at the point 'a' where infraconsciousness gives rise to consciousness the physical development of the brain has generated, or called forth states of consciousness or mind. But, he argues, this is philosophically misleading, violating the neutral monist ontology which segregates the physical and the mental so that the former cannot "cause" the latter. "No conceivable increase in the orderly complexity of the molecular vibrations of brain tissue could give rise to that consciousness which differs 'toto caelo' from any manifestation of energy"[13]. Nevertheless, Lloyd Morgan admits that scientists who arrive at such a conclusion are "practically sound because they are still dealing with the same developmental curve". This leads him to make the following point, of interest for its use of the term "emerge": "When they say that consciousness emerges from the physical conditions at 'a', they presumably mean that at this point we are first justified in speaking of

13 ibid, p. 173

consciousness on the subjective aspect in anything like a human sense.[14]" Lloyd Morgan's continued rejection of the emergence of the mental from the physical in favour of a double aspect theory of the mind/body problem will pose a serious problem once he has developed the emergent evolutionary point of view.

Within the infraconscious domain, Lloyd Morgan distinguishes two varieties: those forms of infraconsciousness which could become conscious under special conditions and with sufficient mental effort - the sub-conscious states, and those which lie too deep to ever be brought into consciousness - the infra-conscious states proper. In **An Introduction to Comparative Psychology** (1892), Lloyd Morgan combines these various technical terms using the metaphor of the wave. He has introduced up to now the concept pairs of psychosis and neurosis, metakinesis and kinesis, infraconsciousness and sub-consciousness. These are combined in the image of the wave of consciousness, part of which is at the focus of attention and part of which is marginal to attention; part of which is above the threshold of consciousness and part of which is below. Outside the focus, mental processes are sub-conscious, but could be brought into consciousness by a change of focus. Below the threshold of consciousness, mental states are infra-conscious in the strict sense of not being able to be brought into focal consciousness at all. Corresponding to focal consciousness are dominant molecular states of the brain, while marginal or subconscious states correspond to the sub-dominant neuroses, and extra-marginal or infra-conscious states of mind are correlated with infra-

[14] ibid, p. 194

dominant states of brain. The following diagram sets out Lloyd Morgan's view of these relationships:[15]

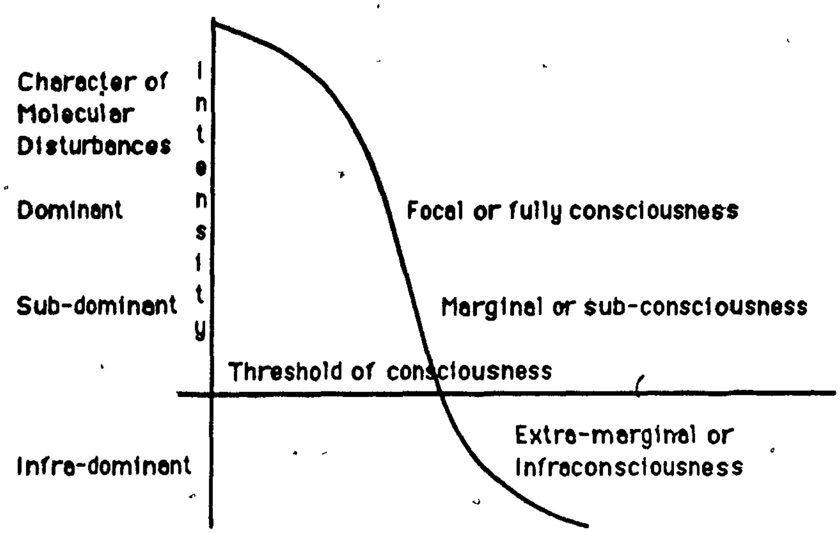

Diagram 2: Lloyd Morgan on the Wave of Consciousness

A tabular presentation of the relationships gives the following:

Physical aspect	Psychical aspect	Threshold
dominant neuroses	focal or conscious psychoses	above
sub-dominant neuroses	marginal or sub-consciousness	above
infra-dominant neuroses	extra-marginal or infraconscious	below

The psychical wave is experienced as "one and indivisible"[16]. It is only by introspection that the subject can analyze the wave into its components. But by that time the wave has passed and analysis is conducted on a memory trace of it.

[15] My presentation of above diagram is based on his graphic in **Introduction to Comparative Psychology**, p. 18.
[16] There is an obvious analogy here to William James' stream of consciousness.

Thus introspection is really "retrospection", with some slight changes introduced by the vagaries of recollection.

Lloyd Morgan's most quoted contribution to comparative psychology is his methodological principle usually known as "Morgan's Canon", intended to rectify the methodology used by Romanes. With Lloyd Morgan, there is a shift from an anecdotal procedural to an experimental one[17]. The use of anecdotes, often collected from pet owners, had the effect of overestimating animal intelligence and the scope for mind in the animal kingdom. Lloyd Morgan formulates his principle as follows: "In no case may we interpret an action as the outcome of the exercise of a higher psychical faculty, if it can be interpreted as the outcome of the exercise of one which stands lower in the psychological scale."[18]

The discussion in **Introduction to Comparative Psychology** illuminates not only a methodological problem (how to gauge animal psychical levels), but also poses a philosophical problem (how to explain qualitative novelty). Lloyd Morgan presents three different models for the comparison of human and animal minds. On the "method of uniform reduction", animals possess the same faculties as humans, but in reduced quantity, varying in degree from one animal species to another. Lloyd Morgan rejects this model as contrary to his canon. The other two methods, the "method of levels", and the "method of variation" have in common the proposition that animals of the lower types have not evolved some faculties found in higher ones and humans. In humans, the higher psychological

[17] This point is discussed at length in Robert Boakes, **From Darwin to Behaviourism: Psychology and the Minds of Animals**, ch. 2, "Intelligence and Instinct".
[18] Lloyd Morgan, **Introduction to Comparative Psychology**, p. 53.

development attained is the result of increased organic complexity and increase in correlated behavioural activities. Here too, the problem of novelty is implicitly posed: the question, not yet resolved, is to explain the appearance in the course of evolution of these novel psychological capacities.

A concept of importance in this early period is that of "selective synthesis", also developed in **An Introduction to Comparative Psychology** . The premature and still tentative nature of the concept is evidenced by its association with the notion of 'breaches of continuity'. Lloyd Morgan argues that evolution is a single, continuous process that sweeps through the inorganic, organic and superorganic stages of nature (in accordance with Spencer's views). The laws of each mode differ, and at each stage something "new" is introduced which did not exist in earlier modes. This is the result of selective synthesis, an operation characterized by "an apparent breach of continuity" in the processes of nature, but which is in fact "not a gap or hiatus in the ascending line of development, but a new point of departure."[19] The examples used include the formation of crystals, the change in state of water from solid to liquid to gas, and chemical combinations. Specifically with respect to this latter, Lloyd Morgan says "There does not appear to be a gradual and insensible change from the physical properties of the elements to the physical properties of the compound, but at the critical moment of the constitution of the compound there seems to be a new departure."[20] Here, he provides a graph charting the volume to temperature relationship for water in each of its three physical states: there are clearly breaks at the freezing and boiling points.

[19] ibid, p. 338
[20] ibid, p. 342

Lloyd Morgan's concern at this stage is how new properties arise within a continuous and gradual process of change. The picture as presented by chemical combination or the water graph is not what he wants, since he still feels that this goes against the basic assumption of continuous Darwinian evolution. But Lloyd Morgan has already taken one step beyond that problematic by admitting qualitative changes. He as yet cannot explain how this can be done within the context of continuity, and hence the concept of "apparent breaches of continuity". He takes the example of the apparent breach of continuity at the boiling point of water and argues as follows: If pressure is increased, the "breach of continuity" will no longer occur at 100 degrees Celsius, and there will be a continuous graph at that point. Of course, this just puts the problem off, because at some higher temperature, boiling and the apparent breach of continuity will still occur. But his hope is that this too can be explained away as contingent and empirical:

> At the same time it should be clearly grasped that these apparent breaches of continuity are to be regarded as merely incidental to the conditions under which the phenomena are presented to our observation. The breach between the liquid and gaseous states of water holds good only under normal conditions of pressure. On these conditions it is contingent. Could we only in other matters, as has been the case with liquid and vapour through the classical researches of Andrews and others, find the appropriate conditions, every apparent breach of continuity would probably disappear. We are constrained to believe that evolution as a process is essentially one and continuous. By which we mean that nowhere is there evidence of supernatural interference ab extra. It is imperative to distinguish with due care between the results of empirical observation and their interpretation on a deeper plane of philosophical thought. The apparent breaches of continuity are empirical, and are incidental only to the limiting conditions of phenomenal presentation.[21]

This paragraph contains a pithy presentation of Lloyd Morgan's dilemma: Darwinian evolution requires continuity; but many processes in nature seem to

[21] ibid, p. 359

involve discontinuous changes when new qualities appear. The attempt to admit selective synthesis as a source of novelty, with only apparent breaches of Darwinian continuity, is ultimately unsuccessful. Lloyd Morgan will have to redefine continuity in his theory of emergent evolution, and in so doing go beyond the framework of 19th century philosophy of evolution.

(ii) The Monist articles on the Philosophy of Evolution

Up to now, Lloyd Morgan has concerned himself mainly with the mind/body problem, though within an evolutionary context. In his writings for the **Monist**[22] in the 1890s, he sets out his views on a philosophy of evolution[23].

The first article, "Mental Evolution, an Old Speculation in New Light" (1892) sets the tone for the series. It begins with a critique of the "crude and demonstrably false materialism expressed in the formula "as the liver secretes bile, so does the brain secrete consciousness"[24], and goes on to criticize John Tyndall's views and those of T. H. Huxley as well. The two aspect theory of monism which Lloyd Morgan defends is called "scientific monism". The

22 The **Monist** was a journal founded by Paul Carus in 1890, and from 1892 on subtitled "A Journal devoted to the Philosophy of Science". As its name suggests, the journal was oriented towards a monistic point of view. Lloyd Morgan contributed the greatest number of articles after its editor to the **Monist** during its first decade. The Monist lapsed in the mid 1930s, but was revived in the 1950s and is still published.

23 The complete series of articles comprise: "Mental Evolution, An Old Speculation in New Light" (1892, v.2), "The Doctrine of Auta" (1893, v.3), "Three Aspects of Monism" (1894, v.4),"Weismann on Heredity and Progress" (1894, v.4), "A Piece of Patchwork" (1895, v.5), "Naturalism" (1896, v.6), "Animal Automatism and Consciousness" (1896, v 7), "The Realities of Experience" (1897, v. 8), "Causation, Physical and Metaphysical" (1898, v.8), "The Philosophy of Evolution" (1898, v.8), "Vitalism" (1899, v.9), "Biology and Metaphysics" (1899, v.9), "Psychology and the Ego" (1900, v.10), "The Conditions of Human Progress" (1900, v.10)

24 This formulation is due to Cabannis, and is also stated by Darwin in his **Notebooks**.

parallelism between the objective and subjective is considered a mystery, in the sense that all ultimate facts are mysterious, be it the nature of life or of gravitation. In the second article of the series, he notes:

> For scientific monism is ... a doctrine of phenomena - phenomena regarded not only in their physical but also in their psychological aspect. Unifying these two diverse aspects, it contends that the conscious organism is one and indivisible; that it is a product of evolution; that in its physical or material aspect this evolution has given rise to the body and brain; that in its psychical or immaterial aspect it has given rise to the mind and human consciousness; that these two aspects, though distinguishable in analytic thought, are inseparable in phenomenal existence; that just as the complex modes of energy of the human brain have been evolved from the simpler modes of energy that are found throughout organic and inorganic nature, so too the complex modes of consciousness of the human mind have been evolved from the simpler modes of infra-consciousness that are associated with merely organic and inorganic modes of energy...[25]

The publication of **An Introduction to Comparative Psychology** marked a slight change in terminology: Lloyd Morgan now calls his position that of analytic monism, a change reflected in his article of that same year in the **Monist**, "Three Aspects of Monism". He distinguishes three aspects of a monism: (1) monism as a theory of knowledge, which denies the independence of subject and object, and recognizes both as "distinguishable aspects of of that which in experience is one and indivisible"[26], (2) monism as an interpretation of nature, which denies the independence or non-natural origin of mind, and argues that "mind is not extra-natural nor supra-natural but one of the aspects of natural existence"[27], the product of evolution, and (3) what he calls analytic monism, which assumes a

[25] Lloyd Morgan, "The Doctrine of Auta" (1893), p. 175
[26] Lloyd Morgan, "Three Aspects of Monism"(1894), p. 322
[27] ibid, p. 323

concomitance between nervous states of the brain and mental states, with the former as the objective aspect and the latter the subjective aspect.

The second key concept for Lloyd Morgan is that of naturalism. His article of the same name, "Naturalism" (1898) is a critique of Arthur Balfour's **Foundations of Belief**. Lloyd Morgan takes issue with Balfour's views that natural selection cannot account for human intelligence and ideals (also claimed by Wallace), and that naturalism cannot explain the existence and development of ethical concepts. Lloyd Morgan distinguishes between organic evolution, where natural selection operates to coordinate or "self-adjust" the organism to a physical and organic environment, and "mental evolution of man as a social being" where the question is that of the coordination, or self-adjustment, of mind to an environment of ideas and ideals. In the following quote, the limits of natural selection are clearly formulated, though unlike Wallace, Lloyd Morgan remains within a naturalistic framework.

> For this cannot be too emphatically insisted on: that natural selection deals with organisms, and that its method is that of elimination, if not from the world of living things, at least from the world of breeding things. Natural selection only affects the development of mind and consciousness incidentally - that is to say, in so far as mind conduces to organic evolution. In social evolution among human beings, natural selection ceases to be the dominant method of evolutionary progress; and mental evolution, involving other principles, not less natural than those which the study of organic development has disclosed, becomes the central feature of the process.[28]

If natural selection has its limits, naturalism is all encompassing, or rather, nearly all encompassing. On the one hand, Lloyd Morgan says: "We must

[28] Lloyd Morgan, "Naturalism" (1894) pp. 81-82

extend our conception of naturalism so as to include a naturalistic interpretation of nature in all its wealth of moods, neither excluding inorganic nature on the one hand nor human nature on the other hand"[29] Naturalism views the world as cognizable under definite laws, which extend as far as the loftiest ideals of ethics and aesthetics. These latter may be ranked among the natural sciences. On the other hand, he also says that naturalism is not incompatible with supernaturalism; these two apparently opposite views are not contradictory: "The truer view is that the sphere of naturalism is throughout its whole extent and in every detail, no matter how seemingly insignificant, interpenetrated with supernaturalism."[30] At first blush, this seems to contradict the statement of naturalism that precedes it. But for Lloyd Morgan the natural is related to the supernatural just as the objective is related to the subjective. Just as the physical and the psychical are correlative, complimentary, or reciprocal, so too are the natural and the supernatural. Huxley's philosophical quest lead him to agnosticism, but Lloyd Morgan's leads him to theism. The supernatural, as interpreted by the philosophy of religion, considers the "inner and deeper" aspect of things. Science deals with the natural aspect of things, religion with the supernatural:

> On this view naturalism and supernaturalism are not antagonistic, but reciprocal; do not dwell apart but are coextensive; do not deal with separate spheres, the one knowable and the other unknowable, but constitute the diverse aspects of that body of belief which is the outcome of human experience at its best.[31]

[29] ibid, p. 82
[30] ibid, p. 84
[31] ibid, p. 84

Lloyd Morgan sums up his view of naturalism, with this added component of the concomitance of the natural and the supernatural, as follows:

> 1. Naturalism sweeps through the whole range of the knowable. 2. It is nowise antagonistic to or exclusive of supernaturalism. 3. It takes as its criterion of reality direct experience prior to the analysis of science 4. Of the two aspects of experience which primary analysis first discloses, the objective and the subjective, it regards both as strictly co-ordinate reality. 5. It asserts the inherent and intrinsic worth and dignity of the human ideals. 6. It refuses to admit that natural selection, potent as this may be as a factor in organic evolution, is to be regarded as chief naturalistic factor in human evolution.[32]

Point number 3 above is further developed in "The Realities of Experience" (1897).[33] Lloyd Morgan is especially concerned with the concept of experience as the starting point of our knowledge, and so convinced is he of its basic role, that he suggests the following: "And it appears to me that, on the principles of Descartes' himself, we should substitute for his celebrated **Cogito ergo sum**, concerning which as its stands very pretty arguments have arisen, the indisputable axiom **Experientia est**."[34] Experience provides the foundations for our knowledge, upon which the superstructure of science is erected. Moreover, experience now provides the basis for Lloyd Morgan's monism: it is anterior to the distinction between subjective and objective which scientific thought introduces at a later stage of the cognitive process. First, there is undifferentiated experience, and only then the differentiation into physical and mental. Belief in experience as the basis of knowledge is not metaphysical; for Lloyd Morgan it is simply a matter of

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[32] ibid, p. 90

[33] This article is a commentary on T. H. Huxley's reading of the history of philosophy, and in particular, the role and place of Descartes as the key to modern thought, as interpreted via the empiricism of Locke and the idealism of Berkeley.

[34] Lloyd Morgan, "The Realities of Experience" (1897), p. 4

common sense, confirmed by our everyday experience and then extended into scientific thought.

The problem of the relation between the metaphysical and the scientific is taken up in "Causation, Physical and Metaphysical (1898)". This is Lloyd Morgan's contribution to the debate over Hume's denial of necessary connection in causation. Lloyd Morgan agrees with Hume as far as science is concerned, but he disagrees with respect to metaphysics. Constructs in science, including law statements such as the law of gravitation, are based on a limited number of observations. How then is the universal form of law statements justified? "The answer is that we carry our law to an ideal limit unattainable by sense and by practical measurement... We trust to a reality of thought which we believe truer and wider than the realities of sense."[35] However, this use of conceptual constructs and the formulation of laws of nature does not go beyond a statement of the regular succession of events. A law statement is said to explain the events that fall under it, but it does not provide an explanation in the sense of an "ultimate, underlying cause". So far, Lloyd Morgan is in agreement with Hume's general principles. But he goes beyond them when he also admits metaphysical causation alongside, or rather, correlative to the strictly scientific one:

> Let us speak of physical or scientific causation which refers events to their antecedents, generalizing the results of observation in an ideal scheme of physical science; and let us speak of metaphysical causation which seeks to get behind or beneath phenomena and to give the raison d'être of their being, generalizing its conclusions in an ideal scheme of metaphysical interpretation.[36]

[35] Lloyd Morgan, "Causation: Physical and Metaphysical" (1898), p. 237
[36] ibid, p. 240

There is a continuity from experience to science to metaphysics. Science uses the observations of experience as the foundation for its production of an ideal scheme of physical theories. Here, there is description of sequences of events and their explanation by subsumption under a general law. But Lloyd Morgan feels there is a need to go beyond the scientific to the metaphysical just as there is a need to go beyond the experiential to the scientific. Metaphysics proceeds to frame an ideal scheme, based this time on science itself, just as science bases itself on experience.

Metaphysics supplements and completes the scientific world view and serves as its framework. Metaphysical assumptions are requirements of human thought, but they must be acknowledged as assumptions. Lloyd Morgan gives as examples of such assumptions those of the existence of a material universe independently of our experience, and the existence of a first cause or supreme being. The former is required for science to be possible, and the latter as the basis for religion. This metaphysical notion of cause differs from the physical one in that it is not concerned with succession of events; but goes beyond the facts of experience to an existence underlying and responsible for all experience. "Thus we reach the metaphysical conception of a unifying existence, omnipresent in space and time, and immanent, founded on the conviction that experience is rational and explicable - a conviction without which the search for knowledge is a vain and illusory dream-quest."[37] Such a metaphysical existence is a reality for rational thought, not for sense-experience, and goes beyond the Humean

[37] ibid, p. 249

limitation of causation to the physical realm. The noumenal exists for rational thought alone.

Lloyd Morgan has developed the themes of the complementarity of the objective and subjective, the physical and mental, the natural and supernatural, and the scientific and religious. These positions will be maintained throughout his later emergentist work as well. The continuity of experience, science and metaphysics is also of importance, as is his distinction among description, explanation and interpretation.

The evolutionary considerations in analytic monism are detailed in the article "The Philosophy of Evolution" (1898) where the Spencerian outlook is much in evidence. This is the key article of the series insofar as it presents a general philosophical view of evolution. The Spencerian notion of the transformation of the homogeneous into the heterogeneous is combined with Lloyd Morgan's views on the primacy of experience and the complementarity of the subjective and objective. Basing himself on Spencer, Lloyd Morgan says that "The root-ideas of the conception of evolution are, first differentiation, and secondly the interaction of the differentiated products."[38] The schema which he presents is the following:

1. There are two basic differentiations. The first is empirical, starting from the "unity of sensory experience", and the second is rational, starting from the "unity of rational thought-products". The empirical differentiation brings about both the objective aspect as considered by physical science, and the subjective

[38] Lloyd Morgan,"The Philosophy of Evolution" (1898), p. 487

aspect as considered by psychological science. The rational differentiation gives the objective aspect as the noumenal cause and the subjective aspect as the rational ego.

2. The rational aspects are said to "underly" the empirical ones. As a result, the phenomenal sequence of objective events studied by the physical scientist is based on the noumenal cause, and the phenomenal sequence of subjective events studied by the psychologist is based on the rational ego. The noumenal cause and the rational ego are "metaphysical postulates" which are not generalizations of phenomenal experience, but products of rational thought.

3. The process of differentiation is supplemented by that of integration. The two end-products of differentiation can interact and produce a "new and more complex unit". According to Lloyd Morgan, experience itself is to be explained as the product of such a differentiation and integration, with the noumenon as the basic, monistic source. This noumenal source, as yet unidentified as to its nature, is differentiated into the self (subjective aspect) and the non-self (objective aspect). The interaction of self and non-self results in experience, which then differentiates into the object and subject. Lloyd Morgan represents this with the following diagram:

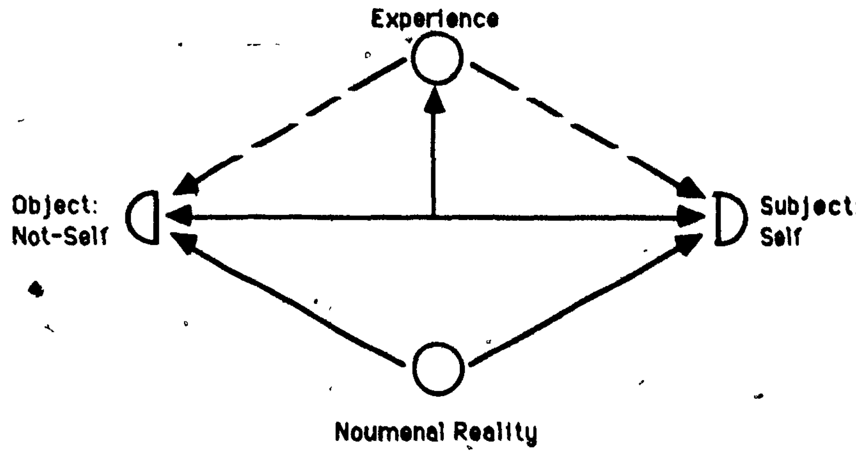

Diagram 3: Lloyd Morgan on Analytic Monism

This diagram, reproduced from Lloyd Morgan's text, is accompanied with the following text:

> The lower circle represents the monistic unity prior to dualistic differentiation; hence arises the self on the one hand and the not-self on the other, which by their interaction give origin to experience, including both sense and thought. The dotted lines express the analysis of experience into object and subject coterminous with the not-self and the self of differentiation. But whereas the subject and object of analytic dualism are dependent on the occasionalism of experience, the self and not-self are persistent so long as the differentiation holds.[39]

4. In inorganic and organic processes, a distinction is made between intrinsic processes of differentiation and integration, and extrinsic processes. In an extrinsic differentiation, a number of external factors combine to produce an effect - Lloyd Morgan gives the examples of planets circling the sun under the effect of gravitation, or natural selection acting upon organisms in their environment. But in intrinsic differentiation, such as the régular pattern displayed by a growing crystal, or the compounds formed by chemical

[39] ibid, pp. 500-501. This thesis will be imported into the later emergentist philosophy.

combination, the result is not predictable as in the case of the positions of the planets in solar orbit: "No one, in the absence of observation or analogy based on practical experience (his own or that of others), could foretell what new characters a compound, resulting from the chemical union of well-known elements, would possess."[40] This concept of "unpredictability" of the novel will re-appear in Lloyd Morgan's later emergentism.

5. When the model is applied more generally to the cosmos the noumenal unity is referred to as the "underlying activity". This is the cause, in the metaphysical sense, of the differentiation and interaction of the cosmic elements, which, under the conditions of time and space, bring about the world as we know it. This metaphysical cause is described as timeless, spaceless, eternal, infinite and transcendent of experience. Its nature cannot be described: "....it must suffice to say that the underlying metaphysical activity, as cause, is neither the product of evolution nor its precursor in time; it is that timeless omnipresent existence in and through which evolution is rendered possible."[41] This corresponds, of course, to God.

In the above theory, we can see in Lloyd Morgan's thought a shift from the empiricism of the article "On the Realities of Experience" to a recognition of a rational source underlying the phenomenal world. He adopts a Spencerian model of differentiation and integration, though without concern for the process of transformation of the homogeneous into the heterogeneous which was an essential part of Spencer's philosophy of evolution. Instead, there is the

[40] Lloyd Morgan, "The Philosophy of Evolution", p. 489.
[41] ibid, p. 501

distinction between intrinsic and extrinsic processes. Intrinsic processes result in novelty, but the significance and mechanism of such processes is left unexplored. Finally, there is the concept of the underlying activity which is the metaphysical cause of the cosmos and of phenomenal reality. This will be later identified with Samuel Alexander's nisus towards deity.

In the remaining articles of the series in the **Monist**, Lloyd Morgan takes up the defense of his monism against vitalism in biology and dualism in psychology. Lloyd Morgan's point is that science must be monistic, if its interpretation of nature is to be naturalistic. Conceptions of vital principle or immaterial mind in science are illegitimate, though Lloyd Morgan does not exclude them as possible assumptions to be made in metaphysics, even if he does not himself agree with them.

Lloyd Morgan concludes the series with an article on the problem of human progress, which he believes to be the outcome of social evolution. Here, he examines the claim, which he believes both Darwin and Spencer have made, that evolution when extended to societies leads to progress. Lloyd Morgan dismisses arguments for social evolution based on natural selection or use-inheritance. Rather, the solution is found in the concepts of imitation and intelligence, social factors beyond the purely biological considerations of natural selection and use-inheritance. On this basis, continuity and progress are said to obtain, with imitation the basic element, and intelligence the leading element:

> Imitation supplies the element of continuity; intelligence, that of progress. All that organic heredity has to do is to maintain the standard of these two essential faculties. Intelligence will devise better moves in the hazardous game where life is at stake; imitation will enable even mediocrity to profit from them; and succeeding

> generations will be the gainers, leaving intelligence free to devise yet better methods of procedure.[42]

Stated in more political terms, Lloyd Morgan states that authority is a factor of continuity, but reason the "mother of progress". It is in this way that the continual outlay of reason, if only by a small number, raises the average level of the mass, and results in social progress. The key is to recognize that the basis for social progress lies not in raising the average level of individual intelligence, but in the establishment of a higher sort of social structure. Average intelligence may even fall, as some fears result from civilization protecting the less intelligent through welfare measures, but so long as the social environment is strong and under the lead of the most intelligent, social progress will result. The motor of progress is not the individual average man, but the achievements of mankind - literature, art, philosophy, science and technology.

Social evolution thus proceeds on a different basis, or with different factors, than organic evolution. It links with the mental evolution with which Lloyd Morgan began his series of articles in having an essentially social and not individual nature. The individual character of development is manifest only in organic evolution, but even here, there must be a coordination of natural selection as leading factor and use-inheritance as temporary conservator of intermediate structures, as will be seen in the examination of Lloyd Morgan's concept of "organic selection". Social evolution is superorganic (the term due, of course to Spencer). It is only in organic evolution that the fit survive at the expense of the

[42] Lloyd Morgan, "The Conditions of Human Progress" (1900), p. 431

less fit. In social evolution, the fittest play a role in "raising the level of the less fit"[43]

The series of **Monist** articles presents a philosophy of evolution going beyond Darwinian organic evolution, to include Spencerian superorganic evolution, but on a modified, social basis. Mental evolution and social progress are dependent on group factors, not strictly individual ones. The overall philosophy is monistic and naturalistic, yet place is left for the dualism of aspects and supernatural agency.

During the same period that he produced the **Monist** articles, Lloyd Morgan also participated in the development of the theory of "organic selection". Organic selection as a factor of evolution combines Darwinian natural selection and Lamarckian use-inheritance. The theory was developed at about the same time by Lloyd Morgan, James Baldwin (philosopher, psychologist and editor of the **Dictionary of Philosophy and Psychology**) and H. A. Osborn, the American biologist.[44] The crux of the theory is that an incipient positive variation may not be sufficiently important to be conserved through natural selection, but it may be allowed to persist and develop if passed on through use-inheritance, or acquired modifications. In this way, it may increase to that point where it will finally be

[43] ibid, p. 438

[44] Lloyd Morgan discusses his view, then called "indirect selection" in **Habit and Instinct** (1896), pp. 315 and following, and in an article in Science, Nov. 27, 1896; Osborn's comments appear in Science for April 3, 1896 and Nov. 27, 1896; Baldwin in Science, March 20, 1896 and in **Mental Development in the Child and Race** (1896) where the term is first used. Baldwin, Lloyd Morgan and Osborn discussed the terminology involved in a joint article in Science, April 25, 1896 and in Nature in 1897. The concept is discussed in detail in the article "Organic Selection" in the **Dictionary of Philosophy and Psychology**, pp. 213-218 in an article initialled by Baldwin, Morgan, and several others

selected for by natural selection and included in the permanent characteristics of the species. Natural selection is the factor determining in the final instance, and Lamarckian use inheritance appears as a helping, temporary factor, allowing minor variations to get over a period of fragility. The role played by organic selection is similar to that of Darwin's preservation of intermediate structures examined in chapter one.

In his article "Mental Factors in Evolution" (1909), Lloyd Morgan represents variations by 'V' and acquired modifications by 'M'. A variation in the direction of increased adaptation is represented by +V and a variation in the direction of decreased adaptation by -V; acquired modifications in the direction of accommodation to circumstances by +M, and those in the direction of diminished accommodation by -M. Organic selection is taken to be the claim that of the four possible combinations, those combining +V and +M are selected for survival, and those combining -V and -M are eliminated. The other two combinations give varying results. Here, natural selection is not sufficient, though it is the leading factor of organic selection, while use-inheritance is not viable as an isolated phenomena.

(iii) Lloyd Morgan's Philosophy of Science

From what precedes, it is clear that Lloyd Morgan has developed a philosophy that goes beyond the problem of evolution itself, and sets out the elements of a general philosophy of science. Indeed, this is just what he expounds in his book **The Interpretation of Nature** (1905), the Lowell lectures delivered in Boston the preceding year. The key concept is that of interpretation, of which

Lloyd Morgan identifies three distinct sorts: meaning within the sphere of knowledge, aesthetic appeal within the sphere of emotion[45], and end within the sphere of purpose. The interpretation of nature involves the "disclosing or unfolding of its hidden meaning"[46]. The distinction is also made between the "retrospective outlook", which is concerned with the origin of a thing and its antecedent conditions, and the "prospective outlook", interested in the future development of the thing and perhaps its final state. Finally, there is the distinction between the objective standpoint and the subjective one in examining phenomena.

Science is largely, though not exclusively concerned with the interpretation of nature in terms of knowledge, in the retrospective mode, and from the objective standpoint. This is what Lloyd Morgan has meant by "naturalism" in his earlier articles in the **Monist**. Naturalism is only apparently at variance with teleology, the prospective mode and the subjective standpoint. The solution is already present in his earlier writings as well: the combination of subjective and objective as aspects of one reality now takes the form of two modes of interpretation of science, the one psychological in outlook and the other physical, depending upon whether the point of departure is the human mind or the phenomena of nature:

> We have here what may, I think, be regarded as the radical and fundamental distinction between two opposing and often strongly antagonistic modes of interpreting nature. On the one hand, the human mind, will, purpose, is taken as the basis of interpretation, and in such terms is the meaning of nature explained. On the other hand, the phenomena of nature, as formulated by science, afford, it is said, the only valid foundations on which we can securely build, and in such terms

45 Lloyd Morgan admits considerations of aesthetics in science, but this is of minor importance in what follows, and is more of a form of presentation than a problem of content.

46 Lloyd Morgan (1905). **The Interpretation of Nature**, p. 8

> is the human mind itself explained. In the one case the course of procedure is from within outwards, until all nature is pervaded by mind analogous to that which interprets. In the other case the course of procedure is from without inwards, until the mind is explained as the product of molecular motion of a peculiar and exceedingly intricate kind.[47]

These two modes of interpretation, the subjective from the mind outwards, and the objective, from nature inwards, have a basis in the history of human mental evolution. For the primitive folk interpretation at the dawn of human history, everything was interpreted in terms of purpose; only later, once a group of specialists in the study of nature arose, did the interpretation in terms of natural law appear. Thereafter, there was a complimentary development of theistic and naturalist conceptions, and teleological and mechanistic interpretations.

Another distinction Lloyd Morgan makes is that between the realities which science studies and the examination of the conditions of consciousness involved in the activity of science itself. When we are concerned only with what Lloyd Morgan calls the "departmental interpretation", that is to say, the study of a class of phenomena by an individual science, there is no need to preface that study with considerations of epistemology. But when science is considered as a whole, the problem of epistemology and the conditions of knowledge arises. Knowledge arises from experience, and this is individual and dependent on the sensory and conceptual apparatus of the knowing subject. That objects can be recognized in common by many subjects arises from the circumstance that men and women are social beings, and can assign common names to "centers of reference" which are the objects of science: "The object then is a common center of reference for a

[47] ibid, p. 6

number of different kinds of impressions, and is thus independent of any given state of consciousness."[48] In this way "facts of experience" become "objects of science".

Individual sciences proceed naively, as it were, accepting their objects as unproblematic and proceeding to analyze them using the mechanistic and mathematical methods characteristic of science. In the psychological sciences, this leads to the notion of the mental as objective. Philosophy of science, concerned with the sciences as a whole, is concerned as well with the status of the object as object of knowledge. The analysis begins as individual, with the sense-impressions of the subject. But because of the social nature of humans, there is the constitution of the object of science as a "common center of reference" One can proceed from the objective to the subjective, or vice versa, depending on whether one is doing research in a particular science, or working on the philosophy of all the sciences.

The analytic dualism demonstrated above has its analog in the history of philosophy, and Lloyd Morgan chooses the debate between Locke and Berkeley as his example. Locke argued that while the secondary qualities are mind-dependent, the primary qualities are properties of matter as such, and independent of humans. Berkeley, however, argued that all qualities are mind-dependent. This was "reconstructive" insofar as it rehabilitated the secondary qualities from subordinate status, but "destructive" insofar as it "dealt the deathblow to a belief in the independent existence of matter and motion as such

48 ibid, p. 31

independent of experience."[49] The solution to the Locke-Berkeley dilemma, and more generally, the objective/subjective debate is the "duality of reference" characteristic of neutral monism:

> Now when we consider experience from the plainest and most practical standpoint of common sense, there is disclosed a duality of reference - an objective reference to things and events independent of us severally and individually, and a subjective reference to our own feelings and emotions and to the stream of our individual thought. This duality of reference is an inalienable feature of our experience, but apart from that experience has no meaning. Instead of saying that a large section of our sensations and their relations are termed matter and motion, while the rest are termed mind and thinking, it would be better to say that the same group of sensations and their relations which constitute our ordinary perceptions exhibit this duality of reference - objective and subjective.[50]

Upon the foundations of experience is built up the "superstructure of physical conceptions", the "ideal construction of natural science", which, however, is just as secure as its basis. Both retrospectively and prospectively, a naturalist view of causation is adopted. The present configuration of the universe is assumed to be the result of its configuration at the preceding moment, and is state in the succeeding moment to be the effect of this present configuration. In this context, Lloyd Morgan briefly discusses the emergence of novelty. The problem is brought up matter of factly following a description of the nebular hypothesis of the origin of the solar system:

> Again and again have new properties, new modes of acceleration, new types of interaction emerged, as minor configurations have been successively differentiated; but every such emergence has been rigidly conditioned and determined within the major configuration embracing the universe at large. In those cases where the conditions of emergence are as yet unknown, as conspicuously, in the origin from not-living matter of the physical basis of life,

49 ibid, p. 35
50 ibid, pp. 46-47. .

> with its characteristic properties and its puzzling physiological accelerations, we are bidden to believe, though we cannot establish by observation. This is part of the evolutionary creed for the earnest and consistent believer.[51]

Lloyd Morgan believes at this time that problem of novelty and its emergence cannot be solved within the naturalistic interpretation, but can be understood only within the supernatural or theistic interpretation, as the immediately following lines imply :

> I confess that as an evolutionist I am myself both ready and willing to believe; but I shall presently claim the right to exercise a like option in other fields of human thought, and in an interpretation of a different order. For the naturalistic creed deals only with the conditions of evolution. The conception of a causal agency of which evolution is the expression, if such indeed there be, is excluded from a naturalistic interpretation of nature so far as it based on the methods of physical science.[52]

The rest of the book is then devoted to a replay of arguments already developed in the **Monist** series: physical causation is a sequence of antecedent and consequent events as Hume claimed, but there is place, coordinate to physical causation, for metaphysical causation, and this, as agency responsible for causation and evolution as well, is deity. This "metaphysical postulate" of God is an ideal construction in the field, not of science, but of religion, and is the purposive cause of the mechanical phenomena studied by science.

(iv) Epistemology and the influence of Berkeley

Although slightly out of historical sequence, it is of interest to examine at

[51] ibid, pp. 60-61
[52] ibid, p. 61

this point an article by Lloyd Morgan delivered to the **Aristotelean Society** in 1915 on the problem of epistemology and Berkeley's views. Its relevance at this juncture lies in the way that the subject/object relation is treated, a follow-up to Lloyd Morgan's views expressed in the book **Interpretation of Nature** considered in the previous section.

Lloyd Morgan's "Notes on Berkeley's Doctrine of Esse" (1915) contains 225 numbered paragraphs dealing with the relation between perception and cognition, and between subject and object. Lloyd Morgan argues that all facts are relational, and poses the question whether part of that relation is the cognizing subject even when the fact purports to be dealing with non-cognitive matters. His reply is in the positive. The scientist assumes that he or she is dealing with a relation between two things, in Lloyd Morgan's notation TR^xT' where T and T' are things, and R^x is a non-cognitive relation between them. Lloyd Morgan symbolizes a cognitive relation between a potential knower E and a thing T as follows: 'ER^cT. His claim is the following: "I hazard the assertion, if it be only to draw the enemy's fire, that all scientific knowledge tacitly presupposes the 'ER^c in the formula '$ER^c(TR^xT')$, where 'E again stands for a supposed knower."[53] In more modern notation, if $R^x(y_1, y_2)$ is a (naive) statement of a relation R^x holding between two things y_1 and y_2, upon analysis, this is claimed to be a statement really of the form $R^c[e, R^x(y_1, y_2)]$, where e stands for a potential knower. In short, a philosophical analysis of fact shows that it involves an implicit reference to a potential knower of that fact.

[53] Lloyd Morgan, "Notes on Berkeley's Doctrine of Esse" (1917)., p. 104

The difference between Lloyd Morgan and Berkeley, is two-fold (1) Lloyd Morgan replaces Berkeley's "actual continuous knower" - God - by his own inclusion of the supposed knower E', and (2) Lloyd Morgan postulates "a real existence nowise necessarily dependent on cognition", even though its "nature as knowable" does depend on the "knowledge relation".[54] This leads on to a discussion of the nature of the thing in the factual relation, and the relation between perception and conception. There are three terms to be analyzed: the physical object as reality (or hypothetical reality), the perceived qualities as appearances, and the perceiving/conceiving subject. Underlying this is the distinction between thing and object, the former as perceived, the latter as conceived: "It cannot be too strongly emphasized that the thing is that with which we have direct perceptual acquaintance, whereas the physical object is that of which we have conceptual knowledge, though no doubt the one is, for scientific interpretation, correlated with the other.[55]" Physical objects are said to have properties, which are not perceivable; what is perceived are the qualities of things. There is then the two series: (a) thing, quality, perception; (b) object, property, conception.[56]

Lloyd Morgan is aware of the complicated process by which sensations are combined into perceptions, but his concern is more with the relation between perceptions once constituted and conceptions. Conception involves the introduction of meaning and significance to perceptions. Meaning is a "low-level" phenomenum, "characterized by unexplained expectation derived from previous

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[54] ibid, #33, p. 105
[55] ibid, #72, p. 112
[56] Lloyd Morgan uses the term "entity" to include both physical things and mental ego. The physical thing is then the perceivable entity, the mental ego the perceiving entity.

perceptual experience, and normally closely related to practical behaviour.[57]" Significance stands for a higher level meaning, "where the particular is related to a general", as in the development of a scientific and law-based understanding of a phenomenum. A perceived fact stands in a relation to further mind-supplied meaning and significance; this latter is termed a "supposal", and such a supposal is related to, or refers to, an order of nature (or truth):

> We must now, assuming the terms in relation to be susceptible of explicit differentiation, note (1) that a presented fact which carries such significance is in relation to some term (often very complex) within the sphere of our thought - I shall call this a supposal; (2) that, since our thought is primarily derived from and applicable to the order of nature, something within that order answers to the significant term - I shall call this a truth; and (3) that when there is a supposal in mind it has the relation of reference, more or less valid, to some truth in the order of nature to be interpreted.[58]

Otherwise stated, the mind supplies higher-order meaning or significance to a perceived fact, and this "supposal" stands in a relation of reference to truths of nature: "In scientific interpretation a somewhat elaborate supposal takes the form of a so-called ideal construction."[59]. This provides a link with the concept developed in the 1905 volume on philosophy of science. In Lloyd Morgan's symbolization, with E as subject (an "ego"), R^c the cognitive relation of knowing, S a supposal, R^r the psychological relation of reference, and W "the world-process", the ideal construction takes the form $ER^c(SR^rW)$. Note that the subject or minding ego (E) is explicitly mentioned, and that the "world-process" (W) is that which is minded, considered as a developing system.

57 ibid, #88, p. 115
58 ibid, p. 116, #94
59 ibid, #98, p. 116

The Berkeleyian position of the primacy of mind has been retained, though modified in its application. This is born out in the conclusion to the article, where Lloyd Morgan speaks of a philosophical doctrine that recognizes the role of human agency and divine source in the affairs of the world. Scientific knowledge is, under this philosophical interpretation, dependent on the human mind (or ego); just as the whole universe is dependent on the "transcendent ego" (or God) when considered under the theological interpretation. On Lloyd Morgan's view, these two interpretations are not in contradiction with a scientific interpretation which does not explicitly mention mind or God. Lloyd Morgan continues:

> Something of this sort was, I think, implicit in Berkeley's thought. It naturally leads up to a philosophical, in contrast with a scientific, doctrine of evolution, as an ascending process of self-revelation,- a gradual realization of that Source on which all mundane happenings are dependent.[60]

The article concludes: "It was Berkeley's merit that he applied his principles consistently; and while he proclaimed that every effect, which can be naively observed or significantly interpreted, is dependent on the Eternal Spirit as the ultimate Source of all that exists, he left to science, as he understood it, a perfectly free hand to pursue its investigation of phenomena on its own special lines.[61]"

A number of aspects of Lloyd Morgan's philosophy are highlighted in this article. The first is the notion of mind-dependence of knowledge and the universe. Scientific knowledge is dependent on the mind of the scientist, which contributes the meaning and significance to the perceptual facts, themselves already the

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[60] ibid, #219, p. 138
[61] ibid, #225, p. 139

result of the cognitive processing of primitive sensations. Similarly, the universe is dependent on mind, insofar as Lloyd Morgan, with Berkeley, holds that God is its source. Nonetheless, things have an existence independent of individual minds, but our knowledge of things (as objects) depends on the mind as subject. There is a combination of ontological and epistemological claims, which can be analyzed as follows:

1) An ontological claim of a scientific and naturalistic sort: The world is made up of things which are produced in an evolutionary process.

2) An ontological claim of a religious and idealistic sort: Infinite mind, or deity, is the source of the world.

3) An epistemological claim of a realistic sort: Knowledge starts from things and their production of sensations in us, through to the perception of common centers of reference.

4) An epistemological claim of a rationalist sort: To go beyond perception, the mind must supply meaning and significance to the facts of perception, in order to constitute the thing as object.

The claims (1)-(2) and (3)-(4) are only apparently contradictory when considered term by term, since Lloyd Morgan accepts as basic principles the reciprocity of mind and matter, object and subject, natural and supernatural. His epistemology combines within this framework an element of realism (knowledge starts from things) and an element of cognitivism (knowledge is dependent on minds). This philosophy of reciprocity, which might also be called one of complimentarity (to use the more modern term due to Neils Bohr), is the foundation of Lloyd Morgan's philosophy up to the development of his emergentist views. The next section will trace the process that lead him on to this further conception.

(2) Influences on Lloyd Morgan

The development of emergent evolution involves the combination of two ideas - the first, that evolution is a general phenomenum, sweeping through all domains of nature, and the second, that at specific points of complexity, new levels of organization, involving novel qualities, appear. The first concept is that of the universal scope of evolution, postulated by such 19th Century thinkers as Spencer and Haeckel. The second concept also had been developed in the 19th Century in the form of J. S. Mill's heteropathic laws, renamed emergent laws by G. H. Lewes (to be discussed in this chapter). But as has been shown in the previous section, most theoreticians of the Darwinian tradition, and foremost among them, Darwin himself, opted for a mode of evolution characterized by quantitative change alone. Qualitative novelty had been accepted by Wallace, but he had postulated a super-natural source for it. Moreover, qualitative change in species production was associated with the saltationist and anti-Darwinian views of Argyll, Mivart and others. Le Conte, who came closest to an emergentist theory with his distinction between planes of reality, also adopted a saltationist view of the transition from one plane to another. Thus, consideration of qualitative novelty in the evolutionary process, essential to the development of emergent evolution, was looked on with suspicion. Either it would be seen as a concession to saltationism or as a concession to supernaturalism, both of which were unacceptable from a strict Darwinian point of view.

Consequently, it was not a simple matter for Lloyd Morgan to move from neo-Darwinism to emergent evolution. This section will sketch out how he did so. The process of theoretical production will be described as a creative synthesis, as was formally the case for Darwin's own thinking. Evidently, the content of the two acts of creative synthesis are different: Darwin's leading to a scientific theory of evolution, Lloyd Morgan's to a philosophy of evolution. The immediate influences on Lloyd Morgan, besides Darwin, Huxley, Romanes and Spencer (and to an extent, Wallace), were J. S. Mill, G. H. Lewes, Henri Bergson, Walter Marvin and Edward Spaulding, these latter two often counted among the group of American "New" Realists"[62].

The sub-section will trace the content of the theories which were to influence Lloyd Morgan; the next sub-section of the chapter will set out the creative synthesis by which Lloyd Morgan arrived at emergent evolution, and the final sub-section will examine the presentation of the theses of emergent evolution by Lloyd Morgan in his mature writings. Since he is considered as the "founder" of emergent evolution, some detail will be given of the stages and problems in his intellectual development. In particular, it will be shown that Lloyd Morgan retains at a later stage, after having developed his theory of emergent evolution,

62 The major writing of this group was **The New Realism: Cooperative Studies in Philosophy** (1912), co-authored by Edwin B. Holt, Walter T. Marvin, William Pepperrell Montague, Ralph Barton Perry, Walter B. Pitkin and Edward Gleason Spaulding. This had been preceded by a programmatic statement "The Program and First Platform of Six Realists" (1910) Of these authors, both Marvin and Spaulding are explicitly referred to by Lloyd Morgan as influences upon him; Montague argued in the 1920s for a form of emergent materialism In a related move, a second group of American philosophers issued **Essays in Critical Realism: A Co-operative Study of the Problem of Knowledge** (1920) This volume was co-authored by Durant Drake, Arthur O Lovejoy, James Bissett Pratt, Arthur K. Rogers, George Santayana, Roy Wood Sellars and C A Strong. Of these, Sellars developed his own monistic, naturalistic and ultimately materialist version of emergent evolution under the term "evolutionary naturalism", and Lovejoy wrote an important commentary on emergent evolution.

concepts developed at an earlier period and which are inconsistent (or at least difficult to make consistent) with the later ones. In particular, this is the case for his combination of a neutral monist and evolutionary emergentist view of mind.

The three major texts of Lloyd Morgan's development of the concept of emergent evolution are (a) the book **Instinct and Experience** (1912), (b) the Herbert Spencer Lecture for 1913, "Spencer's Philosophy of Science", and (c) "Mind and Body in their Relation to Each Other and to External Things", an article which appeared in **Scientia** for 1915. An examination of these texts identifies three sources of influence on Lloyd Morgan's thought - that of the French philosopher Henri Bergson, that of the "New Realists" E. G. Spaulding and R. W. Marvin, and that of the English philosophers J. S. Mill and G. H. Lewes.

(i) Resultant and Heteropathic Laws: J. S. Mill

J. S. Mill's **A System of Logic**[63] first appeared in 1843 and went through eight editions up to the last one of 1872. The section of interest for the present purposes occurs in Book III: "On Induction", Chapter 6: "On the Composition of Causes." Nature is composed of phenomena, some simultaneous and others succeeding each other in time. It is these latter which Mill finds most interesting and challenging, since they bring up the problem of cause and effect. Mill's conception of cause, like Hume's, does not involve an metaphysical cause which

[63] The full title is **A System of Logic Ratiocinative and Inductive: Being a Connected View of the Principles of Evidence and the Methods of Scientific Investigation**. The full title more clearly indicates its goal of not merely serving as a formal logic, but also as a philosophy of science.

produces its effects through an innate power; rather, he is concerned solely with the orderly succession of phenomena:

> The Law of Causation, the recognition of which is the main pillar of inductive science, is but the familiar truth, that invariability of succession is found by observation to obtain between every fact in nature and some other fact which has preceded it; independently of all considerations respecting the ultimate mode of production of phenomena, and of every other question regarding the nature of "Things in themselves".[64]

Mill notes two abuses of the concept of cause current in everyday life and scientific practice: (1) the particular condition under consideration is often styled "the" cause despite the fact that it is "seldom, if ever, between a consequent and a single antecedent, that this invariable sequence subsists"[65]. Rather, it is correct to say that the cause of a phenomenum is the sum-total of the conditions, the occurrence of which invariably precede it. (2) the distinction between agent, or active cause, and patient, or passive effect, is also unjustified, since all the phenomena of nature, whether cause or effect, can be construed as active. Passivity is attributed to certain phenomena by the observer, and is not an intrinsic feature of the phenomena itself.

Having presented a general theory of causation in chapters I to V of Book III, Mill then notes that "To complete the general notion of causation on which the rules of experimental inquiry into the laws of nature must be founded, one distinction still remains to be pointed out: a distinction so radical, and of so much importance, as to require a chapter to itself."[66] What follows is chapter VI, "Of the

[64] Mill, J. S, **A System of Logic** (1872), p. 327
[65] ibid, p. 327
[66] ibid, p. 370

Composition of Causes". The discussion concerns a distinction between two types of causes, the mechanical and the chemical. In mechanical causation, the combined effect of two or more causes acting jointly can be calculated given knowledge of their individual effects when acting separately: "Now, if we happen to know what would be the effect of each cause when acting separately from the other, we are often able to arrive deductively, or a priori, at a correct prediction of what will arise from their conjunct agency"[67]. The example given is the familiar parallelogram of forces acting upon a body, and causation of this type is termed "Composition of Causes". However, Mill claims that this is not the case for chemical and biological combinations. He is bold in his claim for water:

> The chemical combination of two substances produces, as is well known, a third substance with properties different from those of either of the two substances separately, or of both of them taken together. Not a trace of the properties of hydrogen or of oxygen is observable in those of their compound, water.[68]

The same applies to biological entities: "All organized bodies are composed of parts similar to those composing inorganic nature, and which have even themselves existed in an inorganic state; but the phenomena of life, which result from the juxtaposition of those parts in a certain manner, bear no analogy to any of the effects which would be produced by the action of the component substances considered as mere physical agents."[69] Action of this sort is due to laws which are termed "heteropathic".[70] This mode of causation is exceptional relative to the composition of causes, which is the general rule. However, rather than being

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[67] ibid, p. 371
[68] ibid, p. 371
[69] ibid, p. 371
[70] Composition of causes might be then be called "homeopathic" causes on analogy to the term "heteropathic" for cases of composition of causes..

isolated from the homeopathic laws, heteropathic laws may combine with them, even in compositional ways:

> When in short, a concurrence of causes takes place which calls into action new laws bearing no analogy to any that we can trace in the separate operation of the causes, the new laws, while they supersede one portion of the previous laws, may coexist with another portion, and may even compound the effect of those previous laws with their own.[71]

Mechanics, because its laws are subject to the composition of causes, can be formulated as a completely deductive science; not so chemistry or biology, since the heteropathic laws cannot be deduced from knowledge of the laws of action of the component parts of molecules and organisms. But Mill argues that once the non-deducible laws are accepted as axioms, or basic postulates, of a science of chemistry or biology, the rest of the phenomena described by such a science can then be deduced:

> The Laws of Life will never be deducible from the mere laws of the ingredients, but the prodigiously complex Facts of Life may all be deducible from comparatively simple laws of life; which laws (depending indeed on combinations, but on comparatively simple combinations, of antecedents) may, in more complex circumstances, be strictly compounded with one another, and with the physical and chemical laws of the ingredients "[72]

Further, the same laws operating for "simpler combinations of circumstances" will likely also operate for more complex situations: Mill notes in passing, without further elaboration at this point, "This will be found equally true in the phenomena of mind; and even in social and political phenomena, the

[71] Mill, J. S. (1872). **A System of Logic**, p. 373
[72] ibid, p. 374

results of the laws of mind."[73] However, in the section of his work dealing with the laws of mind, in Book VI, "On the Logic of the Moral Sciences", Mill discusses at length the problem of the correlation of psychological and physiological states. He notes that a physiological cause suffices for the explanation of sensation, but is unsure whether this can be extended to the whole field of cognition:

> Further, that every mental state has a nervous state for its immediate antecedent and proximate cause, though extremely probable, cannot hitherto be said to be proved, in the conclusive manner in which this can be proved of sensations... The successions, therefore, which obtain among mental phenomena do not admit of being deduced from the physiological laws of our nervous organization; and all real knowledge of them must continue, for a long time at least, if not always, to be sought in the direct study, by observation and experiment, of the mental successions themselves. Since, therefore, the order of our mental phenomena must be studied in those phenomena, and not inferred from the laws of any phenomena more general, there is a distinct and separate science of Mind [74]

Thus, though still tentative and based on negative results, psychology is admitted as a distinct science. However, in this section of his work, Mill does not relate the question to the compositional/heteropathic distinction he had made earlier. It is at least theoretically possible, though currently not the case, that psychology could be reduced to physiology, were corresponding physiological states to be found for mental states, as has been the case with sensations. The argument for the distinct status for psychology (and of mental states) is weaker than that made for chemistry, where the laws of chemical combination are recognized to be heteropathic relative to the physical laws of atoms.

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[73] ibid, pp. 374-375. Having made this excursion into the realm of novelty, Mill returns in ch. 7 of Book 3 to the consideration of inductive logic, in particular, the problem of observation and experiment. All told, his discussion of the heteropathic/compositional distinction has taken (in a modern version) no more than 9 pages in a book of almost a thousand pages, or about 1% of the total

[74] ibid, p. 556

Mill has traced a theory according to which (1) composition of causes occurs for all phenomena, being the general rule of causation, (2) however, there are some consequences not deducible from antecedents; these are due to the action of heteropathic laws, (3) these heteropathic laws may themselves be combined with homeopathic laws according to the composition of causes, (4) there is a likely a hierarchy of irreducible phenomena as one passes from mechanics through chemistry, biology, and on to the human sciences (mind, social and political phenomena).

(ii) Emergents and Resultants: G. H. Lewes

G. H. Lewes is a second English theorist of the 19th Century to have worked on the problem of novelty. Lewes developed his ideas in his multi-volume **Problems of Life and Mind**[75]. Unlike Mill, whose heteropathic laws are based largely on consideration of one domain, that of chemistry, and who attaches only minor importance to the evolutionary aspect of change[76]; Lewes develops a more

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[75] Published as five volumes in three series from 1874 to 1879 as follows: **Problems of Life and Mind**, 1st Series (1874, 1875), 2 volumes; **The Physical Basis of Mind**, 2nd series (1877) and **Problems of Life and Mind** (1879), 3rd series, 2 volumes. Like many Victorian works, Whewell and Mill in particular, Lewes deals with the full breadth of knowledge, encyclopaedic in scope I will refer in what follows to each series by a Roman numeral, and volumes within a series by an Arabic numeral The first series, subtitled **Foundations of a Creed** contains an introduction dealing with the method of science, its applications to metaphysics and the rules of philosophizing, and then deals with a series of problems the limitations of knowledge (I 1), the principles of certitude, the relation of known to unknown, matter and force, force and cause, and the absolute in the correlation of feeling and motion (I 2) The second series, subtitled **The Physical Basis of Mind** deals with the problems of the nature of life, the nervous mechanism, animal automatism and the reflex theory (II) The third series, subtitled **The Study of Psychology: Its Object, Scope and Method**, deals with the science of psychology and its relation to other sciences, notably biology and psychology (III.1), along with the further problems of mind as a function of the organism, the sphere of sense and logic of feelings, and the sphere of intellect and logic of signs (III 2) The third series was edited and published posthumously by George Elliot

[76] Mill discusses Darwin's theory of evolution as an example of a "legitimate hypothesis": "Mr Darwin's remarkable speculation on the Origin of Species is another unimpeachable example of a

general theory of what he terms "emergents", and situates this explicitly in an evolutionary context. Indeed, it is surprising to see to what extent Lewes foreshadows Lloyd Morgan, and he accomplishes much more than merely renaming Mills heteropathic laws as "emergents".

The second and third series of Lewes' work are of the greatest interest for this part of the dissertation. In the second series, **The Physical Basis of Life**, Lewes is concerned to situate biology in its relation to other sciences. Biology occurs after mathematics, astronomy, physics and chemistry. Lewes is here following Comte's classification of the sciences. Each science adds a new method to the preceding. Mathematics begins with abstraction, deduction and definition; to which astronomy adds observation, physics adds experiment, while chemistry adds nomenclature. It is followed in the hierarchy of sciences by biology:

> Biology adds classification, and for the first time brings into prominence the important notion of conditions of existence, and the variation of phenomena under varying conditions: so that the relation of the organism to its medium is one never to be left out of sight. In Biology also clearly emerges for the first time what I regard as the true notion of causality, namely, the procession of causes - the combination of factors in the product, and not an ab extra determination of the product.[77]

Biology is divided by subject matter into phytology, zoology and anthropology, and each may be dealt with statically by morphology or dynamically by physiology. Biology is followed in the series of sciences by Sociology. Consistent with the monism dominant in English evolutionary circles, Lewes considers the

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legitimate hypothesis. What he terms "natural selection" is not only a vera causa, but one proved to be capable of producing effects of the same kind with those which the hypothesis ascribes to it; the question of possibility is entirely one of degree." in J. S. Mill, **System of Logic**, Book III, Chapter XIV, footnote to #6, p. 328

[77] G. H. Lewes, **The Physical Basis of Mind**, p. 6

notion of a vital force or principle as unwarranted, just as one does not require a crystal force or principle to explain the growth of crystals. Yet he recognizes that life cannot be confounded with the organic compounds which produce it. Biology differs from physics and chemistry in that biology considers organisms as a whole in their relation to their environment, or milieu; while physics and chemistry study the parts of the organism in abstraction from the whole and its surroundings:

> The biologist will employ chemical and physical analysis as an essential part of his method; but he will always rectify what is artificial in this procedure, by subordinating the laws of Physics and Chemistry to the laws of Biology revealed in the synthetic observation of the organism as a whole.[78]

In the third series of **Problems of Life and Mind** Lewes addresses the problem of continuity and discontinuity in evolution, and it is here that he sees the question of qualitative novelty. Lewes develops his reply in a critique of Nageli.[79] Besides anthropomorphic language used in discussing inanimate objects, Lewes identifies two major mistakes in Nageli's argumentation: (1) the whole must have only those properties already present in the parts, and (2) what occurs earlier in the hierarchy of life must have those properties found later on. The first is the part/whole problem of emergence, the second, the problem of continuity and discontinuity in evolution.

The principle of the continuity of life and its properties is one already encountered in Darwin's theory. For Darwin, differences between lower and higher orders of life are of degree and not of kind, so that if a property (such as

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[78] ibid p. 19

[79] The article referred to is Nageli: "On the Limits of Natural Knowledge", Nature, Oct. 25, 1877

intelligence) is found at the summit of the hierarchy (as in man), then it must have its correlates, though less quantitatively developed, at the base. In the fully developed panpsychist form, this holds not only among the most primitive organisms, but at the level of the inorganic as well, with the result that consciousness to some degree or other is universal. Lewes argues against this notion, which he ridicules with some style as follows: "By this line of argument one might maintain that not only were there 'sermons in stones', but that these stones were conscious of their eloquence. Pebbles are philosophers of infinitesimal energy."[80]

But mere ridicule cannot suffice, and Lewes addresses the problem theoretically by setting up a distinction between the law of continuity, which is abstract and quantitative, and the law of discontinuity, which is concrete and qualitative. Thought is driven to quantitative continuity as an ideal construction, as a demand of abstract speculation. But this is not a real transcription of the world. "And why this reliance on the Law of Continuity? That law is simply a deduction from the conception of Quantity, abstracted from Quality by mathematical artifice: it is an abstract idea of Existence irrespective of all concrete Modes of Existence"[81] From this it follows that discontinuity and qualitative change are present at the level of concrete experience:

> If Continuity is a necessity of thought, not less imperiously is Discontinuity a necessity of experience, given in every qualitative difference... The manifold of sense is not to be gainsaid by a speculative resolution of all diversities into gradations. Experience knows sharply defined differences, which make gaps

[80] G. H. Lewes, **The Study of Psychology**, v.2, p. 31
[81] ibid, p. 32

between things. Speculation may imagine these gaps filled, some unbroken continuity of existence linking all things.[82]

Lewes' conception is similar to one which Bergson will also adopt: experience is qualitative, full of gaps; speculation is quantitative, and the gaps between things are filled in by a rationalizing intellect. Both continuity and discontinuity are countenanced, as are quantity and quality. Moreover, like Mill before him, Lewes states that complexes may have properties that none of their components have. This applies as much to water as a complex of hydrogen and oxygen as it does to life itself and the complex organic structures on which it depends:

> Next note the misconception that the properties of a compound can be assignable to any one of its components. We find humidity to be a property of a combination of oxygen and hydrogen gases, and only of this combination; but we do not find oxygen to be humid, nor hydrogen; we find no gas to be humid. In like manner, we find certain phenomena classed as vital and sentient to be manifestations of certain highly complex structures; we do not find them in structures differently configured, nor do we ever find them in any of the elements which compose these structures.[83]

Lewes had already formulated the emergent/resultant distinction, much earlier in his treatise, in the first series, **Problems of Life and Mind** volume two. Here the distinction is made in the context of the discussion of causation, Hume's theory in particular:

> Every resultant is either a sum or a difference of the cooperant forces; their sum, when their directions are the same - their difference, when their directions are contrary. Further, every resultant is clearly traceable in its components, because these are homogeneous and commensurable...It is otherwise with emergents,

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[82] ibid, pp. 32-33
[83] ibid, pp. 30-31. This formulation of the water example is quite similar to that of Mill quoted earlier.

> when, instead of adding measurable motion to measurable motion, or things of one kind to other individuals of their kind, there is a co-operation of things of unlike kinds.... The emergent is unlike its components in so far as these are incommensurable, and it cannot be reduced to their sum or their difference.[84]

With emergents, deduction does not suffice to determine the effect of known causes, and experience is required; once again, Lewes' examples are from chemistry. Now, it is curious that Lewes does not refer to the emergent/resultant distinction when he argues for the discontinuity of experience and qualitative change. Nor does he explicitly refer to evolution when he earlier discusses the emergent/resultant distinction. Moreover, all of this is separated from the analysis of evolution, which though recognized by Lewes, occupies an insignificant place in his work (no separate chapter or even subsection is devoted to it)[85].

Nonetheless, this distinction between emergent and resultant represents a major development in Lewes' thinking from his earlier writings, especially those influenced by Comte's positivism. Lewes had been a positivist and admirer of Comte. His **Biographical History of Philosophy** (1850) concludes ~~with~~ a chapter on Comte. Lewes develops a distinct, though positivist line of thought on life and mind in **Comte's Philosophy of the Sciences** (1853). There, in the chapter on the passage from the inorganic to the organic, he identifies three laws governing the

[84] G. H. Lewes, The Study of **Psychology**, v.2, p. 413. Emergents play a corresponding role in Lewes' system to that of heteropathic laws in Mill's theory.

[85] Lewes first discusses Darwinian evolution in **The Physical Basis of Mind**, v. 1, p. 45 "...the hypothesis of Evolution entirely rejects the notion of organic forms having been diversified in the few physical conditions commonly understood as representing the Medium. Mr. Darwin has the incomparable merit of having enlarged our conception of the conditions of existence so as to embrace all the factors which conduce to the result. In his luminous principle of the Struggle for Existence, and the Natural Selection which such a struggle determines, e have the key to most of the problems presented by the diversities of organisms; and the Law of Adaptation, rightly conceived, furnishes the key of all organic change."

evolution of life. The first two laws are called "static laws", the third, the "dynamic law". The first law states that oxygen, hydrogen, nitrogen and carbon unite to form more complex molecules than is the case with other types of atoms which enter into exclusively inorganic compounds. The second law claims that organic molecules are formed of "indefinite" proportions of component elements and that there is more in the whole as synthesis of elements than an analysis into parts reveals. The third, a law of form, states that organic compounds take on spherical shapes, as distinct from crystals and other inorganic compounds. Lewes formulates his three laws as follows, with inorganic matter referred to as anorganic, organic but not yet vital compounds as merorganic, and living matter as teleorganic:

> Law I. The elements which compose Organic substances are the same as those which compose Inorganic substances; but in the Organic they occur as higher multiples.[86]
> Law II. The presence of higher multiples is accompanied by an indefinite composition in lieu of a definite composition, and by a characteristic immediate synthesis of the elements.[87]
> Law III. Merorganic substances become teleorganic by the assumption of a Spherical Form.[88]

The first law, dealing with complexity, is the least controversial, the point being that carbon, oxygen, hydrogen and nitrogen form more complicated compounds together than do other combinations of atoms. It is now known that this is the result of the properties of the outer electron shell of carbon, which makes it especially apt to combine with other elements in complex structures.

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86 G. H. Lewes, **Comte's Philosophy of the Sciences** (1853), p. 145
87 ibid, p. 152
88 ibid, p. 157

The second law is at first sight simply wrong, at least from a present perspective. Organic compounds are made up of definite amounts of elements, not indefinite amounts. Present-day chemistry shows that differences in molecular properties depend not only on the nature and number of component atoms, but also on their arrangement in space (stereo-chemistry). It is more appropriate to consider the analytic/synthetic distinction as the key to the second law, than the dubious definite/indefinite distinction. In his discussion of this second law, Lewes states that analysis "can teach us little or nothing of organic substances formed of proximate principles."[89] Rather, it is the synthesis which is all important in bringing about molecular properties. Thus, the same components can be synthesized in different ways, even though analysis will yield identical elements. Lewes himself treats the question in this light when he terms the second law a law of synthesis rather than a law of analysis.

The third law is a law of form, and here Lewes argues that the only appropriate form for organic life is that of a sphere, suggested by the circular form of the cell under the microscope:

> Confining ourselves, as we have done hitherto, to the teachings of observation and induction, we have to ask this question: What is the Form which being universal may be supposed indispensable to organic life? Half the prosperity of philosophy lies in being able to put a definite question. Interrogate Nature, and she will answer. She answers in this case emphatically - a cell. The cell, or sphere, is not only the typical Form of an organic being, that with which every organic being, from the lowest to the highest, commences - it is the indispensable condition of the being's existence.[90]

[89] ibid, p. 148
[90] ibid, p. 155

From cell through the association of cells to the formation of tissues, the starting point of life is "the assumption of cellular or spherical form".The sphere is the highest form, and here is used to explain the appearance of life, the capacity of reproduction, where previously, in non-spherical, non-cellular molecules, there was none. The transition from inorganic to organic to living is thus made without any intervention of a non-material vital principle, but is strictly one of complexity, synthesis and form. Lewes abandons this earlier theory in going over to the emergent/resultant distinction, though elements are common, particular in the assertion that synthesis surpasses analysis.

One last element of Lewes' mature theory remains to be dealt with: his analysis of psychology as a science, and the role of the social in the development of the psychological. The first volume of the third series of **Problems of Life and Mind** contains Lewes' exposition of psychology. This science had not been recognized as a separate science in Comte's classification of the sciences some 40 years earlier. Lewes, however, accords it a special place. He chides Comte for contemptuously and erroneously rejecting the introspective method and with it psychology as a science, and he criticizes J. S. Mill for the opposite error of attaching so much importance to introspection that he cuts it from its basis in biology. Lewes argues not only for the autonomy of psychology, but also recognizes its basis in both biology and sociology. This is evident from the definition he gives: "Psychology is the analysis and classification of the sentient functions and faculties, revealed to observation and induction, completed by the reduction of them to their conditions of existence, biological and sociological."[91]

[91] G. H. Lewes, **The Study of Psychology**, vol. 1, p. 6

Animal psychology concerns itself solely with the relation of the organism and its external, physical medium, but human psychology must add as well the social medium. "In relation to Nature, man is animal; in relation to Culture, he is social."[92] Lewes is aware that this approach is novel. It was a great step forward for science to recognize the physiological basis of mind. But psychology is still one sided so long as it does not take the further step of recognizing the social factor in the constitution and development of mind. And here lies his difference with Spencer, who also recognizes social influences on mental phenomena, but does not elevate the social to the rank of a key factor in the evolution of mind.

Lewes makes a sharp distinction between human and animal. In humans, language, a social product and phenomenum, permits abstraction and thought. It is impossible to form the idea of the animal mind, if such exists, because of the inability of animals to communicate in words with humans. Lewes makes a distinction between function and faculty in his discussion of the difference between humans and animals. A function corresponds to a certain structure: the hand as an organic structure has as one of its functions to grasp; but in addition, it has the ability to sew. Sewing is a faculty, a learned adaptation of an innate function to a specific end. "That is to say, let function stand for the native endowment of the organ, and faculty for its acquired variation of activity."[93] This explains the difference between man and animals, especially the primates: the two have the same functions for the various organs, but differ in the faculties they have developed on that basis. It is language as a social product of a special kind

[92] ibid, vol. 1, p. 71
[93] ibid, vol. 1, p. 27

which has enabled humans to synthesize their experience and go beyond mere functions to faculties.

It should be noted that Lewes explicitly excludes the possibility of animal societies in the same sense as the human; "so-called" animal societies - be it the colonies of bees or groups of apes, are mere "aggregations of individuals", lacking the defining characteristics of a true society.

> In the so-called animal societies, there is apparently nothing beyond an aggregation of individuals, with some form of division of employments; there is no subordination nor coordination - only cooperation; no powers invested in individuals and classes; no command and obedience; no relinquishment of personal claims; above all, they have developed nothing like the Family as the social unit, and Tradition as the social experience.[94]

Human societies evolve, they have a history characterized by progress based on the development of functions into faculties: "Thus, while the laws of the sentient functions must be studied in Physiology, the laws of the sentient faculties, especially the moral and intellectual faculties, must be studied in History"[95]. Finally, just as the individual mind evolves, so does the "general mind", considered as the "culture of the age". As a consequence of his radical break between animals and humans, Lewes criticizes Darwin for attributing greater possibilities of mental development or evolution in animals than can be attained by them. Mind (rather than the rudiments of mind) must be limited to humans, who alone possess social organization and language.

[94] ibid, vol. 1, p. 143
[95] ibid, vol. 1, p. 154

Lewes has developed a number of themes to be met later in emergent evolution: (1) the combination of continuity and discontinuity, and of quantity and quality in the evolutionary process (2) the emergent as having properties not possessed, even implicitly, by its components; (3) the inability of deduction, and the necessity for experience, to determine the nature of emergents; (4) the hierarchy of sciences, with higher ones based on lower ones but going beyond them; (5) psychology as a science in its own right, though based on both biology and sociology.

Lloyd Morgan is candid in his admission of the influence of Mill and Lewes on his theory of emergent evolution:

> The concept of emergence was dealt with (to go no further back) by J. S. Mill in his **Logic** (Bk. III, ch. vi, #2) under the discussion of "heteropathic laws" in causation. The word "emergent," as contrasted with "resultant," was suggested by G. H. Lewes in his **Problems of Life and Mind** (Vol. II, Prob V, ch iii, p. 412). Both adduce examples from chemistry and from physiology; both deal with properties; both distinguish those properties (a) which are additive and subtractive only, and predictable, from those (b) which are new and unpredictable; both insist on the claim that the latter no less than the former fall under the rubric of universal causation.[96]

However, Lloyd Morgan's above statement, though correct, is only partially so. He does not mention the differences between Mill and Lewes which the foregoing analysis has revealed, nor does he mention three other influences on

[96] Lloyd Morgan, **Emergent Evolution**, pp. 2-3. See also Lloyd Morgan's article "Consciousness and the Unconscious" (1921), delivered as the the presidential address to the newly created psychology section of the **British Association for the Advancement of Science**. There, Lloyd Morgan publicly states his indebtedness to Mill and Lewes for the concept and terminology of emergence.

his own work which are just as important, and which the following sub-sections analyze: Henri Bergson, W. T. Marvin and E. G. Spaulding.

(iii) Creative Evolution: Henri Bergson

It was Henri Bergson, in his **Creative Evolution** (1907) who introduced the notion of creativity into the evolutionary process. He did this in the context of metaphysical dualism. Here was a new theory of evolution, and one upon which Lloyd Morgan commented in his writings of 1913-1915, Bergson's book having become available in English translation and with English adherents as of 1911.

Whereas previous general philosophies of evolution had been monistic (Spencer, Haeckel, and Lloyd Morgan's 1885 work), Bergson, like Wallace, operated in a dualistic framework. Wallace, however, had appealed to a philosophically dubious "spirit world", and this had diminished his credibility. Bergson, in his earlier works, **Time and Free Will**[97] (1889, translated into English in 1910) and **Matter and Memory** (1896. translated into English in 1911) situated himself in the tradition of Descartes. However, he wanted to avoid the problems inherent in the latter's treatment of the mind/matter relation. He was well aware of the difficulty of explaining how non-extended, thinking mind interacts with extended, non-thinking matter. Rather than postulating a physical site of interaction (Descartes' theory of the pineal gland), Bergson proceeded through the analysis of the relation between memory and perception. Perception is a function

[97] published in French as **Essai sur les donnés immédiates de la conscience**. The authorized English translation by F. L. Pogson retains the original title only as a subtitle, so that the full English title of the book is **Time and Free Will: An Essay on the Immediate Data of Consciousness**.

of the brain, or matter; memory, or more accurately, recollection, a faculty of mind. In **Matter and Memory**, Bergson argues that all real perceptions occur over time, extending from a past into a present; memory must be called in to bind together this duration of perception, and it is here that Bergson finds the essence of mind/matter interaction:

> For after having successively studied pure perception and pure memory, we still have to bring them together. If pure recollection is already spirit, and if pure perception is still matter, we ought to be able, by placing ourselves at their meeting place, to throw some light on the reciprocal action of spirit and matter. 'Pure' that is to say instantaneous, perception is, in fact, only a ideal, an extreme. Every perception fills a certain depth of duration, prolongs the past into the present, and thereby partakes of memory. So that if we take perception in its concrete form, as a synthesis of pure memory and pure perception, that is to say of mind and matter, we compress within its limits the problem of the union of soul and body.[98]

Concrete perception is, metaphorically speaking, Bergson's pineal gland. But his view of mind/brain dualism is not one where there is a one-to-one correspondence between mental acts and brain processes, with the attendant equivalence of complexity between the two. Mind, though linked to the brain, transcends the latter in a sense inimical to theories of parallelism between mental and cerebral states. Fond of metaphors, Bergson at one point compares the mind to a knife, and the brain to its edge, and elsewhere states that the mind is to brain as a picture is to its frame. According to Bergson, the brain is concerned only with the translation of thoughts into action; it is concerned only with space, which for Bergson is inferior and subordinate to time; it is this latter alone which is the domain of mind.[99]

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[98] Henri Bergson, **Matter and Memory**, p. 325

[99] Bergson develops on this idea in "Le paralogisme psycho-physiologique" (1904). He returns to the problem of time and space in one of his last book length writings, **Duration and Simultaneity**

> Speaking generally, the psychical state seems to be, in most cases, immensely wider than the cerebral state. I mean that the brain state indicates only a very small part of the mental state, that part which is capable of translating itself into movements of locomotion.[100]

Related to these distinctions between mind and matter, time and space is that between quality and quantity. Quality is seen as a characteristic of mental events in time, quantity as a characteristic of material things in space. Since interaction between matter and mind is permitted, quantity in space can cause or bring about qualities in the mind; in such a case, quality it is called intensity:

> Examining the first of these ideas [that of intensity], we found that psychic phenomena were in themselves pure quality or qualitative multiplicity, and that, on the other hand, their cause situated in space was quantity. Insofar as this quality becomes the sign of the quantity and we suspect the presence of the latter behind the former, we call it intensity. You will find that it arises from a compromise between pure quality, which is the state of consciousness, and pure quantity, which is necessarily space.[101]

In **Creative Evolution**, Bergson examines neo-Darwinian gradualism, mutationism or saltationism of the de Vries type, T. H. Eimer's orthogenesis, Lamarckian use-inheritance and Spencer's transformation of the homogeneous into the heterogeneous, as possible modes of evolution. But he finds none able to properly explain the phenomena of the development of complex organisms, convergent evolution through which identical organs develop in distinct phylogenies, and the dynamic production of qualitative novelty. No natural

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(1921), where he attempts to show that his views of time and space are consonant with Einstein's theories of relativity.

100 Henri Bergson, **Matter and Memory**, p. xvii

101 Henri Bergson, **Time and Free Will**, pp. 224-225

process can produce these phenomena; only a non-material "élan vital" responsible for life can do so:

> So we come back, by a somewhat roundabout way, to the idea we started from, that an original impetus [élan vital] of life, passing from one generation of germs to the following generation of germs through the developed organisms which bridge the interval between the generations. This impetus, sustained right along the lines of evolution among which it gets divided, is the fundamental cause of variations, at least of those that are regularly passed on, that accumulate and create new species.[102]

The vital spirit confronts matter as its opposite; its freedom is limited by the fact that it must act through matter which represents determinism and necessity. The creativity, freedom or indeterminism of evolution manifests itself in the novelty introduced into organic life, including the splitting of evolution into vegetative, animal and human life, this last being qualitatively higher than the others because of the presence of self-reflective consciousness.

Bergson situates his creative evolution as an alternative to mechanism and teleology, though his main criticism is directed at the former. Mechanism has a limited validity, and is applicable to "systems that our thought artificially detaches from the whole"[103]. But once attention is turned to the whole, to time and more importantly, to duration, Bergson argues that mechanism cannot capture the fluidity and the uniqueness of life and mind.

Just as he criticizes mechanism in his analysis of physical processes, Bergson sharply limits the role of the intellect, considered as a faculty of mind.

[102] Henri Bergson, **Creative Evolution**, p. 87
[103] ibid, p. 36

Intellect is seen as a faculty of analysis of wholes into parts, and the synthesis of wholes from parts. Now, such a faculty of analysis and synthesis is clearly justified, even necessary; but for Bergson it does not suffice to capture the meaning of life, mind and evolution, though it does suffice to comprehend the nature of matter. Instinct, in the form that it is found in humans - intuition, captures the essence of life, mind and evolution through an act of sympathy and self-reflection which intellect cannot achieve.

> Instinct is sympathy. If this sympathy could extend its object and also reflect upon itself, it would give us the key to vital operations - just as intelligence, developed and disciplined, guides us into matter....But it is to the very inwardness of life that intuition leads us - by intuition I mean instinct that has become disinterested, self-conscious, capable of reflecting upon its object and of enlarging it indefinitely.[104]

What comes out of Bergson's volume, independently of the concepts of vital impetus and instinct-intuition, is a commitment to creativity and novelty in the evolutionary process: "Every human work in which there is invention, every voluntary act in which there is freedom, every movement of an organism that manifests spontaneity, brings something new into the world."[105] There is a dualism between creativity and novelty, with creativity as the basic category within the spiritual realm and novelty as its phenomenal result within the world of matter.

Thus, the key concepts in Bergson are (1) mind-body dualism, based on the notion of time and duration (2) vital impetus as the source of life and evolution, (3)

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[104] Henri Bergson,**Creative Evolution**, p. 176. A little earlier in the book, Bergson makes the following (italicized) comment: "The intellect is characterized by a natural inability to comprehend life" (p. 165)
[105] ibid, p. 239

evolution as essentially creative and productive of novelty in the phenomenal world, (4) creative evolution as neither mechanical nor teleological, (5) intellect as a means of understanding matter, instinct as the means of adaptation of life to its surroundings, and intuition (developed from instinct) as a faculty of self-reflective mind. It is especially the third point, creative evolution productive of novelty which is of interest to Lloyd Morgan.

Though well received by some in England, as evidenced by its translation into English in 1911, the volume met with opposition especially from the traditional Darwinian or neo-Darwinian evolutionists. A striking example is Hugh Elliot's **Modern Science and the Illusions of Professor Bergson** (1912), with a preface by Ray Lankester. This book is a protest against the introduction of what is considered as illegitimate metaphysics into science. Lankester, the editor of T. H. Huxley's scientific memoirs, provides an introduction where he rejects Bergson's system in toto. Such, however, would not be the opinion of another pupil of Huxley, Lloyd Morgan, who would accept parts of Bergson's theory, and reject others in a critical analysis much more even-handed than an outright rejection. As will be discussed in section three of this chapter, Lloyd Morgan rejects Bergson's theories of instinct as opposed to intelligence., his mind/body dualism, and the concept of vital impetus as life force. In so doing, he remains within the rationalistic, monistic and naturalistic bounds of the dominant English evolutionist philosophy. The significant Bergsonian influence on Lloyd Morgan is that of evolution creative of novelty.

The influence of Bergson on Lloyd Morgan, however, should not be exaggerated. The view of Rudolf Metz in his **A Hundred Years of British**

Philosophy (1938) involves an oversimplification when he situates emergence as just an English form or variant of Bergson's creative evolution. Metz says of the idea of emergence:

> In substance, this idea is, of course, not new. What is new is the philosophical range which Alexander and Morgan have given it....But it was through Bergson's idea of creative evolution that the doctrine of novelty becomes widely known and made its way into England, where by a similar reaction against the mechanistic evolution theory, Alexander and Morgan became its most influential champions. Emergent evolution is a new, important and specifically British variation of Bergson's creative evolution.[106]

A number of considerations are left out of Metz' otherwise interesting analysis: firstly, the points of Bergson's theory which Lloyd Morgan specifically rejects, secondly, the modifications which Lloyd Morgan makes to those points which he accepts, and thirdly, the other influences on Lloyd Morgan (Mill, Lewes, Spaulding and Marvin).

(iv) Novel Properties of Wholes: E. G. Spaulding

A further influence on Lloyd Morgan's thought in the crucial period of the beginning of the 1910s was the work of the American **New Realists**, E. G. Spaulding and W. T. Marvin.[107] Lloyd Morgan, in his **Spencer Lecture** of 1913, refers in footnotes to articles and books by them

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106 Rudolf Metz (1938), **A Hundred Years of British Philosophy**, p. 656

107 Spaulding and Marvin are not alone among writers in the United States interested in the problem of novelty. William James in his posthumously published work, **Some Problems of Philosophy: A Beginning of an Introduction to Philosophy** (1911) devotes no less than half the book to this problem, with chapters such as IX: The Problem of Novelty, X-XI: Novelty and the Infinite, XII-XIII Novelty and Causation

Spaulding, in his article, "A Defense of Analysis", notes that he is protesting against the indictment of analysis contained in the work of two authors - Bergson in **Creative Evolution** and **Time and Free Will**, and Bradley in **Appearance and Reality**. He does not, however, go into the details of his critique of Bergson or Bradley. Rather, he presents his own position on analysis. What is of interest here is the view that not only is analysis legitimate as an intellectual activity, but that things, when analyzed, may in some cases be shown to have properties that none of their parts possess:

> Given a whole which, for one reason or another, is known to be analyzable, then analysis reveals parts, but it also reveals the relations which relate and so organize these parts into some kind of a whole. Consider also those properties which, in some cases, the whole, as a whole, may have different from those of the parts. Of course, analysis reveals these also.[108]

The analysis may be incomplete, in the sense that the parts may themselves be, in some cases, analyzed into further parts, but as far as it goes, the analysis does give an adequate or valid decomposition of the whole into "the parts and their properties and the relations relating the parts and the possibly specific properties of the whole".[109] This is one of the key claims of emergentism, insofar as the part/whole relation is concerned: the claim that certain wholes have properties which none of their parts possess. Note that this is an article written in 1911, in part in reaction to Bergson's denial, or limitation, of the adequacy of analysis. Note too that Spaulding clearly distinguishes between properties and relations, following in this the new logic of Russell and Whitehead.

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108 Spaulding, E. G. "A Defense of Analysis", p. 161
109 ibid p. 161

Spaulding distinguishes between various types of wholes. The first kind is the aggregate or collection, where the basic relation uniting the parts is that of conjunction. Analysis involves an enumeration of the elements, or parts. Such a whole may consist of disparate parts, such as a heap of different things. The second type of whole consists of similar individuals, so that the whole can be "... designated by so-called universals, by generic and abstract terms, terms with an extension and an intension".[110] The third type of whole is "that whole, namely, which, being itself a class, is analyzed into subordinate classes".[111] The fourth type of whole is the "organic whole", by which Spaulding refers to chemical compounds and living organisms.

The example of water is discussed at some length. Water has both chemical and physical properties, and so do its components, hydrogen and oxygen. Some of the properties differ only quantitatively, such as specific gravity, boiling point and so on. But at least some differ qualitatively as well, though here Spaulding is not explicit in giving illustrations, but rather contents himself with a general statement:

> If the whole be experimentally synthesized out of the parts, then something new appears as properties of the whole, something which is new qualitatively as well as quantitatively. On the other hand, if an experimental analysis be made of the whole, then the whole is also found to have properties which the parts do not have. These properties are put 'in relief' by the analysis; they are a residuum, characteristic of the whole as a whole, and revealed by analysis which at the same time reveals the parts or elements, and through its ramifications, the organizing relations.[112]

110 ibid, p. 170
111 ibid, p. 230
112 ibid, pp. 237-238

At this point, Spaulding refers to the the work of the chemist W. Nernst in his work **Theoretical Chemistry from the Standpoint of Avogradro's Rule and Thermodynamics** (1895). Nernst makes the distinction between an additive property, where the value of a property of the molecule is the sum of the value of the properties of its component atoms, and constitutive properties, which are non-additive. Spaulding's formulation and quote from Nernst are as follows:

> This fact, that in the actual synthesis, artificial or natural and developmental, of existential wholes out of parts, new properties or values appear, is a matter of great importance. It is a fact, too, which is accepted by authoritative investigators. Says Professor Nernst, "A large number of physical properties have been shown to be clearly additive; that is, the value of the property in question can be calculated as thought he compound were such a mixture of its elements that they experience no change in their properties." Examples are the volume, refraction, magnetism, and heat of combustion of organic compounds. But other properties are not additive. "The kind of influence of the atom in a compound is primarily dependent upon the mode of its union, that is, upon the constitution and configuration of the compound. Such non-additive properties are called constitutive." Examples are the absorption of light, the rotatory power, the melting point.[113]

Note that two distinct questions are being discussed at the same time. Spaulding talks about the existence of qualitative as well as quantitative differences between a whole and its parts, while Nernst makes the related, but not identical point, about the existence of additive and non-additive properties between a compound and its elements. These latter do not require a new quality, and thus Nernst's distinction between additive and constitutive properties is weaker than Spaulding's postulation of new qualities in wholes.

[113] ibid, p. 238. The sentences in quotation marks are taken from Nernst, W, **Theoretical Chemistry from the Standpoint of Avogradro's Rule and Thermodynamics** .(1895), p. 365. Lloyd Morgan reproduces Nernst's words in the above quote in footnote 54 of his 1913 **Spencer Lecture, Spencer's Philosophy of Science**, p. 50

According to Nernst, when a property is additive, its value in a chemical compound can be calculated from those of the components as if the compound were a mixture. Otherwise, the property is constitutive, which is the more usual case in chemical combination. But in both cases, we are not, in Nernst's discussion, dealing with a new property of the molecule different from the properties of the constituent atoms. Rather, the numerical value of a property common to the molecule and its constituent atoms is such that the former is not a simple arithmetic sum of the latter. Spaulding is injecting an addition of his own in going from quantitatively non-additive properties, to qualitatively novel properties; and it this aspect which Lloyd Morgan picks up on, even while quoting the excerpt where Spaulding quotes from Nernst.

In making the distinction between additive and constitutive properties, Nernst is following the lead of the physical chemist Wilhelm Ostwald. This latter, in his **Outlines of General Chemistry** (1890), had in fact made a triple distinction, distinguishing among additive properties[114] such as mass, where the simple addition rule applies, colligative properties which do not change at all when components are combined to form compounds, such as the volume of gases[115] ,

[114] "From the fact that the mass of various substances is not changed in a chemical process, it is apparent that the mass of a chemical compound is the sum of the masses of its components. Such properties, which are independent of the state of chemical combination, and whose numerical value in compounds therefore appears as the sum of the values belonging to the different components, will in future be called additive. From the standpoint of such properties it has been concluded that chemical compounds actually contain their components as such, the order only being changed; the additive properties form therefore the foundation of the atomic theory", Wilhelm Ostwald, **Outlines of General Chemistry**, pp. 37-38.

[115] "Properties that always retain the same value for definite groups of substances, independent of the chemical nature and number of the atoms in these complexes, I have, at the suggestion of Professor Wundt, named colligative." (ibid, p. 58) Colligative properties are limited to gases and solutions, with other states of matter explicitly excluded (ibid, p 189) since the colligative property depends on large distances between the parts of the gas or liquid. Ostwald's reference to Wundt is of interest, since Wundt, in his theory of creative synthesis in psychological percepts was

and the constitutive properties, such as the boiling and melting points. The detour into the physical chemistry of Nernst and Ostwald is of interest, in order to indicate the cross-fertilization between chemistry and philosophy combined with innovative interpretations. Nernst and Ostwald develop a point of theoretical interest in chemistry, which Spaulding and Lloyd Morgan (with modifications) transform into elements for an emergentist philosophy of qualitative novelty.

Spaulding went on to develop his proto-emergentist ideas in his **The New Rationalism** (1918). His acceptance of whole/part emergence is clearly expressed as follows: "In the physical world (and elsewhere) it is an established empirical fact, that parts as non-additively organized form a whole which has characteristics that are qualitatively different from the characteristics of the parts."[116] He refers to this process whereby novel qualities appear in the evolutionary process as "creative synthesis".[117]

Spaulding admits a level structure of reality, and distinguishes between causal and functional relationships. Causal relationships hold within a level, while functional relations hold between higher and lower levels. Such related levels are said to be compatible with one another, but not reducible. Spaulding mentions among the irreducible but compatible levels of reality the physico-

concerned with qualitative novelty which makes him one of the precursors of emergent and holistic notions; I use his term "creative synthesis" to denote my theory of the production of novel theories.

[116] Spaulding, E. G., **The New Rationalism** (1918)., p. 447.

[117] I have used this term earlier to refer to the process of development of novel theories in science, at least insofar as Darwin's theory of evolution is concerned, and in this chapter, Lloyd Morgan's emergent evolution.

chemical, the biological and the ethical, though he does not develop on this structure in greater detail.

Spaulding includes a teleological notion in his theory and holds that evolution is heading towards the realization of the extra-natural ideals of justice, truth, goodness and beauty. The existence of such non-evolutionary ideals is the point where Spaulding explicitly parts company with naturalism, which he holds cannot fully account for the rationality of the cosmos. The existence of these extra-natural ideals is linked to his theological notion that God is the sum-total of these ideals. God is both transcendent and immanent: transcendent insofar as the ideals are outside nature, immanent insofar as the ideals direct evolution towards their realization.

(v) Logical Strata of Reality: Walter T. Marvin

The second of the American "New Realists" that Lloyd Morgan refers to in his 1913 **Spencer Lecture** is Walter T. Marvin. However, the reference is not to Marvin's contribution to the collective volume **New Realism**, but rather to another work of Marvin's published in 1912 entitled **A First Book in Metaphysics**. It is there that Marvin develops a theory of the level structure of reality, as well as arguing for a moderate form of creative evolution.

The book, as its title suggests, is intended as an introduction to philosophy, or as Marvin puts it "a student's first book". It is therefore surprising that Lloyd Morgan, who certainly could not be considered a debutant in philosophy, should refer to it. But the volume contains more than a résumé of philosophic doctrines of the past. The chapters that are of interest for the present purposes are those entitled "Temporalism and Evolution" (ch. 12) and "The Logical Strata of Reality" (ch. 13).

Marvin clearly aligns himself with Bergson on problem of time and creative evolution. He contrasts temporalism with eternalism; the former treats time as a fundamental aspect of reality, the latter does not. A second contrast is between theories which admit of the unique and novel in the course of temporal evolution, and those that do not; the former is termed causal pluralism, the latter causal monism. Marvin's views are of this latter type, along with the further consideration of the asymmetry of time and the place of novelty in evolution.

Marvin is concerned with the relationship among the concepts of past, present and future. He argues that time is asymmetrical, with a definite direction from past through present to future, excluding reversibility in the sense that movement from left to right in space may be reversed. Moreover, there is a distinction between the existential status of the present, on the one hand, and that of the past and future on the other. The future must be inferred, and to a lesser extent, so must the past (except perhaps the immediate past which is still fresh in memory); the present existent can "in part coincide with fact."[118] But there is this in common between past and present, which distinguishes the former from the future: the past was once a present, which is not the case (from the standpoint of the present) with the future. We can perceive the present, and perceived the past; but the future cannot be perceived. The past and present exist "as fact", the future

[118] Marvin, W. T., **A First Book in Metaphysics**,(1910) p. 131

does not, and so the asymmetry of past, present and future is not merely one of present contrasted with past and future, but also and more importantly one of past and present contrasted with future.

In his references for further study, Marvin recommends an article by Lovejoy[119] and follows this with two references to books by Bergson for "more extensive study": **Time and Free Will**, and **Creative Evolution**. The filiation of ideas is most clearly revealed when Marvin argues that history is not a mere repetition of the elements of the past, at most in new combinations, but involves novel events that cannot be so analyzed:

> New things, new events, and perhaps even new elementary constituents of these things and events are potentially in the present. This fundamental newness, and the resulting impossibility of knowing the future fully may be called freedom or spontaneity, or better, creative evolution. Rigorously defined, creative evolution is the truth that some particular existential propositions related to future instants are not so related to past instants and that these propositions are neither deducible from universals or from the past, nor knowable beforehand in any other way.[120]

Besides the existence of universal and causal laws there are particular individuals, which are more than mere instantiations of the universals under which each falls: "In short, the particular entity seems infinitely complex, baffling all attempts to put it completely under any assignable number of laws; and this means that each particular thing and event is itself a logical

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119 Lovejoy, A. O., "The Place of the Time Problem in Contemporary Philosophy" (1910), J. Phil. Psych. and Scientific Method, vol. 7

120 Marvin, W. T., **A First Book in Metaphysics**, p. 135. This definition of "creative evolution" is more epistemological than ontological, though Marvin argues that ontological creativity, freedom or spontaneity is the only hypothesis that would explain our epistemological limitations. "That is, the at present unknowable part of the world is assumed by us to be an evolving existent because only this general assumption explains the facts we do know." (ibid).

ultimate."[121] Causal laws cannot be a complete explanation of a particular thing, and Marvin says that this means that besides causality, there is chance which is present, "....chance meaning any event which cannot be deduced from general propositions or laws."[122] In conclusion, he states that there is thus a "two-fold causal system, on the one hand a system of universal causal laws and on the other hand a world of ultimate individuals or particular complex entities."[123] Science aims at discovering the general laws, but is limited by the potentially infinite number of them, and the ultimate uniqueness of the individuals which must also be taken into account.

Science reveals a structure of reality which Marvin describes as that of "logical strata". There is a tension between the mind's desire for the continuity of these logical strata, and the discontinuities introduced by the spontaneity of the evolving existent. It is therefore an idealization to analyze reality into logical strata, but one which science, in its ideal of causal monism, is justified in making, so long as it does not forget the limitations of this aim imposed by the individuals which make up the world. Marvin identifies the following levels of reality: the mathematical and logical which form the basic and the most general level, followed by the physical, chemical, biological, and the mental, including the human and social, which are the latest and least extensive:

> To sum up: the picture of reality just outlined is logically built up of strata. The logical and mathematical are fundamental and universal. The physical comes next and though less extensive is still practically, if not quite, universal. Next comes the biological, extensive but vastly less extensive than the chemical.

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121 ibid, p. 122
122 ibid, p. 124
123 ibid, p. 125. Marvin expresses this also in the following terms "Thus each existential entity seems both a creature of causal law and a center of spontaneous, or creative evolution" (p. 149)

Finally, comes the mental and especially the human and the social, far less extensive.[124]

Marvin makes a number of qualifications about the level structure of reality and its implications for science: (1) it is "..the ideal of science to reduce every problem that can be so reduced to a mathematical problem"[125]; however, this ideal of expressing all levels in terms of the basic and most general is not fully realizable; (2) it is an important metaphysical question as to how far "...there a one-to-one correspondence between the terms of the higher stratum and the terms of the stratum immediately below"[126]. It is a working hypothesis of science that this is so, but an open problem whether it has always been so and whether it must necessarily be so; (3) "each of these logical strata can itself be analyzed into substrata"[127], and so the listing given above, while considered sufficient, may not be definitive; (4) the student of a higher level must be familiar with the lower levels, upon which the higher one depends, but the lower levels are independent of the higher ones.

Lloyd Morgan now had before him four essential components out of which his "creative synthesis" of emergent evolution would arise: (1) the evolutionary theories of Darwin, Spencer, Huxley and Romanes; (2) Bergson's notion of creative evolution production of qualitative novelty. (3) the notions of heteropathic law and emergent properties of Mill and Lewes; and (4) the concept of levels of reality developed by Marvin, and Spaulding's notion of the whole/part relationship. As has been seen in chapter one, it is an essential ingredient or

124 ibid, pp. 143-44
125 ibid, p. 142
126 ibid, p. 143
127 ibid, p. 143

innovation of creative synthesis in theory production to select and reject theses of previous theories, transform them and then integrate the selected elements in a harmonious and new theory. This was the task that Lloyd Morgan accomplished in the period from 1912 to 1915.

(3) Lloyd Morgan's System of Emergent Evolution

This section will deal with three aspects of Lloyd Morgan's emergent evolution: (i) the process of creative synthesis in the period 1912-15 that resulted in its formulation; (ii) the development of the system in Lloyd Morgan's writings of the 1920s and 1930s, and (iii) some problems in the relation between Lloyd Morgan's earlier neutral monist views and his later philosophy of emergent evolution.

(i) Lloyd Morgan's Creative Synthesis.

It was in the 1912 volume **Instinct and Experience**, the 1913 lecture "Spencer's Philosophy of Evolution", and the 1915 article "Mind and Body in their Relations to Each Other and to External Things" that Lloyd Morgan first formulated the theory of emergent evolution. It was then fully expressed in the Gifford Lectures, **Emergent Evolution** (1922) and **Life, Mind and Spirit** (1926), as well as the volume **The Emergence of Novelty** (1933), Lloyd Morgan's last book.

Instinct and Experience is based, in part, on a discussion on "Instinct and Intelligence", at a joint meeting of the **Aristotilean Society, British Psychological Society** and the **Mind Association** held in London in July, 1910. Articles were contributed to this discussion by Charles S. Myers, C. H. Wildon Carr, and Lloyd Morgan. Carr defended a Bergsonian point of view, and explicitly so: "The theory of the nature of instinct and its relation to intelligence that I propose to put forward in this paper is one that I owe to a study of the philosophy of Bergson".[128] In his own article to that symposium, Lloyd Morgan criticized the views of both Myers and Carr on intelligence and its relation to intuition. In **Instinct and Experience** published two years later, Lloyd Morgan returned to the problem debated in 1910, but now explicitly in the context of a critique of Bergson. Bergson's **Creative Evolution** was translated into English by Mitchell in 1911. Lloyd Morgan's reading of it was likely influenced by Carr's presentation of the theory some two years earlier.

Though critical of Bergson's views on intuition, intellect and instinct, Lloyd Morgan is much more open as concerns the argument for a creative element in evolution and the resultant novelty in the world. He examines at length the problem of repetition and creativity in the evolutionary process, and concludes that there are two factors present: "(1) some measure of substantial but never complete repetition, and (2) some measure of the new and unique."[129] He concludes tentatively, leaving open the possibility that the new may simply be an algebraic (not arithmetic) function of its components:

> Here again, however, we are faced with the same difficulty of interpretation. Is the apparently new and unique a veritable "creative" departure from routine? Or is the algebraical sum of characters given in previous routines and therefore predictable if we know the amounts of these characters and the mode of their summation? I see, at present, no ground for denying, though I am not prepared to assert, that really

[128] H. Wildon Carr, "III. Instinct and Intelligence"(1910), p. 230. Wildon Carr also wrote a book on Bergson, and was also a translator and proponent of Leibnitz' system.
[129] Lloyd Morgan, **Instinct and Experience** (1912), p. 171

> new synthetic combinations, as contrasted with quasi-mechanical mixtures of old characters, do occur in the natural history of experience. But since as matters now are, we have not the data for proof of either their presence or absence, let us be content to grant that they may occur.[130]

The key shift occurs in the 1913 article "Spencer's Philosophy of Evolution", which Lloyd Morgan delivered as the **Spencer Lecture** for that year. All the basic elements for the development of the core concept of emergent evolution are present in this text which therefore is taken to be the crucial text in the process of creative synthesis leading to the theory of emergent evolution. The major influences, as identified in the previous section, are those of Bergson, Marvin and Spaulding, Mill and Lewes.

Lloyd Morgan's **Spencer Lecture** is, not surprisingly, devoted to an exposition and evaluation of Spencer's philosophy of evolution. It has been shown in a previous section how Lloyd Morgan's own philosophy of evolution in the **Monist** series of articles was influenced by Spencer's concept of differentiation and integration. While the article devotes its first dozen pages to Spencer, the impact of Bergson is present from page 13 on.In particular, Lloyd Morgan does not accept Bergson's criticism that Spencer has chopped up the concept of evolution and reduced it to mechanical action. For Lloyd Morgan, the Spencerian Unknowable, similar to his own Source, is the metaphysical cause of evolution, distinct from and conditioning it. This leads Lloyd Morgan to consider the problem of causation once again. He distinguishes three sorts of causation: causation as source, ground and condition. Source is "a transcendent cause which produces the phenomena under consideration", ground is "the nature or

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130 ibid, p. 173

constitution of that within which some process occurs", while condition refers to "some external influence" which sets off or catalyzes an action or event. He concludes: "We thus eliminate the word cause altogether"[131], noting that in most cases the notion of condition is what is meant by cause in everyday speech, and the term can be used colloquially in that sense.

Now the transition occurs to the discussion of relatedness. Lloyd Morgan notes that for Spencer all acts of knowledge involve the formation of a relation in consciousness corresponding to the objective relation in the environment. But Lloyd Morgan finds that this project has not been carried out by Spencer in any detail, and to the extent that it has, Spencer has reduced the different kinds of relatedness to the mechanical type. In Spencer's own terms, evolution produces the successive phases of the inorganic, organic and superorganic. Lloyd Morgan's criticism is that he does not sufficiently explain the qualitative diversity of these domains, or as he now formulates it, the different types of relatedness involved:

> But what one asks, and asks of him in vain, is just how, within a connected scheme, the several relational fields in the domain of nature are themselves related, and how they were themselves differentiated. How, for instance, did the specific relationships in the fabric of crystals arise out of the primitive fire-mist relations? At some stage of evolution this specific form of relatedness came into being, whereas before that stage was reached it was not in being.[132]

Lloyd Morgan does not accept the argument that the properties of the crystal were latent or potential in that which preceded it. This seems to be getting

131 Lloyd Morgan, Spencer's Philosophy of Science (1913), p. 24
132 ibid, p. 27

around the problem by pushing it back, rather than by solving it. Lloyd Morgan proceeds to his first clear formulation of his triple-level theory of nature: There are three main types of relatedness to be explained, each symbolized by a letter: A for relations of the physico-chemical type, B for relations of the organic type, and C, for those of the cognitive type. There is evolution from one type to the next and within each type. Speaking of the evolution within the physico-chemical type, he says: "Now the successive products, in which this physico-chemical type of relatedness obtains, have certain and new and distinctive properties which are not merely the algebraic sum of the properties of the component things prior to synthesis."[133] The reference is to Spaulding's interpretation of Nernst's distinction between constitutive and additive properties, as discussed in the previous section. The background of this shift to talk of novelty in the evolutionary process is Bergson's theory of creative evolution, with, however, a significant reservation. For Lloyd Morgan, qualitative novelty in the evolutionary process is a scientific problem to be solved within a monistic philosophic framework; he does not accept the terminology of "creative evolution" insofar as this rests on a dualistic metaphysics. Nevertheless, creativity may be considered in the theological domain of "source". Novelty is a term appropriate to talk of phenomena, creativity to talk of their Source:

> Revert now to the empirical outcome of scientific research, for as such I regard it, that new constitutive properties emerge when new modes and types of relatedness occur, and when new products are successively formed in evolutionary synthesis. This, it will be said, involves the acceptance of what is now commonly called creative evolution. I am far from denying that, in the universe of discourse where Source is under consideration, the adjective is justifiable. But, in the universe of discourse of science, I regard it as inappropriate. What we have is just plain

133 ibid, p. 28

evolution; and we must simply accept the truth - if, as I conceive, it be a truth - that in all true evolution there is more in conclusion that is given in the premises..."[134]

Overlaid on this is Spaulding's development of Nernst's distinction between the constitutive and the additive properties of a compound, to which is added Mill's theory of heteropathic laws. as reformulated as the distinction between emergent and resultant properties by Lewes. The constitutive/additive terminology is dropped in favor of the emergent/resultant one. Finally, Lloyd Morgan considers the logical relationships among the various stages (A, B and C, the physico-chemical, biological and mental, respectively), and notes that it is an implicative one, asymmetrical and in the downward direction:

> There are certain modes of relatedness which belong to the cognitive type. It would seem that whenever these obtain they may be correlated with other modes of relatedness which are of the vital or physiological type; and that these, in turn, may be correlated with those that are physico-chemical. Thus C implies B, and B implies A. The order cannot be reversed. Physico-chemical relations as a class, do not imply those that are physiological. The implication is not symmetrical.[135]

Thus Lloyd Morgan establishes his new system of what he will soon call emergent evolution. Two further influences, however, must still be mentioned. The first is the notion of relatedness and relations. Lloyd Morgan has accepted the relation as just as real as the relata. The reference here is to Alexander, in particular his article "On Relations: and in particular the Cognitive Relation"[136]. Secondly, the notion of a logical hierarchy of stages, where each higher stage is

[134] ibid, pp. 29-30. In **Emergent Evolution**, Lloyd Morgan says: "Such emergence of the new is now widely accepted where life and mind are concerned. It is a doctrine untiringly advocated by Professor Bergson. Wundt pressed its acceptance under his "principle of creative resultants"..." (pp. 3-4)
[135] ibid, p.31
[136] in **Mind** v. 21, p. 318 ff.

"grounded in the constitution of the organism" upon which new forms of relation supervene, is footnoted to Marvin's discussion of the strata or levels of reality in **A First Book of Metaphysics**. Lloyd Morgan states in his footnote: "For just as higher types of relatedness imply a substratum of physico-chemical processes, so do all events imply the underlying logic of events. Cf. W. T. Marvin, **A First Book of Metaphysics**, ch. xiii, 'On the Logical Strata of Reality.'"[137]

It is now possible to see, clearly expressed in this seminal essay of Lloyd Morgan's, the main elements of his emergent evolution (not yet entitled as such, but soon to be): These include the Spencerian view of evolution through three domains: the inorganic, the organic and the superorganic; Bergson's notion of creative evolution, stripped of its dualism; Spaulding on the whole/part relation; Marvin on the logical strata of reality; Mill on composition of causes and heteropathic laws, Lewes on the emergent / resultant terminology, and Alexander on the concept of relatedness and relations. These constitute the elements for the creative synthesis leading to the philosophy of emergent evolution.

Returning to the model of creative synthesis sketched in chapter one, the following elements were identified: the general background, the immediate influences, the critical analysis, and the formal structure, innovative element and evidence class leading to the creative synthesis and the development of a new theory. The general background for Lloyd Morgan is the 19th century philosophy of evolution associated with Spencer, the immediate influences, those of Bergson,

[137]Lloyd Morgan, **Spencer's Philosophy of Science**, p. 51-52, footnote 72

Spaulding, Marvin, Mill, Lewes as well as Alexander[138]. These are subjected to a critical analysis, necessary in part to come up with an overall monistic theory. Spencer was a monist, Bergson clearly a dualist. Their philosophies are as such inconsistent. Lloyd Morgan overcomes this inconsistency by associating Bergson's creative element with Spencer's Unknowable, and his own Source. Vitalism is rejected as unnecessary and untenable within science. Nor is the interpretation of science and evolution in terms of the creative source vitalistic, since the source is not a metaphysical principle or agency, but rather God as revealed in religion.

The formal structure is given by the A, B, C notation and the asymmetrical, implicative logical relationships among them. The innovative element is to place this concept of emergent levels at the heart of a theory of evolution. This had not been done before, even if Lewes had all the elements almost a half century earlier, as did, to a lesser extent, Le Conte. The evidence class is science itself and in its entirety: for the adequacy of the philosophy depends on its ability to make sense of the relations among physics and chemistry, physiology, and psychology. However, it should be noted that Lloyd Morgan usually limits his examples to ones drawn from comparative biology and psychology, his main fields of expertise. This all leads to the creative synthesis which results in the philosophy of emergent evolution. The fleshing out of the theory will be discussed in the following section, and its impact and the debates provoked by it in the section after that.

138 Like Wallace with respect to Darwin, Alexander reinforces Lloyd Morgan by adopting his theory and expounding it (with some differences to be analyzed in section four of this chapter). The influence of Alexander on Lloyd Morgan in the formulation of emergent evolution, however, is not as great as those of Mill, Lewes, Bergson, Marvin and Spaulding.

(ii) Development of Lloyd Morgan's System

Lloyd Morgan developed his system of emergent evolution primarily in the two volumes of his Gifford Lectures, delivered in 1922-23, **Emergent Evolution** (1922) and **Life, Spirit and Mind** (1926), as well as in the last of his books, **Emergence of Novelty** (1933). As well, he produced a large number of articles defending his system, published in the **Monist**, **Journal of Philosophy**, **Philosophical Studies**, and other reviews. The analysis in this section will largely be based on the book length presentations of his theory. The basic concepts have already appeared in the **Spencer Lecture**, leaving room for a certain elaboration and development in detail. The following are the key theses of the developed system, divided into three groups (1) theses concerning emergence and evolution; (2) theses concerning the level structure of reality; (3) theses concerning the nature of mind:

(I) Theses concerning emergence and evolution: Lloyd Morgan adopts Lewes' terminology of emergents and resultants, and specifies the following specific theses with respect to the relation between the two types of occurrences:

(a) Occurrence of resultants and emergents: Resultants may occur without any accompanying emergents, but all emergents occur in the context of at least some resultant effects: "There may often be resultants without emergence; but there are no emergents that do not that do not involve resultant effects also."[139]

[139] Lloyd Morgan, **Emergent Evolution**, p. 5

(b) Quantitative and qualitative continuity: Resultants form the basis for emergents, and serve as an underlying quantitative continuity; emergents are not saltationist breaks but qualitative changes in direction:

> Resultants give quantitative continuity which underlies new constitutive steps in emergence. And the emergent step, thought it may seem more or less saltatory, is best regarded as a qualitative change of direction, or critical turning point, in the course of events. In that sense there is not the discontinuous break of a gap or hiatus. It may be said, then, that through resultants there is continuity in progress; through emergence there is progress in continuity.[140]

(c) Involution and dependance: This involution (involvement)/ dependance distinction is discussed in **Emergent Evolution** as follows: "I speak of events at any given level in the pyramid of emergent evolution as "involving" concurrent events at lower levels...But when some new kind of relatedness is supervenient (say at the level of life), the way in which the physical events which are involved run their course is different in virtue of its presence - different from what it would have been if life had been absent... I shall say that this new manner in which lower events happen - this touch of novelty in evolutionary advance - depends on the new kind of relatedness..."[141]

(d) Unpredictability of emergents: It is not possible to predict the character of events emergent at a higher level in advance of any experience of them. "What, it is claimed, one cannot predict, then, is the emergent expression of some new kind of relatedness among pre-existent events."[142].

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[140] ibid, p. 5
[141] ibid, pp. 15-16
[142] ibid, p. 6

(e) The Nature and Types of Evolution: Evolution may be considered in its scientific or in its philosophical sense. In its scientific sense, it is the "outspringing of something that has hitherto not been in being"[143], and involves essentially the emergence of novelty. "Emergent Evolution" is for Lloyd Morgan a scientific concept, a description of fact. In the philosophical sense, evolution is "the unfolding of that which is enfolded; the rendering explicit of of that which is hitherto implicit"[144]. In this sense, evolution involves the Activity which is its source, and it is this activity which unfolds itself and renders itself explicit.

(f) Evolution and Devolution: Although evolution most commonly proceeds from lower to higher, characterized by new emergent levels, it may also bring about degeneration or loss of properties and qualities:

> Is it then claimed that in this varied world there is always evolutionary advance from lower and less complex entities - each an integral system of events, to those which are higher and more complex on the same path of advance? By no means. There is also the reverse process of dissolution with degradation of higher entities to lower. Take the atomic series. The evolutionary path of advance is, let us say, from the atom of hydrogen to that of uranium. Under dissolution the path of degradation is from uranium downwards. Both processes - ascending and descending - are abundantly illustrated in all provinces within the domain of nature. To emphasize the one does not entail denial of the other.[145]

(g) Mechanism and Vitalism: Emergence provides an intermediary position between the extreme positions of mechanism and vitalism. Mechanism accepts only resultant effects, and denies the existence of emergent ones. Vitalism

143 ibid, p. 112
144 ibid, p. 111
145 Lloyd Morgan, **Life, Mind and Spirit** (1926), p. 3. **This is also briefly alluded to in Emergent Evolution**, p. 13

posits an extra-natural or alien influence which brings about the new qualities. Both are dispensed with by emergence, which accepts the emergence of some new qualities and levels within a naturalistic scheme of science.

(h) Natural piety and acknowledgement: The fact of emergence is irreducible and cannot be further explained. It must be accepted as such. This natural piety in philosophy of science is based on the acknowledgement of God in religion, with God the source, in metaphysical/theological terms, of the universe and its processes:

> Under naturalistic treatment, however, the emergence, in all its ascending grades, is loyally accepted, on the evidence, with natural piety. That it cannot be mechanically interpreted in terms of resultants only, is just that for which it is our aim to contend with reiterated emphasis But that it can only be explained by invoking some chemical force, some vital élan, some entelechy, in some sense extra-natural, appears to us to be questionable metaphysics It may be that we have just to accept the newly given facts - all the facts as we find them - in the frankly agnostic attitude proper to science. Or it may be that in the acknowledgement of God an ultimate philosophical explanation, supplementary to scientific interpretation, is to be found That will be the position I shall try to maintain.[146]

2. Emergent Levels of Reality: There are three emergent levels of reality, the physico-chemical, the vital and the mental, symbolized as before by the A, B, C terminology. A higher level supervenes on a lower one which serves as its basis. Lloyd Morgan begins his **Emergent Evolution** with a discussion of Alexander's **Space, Time and Deity** (1915-16)[147]. According to Lloyd Morgan, Alexander had

[146] ibid, pp. 8-9

[147] Though Lloyd Morgan had, as has been shown in the preceding section, formulated his key ideas about emergent evolution in the period 1912-16, he did not publish his major work **Emergent Evolution** until 1922, based on his **Gifford Lectures** of the preceding year. Influenced by Lloyd Morgan, Samuel Alexander had presented his own emergentist system **Space, Time and Deity** as the Gifford Lectures for 1916-1917 Thus, Lloyd Morgan, the originator of the theory, found himself commenting on the previously published system of Alexander in his own first systematic

argued for a level structure of reality characterized by five levels: (1) space-time as the basic or ultimate level, from which emerges (2) matter, with its primary and secondary properties, (3) life as exemplified in organisms, (4) mind, along with tertiary properties, or values, that arise in the course of mental evolution, followed by (5) the emergence of deity.[148] Lloyd Morgan presents Alexander's analysis in diagrammatic form as follows[149]:

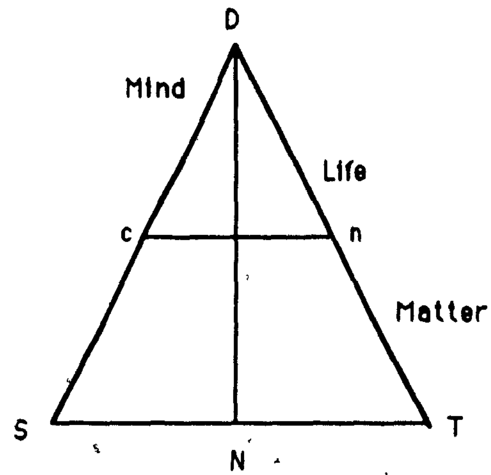

Diagram 4: Lloyd Morgan's Representation of Alexander's System

(a) The Space-time Axis: The ST axis represents the space-time continuum, considered as the basic level, while D represents deity, the highest level. Though Lloyd Morgan accepts the spatial-temporal as the "stuff" out of which entities, considered as "substance" are made, he does not consider space-time as a level

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statement of the philosophy. The relation between Lloyd Morgan and Alexander was a cooperative one, Alexander recognizing Lloyd Morgan's priority in the formulation of emergent evolution.

148 I will return to the adequacy of this analysis of Alexander in the next chapter. Alexander plays a role with respect to Lloyd Morgan similar to that of Wallace with respect to Darwin: Alexander's work is a reinforcing influence, and appearing in print in book length before Lloyd Morgan, a stimulus to Lloyd Morgan's publication of 1923 of his own presentation of the system.

149 Lloyd Morgan, **Emergent Evolution**, p. 11

with the same status as matter, life and mind. Moreover, he rejects Alexander's notion of time as the mind of space.

(i) Events and Entities: Lloyd Morgan accept "events" as basic to all entities, at whatever level they may be. This is developed in volume two of his **Gifford Lectures**, entitled **Life, Mind and Spirit**, as follows: The object of enquiry of science is that of events. These events "go together in orderly clusters.", and intrinsic clusters of events constitute things: "Any such cluster within which the relations of events are intrinsic constitutes a natural entity - for example, an atom, a crystal, an organism; and in virtue of the intrinsic relations of its constituent events any such entity exhibits certain distinguishable qualities."[150] These entities are themselves in relational fields, related extrinsically with other entities.

(ii) Stuff and Substance: Moreover, in any system, the component parts (as events) constitute the stuff of the entity, and once combined in a relation, form the substance of it by virtue of this relation. In any one entity, there may be many elements of stuff, but just one substance. :

> In any integral system there are certain events, or orderly groups of events, which constitute its stuff. But these items of stuff go together in certain specific ways; and this "gotogetherness", as I ventured inelegantly to call it, is its substance. In generalized form: Where a, b, and c go together, in specific integral fashion, so as to form the entity (abc), these several items constitute its stuff, and their going together, in such manner as they do go together, is its substance.[151]

[150] Lloyd Morgan, **Life, Mind and Spirit**, p. 2
[151] ibid, pp. 4-5

Stuff is characterized by "discreteness and multiplicity", while substance forms "individual unity". It is possible therefore to speak of the complexity of stuff, but only of the richness of substance as one ascends the evolutionary scale.

(b) Nisus towards deity: the ND arrow represents the "nisus towards deity" which is the driving force of evolutionary advance. This is accepted in Lloyd Morgan's own system along with the related "natural piety", and corresponds to what he called in earlier texts the ultimate source, or metaphysical source, i.e. God.

(c) Physico-psychical correlation: the c-n dotted line represents the correlation of the psychical and the physical, which is present in all entities, whether organisms or not. This point will be modified in volume two of Lloyd Morgan's **Gifford Lectures**, but is expressed in volume one as follows:

> ...I fully accept unrestricted and universal correlation as an acknowledgement - avowedly speculative, and admittedly beyond positive proof (or disproof), but essential to my constructive philosophy of evolution This means, for me, that there are no physical systems, of integral status, that are not also psychical systems; and no psychical systems that are not also physical systems. All systems of events are in their degree psycho-physical. Both attributes, inseparable in essence, are pervasive throughout the universe of natural entities [152]

(d) Matter, Life and Mind: Matter, Life and Mind are the three intermediate levels of Alexander's system, which are present in Lloyd Morgan's system as well. Indeed, these are the only three levels in his own system. Matter and Life are thought of primarily as physical, but by the principle of correlation, they have

152 Lloyd Morgan **Emergent Evolution**, p. 25

psychical correlates, and mind, which is thought of as primarily psychical, has a physical correlate:

> Hence our comprehensive scheme runs thus:
> C, Mind (with physical correlates)
> B, Life (with psychical correlates)
> A, Matter (with psychical correlates)[153]

(III) The nature and status of mind: The status of mind and its relation to the physiological and the physical is a complicated question in Lloyd Morgan's system, since he attempts to combine elements of his older philosophy of neutral monism with his newer theory of emergent evolution:

(a) Unrestricted concomitance of the physiological and the psychological: Whereas in volume one of his **Gifford Lectures**, Lloyd Morgan had argued for the correlation of the physical and the psychic, in volume two, he modifies his position. The correlation, now termed concomitance, is limited to the physiological and the psychological. Neutral monism can take a number of different forms: from panpsychism (all physical entities, even inanimate ones, have a psychic correlate), to biopsychism (only organisms, but all organisms, have psychic aspects), to zoopsychism (restricting the psychic to animals only).[154] The theory of concomitance as developed in the second volume of the **Gifford Lectures** postulates the correlation of only physiological states, and not all physical ones, with psychic states. It represents a retreat from pan-psychism to bio-psychism. Any individual organism (but not any non-living thing) can be

153 ibid, p. 27

154 As noted in chapter one, the terms are due to Ernst Haeckel. Zoopsychism can take an unrestricted or a restricted form, according to whether all animals, or only some (e.g. the higher primates) are considered as having psychological correlates.

viewed under two aspects, the psychological and the psychological, corresponding to its physical and the psychical aspects, which are jointly due to an underlying unity of which they are the aspects:

> On this understanding our hypothesis is that any given organism affords an instance of the fundamental duality in nature, spoken of by Spinoza as interpretable under two "attributes". The organism may be considered (1) in physiological regard in respect of its life; or (2) in psychological regard in respect of its mind. Concomitance emphasizes that which may be otherwise expressed: Never one attribute without the other. This does not preclude the belief that, underlying this two-fold expression in life and in mind, there is substantial unity common to both.[155]

Lloyd Morgan distinguishes between two positions, that of unrestricted concomitance, according to which all living things having mental aspects, or only those with nervous systems and brains. He introduces the terminological distinction between "bioses", denoting any physiological system, and "neuro-bioses", denoting only neural systems. Unrestricted concomitance has mental events accompanying all bioses, restricted concomitance limits them to accompanying neuro-bioses alone. Lloyd Morgan opts for the unrestricted position, because he finds it impossible to come up with a criterion to distinguish between bioses accompanied by or concomitant with mental events, and those not so accompanied. This is a position of bio-psychism: "I am therefore prepared (until evidence to the contrary is forthcoming) to accept as a working hypothesis unrestricted concomitance of all bioses in an ascending order of rank with mental events in a corresponding order of rank."[156]

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155 Lloyd Morgan, Life, Mind and Spirit p. 8
156 ibid, pp. 10-11

This position poses a certain problem internal to Lloyd Morgan's system. According to the thesis of unrestricted concomitance, even infusoria and amoeba, as living things, must have some psychic or mental life. Lloyd Morgan uses these two examples in his discussion of the question. The problem is how to reconcile this with the thesis of emergent evolution that new qualities, in particular the mental, appear in the course of evolution? At the level of unicellular organisms, the emergence is that of life, with its novel properties of metabolism, growth and reproduction. This Lloyd Morgan readily admits in the emergent evolutionary aspect of his philosophy. But he does not extend this emergence to mind, and explicitly so:

> Let it then be understood clearly that the hypothesis of unrestricted concomitance does not imply that occurrences in either attribute emerge from occurrences in the other. The hypothesis is that from the very beginning, so far as we can descry it, mind is concomitant with life.[157]

The contradiction between the emergentist and the dual aspect theories is evident, both to Lloyd Morgan and to many commentators of his work. The reason for this inconsistency, however, has been little analyzed. I will return to this problem in the section four of this chapter; suffice it to say at this point that the reason involves both historical considerations (Lloyd Morgan's early formation in Romanes' monism) and theoretical (Lloyd Morgan's world view of reconciling science, philosophy and religion). Irregardless of the reasons, however, this constitutes a major weakness of his system.

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157 ibid, p. 12

(b) The stages of mental evolution: Lloyd Morgan develops a number of concepts throughout the two volumes of his **Gifford Lectures** to describe mental evolution. Here, he is considering the "mental" in a restricted sense, presumably limited to humans and some animals. Of prime importance are the concepts of influence, reference and enjoyment. Influence involves any physical process impinging on the nervous system, such as the arrival of light rays at the eye. This sets up, or constitutes the occasion of an act of reference: the mind interprets the physical influence. The act of reference is instantaneous, and is divided into three sorts, reflective, cognitive and non-cognitive.

Reflective reference is the highest sort, characteristic of human minds: "Under reflective reference there is a mental rehearsal of events conjured up under intentional revival or recall."[158] Cognitive reference involves "mental revival in the form of imagery or of practical meaning for behavior".[159] This is characteristic of animal minds. In reflective reference, there is meaning for its own sake, while in cognitive reference, meaning is called up in expectation of behaviour. Finally, there is non-cognitive reference, characteristic of "the outset of sensory acquaintance with things and events"[160]; this is the basis for the other forms of reference, and presumably exists in all animal life.[161]

[158] ibid, p. 16
[159] ibid, p. 17
[160] ibid, p. 18
[161] A certain number of developments related to mental evolution are contained in Lloyd Morgan's subsequent books. In **the Emergence of Novelty** (1933), there are some terminological changes in his theory of mental evolution, though Lloyd Morgan continues to recognize three sub-levels of reference within that of mind: the reflective level, and the unreflective level, itself divided into the perceptive and the sentient. In reflective reference, there is both prospective reference, reference to some future occasion involving the subject of the thinking, and retrospective reference, reference to some past occasion involving the subject. Unreflective reference, however, is devoid of any prospective or retrospective reference, the self is "unreflectively immersed in the current

Finally, there is the concept of 'enjoyment', which is the mind's reflection on its own content, the meanings supplied in reflective reference. Enjoyment (the term due to Alexander) concerns itself with the self, i.e. the substance which does the 'enjoying': "The several items of constituent stuff are enjoyed; but enjoying is the substantial unity in someone, or in some mind, however lowly in status."[162]

(c) The relation between mind and brain: The above psychological/ philosophical discussion is typical of Lloyd Morgan's treatment of the question of mind and mental capacities. In only one occasion, and then briefly, did he consider mind in the psychological /physiological context. This was in his foreword to an English translation of Leonard Bianchi's **The Mechanism of the Brain and the Function of the Frontal Lobes** (1922). Lloyd Morgan begins by setting out a naturalistic interpretation of the course of evolution, through the material, vital and mental stages, highlighting the emergence of novelty at each level. He then distinguishes between involution (higher processes involve lower ones) and dependence (once the higher level has arisen, the lower level from which it arose now depends in certain ways on the higher one), with the example given that of vital (higher, biological) and energetic (lower, chemical) changes: "No vitality without changes of energy (involution); no such changes of energy without vitality (dependence)."[163] Applied to the mind/brain relation, this means that mental states involve brain states, and that brain states depend on mental ones.

situation", with "no self in the picture" (p.69). At the adult human level, mind involves both reflective and unreflective reference.

162 ibid, p. 25

163 C. Lloyd Morgan (1922). "Preface" to Bianchi, Leonard: **The Mechanism of the Brain and the Function of the Frontal Lobes**, p. 11

Bianchi, as the title of the book indicates, investigates the frontal lobes of the brain. His thesis is that intelligence depends on the proper functioning of that part of the brain. Lloyd Morgan notes the problem that the language centers, evident marks of higher mental development, are located in the post-frontal areas.[164] He explains this in terms of the involution/dependence relation. Language as a manifestation of the higher level of mind is considered as an emergent relative to speech, which is considered as a manifestation of the physiological and therefore lower level, so that "(1) speech depends on higher mental processes, and (2) language involves the appropriate functioning of post-frontal centers."[165]

(d) Three concepts of Mind: Lloyd Morgan explicitly recognizes that he uses three distinct concepts of mind: as God, which is the Activity underlying emergent evolution, as Mind, one of the levels in the hierarchical structure of reality, and as the psychical quality which is correlated with the physical (as expressed in earlier formulations) or is concomitant with the physiological (as explained in **Life, Spirit and Mind**). In the volume **Emergent Evolution**, this is expressed as follows:

> We have seen that the word 'mind' may be used in three senses: first, as Mind or Spirit in reference to some Activity, for us God; secondly as a quality emergent at a high level of evolutionary advance; and thirdly, as a psychical attribute that pervades all natural events in universal correlation. In what here follows I use the word in the second of these senses, i.e. as an emergent quality of correlates. I must

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164 The syntactic language center (Broca's area) is just at the posterior limit of the frontal lobe and the temporal lobe, the semantic language center (Wernicke's area) is located in the superior part of the temporal lobe. Presumably, Lloyd Morgan is referring to the latter in particular.

165 Lloyd Morgan, "Preface" to Bianchi, Leonard: **The Mechanism of the Brain and the Function of the Frontal Lobes** (1922) p. 14

here repeat that only in this sense is the word "emergent" in place or applicable; for Mind as directive of emergent evolution does not emerge; and mind as unrestricted and universal correlate is, in Spinoza's terminology, that "attribute" of the world from which the mind we are now to consider emerges at its level in the hierarchical order."[166]

Using the considerations of the preceding subsections, Lloyd Morgan's own position could be represented by the following modification of the diagram of Alexander:

1) A, B and C represent the three emergentlevels of matter, life and mind

2) Any organism from PT and above has concomitant psychical and physiological aspects

3) RD represents the activity of the Source which underlies Evolution

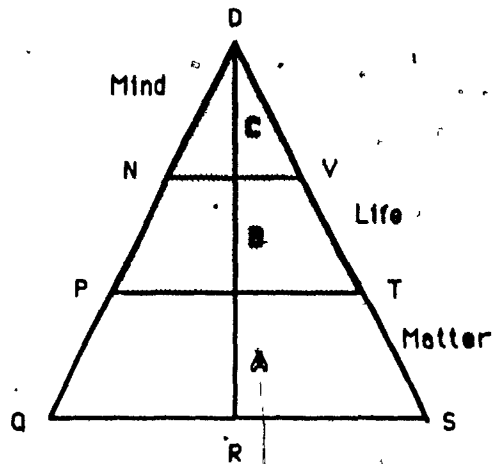

Diagram 5: Representation of Lloyd Morgan's Level Structure

(iii) Evaluation and Problems

The core of Lloyd Morgan's system are the theories of the relation between resultants and emergents, and the level structure of reality. He has argued for the position that resultants may occur without accompanying emergents, but that emergents always appear in the context of accompanying resultants, the resultants providing a quantitative continuity or basis for the appearance of

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166 Lloyd Morgan, **Emergent Evolution**, p. 37

emergents. Emergents do not break the underlying continuity, but represent rather a new qualitative direction of development. Emergence provides a reasonable alternative to both mechanism, which accepts only resultants, and vitalism, which sees new qualities as absolute breaks due to outside influences. Coupled with this is the thesis that the level structure of reality is constituted by the hierarchy of matter, life and mind. These theses are consistent, and moreover, quite powerful in their philosophical deployment. Lloyd Morgan has provided a solution to the problem of qualitative novelty raised by Wallace, without, however, having to call in non-material entities such as the spirit world (Wallace) or the élan vital (Bergson). He has combined the naturalism of the mechanistic position, with the recognition of life and mind as irreducible to the chemical and physical characteristic of the vitalists, without having to adopt the weaknesses of either: the reductionism of the mechanists and the dualism of the vitalists. This is certainly an achievement, and an important reason for the interest in his system that will be examined in the next chapters.

However, there are problems in Lloyd Morgan's presentation of the theory which will provoke criticism and debate in the period to come. In the first place, Lloyd Morgan has combined his new, emergent evolutionary point of view with the older neutral monist theory he had grown up with in the 19th century evolutionary tradition of Spencer, Huxley and Romanes. Mind is an emergent level after that of Life, but the mental is correlated with the physical at all levels (in book one of his **Gifford Lectures**), and concomitant with organisms at the biological level (in book two of the **Gifford Lectures**); the panpsychism of the earlier volume is replaced by a bio-psychism in the later. But many commentators will soon note that even this weaker theory of concomitance is not needed; it is redundant or worse, inconsistent with the emergent point of view. For once mind has been postulated as an emergent from life, it is difficult to argue that it is also concomitant with life. Either emergent evolution or neutral monism, but, so it seems, not both.

Yet Lloyd Morgan persists. Surely he must have seen the problem himself. And indeed he admits not only a double meaning of mind, but a triple one. The third aspect, Mind as God, is, I believe, the reason he does not drop the earlier double aspect theory of the mental and the physical. A reconstruction of his motivation for this pluralism on mind is as follows: science, via emergent evolution (and recall that for Lloyd Morgan, emergent evolution is scientific, not philosophical), postulates mind as emergent from life; philosophy (he is thinking of the neutral monism of his teachers) argues that mind is correlated with matter in a double aspect theory; and religion (as an interpretation going beyond science and philosophy) postulates a transcendent God who is the Source of all activity, including evolution itself. Lloyd Morgan wants to harmonize science, philosophy and religion: this is his world view. And in trying to do so, he grafts together three mutually inconsistent, though singly defensible, views. In other words, his world view blinds him to his own inconsistency; he is aware of the problem, but sees it as at worst as a necessary redundancy.

Secondly, there is the question of natural piety. Lloyd Morgan has explained qualitative novelty as the outcome of a process of emergent evolution; the question now is how to explain emergence itself. How does it come about that new levels are formed, and that stages or sub-levels appear within a given level? Lloyd Morgan has no explanation within science itself, nor for that matter, within his philosophy of science. Ultimately the answer is religious (or theological since it does not depend on any one religion): the concept of Activity as "nisus towards deity". This is unsatisfying except to those who share Lloyd Morgan's world view of the reconciliation of science, religion and philosophy. Once one adopts a different assumption, one which recognizes philosophy itself as explanatory vis-a-vis science, in the sense of providing the concepts for a foundation of science, Lloyd Morgan's solution is put into doubt.

A third problem involves Lloyd Morgan's analysis of mind. The terminology used is prolix: influence, reference and enjoyment, and within reference: the reflexive, perceptive and sentient stages. It is only rarely (in the preface to Bianchi's book) that Lloyd Morgan analyzes the physiological basis of mind; for the rest, he is content with a largely psychological and philosophical discussion. The lack of a solid physiological grounding for his theory of mind is a weakness of his system.

Fourthly, there is the problem of social evolution. This concept, clearly present in his discussions of evolution in the 1890s when he was still under the influence of Spencer, is absent from his work on emergent evolution.[167] The key here seems to be the influence of Alexander, who also neglects any consideration of the social level and social evolution in his system of emergent evolution. The disappearance of the social is a major step back in terms of the conceptual completeness of the system.

[167] There is a pamphlet Lloyd Morgan published on the problem of eugenics, titled **Eugenics and Environment** (1919)but this question is not considered in his philosophical system of emergent evolution.

In what follows, I will examine other commentators views in the context of their analysis of the above four points: (1) the adequacy of the core theory (the emergent/resultant distinction and the level structure of reality), (2) the problem of neutral monism combined with emergent evolution, (3) the problem of natural piety and the religious dimension of the system as the ultimate explanation, and (4) the status of the social as a possible level and the question of social evolution. Lloyd Morgan has established the core of a new philosophical trend, and the following sections will trace the highlights of its subsequent development.

(4) Other Early Emergentist Systems

This section will be devoted to three important contributions during the 1920s: those of Samuel Alexander, Roy Wood Sellars and C. D. Broad, whose presentations were the most elaborate and developed after that of Lloyd Morgan.

(i) Pyramid of Levels: Samuel Alexander

Samuel Alexander's concept of emergence is based on that of Lloyd Morgan: "I use the word 'emergent' after the example of Mr. Lloyd Morgan. It serves to mark the novelty which mind possesses, while mind still remains equivalent to a certain neural constellation."[168]. Alexander's major work, **Space, Time and Deity** (1920), uses the the mind/body relation as expressed in emergentist terms as a basic principle in order to set out a level structure of

168 Samuel Alexander, **Space, Time and Deity** (1920), vol. 2, p. 14

reality. Starting from space-time and culminating with deity, one level plays the role of "mind" to another level, which has the status of "body" in relation to it. This notion is peculiar to Alexander, and was not taken up by Lloyd Morgan or any other proponent of emergent evolution. Alexander's arguments for it are entirely metaphorical, though the rational core seems to be the idea that time, as in Bergson, but unlike Kant, is superior to space.

(a) Levels of Reality: From Space-Time to Deity

The basic level for Alexander is that of Space-Time. Space-Time is not only the stuff of which all things are constituted, but also the matrix or basis from which all the other levels emerge. This is one of a number of innovations he introduces in his theory of levels. The primordial place he assigns to space-time in his philosophical theories is a result of the significance attached to space-time in the theory of relativity.[169] However, Alexander, who notes his debt to Einstein in the preface to his work, does not formulate his theory to meet the physical requirements of either the special or the general theories; relativity forms the background and provides at most the impetus for including the level of space-time as the primary one.

Space-Time is able to generate things because of its primitive motions: "Empirical things come into existence, because Space-Time of its own nature breaks up into finites, the lowest such finites being simple motions of different

[169] The same comment applies to A. N. Whitehead's **Principles of Natural Knowledge** (1919) and his **The Concept of Nature** (1921).

velocities or intensities of motion..."[170] More specifically, it is Time which is the determining force and Space the condition:

> But in a special sense Time is the author of finitude, for it is the transition intrinsic to Time which in the first place makes motion possible, and secondly provides for the ceaseless rearrangements in Space through which groupings of motions are possible. Time could not do its work without Space; but this being presumed, Time is the principle of motion and change.[171]

From these primitive motions in Space-Time (under the lead of Time) develops the following levels: "Roughly speaking, the different levels of existence which are more obviously distinguishable are motions, matter as physical (or mechanical), matter with secondary qualities, life, mind".[172] The evolutionary process is driven by a "nisus towards deity", the source of evolutionary advance which must be accepted with "natural piety".

Development of higher levels results in an increase of complexity. This increase of complexity is an effect, however, and not the cause of the emergence of novelty and new levels. Complexity is not chaos, but rather coherence; all things, whatever their degree of complexity, are systems. Science studies the systems which make up nature:

> Organization is a great empirical fact. It begins lower down than organic life and is perpetually overcoming the repetitive tendency which is equally empirical. As we ascend the scale of being in the order of time, aggregates are replaced by organic systems; and the higher a thing is in the scale, the greater it seems in ordered complexity. But system in general exists in every complex even in the least

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170 Samuel Alexander, **Space, Time and Deity** vol. 2, p. 47. Motion is the highest of Alexander's categories, which mediate between space-time and the subsequent level structure of reality. This will be discussed in the following section.

171 ibid, vol. 2, pp. 47-48

172 ibid, vol. 2, p. 52

> organized, all disorder has its own complex plan. System is the coherence of elements, and the notion of system represents the essential continuity of Space-Time which it retains while it breaks up into its parts. The parts remain within the whole and are coherent with one another. Science investigates the particular forms of such coherence, and organisms are a highly-developed instance of it.[173]

The primary qualities of things include the empirical ones of size, shape, number and motion; while scientific concepts such as mass, inertia and energy are derivative from these. The secondary qualities are the usual ones of colour, taste and so forth. Alexander rejects the Lockean thesis that the secondary qualities, unlike the primary ones, are mind dependent. Rather, he states that both are mind independent. The primary and secondary qualities are levels following that of space-time, and occur before any consideration of the level of mind. Secondary qualities stand on their own, they do not need human minds to generate them. Mind does not create sense-data. "We are compelled to deny that either mind or the living sense organs give to secondary qualities their being, and to affirm that these reside in the material things themselves."[174]. The secondary qualities stand to the primary qualities as mind to body:

> Accordingly for me the sensible character of what we apprehend in the object, that is of the sensum, stands to movements in the thing, that is to the primary determinations which underlie it, in the relation of consciousness to its underlying vital process. The secondary quality is the mind or soul of its corresponding vibration or whatever the primary movement may be.[175]

Colour, taste and other secondary qualities exist in a thing, independently of our perceptual system. Alexander notes, however, that the secondary quality of redness, if that be the colour of the thing in question, is only potentially present in

173 ibid, vol. 1, p. 237.
174 ibid, vol. 2, p. 142
175 ibid, vol. 2, p. 59

the absence of light. Taken by itself, Alexander says, "the thing possesses the quality in the potential form"[176], and certain conditions are necessary to actualize it. These conditions are (a) the transmission of that quality to the body through some medium - e.g. light carrying the colour of a patch of red and (b) the appropriate functioning of a sense-organ, here the eye, to receive that quality. On these conditions, the mind then contemplates that quality. This qualification of his theory is an attempt to bring it more into line with a standard perceptual view of secondary qualities. However, it is difficult to reconcile the view of secondary qualities as the "mind" of the primary ones, and this view of secondary qualities as potentially present, to be actualized in the appropriate conditions provided by the presence of a medium and a receptor.

Alexander is undecided as to the level following matter with its primary and secondary qualities: it might be immediately that of life, or the level of chemism may precede it:

> I pass over as beyond my competence the question whether life is the next level of existence to matter, or whether chemical process is not an independent intermediate level between physical existence and vital: whether, that is to say, chemical matter is not so distinctively different in the way of complexity from mere physical matter that 'chemism' is properly a new quality emerging from physical existence.[177]

The next level is that of mind, the last of the "empirical qualities of finites", to emerge, based on the organic organization characteristic of brains. A mind as member of the level Mind is the "mind" of a body, which is part of the level of Life.

[176] ibid, vol. 2, p. 61
[177] ibid, vol. 2, p. 61

The highest level is that of deity, a level which is infinite, and serves as the "mind" of all the previous levels. Alexander says of Deity:

> Deity is the next higher empirical quality to the to the highest we know....There is a nisus in Space-Time which, as it has borne its creatures forward through matter and life to mind, will bear them forward to some higher level of existence....Deity is the next higher empirical quality to mind, which the universe is engaged in bringing to birth." [178]

The basic propositions of Alexander's system are the following: (1) reality is a level structure; (2) each higher level emerges from the lower with a resulting increase in complexity (3) this process of emergence is analogous to the mind/body relation for persons, with higher levels serving as "mind" to the lower levels serving as "bodies"; (4) there is nothing substantial added to get from one level to another, so in a sense, the higher level is "expressible completely without residue" in the lower.[179]

> Quality is something empirical which in every case but that of motion is seen to emerge from a level of existence lower than itself; and as to motion it is to be described indifferently as empirical or categorial, for it is the meeting place of the two. Each new type of existence when it emerges is expressible completely or without residue in terms of the lower stage, and therefore indirectly in terms of all lower stages; mind in terms of living process, life in terms of physico-chemical process, sense quality like colour in terms of matter with its movements, matter itself in terms of motion. Moreover, everywhere this result appears to be secured as it is in our own persons. There is a body or material of the lower level, of which one part is so complicated as to be endowed in fact with a new quality, which performs to it the office of soul or mind and may be called with proper caution its mind, body and mind being identical in this portion of the body in question.[180]

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178 ibid, vol. 2, pp. 345,346,347.

179 Ultimately, then, everything is really made up of Space-Time, i.e. all things, including mind, are made up of the same stuff - this is Alexander's monism.

180 Samuel Alexander, Space, Time and Deity, vol. 2, p. 68

The hierarchy of minds is that of time with respect to space, the secondary qualities with respect to the primary ones, life with respect to physico-chemical organization, and mind with respect to life. Finally, deity is the mind of all the preceding levels. Levels differ not in degree, but in kind. Further, each level once reached establishes its own sort of simplicity relative to the complexity of the preceding level. At a higher level, some properties of the lower level are lost: Alexander gives the examples of secondary qualities which have colour, but life is not coloured; matter has energy, but according to Alexander, life and mind cannot be so described. Only the categories, to be discussed in a moment, are carried up intact throughout the hierarchy. A graphical representation of Alexander's system gives the following:

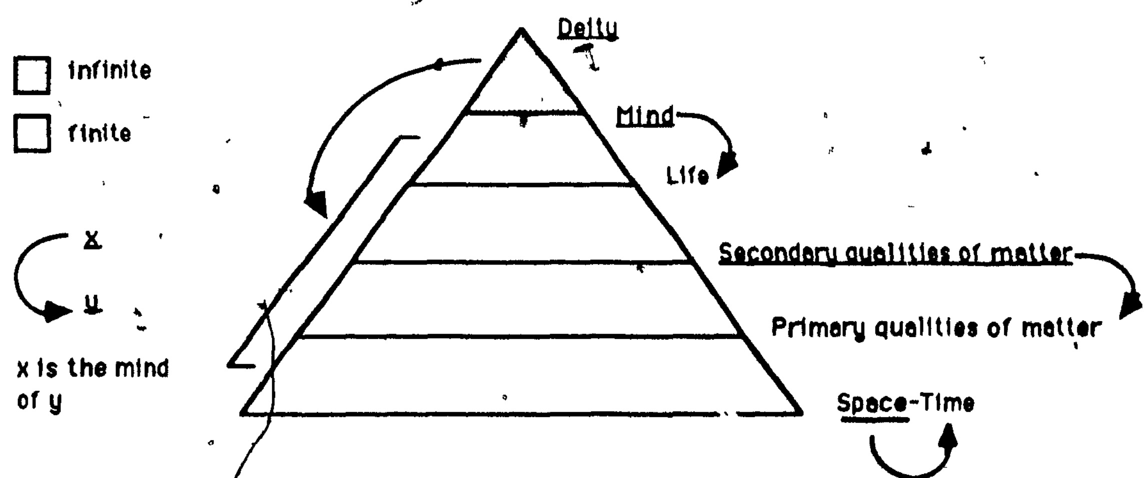

Diagram 6: Graphic of Alexander's Level Structure of Reality

Alexander argues for a monistic but non-materialist position.[181] He avoids a materialist position in two ways: firstly, matter itself is not primitive, but the

181 Alexander produced a number of articles on Spinoza, whose monistic position seems to have been a major influence on him.

outcome of intrinsic motions of the preceding level, that of space-time, and secondly, even within space-time, mind is present in at least a metaphorical sense, with time as mind initiating those motions which lead to matter:

> My motive in anticipating the discussion of empirical qualities by the hypothesis that Time performed towards Space the office of mind, was, that by suggesting that something corresponding to mind was present from the beginning at the lowest level of mere motion, I might remove the prejudice against any attempts to exhibit all forms of existence as a continuous series from Space-Time upwards through matter to mind.[182]

Alexander holds that materialism is identical with the eliminative form which denies any ontological status to mind. It is evident from his view on emergentism that Alexander would reject out of hand such an alternative. A weakness in his position is that he does not allow even potentially for an emergent materialist position, though this is logically possible and will be held by a number of other emergentist theorists (C.D. Broad for a time, Roy Wood Sellars, W. P. Montague, Mario Bunge). Alexander's critique of materialism is formulated as follows:

> As for materialism, that is a word of abuse, and perhaps no reputable philosophy has ever been pure materialism, except in the days of the great thinkers before Socrates, and they were not strictly materialists because the contrast of materialism and immaterialism had not yet dawned upon Western Europe: they had not yet discovered mind. If materialism means, as it is taken to mean, that there is nothing but matter and its forms, and that mind as something with a distinctive character of its own does not count in the system of things, which would be the same as it is without mind, it is neither naturalism nor a possible philosophy. For at least minds are not stones, and the world of physical matter has at any rate ended by producing minds. Materialism can only become reasonable by allowing an

[182] ibid, vol. 2, p. 50. The problem here is similar to that faced by Lloyd Morgan, who maintains his physical/mental dual aspect theory (in a restricted form, limited to the level of organisms) in order to avoid having mind as a level arise solely from matter.

element to exist in matter which has affinity with the latest outgrowth from matter which is mind. But then matter ceases to be sheer matter and acquires life.[183]

(b) Categories and Ontogeny

Alexander discusses his theory of the categories immediately after his discussion of space-time. The categories are the set of characteristics which persist throughout all the various levels of the emergent hierarchy. "The pervasive characters of existents are what are known from Kant's usage as the categories of experience, and I shall call them, in distinction from the empirical ones or qualities, categorial characters."[184]

The reference to Kant is mainly terminological, for Alexander points out that the categories are not pervasive because they are a necessary product of mind. In his system, the categories precede mind considered as a level of reality, and are independent of it. At most, Alexander is willing to admit that we know the categories on analogy to our knowledge of the characteristics of our own minds, and then impute them to the non-mental world. But this merely is a psychological explanation, based on a "mutual interplay of mind and things", it does not explain why just those categories such as substance, causality, and motion are introspected by mind.

[183] Samuel Alexander,"Naturalism and Value" (1928), p. 281
[184] Samuel Alexander, **Space, Time and Deity**, vol. 1, p. 185. Alexander also notes: "These categories then are the prerogative characters of things which run through all the rest as the warp on which the others are woven". (ibid, p. 186); "The categories being the fundamental determinations of Space-Time are the pervasive features of the experienced world" (1.2.330)

Since the basic level for Alexander is space-time, he considers the categories as the fundamental properties of space-time, and of time more specifically, since this is the leading aspect of space-time. "The categories are, as it were, begotten by Time on Space"[185]. They are not introduced from the outside on Space-Time, but are "features" or "determinations' of Space-Time itself. The system of categories which Alexander develops contains itself a hierarchy of levels, as follows (according to his division into chapters of book II):

1. Identity, diversity and existence: Space-Time is continuous and may be divided into regions or parts. Space-time is divisible because it is by definition complex, made up of the union of Space and Time. "For Time makes Space distinct and Space makes Time distinct" Through the categories of identity, diversity and existence, the possibility of individuating things in Space-Time is actualized. Alexander states that existence is identity of time and place.

2. Universal, particular and individual: The existence achieved through the first group of categories is further concretized through this second group. Alexander considers universality as the identity of kind, with the appropriate particulars falling under it. .Universal and particular, however, are one-sided, and find their real existence in Space-Time united as individuals.

3. Relation: Having reached the category of individuals, Alexander then introduces that of the relations between and among them. Relations and their relata are all spatio-temporal in nature: "Relations, then, are the spatio-temporal

[185] ibid, vol. 1, p. 189

connections of things, these things themselves being also in the end spatio-temporal complexes."[186]. Relations cannot exist without terms, nor can the terms exist in isolation.

4. Order: One sort of relation is singled out as basic to Space-Time, that of order. Order is based on "betweeness", which like continuity, is considered by Alexander as a basic feature of Time and Space.[187] "Betweeness" is not, however, a category, but rather defines the category of order.

5. Substance, causality and reciprocity: A substance is a thing qua complex of qualities existing in space and time, involving the notions of configuration and construction. Each substance has a general law of construction determining the overall relationship of its parts, and a particular configuration at a given moment of time. The identity of a substance is "individual identity as persisting through a duration of time." Qualities inhere in a substance, but do not themselves interpenetrate.

Note that "quality" is another basic concept not itself a category because it is merely "an empirical generalization of the various specific qualities of things, or a collective name for them all."[188] Quality is derivative of the complexity of motions in space-time. Nor is change a category, since it is not pervasive (there may be persistence without change), and always empirical (the transition from one empirical determination to another).

[186] ibid, vol. 1, p. 249
[187] Alexander refers to Russell's work on ordering relations at this point.
[188] ibid, vol. 1,p. 326

The continuity of motions within a substance and between one substance and another is causality. "The causal relation is the obverse side of the existence of a substance."[189] Alexander is Humean in his rejection of the notion of causality as power or necessity: "Stripped of these dangerous anthropomorphisms [force, necessity, power] the principle or law of causality that any event has a cause means nothing more nor less than the proposition that a motion is continuous with some precedent motion."[190] When one substance causally interacts with the other, the other may react in turn upon the first, leading to the category of reciprocity.

6. Quantity and intensity: Quantity, or extensive quantity, expresses itself in the fact that Space has length, area and volume, and that Time has duration. Alexander states that intensity, or intensive quantity, is manifested in the velocity of a simple motion.

7. Whole and parts, number: Since space-time is continuous and everything complex can be divided into parts, the parts may also be united to form a whole. Number "is the constitution of a whole in relation to its parts; and it is generated in the concurrent or correspondent distinction of parts in space and time within a spatio-temporal whole."[191]

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189 ibid, vol. 1, p.281. In other words: "Causation is thus a perfectly definite character of things; it is the continuity of existents within continuous Space-Time as subsisting between substances, which are themselves motions or groups of motions" (vol.1, p..284)

190 ibid, vol. 1, p. 292

191 ibid, vol. 1, p. 313

8. Motion: The last category is that of motion. Motion is not an emergent from space-time, but rather is held to be the highest category, involving every portion of space-time. The basic motions of space-time constitute the transition point to the level of matter in Alexander's level structure of reality. "Motion is thus the border-line between the categorial and the empirical region."[192]. Motion in Alexander's system leads on to the formation of the various qualities which make up the levels of his hierarchy of emergent levels. The eight ranks of categories themselves form a hierarchy of grades as follows:

1. The first grade is that of the major categories of existence, universality, relation and order, which form a grade because they "communicate with each other". The notion of "communication" may be translated in logical terms as follows: If a category A communicates with another category B, it is the case that B can be predicated of A. For example, since existence and universality communicate, universals have existence, and in some sense at least, existences are universals. Similarly, if A does not communicate with B, then B cannot be predicated of A.

2. The second grade is composed of the categories of substance, causality and reciprocity; quantity and intensity; wholes, parts, and number. These communicate with each other, and with the major group, but the major group does not communicate with them. For example, Alexander states that substance is in the relation of causality with other substances and exists, but existence is not a substance, nor is a relation necessarily causal.

[192]ibid, vol. 1, p. 322

3. The third grade is composed solely of motion, which presupposes the other grades, and communicates with them, though they do not communicate with it. This whole system may be represented as follows:

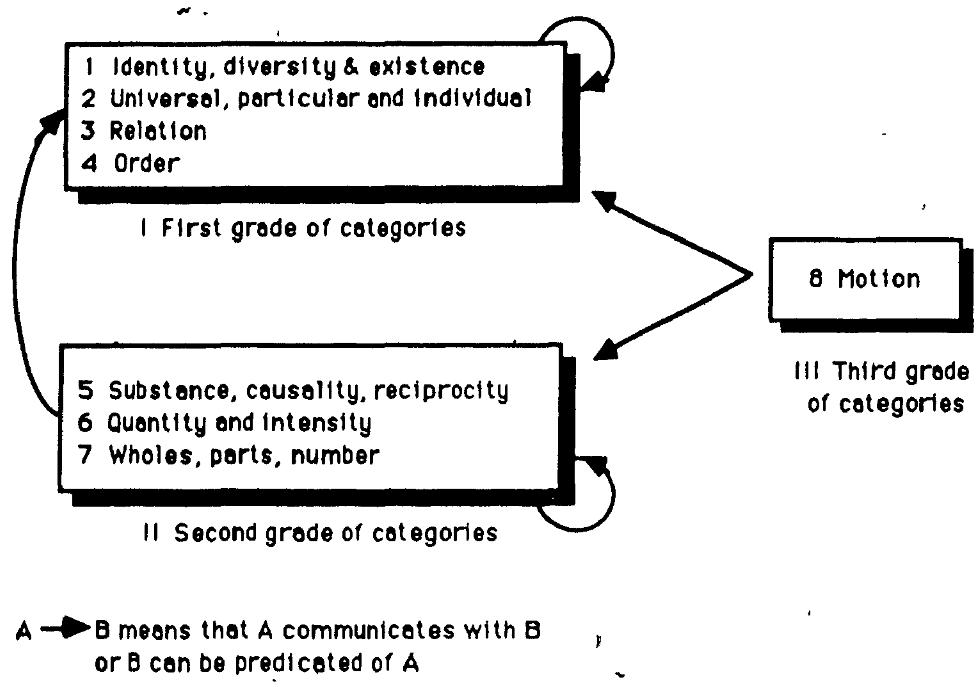

Diagram 7: Graphic of Alexander's Hierarchy of Categories

There are a number problems with Alexander's system of categories. In the first place, concepts such as continuity, quality and stuff are not included as categories, though causality, quantity, and substance are. In this respect, the system does not seem to be complete. Secondly, Alexander has committed himself to the view that categories are ontogenetic, rather than merely conceptual. Since the categories are supposed to ground the transition from pure Space-Time to the other levels of reality, it is not unreasonable to expect that the transition from one grade of categories to the next also have a mechanism. In particular, there should be a demonstration of how the first two grades of categories lead up to motion, the highest category, which serves to generate the qualities and things of the world. However, despite the level structure of the categories themselves, it does not seem to be the case that Alexander can derive the category of motion from the others. The system of "communication" which Alexander specifies is no more than a statement of certain possibilities and restrictions of predication. A more modest point of view on categories will be developed by Roy Wood Sellars who views the categories as conceptual conditions for a critical realistic epistemology.

(c) Axiology: Values as Tertiary Properties

Truth, along with goodness and beauty, are considered as tertiary qualities[193]. Unlike primary and secondary qualities, which are levels of reality, tertiary values do not constitute a distinct non-mental level. Nor are they entirely mental either, since all that exists for the mind are its cognitions and conations. Rather, tertiary qualities or values depend on both the object evaluated and mind that is evaluating:

> We have values or tertiary qualities in respect of the whole situation consisting of knower and known in their compresence. Strictly speaking it is the totality of knower and known, of subject and object, which is true or good or beautiful.... [Values or tertiary qualities] are subject-object determinations [194]

This joint determinations distinguishes the tertiary from the preceding primary and secondary qualities. Tertiary qualities are related to the traditional Platonic triad of truth, beauty and goodness. However, there is a distinction

[193] See also Alexander's article "Qualities" in the **Encyclopaedia Britannica**, 1929, v.10, pp. 810-813 for his discussion of this question.
[194] Samuel Alexander, **Space, Time and Deity**, vol. 1, p. 238

between truth on the one hand, and beauty and goodness on the other. The appreciation characteristic of truth is determined primarily by the object, while in beauty and goodness, the appreciation of the value is determined primarily by the subject. Appreciation arises from a community of minds, for otherwise there is no independent standard of truth, goodness or beauty. For example, "We only become aware that a proposition is false when we find it entertained by another and our own judgment disagrees with his"[195]. The notion of other selves, and of a community of minds is essential for the determination of values:

> Hence it is that these experiences of apprehending truth or error, goodness or evil, beauty or ugliness, are the culmination of the most potent variety of the experiences of cooperation and helpfulness, or conflict and dissidence, whereby we come to be aware of the existence of other minds or selves as well as our own, or to speak more accurately of ourselves as merely one unit in a group of selves. In judging our objects as true or false, right or wrong, beautiful or ugly, we attend to ourselves as like or different from other selves [196]

Value judgments essentially involve reference to this community of selves. Through cooperation and conflict among its constituent minds the community produces standards, and it is in virtue of these standards that we can determine truth, goodness and beauty. This is not arbitrary; for the judgments of the community establishing a standard must be coherent, and this limits the possibilities of value assignments.

The values of truth, goodness and beauty are not the only values: they are situated at a hierarchy of levels of value, beginning with instinctive values found even in social animals (called quasi-values) and continuing on to economic values

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[195] ibid, vol. 2, p. 239
[196] ibid, vol. 2, p. 240

in human societies, culminating in the highest values, truth, goodness and beauty. Economic values determine the worth or place of a good or service (Alexander is thinking here of exchange values). Economic valuation is instrumental, and based largely on individual psychology, while the highest values are based on social psychology. There, is however, an interaction between economic and social values, as when moral considerations correct economic inequalities.

In his theory of values, Alexander has proposed yet a third hierarchy of levels, complimenting the levels of reality and the grades of categories. His identification of values as tertiary qualities is hampered, however, by the problems associated with his theory of primary and secondary qualities as mind independent. This introduces an asymmetry between the primary and secondary qualities, on the one hand, and the tertiary qualities on the other. Yet the term "tertiary qualities" seems to suggest a greater communality than this.

Suitably modified, Alexander's theory of values as tertiary qualities could be of interest. Primary qualities would be the perception-independent characteristics of objects as conceived by the mind; secondary qualities would be the perceived characteristics of objects as they effect the sense organs; while tertiary qualities would be the evaluated qualities of objects as determined by socially organized minds.

(ii) Evolutionary Naturalism: R. W. Sellars

Whereas both Lloyd Morgan and Alexander were writing in Great Britain and set out their emergent systems in the course of the **Gifford Lectures** on natural theology, the third major system in this philosophical trend was developed in the United States in a quite different context. Roy Wood Sellars' work until the later 1910s was devoted to developing a naturalistic, realistic and humanistic philosophy, a theme which was to be a constant throughout his life. His interest in evolution appears most clearly with his volume **Evolutionary Naturalism** (1922), where he develops an embryonic emergentist viewpoint. An interest in the typical concerns of emergentism, particularly the problem of the level structure of reality, can be seen in his further works.

(a) Level Structure of Reality: Naturalism and Society

In his **Principles and Problems of Philosophy** (1926), Sellars makes explicit his emergentist point of view. Referring to the hypothesis that there is novelty in the world, he notes: "This thesis has been given various names of much the same import: creative evolution, emergent evolution, epigenetic evolution, originative evolution."[197] He then quotes from the introductory chapter of Lloyd Morgan's **Emergent Evolution** where Lloyd Morgan defines novelty as the essential characteristic of emergent evolution. In his **Principles and Problems of Philosophy** (1926), Sellars summarizes his own views as follows:

[197] Roy Wood Sellars, **Principles and Problems of Philosophy** (1926), p. 362

> The general plan of nature which presented itself to us with this perspective we likened to a pyramid of a tier-like construction. A process of creative evolution led at each stage to the advent of gradients or levels above. Each new level depended upon the energies and conditions of the lower level and was adjusted to its wide-spreading foundation.[198]

The general plan of nature which Sellars' sketches out is given by him in the following diagram[199]:

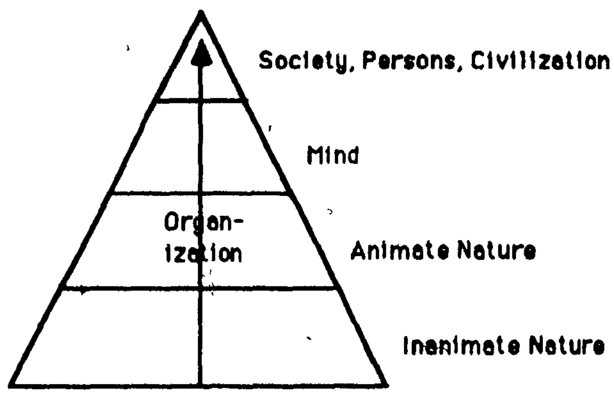

Diagram 8: Sellar's Representation of his Hierarchy of Levels

Note several differences with Alexander's system: (1) the level of "society, persons, civilization" is added, while those of space-time, and deity are dropped; (2) nisus towards deity is replaced by organization. In general Sellars holds that increase of complexity of organization is the driving force behind emergent evolution. He later says of emergence: "To me it meant simply the fact that novel organization involved novel properties. Such properties must not be considered to be stuck on externally and miraculously, but to be functions of the organization. It

198 ibid p. 362
199 ibid p. 345

was, after all, 'just the conviction that structure and function are internally related."[200]

Sellars holds that society is the highest level reached and to be reached in evolution.[201] "We are nearing the apex of evolution as we know it, for we are now to study that Leviathan or mortal god, of whom old Thomas Hobbes wrote, the society in which we live and move and have our being."[202] Sellars' argues that the group is strictly biological in origin. The difference between brutes and humans is the ability to communicate through language. Human society has been formed by a group of animals endowed with language:

> To conclude, a society, or group, is not a physical thing, but a new kind of organization depending upon, and expressive of, the capacity of the human organism. We may call this capacity the social nature and intelligence of the human organism... A society is, in other words, a complex of modes of behavior on the part of human beings due to the way these individuals have affected one another....Thus society is a mentally mediated and historically developed integration of human beings which finds expression in cooperative, or joint, behavior and in personality.[203]

Sellars states that society is not an organism (it is not reducible to the biological level), and that society does not have a mind. "Society is mental in that it depends upon minds and is an expression of minds, but it does not have a mind as a human body has a mind."[204] Sellars also notes that human consciousness is a

200 Roy Wood Sellars, "Analytic Approach to Mind-Body Problem" (1938) in **Essays**, p. 203
201 At the same time, W. M. Wheeler also suggested that the social should be included as the highest level of reality. This will be discussed in chapter 4 of the thesis.
202 Roy Wood Sellars, **Principles and Problems of Philosophy**, p. 343. The reference to Hobbes refers to an obvious play on words from the Biblical quote about "God in whom we live and move and have our being" which Berkeley so often quotes.
203 ibid p. 351
204 ibid pp. 350-351

socially conditioned consciousness, in the sense that its contents are conditioned by and reflect its social circumstances. He then notes: "The new level cannot so basically contradict the facts of the level which conditions it."[205] This is an unresolved tension in Sellars' system. Mind seems to presuppose the social, yet it is placed as a level preceding and not following it. This problem will be discussed in greater detail in the conclusion to the thesis, and an alternate ordering proposed, one in which the mental will follow the social.

In his 1926 book, Sellars formulates typical evolutionary emergentist positions: (a) higher level laws cannot be deduced from lower level ones, with the examples of chemical laws not deducible from mechanical ones, and biological laws not deducible from chemical ones; (b) such laws must be discovered, not inferred; leading to the conclusion (c) "the laws of nature form a hierarchy in which the different levels are discontinuous." [206] Note however, that nature itself, in its evolutionary advance is continuous:

> 'This logical, or deductive discontinuity, does not at all conflict with the genetic continuity of orders of things in nature. But it does mean that there are "junctures" in nature at which critical arrangements occur with the origination of novel properties. Genetic continuity is not smooth but mutative, as it were. What nature does we must accept. Knowledge is an affair of discovery. For this attitude, S. Alexander and Lloyd Morgan, two very able English thinkers, have an attractive phrase. We must, they say, accept these mutative junctures with "natural piety'. So much for the logical structure of the evolutionary view.[207]

Sellars' has adopted a completely naturalist point of view, explicitly excluding all supernatural phenomena. Moreover, it is the increasing complexity

[205] ibid, p. 359
[206] ibid, p. 364
[207] ibid, pp. 364-365

of organization which is the source of new levels, not a nisus towards deity as in the case of Alexander and Lloyd Morgan. Sellars agrees, however,that this emergence of novelty cannot be further analyzed and must be accepted with "natural piety". This contradicts to some extent his recognition of complexity of organization as the source of emergent advance.

In "Reformed Materialism and Intrinsic Endurance" (1944) Sellars argues against a linear view of evolution that pictures an initial creation followed by directed development in time. Sellars also rejects the notion of a running-down of the universe. He opts for an eternal universe with no direction, where life and mind emerge only locally and but rarely. This anti-teleological and anti-theological view is a further point of difference between Sellars' version of emergent evolution, and that of Alexander and Lloyd Morgan.

> Being a believer in the eternity of the universe and skeptical of linear and cyclical notions, I am naturally led to suppose that the universe has always been much as it is now, a variegated existential domain with a floor, much the same everywhere, above which rise here and there mountain peaks of emergent becoming followed in time by recession. The picture is that of a qualitative rising and subsiding in quite plural and local ways with a cosmic floor woven of particles in their dynamic relations. Biological existents and qualities occur but rarely; and it may well be that mental abilities and symbolic processes are seldom generated. To the traditional religionist this is not a congenial picture and he would like a celestial ceiling or another story. But the naturalistic humanist is ready to accept an austere ontology; austere even though this earth harbor no secret hostility to man. The human drama is local but not without its engrossing qualities of life and death. Cosmic epics must be left to the theist and to all those who, denying the intrinsic endurance of nature, speculate on a metaphysics.[208]

[208] Roy Wood Sellars, "Reformed Materialism and Intrinsic Endurance" (1944)., in **Essays,** 171-172. A. O. Lovejoy had arrived at the tentative conclusion that we can only be certain of local progress in an article "The Meanings of Emergence and its Modes" which appeared in 1926, his contribution to the debate on emergent evolution at the **VIth World Congress of Philosophy**..

Lloyd Morgan immediately recognized Sellars' **Evolutionary Naturalism** as a variant of emergentism, and included an appendix on it to his own work **Emergent Evolution** when this latter was published in 1923. The major disagreement with Sellars concerns the source of evolution. Lloyd Morgan characterizes Sellars' position as follows: "He sees no need, and feels no call, for explanation save in the accredited meaning of this term as it is used in the universe of scientific discourse."[209] Behind this surface disagreement, however, is are deeper ones, concerning the problem of the relation between religion, philosophy and science, and concerning the question of teleology. I will reserve discussion of this latter point for the conclusion to this chapter.

(b) Ontology: From Naturalism to Materialism

Through the early 1920s Sellars described his ontology as naturalist. His opposition to materialism was its association with (a) a mechanistic approach to vital and mental phenomena, (b) a pre-evolutionary conception of change, (c) an atomistic view of the nature of things (d) a naive realist epistemology, and (e) a lack of developed axiology. In his writings of this period, Sellars criticizes that specific form of materialism, but not materialism in any possible form. Already in his article "Why Naturalism and not Materialism?" (1927), Sellars addresses the question of whether to adopt a new materialism, one based on the evolutionary, emergentist and critical realistic concepts he himself has been developing. After all, his pyramid of reality begins with the material level, from which all the other develop successively, and he rigorously excludes all

[209] Conwy Lloyd Morgan, **Emergent Evolution**, p. 303

supernatural phenomena. Indeed, in this article, he distinguishes in a different way than previously between materialism and naturalism, with naturalism as the general, cosmological view and materialism a more restricted ontological position. Moreover, he admits the possibility of a different sort of materialism, one which would not be reductive, mechanistic, and atomistic, but would be a "new, or emergent materialism":

> Materiality must take on the meaning of a common denominator quite harmonious with all sorts of variations in material systems. I am inclined to believe that a transformation of this sort is taking place into a new, or emergent materialism.[210]

Subsequent articles record his transition from naturalism to just such a new, emergent materialist point of view, including "Is Naturalism Enough?" (1944), which is a critique of Dewey's naturalism and a defense of materialism, as well as "Can a Reformed Materialism Do Justice to Values?" where he replies in the positive.[211] It is not surprising then that Sellars was one of the co-editors of the 1949 volume **Philosophy for the Future: Quest of Modern Materialism**, which was one of the few volumes of that period to explicitly advocate materialism.[212]

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210 Roy Wood Sellars, "Why Naturalism and not Materialism" (1927), p. 224

211 Other articles include "Reflections on Dialectical Materialism" (1944-45), "Materialism and Relativity: A Semantic Analysis" (1944-45), "Positivism and Materialism" (1946-47), "

212 At about the same time, i.e. the McCarthy period in the United States, D. O. Hebb, writing from the relative safety of Canada, still refers to this own materialism as "monism of a non-vitalistic sort" in his **Organization of Behaviour** (1949). It was therefore a brave and hardy matter to bring out a book on materialism at a time when the cold war identification of materialism and communism was at its peak. Sellars replies to an academic critique in "Professor's Goudge's Queries with Respect to Materialism" (1951)

(iii) Mechanism, Vitalism and Teleology: C. D. Broad

In common with Lloyd Morgan, the English philosopher C. D. Broad argues for emergentism as an alternative and middle road between mechanism and vitalism. In this section, his argument will be set out in some detail, since his (temporary) acceptance of emergentism in 1926 marked an inroad of that philosophy within a different philosophical trend, that of analytic philosophy, of which Broad, along with Bertrand Russell and G. E. Moore, was a foremost representative.

(a) Emergentism as an Alternative

Broad considers that emergentism is the alternative to pure mechanism, biological mechanism, and substantial vitalism. His reasons for rejecting the first three philosophies are set out as follows:

(1) Pure mechanism is a single factor theory, attributing (a) one kind of stuff to all things, distinguished only in terms of the arrangement of parts and distribution of velocity; (b) one kind of change, namely, change of position; (c) one change of causal law, according to which the interaction between parts within a whole and among different systems is due to the pair-wise influences of constituent particles. This theory is clearly atomistic and extreme in its simplifications and restrictions. Broad rejects it because it cannot explain so simple an existent as secondary qualities.

(2) Biological mechanism is a weaker view than pure mechanism, and involves the view that the laws governing biological phenomena can be deduced from those of physics and chemistry, without any further assumptions. According to Broad, biological mechanism would still hold even if the laws of chemistry were not themselves reducible to those of physics. Again, Broad says that this still cannot explain secondary qualities

(3) Substantial vitalism, as in the dualisms of Henri Bergson and Hans Driesch, calls for a special component to explain the vitality of living organisms. The vital principle, or in Driesch's term, the entelechy, is a necessary but not a sufficient condition for life; the material organization of the body is required in addition. Moreover, entelechies cannot be isolated apart from living bodies. Broad argues that substantial vitalism violates scientific method, and specifically, the principles used in chemistry. He compares the entelechy to an as yet unisolated chemical radical. But (i) unlike a chemical radical, entelechies cannot even in principle be isolated; (2) entelechies cannot be transferred from one body to another as radicals can; and (3) nothing can be said about how the entelechy differs from the body or about the overall structure of the body-entelechy complex.

Broad considers that a system is teleological when it meets two tests: (a) an initial examination of its construction is consistent with the hypothesis that it was constructed by an intelligent being for a specific purpose, and (b) a further examination of it discovers new parts and relations which are still consistent with the hypothesis of intelligent design for a purpose. The second clause is intended to strengthen the definition and avoid classifying as teleological what upon further examination turns out be haphazard. External teleology applies to a system which serves not its own end of self-preservation, but an end which was introduced from without by the maker of the system; and internal teleology applies where the goal is one of self-preservation or reproduction. Machines of all kinds are teleological systems of the first sort, living organisms are examples of teleological systems of the second sort. External teleology logically requires a designer; while internal teleology is independent of design, and is consistent with its presence or absence. If a designer is accepted for living organisms, this must be a super-human or god-like designer.

Broad's point is that biological mechanism also implies design. For if it is true, then all living bodies are machines. But all machines were designed by a designer other than the machine itself. Therefore, there must be a super-human designer of the human machine. "Thus the proper complement to a completely mechanistic theory about organisms is some form of the doctrine of Deism".[213] Broad, however, wants his natural philosophy to be independent of any religious commitment, and this is one reason motivating his preference for what he terms emergent vitalism:

> It seems to me on the whole Emergent Vitalism is distinctly to be preferred to Biological Mechanism. It does not necessitate a complicated Deistic supplement, as Biological Mechanism does; and this seems to me to be an advantage. At the same time it is perfectly consistent with the view that there is a God who created and controls the material world; so that, if there should be any good reason to believe in such a Being, the Emergent Vitalist could meet with situation with a quiet mind.[214]

213 C. D.Broad, Mind and its Place in Nature, (1926), p. 90
214 ibid, pp. 93-94

Broad's conception of emergentism shares some features of mechanism, specifically, its denial of any special component to explain vital functions, and the view that the behaviour of organisms is determined by the nature and arrangement of their components. But emergentism differs insofar as the properties of the whole cannot be deduced from antecedent knowledge of the properties of the parts:

> Put in abstract terms the emergent theory asserts that there are certain wholes, composed (say) of constituents A, B and C in a relation R to each other; that all wholes composed of constituents of the same kind as A, B and C in relations of the same kind as R have certain characteristic properties; that A, B and C are capable of occurring in other kinds of complex where the relation is not of the same kind as R; and that the characteristic properties of the whole R(A,B,C) cannot, even in theory, be deduced from the most complete knowledge of the properties of A, B and C in isolation or in other wholes which are not of the form R(A,B,C). The mechanistic theory rejects the last clause of this assertion[215]

Broad gives the standard emergentist example of water, hydrogen and oxygen, in terms very similar to those of Mill, Lewes, Lloyd Morgan and others. Broad's general view of emergentism is a very strong one. Every chemical compound involves the emergence of a new property. Moreover, he holds that even the law of composition of forces, the paradigm case of a homeopathic law for Mill, involves an element of emergence, in the sense that it is itself not a deduction from other laws, but had to be discovered when first it was formulated. It is a "suppressed hypothesis" when it is not explicitly stated by those so used to it that it has become obvious and a matter of routine. It was not obvious the first time it was encountered in the history of science.

215 ibid, p. 61

Thus, for Broad, there are three characteristics of the Emergent Vitalism which he defends: (1) the biological whole is determined by the nature and arrangement of its component parts and no special, non-material component or life principle is required; (2) the behaviour and properties of the biological whole cannot be predicted from that of the behaviour and properties of the component parts taken separately; and (3) the law relating the whole and its parts is unique and irreducible, not a special case of a more general law or a combination of two or more general laws. He concludes: "This view about living bodies and vital behaviour is what I call "Emergent Vitalism"; and it is important to notice that it is quite different from what I call "Substantial Vitalism."[216]

Broad distinguishes three types of properties: (1) emergent properties which are ultimate properties characteristic of an order, since they do not exist at lower levels and cannot be deduced from the properties of any lower order or orders; (2) reducible properties which though characteristic of an order can be deduced from knowledge of the lower levels and (3) neutral properties which exist at a level and at lower orders as well. He gives the following examples: sexual reproduction is an emergent characteristic of the biological order; the beating of the heart is a reducible property, since it can be derived from the strictly mechanical properties of the heart muscles, while the conservation of energy is a neutral property of both living and non-living matter.

Broad's contribution to the debate over emergentism was the analytic characterization of such terms as mechanism, vitalism and teleology. He views

216 ibid, p. 69

emergentism not only as an alternative to the first two, but as opposed to the third as well. The denial of purpose in evolution is a position similar to that of Darwin, for whom evolution has no pre-defined goal. The problem arises once more when we are dealing with an emergentist system, where a hierarchy of emergent levels is accepted, with distinctions between higher and lower levels. Do the lower levels tend to the higher ones as their goals? For Lloyd Morgan and Alexander, this is the case; while Broad argues that for emergentism it should not be the case. The teleological component of the systems of Lloyd Morgan and Alexander is related to the theological component of their total world view, while Broad argues in favour of a philosophical world view that it is independent of theology. The question whether teleology contradicts emergentism will be examined at the end of this chapter.

(b) Ontology:Emergentist Materialism and the Compound Theory

Broad has accepted the physical, the chemical and the biological as the first three levels of reality. In addition, he accepts the psychological as a fourth level, emergent relative to the biological. This is made clear in his long section on the mind/body problem. Broad analyses, in some detail, 17 different theories of the mind/body problem, which he organizes as follows. He distinguishes three levels of attributes: (1) attributes which are applicable to a thing or substance, and those which are not applicable to anything, termed "delusive" attributes; (2) among the applicable attributes, those which are differentiating, and determine distinct substances, and those which are non-differentiating, distinguishing kinds within the same substance; (3) among the non-differentiating properties, those that are emergent and those that are reducible. The relationship among these categories is as follows:

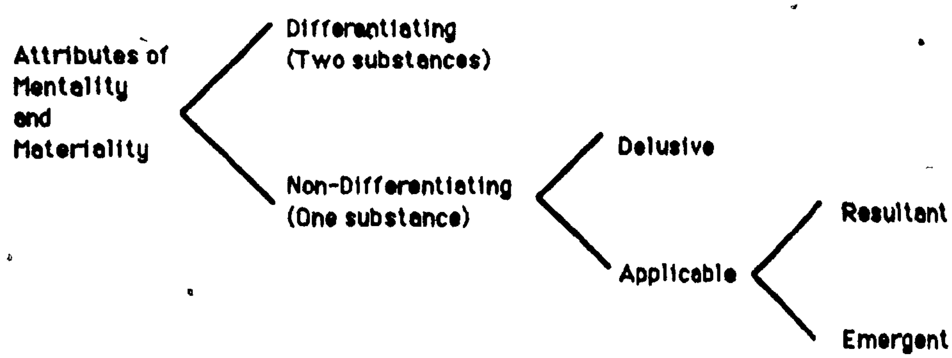

Diagram 9: Broad's Categories for Classification of the Mind/Body Problem

Applied systematically these three groups of distinctions result in 17 different theories of the mind - body relation. The main branching is the result of three possibilities for the differentiating/non-differentiating status of "matter" and "mind": if both are differentiating, dualism results; when only one is differentiating, the result is either materialism or idealism, depending on the one which is differentiating; and in the case whether neither is differentiating, neutralism results. The second level of analysis considers the applicable/non-applicable distinction. A pure form of materialism, idealism or neutralism results when the non-differentiating term is not applicable; i.e. is delusive. In the cases where the non-differentiating term is applicable, the emergent/resultant distinction is applied as a third level of analysis, resulting in two possibilities in the case of materialism and idealism (emergent or reductive materialism, and similarly for idealism), and 8 special cases for neutralism.

Because of the way he has set up his system of classification, there are more forms of neutralism (9, including pure neutralism) than materialism and idealism combined (6, with 3 forms each: pure, emergent and reductive). Dualism is left rather undeveloped, with the simple distinction between the dualism of compatibles and the dualism of incompatibles. He does not take into account the traditional distinctions among interactionist, parallelist, epiphenomenalist and animistic dualisms, and this, along with the excess of neutralist categories, is a weakness of the system.

Broad devotes some 60 pages to a detailed examination of each of the 17 theories. But given the way he has set up his view of emergent orders - the physical, chemical and biological being distinct and irreducible, it is not surprising that he concludes that the psychological order is also emergent. In his own terms, he opts for an emergentist materialist position, holding that " (a) materiality is a differentiating attribute, and (b) that mentality is an emergent characteristic."[217] He is the first of the emergentist theorists (even before Sellars in the 1930s) to hold such a view. But he adds the proviso that this is the case only so long as considerations of what he calls "normal" facts are allowed: "If there were no facts to be considered except the normal ones, and we rejected all the alleged abnormal facts dealt with by Psychical Research, I should regard Emergent Materialism as on the whole the most reasonable view to take of the status and relations of matter and mind in Nature."[218]

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217 ibid, p. 646
218 ibid, p. 648

It is most surprising, at least from what has preceded, that Broad suddenly enlists consideration of what he calls the "Psychic Factor", a "something which is capable of persisting for some time after the death of the body and of entering into temporary combination with the brain and nervous system of certain peculiarly constituted human beings called 'mediums'"[219]. He states that there is convincing evidence for survival of the psychic factor for something in the order of several days. Were the evidence there for permanent survival, he would be a dualist, but as it is he opts for an intermediate or Compound Theory point of view. Mentality is "an emergent characteristic of a compound of a living brain and the psychic factor." [220]

This development seems to me to be inconsistent with Broad's own criticisms of entelechy or the vital principle in biology. He has argued against the addition of any such vital factor. But now he matter of factly accepts the existence of the psychic factor. Consider the criteria that Broad himself says the vital factor fails to meet: (a) it cannot be isolated, (b) it cannot be transferred and (c) it cannot be analysed. The same applies, however, to the psychic factor. Broad has not stated how it may be transferred, isolated and analyzed. Why does it persist for only several days and not several weeks? What does it decompose into after its period of persistence if over? How is it related to the mind of the once living person that it now represents? How does it combine with the body of the medium? These questions are left unanswered, and because of that, Broad's compound theory is unsatisfying. It is a fact that Broad thereafter devoted much of his effort to

219 ibid, p. 651
220 ibid, p. 651. In subsequent writings, Broad deals exclusively with the psychical factor and drops further reference to emergent materialism.

writing on para-psychology, but in order to modify his own emergent materialist option in the way he has, requires more than he has offered in **Mind and Its Place in Nature**.

(5) The Problems of Levels, Teleology and Progress

An comparison of the writings of the four authors dealt with to date shows that the following levels have been postulated by them:

level	Lloyd Morgan	Alexander	Sellars	Broad
space-time	partially[221]	1	-	-
matter	1	partially[222]	1	-
primary qualities	-	2	-	-
secondary qualities	-	3	-	-
physical	-	-	-	1
chemical	-	possibly[223]	-	2
life	2	4	2	3
mind	3	5	3	4
society	-	-	4	-
deity	partially[224]	6	-	-
Number of levels	3	6	4	4

In a preliminary way, the debate over the problem of levels can be divided into three parts: (1) what is the basic or first level? (2) what are the intermediate levels? and (3) what is the highest level?

221 Insofar as Lloyd Morgan accepts space-time as the "stuff" of all things; but he does explicitly mention this as a level in his subsequent discussions, limiting himself to the three: matter, life and mind

222 Matter is included along with its primary qualities as the second level.

223 Alexander, as noted in the text, leaves the possibility of a chemical level open.

224 Again, deity is recognized as the driving force or source, in a sense, the complimentary "level" to the whole level structure of reality. But it does not appear as one of the three levels in his A, B, C notation.

(1) The basic difference regarding the first level of reality is that between Alexander and Sellars. Alexander argues that it is space-time, Sellars opts for matter. Lloyd Morgan adopts an intermediary view, with matter as the first level, but with space-time as the stuff of which things are made. Broad accepts matter, making the further distinction between the physical and chemical levels.

(2) All the authors agree on life and mind as among the intermediary levels. Indeed, the basic core of the four major emergentist theories is the matter, life, mind triad. The argument is one of strong analogy: just as some combinations of inanimate matter (characterized by carbon, nitrogen, oxygen and hydrogen compounds) give rise to living organisms through emergence and without any admixture of a animating entity or principle, so some living organisms (characterized by the development of the cerebral neo-cortex) give rise to mind without any admixture of a thinking entity or principle.

(3) As the highest level, Alexander argues for deity, Lloyd Morgan and Broad opt for mind, while Sellars accepts society. Sellars argues that society is sufficiently distinct from individual organisms, and produced only by some small number of them, that it should be included as a distinct and indeed culminating level. Like Broad, he excludes deity as a level, and argues for an emergentist system which is independent of religious or theological considerations. An alternative level structure to these four will be proposed in the conclusion to the dissertation, based on the ordering matter, life, society and mind.

All of the authors canvassed so far agree on evolution as a general process underlying the various domains of nature, one which is productive of novelty, and more specifically, of non-reducible levels. But within an emergent framework, they disagree about the directedness of that change, its goal and its source. Lloyd Morgan and Alexander adopt a teleological point of view which sees evolution as goal-directed, and intrinsically progressive. The source of that change is supernatural, in deity, which is an ever present complement to the natural (Lloyd Morgan), or the highest level still in the process of development (Alexander); in both cases the driving force is "nisus towards deity". Sellars' position is more consistently naturalistic: there is nothing outside of nature, nor anything back of it; this position is also defended by Broad. Sellars, in his most radical sortie against teleology, even denies the globally progressive nature of evolution, with life, mind and society exceptional peaks due to random variations in a small part of the cosmos. Broad explicitly rejects teleology and sees emergentism as an alternative to both mechanism and teleology. The contradiction between the two positions: the teleology of Alexander and Lloyd Morgan, and the anti-teleology of Sellars and Broad is clear.

As expressed in the writings of Alexander and Lloyd Morgan, the teleological cause (as final cause) is closely linked with theological cause (as first cause). Common to them are the following theses:

(1) Teleology essentially involves the notion of a goal or final cause. A teleological process in the ontogenetic sense requires an end-state to which the evolutionary process tends.

(2) Teleology presupposes as well the notion of purpose, so that the goal is to be achieved for a reason. The purpose may be intrinsic to the process, as when a

person strives for a goal, or extrinsic to the process, as when deity, according to Lloyd Morgan, provides the direction for evolution.

(3) Teleology presupposes a designer, who has so designed the thing that it tends to achieve its purpose and arrive at its goal. This is an efficient cause in a non-theological context and a first cause in a theological one.

(4) Teleology implies the concept of progress. Evolution as a process is progressive since it includes a sequence of levels $a_1,...,a_f$ where a_1 is the initial level and a_f the final state, where each of the levels a_i represents a further step towards the final goal a_f.

Sellars and Broad, however, maintain an anti-teleological position: Evolution has neither a goal nor a source. This position has three variants, depending on the scope accorded to progress:

(a) global progressionism: despite the lack of goal, design and purpose, evolution proceeds in a progressive fashion in all parts of the world, though perhaps not at the same rate or at the same level. This position is certainly consistent with an emergentist point of view; but it has a disadvantage relative to the teleological position. It would be surprising for evolution to progress everywhere and yet have no end or goal; the teleological assumption would be a more reasonable assumption in this case of global progress. Weaker forms of progressionism are more coherent with an anti-teleological position.

(b) global anti-progressionism: progress never occurs for any length of time in any locality; change is either chaotic or tends to a steady state with involution following evolution and cancelling it out. This position is incompatible with emergentism, which claims that at least in some parts of the world, there is an orderly succession of qualitatively new levels of reality.

(c) local progressionism: progress does occur in some place or places, but is not guarantied to occur elsewhere or everywhere. This is the position which, while in accord with emergentism, is most clearly demarcated from teleology.

The adoption of a teleological view does not explicitly contradict the basic premise of emergentism, as a defence of vitalism would. Emergentism is clearly opposed to vitalism, since vitalism requires a second substance (entelechy, élan vital) which brings about higher forms, contradicting the monistic claim shared by all emergentists discussed so far that novelty occurs without the admixture of a foreign (vital or animating) entity or principle. A teleological reading of emergentism, however, requires no such entelechy, elan vital, or immaterial mind to produce higher levels and so it is not formally inconsistent with it. Teleology is however not necessarily implied by emergentism, and so is a supplement to it.

In the teleological systems examined so far, this aspect of the theory is linked to a theological component: Lloyd Morgan invokes a supernatural source to stand behind evolution and to drive it towards its goal, while Alexander's deity seems to stand before evolution and to pull it towards its end. Such a position can be saved from a charge of dualism only by the strategem of invoking the supernatural as complimentary to the natural (Lloyd Morgan) or postulating deity as one of the levels in the emergent structure of reality (Alexander). In both cases, there is an additional complication to the basic emergentist claim, requiring the further assumption of complimentary aspects or an infinite level. This is a disadvantage supposing that one wishes to have the simplest possible system of emergentism. The advantage of the teleological approach is the reconciliation of the philosophy of evolution and natural theology, which of course was one of the stated goals of the **Gifford Lecture** series in which the major volumes of Lloyd Morgan and Alexander appeared. The weakest claim is that of Sellars in his 1944 article: anti-teleological and local progressionism. Its advantage is that of a minimum of extra-emergentist assumptions. Thus, while a teleological view does not contradict emergentism, as Broad claims it does, it nevertheless complicates it.

The conclusion then is that neither teleology nor progress are inconsistent with emergentism. They differ, however, in that teleology is neither presupposed nor implied by emergentism, whereas progress (whether global or local) is clearly implied by it. It is possible to develop an emergentist system without teleology, and such a system would have the virtue of greater simplicity. Including a teleological element permits a reconciliation between evolution and belief in deity. The simplest possible system of emergentism involves the notion of local progressionism.

Chapter Three: Further Debate over Emergentism

This chapter will analyze further discussion of emergent evolution in the period from the early 1920s to date. Emergentist ideas were examined, adopted, at least in part, or rejected by a number of major and minor philosophers and biologists. Five different sorts of reactions are discussed:

(1) Analytic concepts of emergence: This section discusses philosophers who attempted to analyze the the concept of emergence and who developed variant versions of emergentism: G. P. Conger and his notion of epitomization, W. P. Montague and his factor analysis of emergence, and O. L. Reiser's concept of the stochastic basis of emergence.

(2) Critical reactions to emergentism: A number of criticisms of emergentism will be examined, including Stephen Pepper's claim that emergence is an incoherent concept and Charles Baylis' argument that the ubiquity of emergence rules it out as a basis for a distinctive philosophy. William McDougall's criticism of emergentism from a dualistic point of view, and Bertrand Russell's rejection of emergentism from a monistic point of view will be discussed as further critiques of emergentism.

(3) Related philosophical systems: Two evolutionary philosophies closely related to emergentism will be discussed: J. C. Smuts' holistic evolution, and J. E. Boodin's cosmic evolution. In addition, the influence of emergentism on a number of more distantly related views will be examined: J. S. Haldane's levels of interpretation, C. E. M. Joad's views on emergence and interaction, A. N. Whitehead's process and novelty, and G. H. Mead's social emergentism.

(4) Related biological views: To be discussed in this section is the work of a number of biologists, beginning in the later 1920s, who developed concepts related to emergentism These include Joseph Needham and J. H. Woodger, whose theories of integrative levels share with emergentism the recognition of non-reducible levels of reality. This notion of integrative levels was also taken up by Julian Huxley and Alex Novikoff. During the 1940s the concept of integrative levels was the major residue of emergentist ideas in science and philosophy of science, at a time when emergentist philosophy was in a period of "eclipse".

5. Recent debate: This section will discuss the work of James K. Feibleman and Nicolai Hartmann, both of whose books on emergent evolution were published in the early 1950s, though their preparatory work goes back to the 1940s. The section will then conclude with an examination of the more recent work of Mario Bunge, Karl Popper and Jonas Salk, as indications of the renewed interest for emergentist ideas in the philosophy of science.

The import of this chapter is to show that emergent evolution was a philosophical trend, particularly during the period from the late 1910s to the mid 1930s. Though "eclipsed" by other developments in the philosophy of science from the mid 1930s to the early 1950s, it is now a focus of renewed interest. The general conclusion to the dissertation sums up this analysis of emergent evolution as a trend and a puts forward a proposal for a modified emergentist level structure of reality.

(1) Other Concepts of Emergence

Three philosophers will be discussed in this section: George P. Conger, Oliver L. Reiser, and William P. Montague. Their contributions involve an attempt to analyze the concept of emergence, though their efforts did not have as great an influence as those of Alexander, Broad and Sellars.

(i).Emergence as Epitomization: George P. Conger

Conger's article "Evolution and Epitomization" appeared in 1921, and thus very early in the development of the evolutionary emergentist trend. Indeed, it appeared before the publication of the major books on the subject by Lloyd Morgan and Sellars. Though Alexander's **Gifford Lectures** were by then available, Conger does not cite them in this article. He does, however, refer to Spaulding's "creative synthesis", and Sheldon's "productive quality"[1].

(a) Factual and Formal Realms of Reality

Conger's point of departure is the the conflict between mechanistic and teleological explanations in biology and psychology. The solution he finds is the principle of epitomization, defined as follows: "It may be defined in general as the occurrence, at the so-called later stages of evolution, of structures and processes which are essentially analogous to those occurring at the so-called earlier

[1] This latter concept is discussed in W. M Sheldon, **Strife of Systems and Productive Duality** (1918)., though this system is not otherwise an emergent evolutionary one.

stages."[2] These significant structures and processes are identified as: individuation, interaction, reproduction and integration. Following Spaulding, Conger holds that integrations which are not mere aggregations are productive of new things. A whole is equal to the sum of its parts only as an abstraction in mathematics, not in evolutionary reality. It is through the process of epitomization that novelty is to be built up, a novelty which is relative, not absolute, since based on preceding stages, :

> There is no such thing as the absolutely new; things that are called new have to be related to former experiences in order to be called anything at all. That old things, under appropriate conditions, unite to form new things is then the very spring of evolution - it is this process which enables the world to get from one stage of evolution to another.[3]

There are three implications of epitomization for the level structure of reality which Conger discusses at this stage of his theorizing:

(1) The principle of realistic monadism: The basic kinds of objects, called monads, can be enumerated in one or more evolutionary series. In this first article, Conger enumerates three series: (a) the physical series, with six monads (electrons, atoms, molecules, astronomical bodies, solar systems, galaxies; (b) the biological series, with at least five monads and perhaps more: organic compounds, further products of the organic compounds, unicellular organisms, multicellular organisms, and social groups of multicellular organisms; (c) the nervous system, with perhaps five monads: effector and receptor cells, nervous

[2] G. P. Conger, "Evolution and Epitomization" (1921), p. 539
[3] ibid, p. 571

areas, simple reflex arcs, complex reflexes, and finally, sentiments, values and selves. To this effect, he sets out his monads in three parallel series as follows:

Cosmogonic (medium)	Biological (environment)	Neuropsychological (internal medium)
(1) Electrons	(..7?) organic compounds	(..12?) specialized cells
(2) Atoms	(8?) chromatin?	(13?) Nervous areas
(3) Molecules	(9?) unicellular organisms	(14?) Simple Reflexes
(4) Astronomical bodies	(10?) multicellular organisms	(15?) Complex Reflexes
(5) Solar systems	(11?) Social groups	(16?) Complexes
(6?..) Clusters, Galaxies, etc.		

Note that Conger has (6) left over with no correspondences in the two other series. Moreover, he is not fully sure of the monads after the fifth, and indicates this with question marks. The cosmogonic series is considered as the medium, the biological as environment, and the neuropsychological as the internal medium.

(2) The principle of parallelism: The grouping of the monads into three series is not an isolated fact, but reveals an inner relationship among corresponding monads of the three series. "Essential similarities of structures and processes are repeated, not only in monadic stages, but in the cosmogonic, biological and neuropsychological series as such, with successive relations of container and contained on smaller scales, but with higher degrees of complexity - or, as it may be put briefly, cosmology is epitomized by biology; biology, in turn, is epitomized by neuropsychology."[4]

[4] ibid, p. 574.

Conger sees the possibility of incorporating in his system, a monistic one, the hitherto opposed positions of mechanism, vitalism and behaviorism, each describing an aspect of one of the physical, biological and mental stages:

> Perhaps the conceptions of mechanism should be employed to describe the chemical origin of the life processes, while those of vitalism should be interpreted to signify the fact that the biological series departs from the cosmogonic series in what we have called an internal deployment In other words, perhaps mechanism is properly a concept of origins, while vitalism is properly a concept of orientations of the biological series with reference to the cosmogonic. Similarly, perhaps behaviorism can tell us more of the origins and elementary characteristics of the neuropsychological series, while the older views exhibit more of the orientation and larger relationships of the neuropsychological structures and processes.[5]

Conger's system, however, is a monistic one. There is no need to assume extraneous forces which intervene between two series, be it a vitalist impulse or a spiritual force. The metaphor is that of a multi-stage projectile: at a point in the trajectory, a second explosion and then a third occurs. No outside factor or force different in nature from that producing the initial trajectory is required.

(3) <u>The principle of connection</u>: Instead of considering each series separately, or in parallel, the series are considered in their connections two at a time:

> When the first and second series are taken together, we have ecology; when the second and third are taken, we have physiological psychology. The third implication of the hypothesis of epitomization is that ecology is epitomized by physiological psychology; the living organisms are to the earth as the nervous system is to a multicellular organism.[6]

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[5] ibid, pp. 579-80. He refers to Bergson in Creative Evolution as the source of this suggestion.
[6] ibid, p. 581. As a deduction from this, Conger says that "social groups in the history of the earth may be compared to complexes in the experience of an individual".

Other articles Conger wrote in the 1920s will be considered in the next subsection in the context of his debate with H. Chapman Brown. The major addition to the theory came in 1928, in his article "A Hypothesis of Realms". The three series (physical, biological and mental) are now called realms, but this is merely a terminological change. The substantive change is the addition of three additional realms from the formal sciences: logic, mathematics and "geometry-kinematics". Conger opts for a realistic view of the logical and mathematical forms which are "...independent not merely of mind, but of life and matter as well."[7]. This is the motivation for Conger's placing of logic and mathematics in realms of their own. Moreover, he adds to the two realms of logic and mathematics, a third, the "entities or events" of geometry-kinematics. This is really a formal representation of space-time events, and the references Conger gives are to Whitehead on extensive abstraction, and similar notions of C. D. Broad and Bertrand Russell.

To the previously mentioned three basic implications of epitomization, Conger now adds a further principle:

(4) <u>the principle of "cumulative coordination"</u>: This is an analogue to Alexander's idea that higher levels are the "minds" of the lower ones, and is formulated as "each succeeding realm is the "mind" of the preceding realm."[8] He notes that each realm ends with a level which is the first level of the succeeding realm, and concludes: "My conclusion, then, is that there is a chance

[7]G. P. Conger, "A Hypothesis of Realms" (1928), p. 209
[8] ibid, p. 215

for a consistent argument that logic, number, geometry kinematics, matter, life and mind form a progressive series of realms offering at least a framework for a realistic metaphysics to be developed in accordance with the data of the various sciences both natural and abstract."[9]

This plan was carried out in his massive, and unusual **A World of Epitomizations: A Study in the Philosophy of the Sciences** (1931), a work of just over 600 pages which outdoes Wittgenstein's **Tractatus** in at least one respect: Conger's numbering of his sections utilizes decimal numbers to six places! And of course, the number of levels has increased with the increase of realms, though the work should not be written off because of its prolixity. Conger could be quite clear and expository when he wanted. His **New Views of Evolution** (1929) is a pleasant and useful history of evolutionary philosophy of both the 19th and 20th centuries, and one of the only books mentioned in this dissertation which criticizes the campaign against evolutionary theory being waged in the southern United States during the period. Further comments on Conger's system will, however, be based on the more accessible article "Epitomization and Epistemology" (1933), which Conger himself notes is a résumé of the major points of his 1927 book on epitomization. No substantive changes are made, but an interesting metaphor for a visual representation of his system as concentric circles is made:

> The six realms, then, taken in the order logic, number, geometry-kinematics, matter, life and mind, are in transitive relationships of inclusion, or of "container and contained", most easily visualized in a diagram of six circles in such a relationship, with mind represented by the inmost. The structures, or monads, of each level and realm selectively interact with the monads of environing or

[9] ibid, p. 216

containing prior levels and realms. As the various levels and realms develop, and the successive epitomizations proceed, the interactions become more and more intricate and appear as a kind of "cumulative coordination" in the universe, so that, for example, the living organisms are cumulative coordinations of the structures and processes in their environment, and minds (which, at least for the sake of the argument, are defined as "nervous systems at work") are cumulative coordinations of the structures and processes ins their bodies and their environments, too. Cumulative coordination makes for differences between successive levels and realms, while epitomization makes for underlying and essential resemblances.[10]

He notes as well that some structures and processes from one realm persist into later realms, which allows for elements of reductive treatment. "This is why psychology, for example, taken analytically or reductively, is after a fashion describable in terms of physiology, and physiology in terms of physics and chemistry, and physics and chemistry in terms of mathematics and logic."[11]

(b) Emergentism and Materialism: Conger-Brown debate

Conger's early writings provoked an immediate response from Harold Chapman Brown (Stanford University). Brown had already published an article several months previously entitled "The Material World - Snark or Boojum" (1925). The reference in the subtitle is to the Lewis Caroll poem, where the hunting of the snark may determine it to be really something, a snark, or evanescent and vanishing, the boojum. Brown's philosophical question is whether modern science has found matter to be real or whether matter has "vanished" as the result of the analysis of the atom into electrons and protons.

[10] G. P. Conger, "Epitomization and Epistemology" (1933)., p. 74
[11] ibid, p. 74

In Brown's view, matter has not vanished, but has been shown to be more complex than previously thought. What has to be changed is the old mechanistic theory of matter, according to which atoms are solid and imperishable; atomism must be replaced by a "dynamic conception of certain critical regions in space-time reality," involving new types of entities described by the equations of mathematical physics. Atoms are integrations of such space-time regions, "structural regions functioning as wholes, but analyzable into interrelated lesser critical regions."[12] With this new conception of 'physical', he then notes that materialism[13] can be defended, since "In this sense the living object, or even a mind or a society, is as much a physical object as an atom"[14]. Brown argues that in any level theory of reality, the properties of entities at higher levels can be reduced to those at lower ones, since all properties are characteristics of regions of spacetime:

> The thesis is being clarified that reality may be analyzed into levels of entities such that the properties of he entities on any level can be conceived as consequences of the properties on a lower level, and conditions of the occurrence of properties on a higher level, in the sense that if any entities change, their ~~constituents~~ must have changed, and their consequences be different.[15]

Yet this proposition seems contradicted by the following declaration, just one page later, which can be read as a move towards a holistic, perhaps an emergentist view. Certainly, it is not reductionist:

[12] H. C. Brown, "The Material World - Snark or Boojum" (1925), p. 210
13 Materialism has been defined as follows: "Materialism aims to interpret the processes of life and mind as manifestations of the fundamental processes of physical nature." ibid, p. 209.
[14] ibid, p. 210
[15] ibid, p. 210

> In general, when any integrated whole reacts with another, the related processes in its constituents have to conform themselves to demands put upon them by the whole. This is particularly important for a materialistic philosophy, for it means that, even although man is conceived as an actual part of the cosmos, a physical object amongst other physical objects, nevertheless, his behaviour is not reducible to mere chemical and physical laws, however it may be conditioned by such laws.[16]

The question is open: will Brown move towards an emergentist as well as a materialist position? The negative response appears in his next article, "A Materialist's View of the Concept of Levels" (1926), which is a reply to Conger's "The Doctrine of Levels", and a development of his own "The Material World". This 1926 article is a general criticism of emergent evolution and refers to Lloyd Morgan, Alexander and Sellars as well. Brown's criticisms specifically directed at Conger's definition of levels are as follows: (1) The notion of "relative independence" of levels (and the things that are parts of them) only applies to biological organisms; physical entities (such as atoms and molecules) are not only relatively independent, but manifest "a more radical type of independence"; (2) The notion of more complex things built up through the integrative operation of evolution neglects the existence of disintegrative processes even in physical evolution; (3) Brown disagrees with the proposition that matter, life and mind form three distinct levels. His own classification is that of a bifurcation between matter up to and including unicellular organisms, and life, taken to include vital processes from the multicellular up to and including mind. Mind in particular can be explained by biological considerations as the result of the action of certain biochemical complexes already present in more primitive multicellular organisms. Brown considers the possibility of a third level, that of societies, but is unsure whether the properties of the group are not just statistical manifestations

[16] ibid, p. 211

of the behaviour of the individuals, even when the individual behaviour is modified by group membership.

Conger replied with the article "What are the Criteria of Levels?" (1926). This article takes as its point of criticism Brown's rejection of the level structure of reality Conger had proposed. Conger reviews his analysis of three realms, the cosmogonic, biological and neuropsychological, with now a total of 19 levels each, for a total of 57 levels! In the physical realm, the advance is now from the aether or space-time through to the physical cosmos; in the biological, from the inorganic environment of life through to the totality of nations forming the "great society"; and in the neuropsychological, from animal bodies to the totality of values or ideals considered as personality. It is not surprising that Brown, who had difficulties with three levels, did not reply to Conger, and the debate ended at this point.

In terms of the analysis of this dissertation, the above debate is disappointing. Conger has defended an emergentist level theory of reality, but one so complicated and eccentric as to repulse any adherents; while Brown has defended a materialist point of view, but one too simplistic when it comes to the level structure of reality. The views of Conger and Brown are not antagonistic in principle, but fail to coalesce because of the extremes of complexity and simplicity each manifests.

(ii). Emergence and the Stochastic: Oliver L. Reiser

Oliver L. Reiser (University of Pittsburgh) tried to link emergence with thermodynamics and electrodynamics in "Life as a Form of Chemical Behaviour" (1924) and "An Electromagnetic Theory of Matter, Life and Mind" (1927). The second law of thermodyamics is said to provide evolution with its direction and irreversability. Electromagnetic theory is considered as an attempt to analyze things into their associated fields in space-time. The key point is reached when Reiser states his view that emergence rests on the relation of the macroscopic to the microscopic: "The theory which I wish to propose is that these discontinuities of the strata of nature, with their new laws of behavior, emerge when the microscopic whirls of events are unified into the groups of behavior which may be termed macroscopic rhythms".[17] In the transition from the micro to the macro, statistical considerations are brought into play, but a priori predictions cannot be made as to the exact outcome:

> Any thing is a kind of statistical constant of high stability (vide "isotopes"), but in the transition from one behavior complex to another the probability becomes discontinuous, and a priori induction gives way to the empirical observations which record the "history" or forward movement towards the "cone of the future", which is the asymmetric time order of evolution.[18].

A major distinction is between the static and the dynamic. The point is developed in "Probability, Natural Law and Emergence" (1926). In Reiser's view there are two distinct laws of nature: "(a) causal laws giving rigid determinism and predictability, and (b) statistical laws yielding mere probability and

17 Oliver L. Reiser, "An Electromagnetic Theory of Matter, Life and Mind" (1925)., pp. 611-612
18 ibid, p. 613

introducing indeterminism into the calculations".[19] The transition from the microscopic to the macroscopic brings about "order" from "chaos" through a process of statistical averaging. "Now if order can be produced from the "chaos" of random distributions through an averaging process, perhaps the "emergents" which are figuring so prominently in the speculations of contemporary evolutionary philosophy are but the "central tendencies" of statistical distributions."[20]

In his "Mathematics and Emergent Evolution" (1930), Reiser takes a further step to formalizing the difference between emergent and resultant processes, in the distinction he makes between the types of mathematics involved in the two distinct processes. Continuous equations of differential calculus are said to apply when working within a level of reality, but discontinuous, finite difference equations must be used in going from one level to another:

> In transition from one "level" to another a different type of mathematics must be employed, probably that of finite difference equations. However, when we have reached the "new" level, where uniformity again reigns, it is again possible to employ calculus.[21]

In his book **Philosophy and the Concepts of Modern Science** (1935), the distinction is expressed as follows:

> When dealing with wholes (W), the properties of which are additive (W add.), the result can be represented by a linear equation symbolized in the most general form as follows:

[19] Oliver L. Reiser, "Probability, Natural Law and Emergence" (1926), p. 428
[20] ibid, p. 431
[21] Oliver L. Reiser, "Mathematics and Emergent Evolution" (1930), p. 516

$$W \text{ add.} = f(A) + f(B) + f(C) \ldots\ldots n.$$

But the properties of a true emergent, or gestalt, are non-additive; the properties of the whole (W non-add.) are not the sum of the properties of the constituents, and mathematically we can only indicate:

$$W \text{ non-add.} = f(A, B, C, \ldots\ldots n)$$[22]

Reiser does not develop his analysis of emergence any further, and he devotes more space in **Philosophy and the Concepts of Modern Science** (1935) to a favorable review of holistic ideas (based on the gestalt theorists in psychology) than he does to the problem of emergence.

(iii). Functional Analysis of Emergence: W. P. Montague

William Pepperill Montague was one of the contributors to the collective volume, **The New Realism**, with an article entitled "A Realistic Theory of Truth and Error" (1912). In his 1929 article, "A Materialistic Theory of Emergent Evolution", he attempts to provide a mechanism to explain the emergence of plants, animals and persons. Montague attempts to analyse the mechanism of this transition, and he argues that this can be done by demonstrating the existence at each level of reality of two factors, one dominant and the other subordinate. The emergence of a new level occurs when the subordinate factor becomes the dominant one. This is an attempt to ground qualitative novelty on quantitative displacement:

"That is to say, we shall endeavor to show that there are the same two factors in any pair of successive levels, and that the transition from one to the other, momentous

[22] Oliver L. Reiser **Philosophy and the Concepts of Modern Science** (1935), p. 131

> though it may be, is adequately explained by a continuous quantitative growth of the lower factor until the critical point is reached when it gains ascendancy over its former superior and there emerges a novel quality of being seemingly discontinuous with that which gave it birth.[23]

The transitions on his theory are as follows:

(1) The emergence of the organic from the inorganic: At the inorganic level the dominating factor is that of kinetic energy "with its tendency to diffuse and run down by conduction" while the secondary factor is that of "potential energy with its tendency to perpetuate and reproduce by polaric induction"[24]. With the evolution of protoplasm, this second factor comes to predominate and with it emerges the organic level.

(2) The emergence of animal life from plant life: At the level of plant life the dominant factor is "the capacity for receiving, retaining and organizing the energies that are bound up with matter as food" [25]. The secondary factor is the same capacity, but not restricted to matter in the form of food. Rather, it includes the capacity of the nervous system to utilize energies such as light and sound for the various senses such as sight and hearing. This goes beyond the merely passive capacity of the chlorophyll mechanism of plants. Animal life emerges with the dominance of the second factor, so that the animal is a "doer", and not merely a "grower" as with the plant.

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[23] William Pepperrell Montague, (1929). "A Materialist Theory of Emergent Evolution", p. 269
[24] ibid, p. 269
[25] ibid, p. 270

(3) The emergence of persons from animal life: The two factors here are identified as (a) "the vegetal and inherited factor of body-building anabolism", and (b) "the private history of the organism's own adventures with the surrounding world."[26]. Montague also admits the possibility of a fourth emergence, from the personal to the divine, this latter a reading of Alexander's deity as independent and self-reproducing culture:

> If man were able to give actual life to the children of his spirit and to endow them with the same independence and capacity for self-preservation and reproduction as that possessed by the parts of his body, he would have attained the next higher level of evolution, which following Alexander, we may denominate the level of Deity.[27]

Montague's analysis is unique, in that he attempts a two factor explanation of emergence. Emergence is the result of the secondary factor growing quantitatively beyond a critical point and supplanting the formerly dominant factor. One problem involves his choice of primary and secondary factors. They seem to be no more than a description of some characteristic of the level being considered, and not a causal factor bringing about the state of affairs described. A second problem involves the determination of what the critical point may be, beyond which emergence occurs according to the mechanism he puts forward. How does one quantify the various factors? How does one determine the value of the critical point? Montague makes no suggestion concerning a measure of complexity that might be relevant to this problem. The attempt at a materialist theory of emergence is still born in this respect, and Montague did not develop it further.[28]

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[26] ibid, p. 271

[27] ibid, p. 272

[28] Montague, in his autobiographic article, "Confessions of an Animistic Materialist" (1931), does not discuss the problem of emergentism

(2) Critical Reactions to Emergence

The criticisms to be discussed in this section have been selected as typical of different types of negative reactions towards emergentism. Among the critiques formulated are the propositions that emergentism is incoherent and therefore illegitimate, ubiquitous and therefore trivial, or offering alternative interactive dualist or neutral monist philosophies.

(i) Emergence as Epiphenomenal or non-Causal: Stephen Pepper

The strongest critique of emergentism was that put forward by Stephen C. Pepper in his article "Emergence" (1926). Pepper sets up his argument as follows: According to emergentism, there are emergent qualities or emergent laws. A theory of emergent qualities is dismissed as "palpably" epiphenomenalist, and he devotes no more analysis to this aspect of the problem. As to emergent laws, Pepper considers as typical the case where four variables q, r, s, and t at level B are related by some law f_1(q, r, s, t). Next, he supposes that r and s give rise to some new emergent property at a higher level C, so that a new function f_2(q, r, s, t) describes the relationship at this new level, with f_2 an emergent law for level C. Pepper says that this cannot be the case, for according to him, if f_2(q, r, s, t) holds, then this implies that f_1(q, r, s, t) could never have held, (unless the event were a chance occurrence which would, however, eliminate any regularity). His reasoning is as follows: "The point is, either f_1 adequately describes the interrelationships of (q, r, s, t) or f_2 does; or if neither adequately describes the interrelationships there is some f_3 that does, but there can not be two adequate descriptions of the same inter-relationships among the same variables."[29] Therefore, either emergent change is epiphenomenal (in the sense of emergent qualities), or there can be no such change (because emergent laws are impossible).

Thus, if emergent laws exist, they must either be ineffectual and epiphenomenal, not entering into further causal relationships, or effective and reducible, "capable of being absorbed into a causal system". This part of his argument is motivated by the belief that emergent laws contradict the basic aim of science: "It is a natural ideal of science to derive all laws from a certain limited number of primitive laws or principles - not necessarily from one single law - and so to convert science into a mathematics" [30]. If the emergentist presses his claim that there are irreducible but effective laws, Pepper admits these as chance occurrences, "irreconcilable inconsistences in the physical system".[31]

In conclusion, Pepper holds that (excluding chance occurrences) qualities and laws which are considered as emergent must be epiphenomenal, not entering into further causal relationships, and thus incapable of leading to a level structure of reality. Laws are either predictable, or epiphenomenal, but they cannot be both emergent and causal.

Pepper's argumentation, however, is based on the recurrence of r and s as variables in laws at levels B and C, despite the fact that a new emergent system

[29] Stephen C. Pepper, "Emergence" (1926), p. 242. Pepper was teaching at the University of California at the time.
[30] ibid, pp. 243-44
[31] ibid, p. 244

has arisen at level C with components r and s from level B. Consider the case of the transition from the organic chemical to the biological level. In this example, let some carbon based molecules r and s appear at the lower, chemical level. Molecules cannot reproduce, but suppose that r and s combined together form a cell, which does have the (emergent) property k of reproduction.. Symbolically, $c = f_4(r, s)$; where c is a system (the cell) which has an emergent property relative to r and s; it is a property k of the system $f_4(r, s)$ which neither r nor s possess. Now there are laws about the operation of cells, into which c now enters, say $f_5(c, a, b)$. Here it is c, a system composed of r and s, which enters into the law, not r and s, the component parts. Pepper's argument is based on the laws f_1 and f_2 taking precisely the same arguments; but in the above analysis of emergence, this is not the case.

Pepper's claim that emergent laws contradict the "aim of science" to have a system of causal laws reducible to a small number of basic laws, is explicitly based on the axiomatic model of mathematics. But mathematics is a formal science, and biology, psychology and chemistry are factual ones. It is not prima facie evident that an ideal for the formal sciences (if indeed, it is an ideal at all, and the failure of logicism seems to show that it cannot be achieved even in mathematics, at least insofar as the reduction of mathematics to logic is concerned) can be transferred automatically to the factual sciences. At the very best, his argument is that the knowledge structure of science postulated by emergentism is different from his own ideal of what science should be; this does not refute emergentism, but rather says that Pepper is not an emergentist.

(ii) Emergence and Submergence: Charles Bayliss

The criticism by Charles Baylis' (Brown University) in "The Philosophical Functions of Emergence" (1929) is more profound. Baylis makes the point that attention has been centered on the emergence of new properties due to the synthesis, or integration of components; he draws attention to the converse phenomena of submergence, and then adds to this the process of disintegration of wholes. Rather than having only (1) integrative emergence, where a new property appears as the result of the integration of parts into a whole, he adds three other possibilities: (2) integrative submergence, where some properties of the parts are lost in the resulting whole; (3) disintegrative emergence, where new properties arise as the result of the separation of a whole into its parts, and (4) disintegrative submergence, where properties of the whole are lost in the process of disintegration of the whole. Baylis then argues that all four types are legitimate occurrences. This may be represented as follows:

	emergence	**submergence**
integrative	integrative emergence	integrative submergence
disintegrative	disintegrative emergence	disintegrative submergence

Baylis provides the following analysis taking the standard case of hydrogen and oxygen combining to form water:

(1) Integrative emergence: At normal temperature and pressure, water is a fluid, though at the same conditions, neither of its components had that property.

(2) Integrative submergence: Water loses the property of being a gas at normal temperature and pressure, a property which both of its components had.

(3) Disintegrative emergence: Hydrogen and oxygen when separated from water exhibit the property of being a gas, which they did not possess as members of the compound.

(4) Disintegrative submergence: Hydrogen and oxygen lose the property of being part of a liquid compound which they had when combined as water.

Baylis argues that each of the four above cases involve the non-predictability of the emergent or submergent property resulting from integration of parts or disintegration of the whole. One may assume with him that for a scientist who knew nothing of hydrogen and oxygen before the separation of water, their submergent properties (of being a gas) via disintegration would be a genuine novelty, unpredictable on the basis of his previous knowledge. The same applies to the other cases.

Now Baylis makes two further points in his argument: (1) "Emergence and submergence, integrational and disintegrational, occur in the realms of physical, mental and logical entities, not merely occasionally but ubiquitously."[32] In short, they "accompany every change in the universe." (2) This ubiquity and the problem of distinguishing between the four types of emergence/submergence is precisely the problem with emergence. Baylis holds that if a philosophical system is to be

[32] Charles Baylis, "The Philosophical Functions of Emergence" (1929), p. 375

based on emergentism, this characteristic must be non-ubiquitous and detectable. But Baylis argues that emergence is neither of these.

Consider the problem of detectability. By the ubiquity argument, we can be assured that every complex has at least one emergent property. But which one? Baylis considers the case where it is believed that X is an emergent property of the complex R(A, B). For X to be emergent, it must not be a property of A or B or any proper part of A or B. But analysis is never complete, and we can never be sure that X is not a resultant property of some part at a further level of analysis. "So in the case of any complex, it is always possible that any character thought to be an emergent from it may be a character of some as yet undiscovered element of the complex."[33] Baylis then concludes: "These two facts, the ubiquity of emergence, and the difficulty of ever being sure that a particular character is an emergent of a particular complex, render the concept almost useless philosophically."[34]

Baylis goes on to make the following further criticisms: (1) The inference from emergence to evolution is erroneous. Emergence, as the mode of introduction of novelty, may be a necessary condition for evolution, but it is not a sufficient one. For the process may be one of devolution (disintegrative emergence or disintegrative submergence); (2) There is dispute among the emergentists as to the number and type of levels of reality. "Such disagreement itself indicates the futility of the labor. The truth seems to be that any number of levels may be picked out according to the taste and inclination of the chooser."[35]

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[33] ibid, p. 377
[34] ibid, p. 377
[35] ibid, pp. 378-79

Baylis' criticisms are more important and better formulated than those of Pepper, though historically, the latter's criticisms had a greater impact, if only in the negative.[36] Baylis' argument rests to a great extent on his contention that every change, or at least every change bringing about an integration of components or a disintegration of a whole, involves emergence or its converse, submergence. The argument is based on the universality of emergence, and it this assumption that is not warranted. All change has become emergence, and emergence has simply become another term to designate change. The move required to prevent Baylis' critique (emergence as so pervasive as to be trivial) is to limit the application of emergence to significant cases, and make the emergence of levels the paradigm case. It becomes necessary to circumscribe the scope of emergence in such a way that not everything has emergent properties. This means that emergence occurs only in some classes of things, resulting in the emergence of new levels of reality. This, and Baylis' suggestion that submergence should be taken into account as the corrrelate of emergence, will be taken up in the conclusion.

(iii) Dualistic critique of Emergentism: William McDougall

The foremost critic of emergentism during the 1920s was the psychologist William McDougall, whose **Modern Materialism and Emergent Materialism** (1926) was the only book length criticism of emergent evolution published in

[36] It was Pepper's article that Wilfrid Sellars and P. E. Meehl would address in their own 1956 paper which would do so much to reinstate discussion on emergentism in the mainstream of philosophy of science:

England. McDougall had already made a sortie into the field of philosophy of mind with his **Body and Mind: A Defense of Animism** (1915), where he had defended an interactionist dualist point of view. Among his other philosophical writings was **Riddle of Life: A Survey of Theories** (1938) where he extended his psychological dualism to vitalism in biology.

McDougall had early on developed an interactionist dualist approach to the mind-body problem, evident in his article "On the Seat of the Psycho-Physical Processes" (1901), where he combines this with interesting speculations of the role of the synaptic connections. The philosophical background to his view is found in Hermann Lotze, who argued that the mind is immaterial with multiple sites of interaction with the material brain. There is no one site of interaction, such as the pineal gland in Descartes' theory, but many, and McDougall identifies the synapses with these multiple sites of mind/brain interaction: "And if the view that I advocate should prove to be true, then those who adopt the spiritualistic hypothesis will have to regard the synapses as the places of interaction of the body and soul."[37] He combines this with a correspondence view of the relation between ideas, considered as mental objects, and complexes of neurons, the material base of ideas. In terms anticipating D. O. Hebb's cell assembly theory, McDougall states that to each idea there corresponds a complex of neurons, strongly interacting via their neuronal links. A new idea is associated with an existing one, or a new feature of the idea developed, by the facilitation of nerve impulses between the old neuronal system and the newly activated neurons corresponding to the new idea or aspect of the idea.

[37] William McDougall, "On the Seat of the Psycho-Physical Processes" (1901), p. 580

In his volume **Physiological Psychology** (1905), McDougall develops his views on interactionist dualist philosophy. What is of interest in the context of the discussion of emergentism is the analogy he makes between mind-brain interaction and electro-magnetic fields. When an electric current passes through a wire, a magnetic field is also established about it. When two such wires are placed near each other, a complex interaction results, with mutual modifications of the electric currents and magnetic fields until a new equilibrium is achieved. McDougall makes the following analogy between the electro-magnetic interaction and the mind-body interaction:

> In this crude simile the wires stand for nervous arcs, the electric current for the flow of nervous energy through each arc, the magnetic field generated by the current in each wire flowing separately for a psychical element, and the total magnetic field, when several or more wires are in action, for the state of consciousness.[38]

The total magnetic field (corresponding to the state of consciousness) is different from the sum of the fields generated by electrical flows in each wire; similarly, the state of consciousness is more than the mere sum of the individual psychical elements. The generated field reacts back on the original ones as well, modifying them just as they modify it. It is undoubtedly this model of mind-brain interaction which McDougall refers to in his "Autobiography" (1930) as anticipating emergentist and holistic views of subsequent authors:

> I continued to hold the view.... that the psychical qualities are engendered by (or as would now be said "emerge from") the complex conjunctions of brain-processes (now called "configurations") but not as mere epiphenomena, but rather as

[38] William McDougall, **Physiological Psychology** (1905), p. 168

> synthetic wholes that react upon the physical events of the brain or have causal efficacy within the whole complex of psycho-physical events.[39]

The above might be suggestive of an emergentist or holistic view were it not for the overlaid dualism. In the electro-magnetic analogy, McDougall (writing in the year of Einstein's special theory of relativity, but surely unaware of it), makes the further correspondence between the aether, as the immaterial medium for electro-magnetic fields, and the soul as the immaterial ground of mind.

> ...[W]e are compelled to postulate, as a necessary condition of the development of the magnetic field, a medium or substance which we call the aether... Just so we are compelled to postulate an existent, an immaterial being, in which the separate neural processes produce the elementary affections which we have called psychical elements, and this we call the soul. The soul then is the ground of unity of psychical process, of individual consciousness.[40]

There is an evident tension between two aspects of the model: the electrical and magnetic interactions, on the one hand, and the immaterial aether on the other. As is now known, the result of Einstein's theory of relativity was the rejection of the aether. But McDougall goes in the opposite direction: he rejects the proto-emergentist part of his theory, and reinforces the dualist dimension. This means that he quite correctly recognizes the incompatibility of the two positions: either mind is generated from the brain by complex interactions of neuronal parts, or it is the result of an immaterial psychical element, but not both. McDougall opts for dualism.

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39 William McDougall, "Autobiography" (1930), pp. 205-206
40 William McDougall, **Physiological Psychology** pp. 168-169

In his article "Mental Evolution" (1925), McDougall formulates a number of criticisms of evolution and emergentism. He does not reject either outright, but he certainly limits their scope. In the first place, he states that there is no evolution of the inorganic. Physical and chemical changes occur independently of the changes preceding them; the same reaction may occur today as occurred a million years ago. He does not consider the Kant-Laplace nebular hypothesis.

He does accept evolution in the biological realm, though his preference is for a Lamarckian, rather than a Darwinian version. This is related to his repugnance for materialism. McDougall is well aware that August Waismann in the 19th century had demolished Darwin's theory of pangenesis as a material basis for use-inheritance. McDougall believes that, if for all the lack of a material basis, Lamarckian inheritance in the sense of use-inheritance still occurs, then it must be due to some immaterial agency: "If, then, Lamarckian transmission occurs, it is in itself good evidence of the reality of that immaterial organization of the facts of memory, the facts of the unity of consciousness, the facts of integration and disintegration of personality, the facts of intelligent purposive activity."[41]

Mind itself does not evolve from matter, but has its source in the immaterial psychic principle. However, McDougall does admit evolution of mind, but without emergence of new mental qualities: "There has been, not evolution of Mind from the physical realm, but evolution of mental capacities - and this evolution has been characterized by a progressive differentiation of the powers of Mind, rather than by emergence of new kinds of relation, causal or other." There

[41] William McDougall, "Mental Evolution" (1925)., p. 155.

is no emergence of sub-levels within mind as Lloyd Morgan, for example, argued. McDougall does, however, accept that mental products have qualities that their parts do not have: a fugue is more than the sum of the notes that compose it, to use one of his examples, and here, rather belatedly, there is an example of an emergent property.

Emergentism is seen, as a philosophy, as an unsuccessful attempt at finding a middle path between mechanism and teleology. For McDougall, there is an irreconcilable gulf between the inorganic, where mechanism is dominant and evolution does not occur, and the organic, where teleology is dominant and evolution does occur.

In his book, **Modern Materialism and Emergent Evolution** (1929), McDougall is concerned, as the title indicates, not only with the problem of emergent evolution, but with that of materialist ontology as well. The link he sees between the two has been evident only in the writings of Broad and Montague, but McDougall argues that emergence is intrinsically related to materialism. He is referring to the fact that emergentist systems (with the exception of Alexander) start with matter as the first level, and so logically must be based on a materialist ontology. The themes he develops in this book, the only full length study of emergentism to have been published, develop on work mentioned previously: the dualism of mind and body and the subsequent non-emergence of mind from life, as well as the defence of teleological conceptions as opposed to mechanistic or emergentist ones.[42]

[42] McDougall discusses in detail the various theories of emergent evolution only in Note 12 in his Appendix to **Modern Materialism and Emergent Evolution**. Here he examines Lloyd Morgan and

(iv) Monistic and Neutralist Critique: Bertrand Russell

In **Our Knowledge of the External World** (1914), delivered as the Lowell lectures for that year, Russell, although he does not reject scientific evolutionism, is highly critical of the "philosophy" of evolution, which he associates with progress and teleology, two concepts he considers out of place in a scientific philosophy. The philosophers cited are Spencer, whom Russell includes in a trend of "Hegelian" evolutionists, and Bergson, whose appeal to a modified teleology is quoted at length. Bergson particularly upsets Russell because of the limitations he places on the intellect and his extolling of intuition. In general, Russell appears to confound evolution as a philosophy with the Bergsonian and Spencerian forms of it, and since he rejects necessary progress and teleology, as well as appeals to intuition and the unknowable, he rejects evolutionism. The error here, that of confounding specific forms of a philosophy with the general philosophy itself, and rejecting the latter because of disagreements with some of its variants, will be repeated with respect to emergentism as well. This is a sort of category error similar to rejecting materialism because one disagrees with eliminative materialism, or rejecting dualism because one disagrees with the non-causal variant of it. Rejecting one form of a philosophy does not logically imply rejecting all forms of it, so long as some other form is able to deal with the

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Alexander's work, as well as three other volumes that cannot strictly speaking be termed emergentist: L. T. Hobhouse **Development and Purpose** (1913), C. A. Strong **Origin of Consciousness** (1918), and Edmund Noble **Purposive Evolution, the Link Between Science and Religion** (1926). Hobhouse, though he defends the evolution of mind (as did Romanes and Darwin before him), does not develop any specifically emergentist theses Nor does Strong, whose theory is more one of mind/body parallelism of a Leibnitzian type Noble's book accepts evolution of mind, but specifically states that this is an indication of divine purpose and teleology McDougall has cast his net too widely in his haste to condemn all notions of the evolution of mind, including non-emergentist ones among his "catch" of emergentist ones.

objections.[43] Thus, rejecting Bergsonian and Spencerian evolutionism does not imply rejecting all forms of evolutionism, though this is just what Russell does.

Given this negative view of evolutionism, it is interesting that Russell seriously examines emergentism in the later 1920s, influenced by Broad's **Mind and Its Place in Nature** (1926). The main discussion occurs in Russell's 1927 book, **An Outline of Philosophy** in chapter 26 dealing with events, matter and mind, where he develops his neutral monist theory. Despite the fact that his neutral monist view of matter and mind is explicitly reductionist (with events the ultimate category from which the mental and physical sequences are built up), Russell considers at some length the emergentist alternative. Russell spends about a page explaining Broad's version of emergentism, mentioning the fact that on this latter's view, the emergent properties of mind cannot be deduced from the properties of its physical constituents, and giving the usual example of water as a case of the emergence of chemical properties of molecules relative to the physical properties of the atoms. He notes that "...the possibility is an important one, and it will be worth while to consider it."[44]. Russell's argument proceeds in the following steps:

(1) Matter may indeed be emergent from events, at least as concerns its quantum mechanical properties.

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[43] For example, one might reject eliminative materialism because it denies the existence of mind. This does not hold as a general critique of all forms of materialism, since emergent materialism allows for mental properties, and in some cases, a mental level of reality. Similarly, rejecting parallelist dualism does not tell against interactionist dualism, which admits causal interaction between mind and body.

[44] Bertrand Russell, **An Outline of Philosophy** (1927), pp. 293-294

(2) Mind may be emergent from events, at least insofar as the qualitative aspects of sensation are concerned.

(3) But mind is not made up of matter; there is instead a mental series that runs parallel with the physical one.

(4) It is at least imaginable that all that exists is mental, and moreover solipsistic, existing in an instantaneous and subjective present only.

In points (1) and (2) above, he seems to be approaching an emergentist point of view; in point (3) he reverts to his neutral monist ontology, and in point (4) he questions whether subjective idealism may not be the case, for reasons that are largely epistemological. It is not clear how (3) in particular, since he rejects (4), can reasonably be considered a refutation of emergentism. It is certainly an alternative, just as McDougall's dualism might be consistently argued against the monism which Russell shares with the emergentists. Russell has set up his argument so that he must show mind not to be made up of matter if emergentism is to be excluded despite points (1) and (2). To merely reiterate his antecedent position, that it is not, because he has arguments for neutral monism (contained elsewhere in the book, in the preceding chapters) is not a refutation of emergentism.

Russell has convinced himself, at any rate, to reject emergentism. In his **Analysis of Matter** (1927), he devotes a scant one paragraph to emergentism[45], and this in a footnote. In discussing the relation of events to things, and defending the

[45] Russell's **Analysis of Matter** and **Outline of Philosophy** appeared in the same year, 1927. But clearly, the **Outline** was written before the **Analysis**, as the view on emergentism is more developed in the former than in the latter. It is also listed after it in the bibliography in the Schilpp volume of the **Library of Living Philosophers** devoted to Russell.

legitimacy of analysis, he states: "We may say that this is the characteristic merit of analysis as practised in science: it enables us to arrive at a structure such that the properties of the complex can be inferred from those of the parts."[46] This is a statement obviously opposed to the emergentist contention that the whole possesses properties not possessed by any of its parts. He then adds the following footnote, one which concludes that "emergent" is an epistemological category applicable to properties the nature of which is provisionally unknown to science:

> Dr. C. D. Broad, in the **Mind and Its Place in Nature**, lays stress upon what he calls "emergent" properties of complexes - i.e. such as cannot be inferred from the properties and relations of the parts. I believe that "emergent" properties represent merely scientific incompleteness, which would not exist in the ideal physics. It is difficult to advance any conclusive argument on either side as to the ultimate character of apparently "emergent" properties, but I think my view is supported by such examples of the explanation of chemistry in terms of physics by means of the Rutherford-Bohr theory of atomic structure.[47]

Russell's opinion of emergentism continues to diminish in his 1931 book, **The Scientific Outlook**. He now discusses it briefly in the section devoted to science and religion, and in particular in the subsection entitled "evolutionary theology". He is concerned to criticize the school of apologists who see in evolution "evidence of a Divine Plan slowly unfolding through the ages."[48] The purpose may be immanent in the organisms, or transcendent, in the mind of deity. Russell rejects arguments for purpose of either sort based on his view of reality where everything may ultimately be reduced to the physical-chemical and mechanical causes. This is once again contrasted with the emergentist point of view, Lloyd Morgan and his two **Gifford Lectures** being explicitly referred to. On page 134 Russell outlines the

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[46] Bertrand Russell, **The Analysis of Matter** (1927), pp. 285-286
[47] ibid, p. 286
[48] Bertrand Russell, **The Scientific Outlook** (1931), p. 123

usual emergentist view of the irreducibility of the mental to its physical basis, and the molecule to its atomic constituents. Then, on the next page, Lloyd Morgan is quoted, to the effect that emergent evolution is "from first to last a revelation of that which I speak of as Divine Purpose." Curious as it may seem, this seems to be a definition of emergent evolution as far as Russell is concerned, or at the very least, an essential characteristic of emergentism. It has been argued, however, in the conclusion to chapter two of this dissertation, that Sellars develops a system of emergent evolution which consistently denies general purpose and divine guidance, and that even for Lloyd Morgan, the nisus towards deity is not the core of the theory.

The problem here is the category mistake of confusing the part for the whole, and the species for the genus. It is certainly true that Lloyd Morgan includes nisus towards deity and natural piety in his system of emergent evolution. But it is only a part, and indeed, if the argument in the conclusion to chapter two is correct, a dispensable part, in the sense that it can be rejected, as Sellars does, without sacrificing the integrity of the system. Global progressionism and divine purpose can be replaced by local progressionism and global anti-teleologism in a non-theological framework.

Russell has reasoned, so it seems, as follows: (1) Divine purpose is essential to emergent evolution; (2) Divine purpose is to be rejected; (3) therefore, so is emergent evolution. The argument is valid, but it is not sound, for the main premiss is demonstrably false. Moreover, the critique of emergent evolution cannot be complete without considering other versions, such as that of Sellars, which Russell systematically fails to do.

(3) Related Philosophical Views

This section deals with two evolutionary philosophies which are closely related to emergentism, though differing with it on some key points: Smuts' holistic evolution and Boodin's cosmic evolution. I then go on to consider a number of more remotely related philosophical views of the 1920s, which, however, indicate the influence of emergentism on other trends of thought, in particular, within the **Gifford Lecture** Series.

(i) Holistic Evolution: J. C. Smuts

The first such relative of emergentism is evolutionary holism, as expressed by J. C. Smuts' (South Africa) in his **Holism and Evolution** (1926).[49] Smuts accepts the propositions that (a) wholes have properties that none of their parts have; (b) evolution in its advance is creative of novelty, and (c) reality as a result is a structure of irreducible levels. Smuts basic theses can be summarized as follows:

(1) Causation must be replaced as a basic operative concept of science by that of 'fields'. Cause and effect analysis according to which a certain factor brings about another is atomistic; whereas from a field theory point of view,

[49] At about the same time, the gestalt psychologists (Kohler and others) were developing their holistic view that what counted was the overall configuration of a complex, and that knowledge of the whole was not only necessary, but sufficient as well. It is of interest to note that such was the growing influence of holism in its gestaltist form, that Wheeler included a second chapter devoted to it when he issued his **Emergent Evolution and the Development of Societies** (1928), and Reiser gives it a prominent place alongside emergence in his **Philosophy and the Concepts of Modern Science** (1935).

things are centers of mass, energy and activity, and are surrounded by areas of diminishing influence. This concept of field will later be merged into that of the 'whole'.

(2) Space and time have been combined through relativity theory into Space-Time, which defines the structure of the universe. "According to the new Space-Time concept, structure, definite structure, becomes the essential characteristic of the physical universe, and this structural character accounts for many hitherto inexplicable phenomena."[50] Structure, like field, leads to the concept of the whole.

(3) Evolution is a creative process, not a mere unfolding of immanent potentialities. It passes through the levels of matter, life, and mind to the fourth and final level of Smuts' system, personality. The factor allowing for progress is that of the formation of wholes, or holism, which is the vera causa, or motive force of evolution:

> Wholes of various grades are the real units of Nature. Wholeness is the most characteristic expression of the nature of the universe in its forward movement in time. It marks the line of evolutionary progress. And Holism is the inner driving force behind that progress.[51]

(4) Matter in the colloid state of protoplasm manifests properties necessary for the function of life, and is the antechamber for that level of reality. Life, based on the cell, differs from the atom and molecule in its far greater complexity of structure and function, differentiation of parts and coordination of the whole. Life evolves from single cells to multicelled organisms. In organisms, there is a

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[50] J. C. Smuts, Holism and Evolution (1926)., p. 23
[51] ibid, p. 99

system of organic regulation that coordinates the various parts, and which foreshadows the later development of mind.

(5) Mind is the third great structure created by evolution after that of the atom and the cell. It is a continuation of the process of regulation of complex physiological organs which themselves are wholes, "an organ of wholes"; but mind is at the same time also a point of new departure in the level structure of reality. The field of mind includes science, culture, art, religion and the other intellectual products.

(6) Mind, however, is incomplete so long as it has not developed into personality. Personality is the highest whole produced by evolution, as mind develops a purpose and expresses itself in ideals and values. Mind proceeds from the realm of necessity, where it is intimately linked to body, to a realm of freedom which is a spiritual domain. With this latest creation of personality, the holistic universe is complete.

Smuts mentions Bergson as an inspiration for his view of creative evolution, though he evidently differs with him on the question of the élan vital, which Smuts rejects. As to Lloyd Morgan's emergent evolution, Smuts notes in a long footnote the following differences: (1) Lloyd Morgan stresses emergence, but according to Smuts, the formation of wholes is more fundamental, and (2) Lloyd Morgan accepts psycho-physical correlation at all stages of evolution, whereas Smuts admits mind only as a distinct level achieved by evolution after that of life. He notes that Lloyd Morgan's view on this point "seems to be a reversion to the preformation type of evolution and to be destructive of all real effective 'emergence'."[52] To this list of differences should also be added (3) Lloyd Morgan accepts a role for deity in his system, whereas Smuts studiously avoids the question, to the point of not even mentioning this difference. Smuts' system bears some similarity to that of Roy Wood Sellars, who also recognizes four levels in a naturalistic universe; the difference being in the identification of the fourth level (society for Sellars, personality for Smuts).

(ii) Cosmic Evolution: J. E. Boodin

John Elof Boodin (Carleton College) published his **Cosmic Evolution: Outlines of Cosmic Idealism** in 1925[53]. The point of departure for Boodin is that the universe is divided into levels, of which he mentions four: the inorganic, the organic, the mental and the spiritual. This level structure is characteristic of the cosmos as a whole. But in each part of the cosmos, or our immediate vicinity at any rate, there is an evolutionary process whereby these levels are progressively attained. It is through the interaction of the part with the whole (the earth with the cosmos) that this transition from level to level occurs locally:

> Since in the universe as a whole all the levels of reality may be suppose eternally to coexist, there would thus be provided the rationale for the evolution in one part of the cosmos from a lower to a higher level of existence without introducing magic.[54]

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[52] ibid, p. 321. Smuts also discusses his theory of holism and its relation to Bergson, Lloyd Morgan and others in his **Encyclopaedia Britannica** article, "Holism", in the 1929 edition, volume 11, pp. 640-644

[53] A major influence on him was Henry Fairfield Osborn's **The Origin and Evolution of Life**, which he quotes extensively in his introduction to his own book, **Cosmic Evolution**. He agrees with Osborn's distinction of four causative factors in evolution: the inorganic environment, the developing organism, the hereditary material and the life environment, but believes that though necessary, these are not sufficient to explain the emergence of the living from the non-living.

[54] John Elof Boodin, **Cosmic Evolution** (1925)., p. 36

If what Boodin calls the 'magic' of pure emergence is claimed to be done away with, it is not, however, clear how the whole communicates with its parts, though Boodin says that "... it communicates, whatever be the medium, in the impulses it sends out, the whole complexity of the energies of its constitution, with its order and movement, to be received selectively and in kind by such cosmic instruments as are prepared to receive them."[55] Evolution is therefore a "cosmic interaction", such that "...in the evolutionary process as a whole, the advance to higher levels in a particular series is due to the fact that these levels pre-exist as guiding causes." That is to say, "...the actual is prior to the potential and furnishes the plus factor which makes a given level of development potential of a higher one. The stream of evolution does not rise higher than its source."[56] Traditional emergence is based on the fallacy that "... we can account for new forms and characters in terms of the simpler antecedents in the series." Rather, the elements of the cosmos "... assume a new form with new properties only under the impetus of a larger whole."[57] The controlling field as well as the antecedent conditions must be taken into account.

Boodin sees three major advantages of his system. (1) It avoids the excesses of both materialism and idealism, while satisfying the legitimate desires of each. In accord with materialism, life emerges from matter, and in accordance with idealism, the spiritual level of values is the highest level and guiding force. (2) It combines epigenesis and preformationism, though each on its own is unintelligible and in contradiction with the other. When a part of the cosmos is

[55] ibid, p. 38
[56] ibid, p. 78
[57] ibid, p. 85

examined in its relation to the whole, the relation is a preformationist one: the local recapitulating the global. But considered in its local context, evolution does manifest some epigenetic characters, since new levels do arise, not strictly contained in the previous (local) ones. (3) It incorporates emergentism but goes beyond it by explaining emergence as the result of cosmic interaction: "The claims of the emergence theory, so far as it is truly descriptive, are recognized; viz. there is creative synthesis and emergence of properties, forms, levels, but a rationale is furnished for this emergence in the conception of the interaction of the particular history with the structure of the cosmos."[58]

(iii) Levels of Interpretation: J. S. Haldane

J. S. Haldane delivered his series of Gifford lectures, published as **The Sciences and Philosophy** in 1927-28. Like Lloyd Morgan, Haldane examines the three domains of matter, life and mind. His goal is to determine the applicability of mechanistic, vitalistic and animistic conceptions. He finds that a series of different "interpretations" are required to give an adequate account of each level. Like Alexander, he accepts a hierarchy of levels from space-time, through matter, to life, mind and deity. And like Smuts, he argues that it is because existents at higher levels form wholes that the interpretation adequate to lower levels breaks down when higher levels are considered.

Haldane argues that physical science may interpret inanimate bodies in a mechanistic way, as atoms colliding under the conservation of force. But such an

[58] ibid, p. 128

interpretation is inadequate in the biological, and again in the psychological sciences. The units being dealt with - organism and mind, are such that they must be viewed as wholes interacting with their parts and their environment: "The difference consists in the fact that we do not, as in physical interpretation, regard an organism and its environment as consisting of things independently of one another in space, but must regard them as forming a co-ordinated whole, of which the observed form, composition and activity are at all times the expression."[59] The distinction between biological and psychological interpretation is the following: in biological interpretation, we consider only wholes in space, but in psychological interpretation, we consider wholes in time as well:

> ...[I]n psychological interpretation we assume, and must assume, the existence of unity embracing not only the spatial relations of what we are perceiving, but also relations of time, so that the present is the fulfillment of the past and the promise of the future. When we interpret our experience psychologically, each experience is an expression of unity of the past and future with the present. [60]

At the same time that Haldane criticizes mechanistic interpretations which do not take into account this unity over space (in biology) and over time as well (in psychology), Haldane rejects both vitalism in biology and animism in psychology. Modern physiology has shown that life is dependent on physical and chemical conditions, and there is no need to assume a vital principle or force over and above these. There is a difference between the physiological and the physico-chemical, but this difference is one of a holistic character, concerning the whole-part relations within the organism, and its inter-active relations with its environment.

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[59] J. S. Haldane, The Sciences and Philosophy (1929), p. 176
[60] ibid, p. 177

Similarly, he rejects the notion of soul or any other animating principle in psychology. Paradoxically, Haldane holds that it is the Newtonian (and Cartesian) mechanistic view of physical nature that has led to a resurgence in belief in the soul and immaterial mind. For if all material bodies are to be explained mechanically, it is clear that mind involves more than that, and the temptation is to call in a psychic principle outside of nature to explain the mental phenomena. A similar situation in the realm of biology leads to vitalism. The inadequacy of mechanism as a general philosophy of science calls forth its opposite - vitalism in biology, animism in psychology. The attempt to supply a mechanistic interpretation of psychological phenomena fails to do justice to the facts, by treating a complex phenomena in simple terms inadequate to it.

Just as the physical interpretation breaks down when confronted with biological phenomena (since it has no holistic content), the biological interpretation breaks down when confronted with the psychological (since it is limited to unity over space and ignores unity over time). The question arises whether the psychological interpretation is the ultimate one. Haldane argues that the psychological interpretation leads on to the spiritual: "Since we cannot interpret conscious experience in terms of mere life, and far less in terms of physical conceptions, there is no escape from the conclusion that behind the appearances of physical or biological world we are in the presence of a psychological or spiritual world."[61] The key is the term "spiritual". Haldane argues that beyond the scientific concerns of matter, life and mind are the

[61] ibid, p. 189

spiritual concerns of value and deity. This can be grasped only through philosophy and religion, and here science meets its limit. The theology that Haldane argues for is a natural theology, with faith defined "as the conviction that our universe is consistent with itself"[62]. Space and time are merely the phenomenal order through which spirit expresses itself. Physical things, biological organisms and psychological personalities are in essence spiritual insofar as they are the manifestation of deity: "The conclusion to which the argument of this course of lectures will lead up is that our universe, under whatever guise of constituent self-existent things or personalities it may for the moment appear to us, can be nothing else but the manifestation of one Spiritual Reality, or one God."[63] It is for this reason that Haldane calls his philosopny by the title "spiritual realism".

Haldane's philosophy contains a hierarchy of sciences, from the mathematical, through the physico-chemical, to the biological and psychological. He divides the kinds of knowledge into "mathematical, physical, biological, and psychological or humanistic knowledge"[64]. Of the mathematical sciences, he says that "...they deal merely with time-relations (arithmetic and algebra) and space-relations (geometry)."[65] The Kantian background is clear in this formulation. The place of the physico-chemical sciences is recognized, and in both directions: they are based on the use of mathematics, and serve as basis for the biological sciences. They have their role in explaining the "visible and tangible" universe. But considered as an complete interpretation of all of nature, they are inadequate.

[62] ibid, p. 189
[63] ibid, p. 190
[64] ibid, p. 323
[65] ibid, p. 323

Even the biological interpretation does not suffice, but we must ultimately have recourse to a psychological and then a spiritual interpretation, informed by Haldane's spiritual realism.

There are a number of themes developed by Haldane which are related to emergent evolution and holistic evolution. It can be seen that he has a hierarchy of levels of knowledge, from the mathematical to the spiritual. To this correspond a hierarchy of levels of reality: from space-time, through the visible and tangible universe, to life, mind and deity. Higher levels are based on lower ones, but are truer, or more real, involving greater complexity of relationships and wholeness. Though Haldane does not discuss Lloyd Morgan at all, his use of interpretation is close to that which Lloyd Morgan had developed in his 1905 **Interpretation of Nature**.

Haldane, however, disagrees with the evolutionary component of emergent evolution. He cannot accept the "jumps" from one level to another, which he describes as "abrupt and unintelligible". He concludes that "It seems to me that Alexander produces the real world very much as a conjurer produces rabbits from a hat. The rabbits are real enough, and not shams; but in reality they were there from the beginning."[66] Matter, Life and Mind are there from the beginning in Space-Time, they do not arise successively in the course of an emergentist deduction:

> Reality is there all the time, and we cannot deduce it. Our perception of it is, however, more adequate or less adequate according as our interpretation of it is more adequate or less adequate. The mathematical interpretation as space- and

66 ibid, p. 261

time- relations is extremely inadequate; the physical interpretation less inadequate; the biological interpretation less inadequate; and the psychological interpretation as a world of interest and values least inadequate of all these interpretations.[67]

Haldane feels closer to Smuts' holism, which he also discusses at some length:

Intermediate between mechanistic and animistic interpretations of conscious experience there is another mode of interpretation, which I shall call the biological interpretation. This is represented to some extent in the writings of Leibnitz, Bergson, and other philosophical and scientific authors; but I think that it has been given by far its most developed and clear-cut form in the remarkable recently published book by General Smuts on **Holism and Evolution**.[68]

Haldane shares with Smuts the importance of the concept of wholes, but once again, he disagrees with the evolutionary component. The criticism he makes of Smuts is the same as that addressed to Alexander. He rejects the proposition that personality (mind) and spirit only appear at a certain stage of evolutionary development, and did not exist antecedently. Haldane's philosophy reads spirit back to the earliest time and the simplest matter, even though the scientific interpretation we make of the inorganic does not require explicit reference to this fact.

(iv) Interaction and Emergence: C. E. M. Joad

C. E. M. Joad, in an article entitled "Emergence to Value" (1928), attempts to combine elements of realism, vitalism and emergentism. By realism, he means

67 ibid, pp. 261-262. The most adequate interpretation, the only true one in fact, is that of spiritual realism
68 ibid, p. 136

the theory of knowledge according to which (a) in knowing, the mind is aware of something which is other than itself, and (b) the object is known without amplification or distortion, and without the imposition of categories of the mind. By vitalism, he means the view that "life is not a mere outcome or offshoot of matter, but is a distinct and irreducible force or principle, that this principle is spontaneous and creative, and that it can in some sense, which it is difficult to define, direct and control matter..."[69]. He stops short, however, of accepting life, or mind, as creative of matter, and opts for a dualism of matter and mind. One would suppose that given this preference for vitalism and dualism, he would not find a place for emergentism. Yet the bulk of his article is devoted to just such an attempt.

How does he attempt this? Clearly, a strong version of emergentism is out of the question, and Joad himself states that he cannot accept any form of emergentism in which the emerged product bears the marks of its constituent parts (i.e. is "infected" by their natures). For in this case, supposing mind to be an emergent from body, mind will exhibit some characteristics of body, it will be "infected with materiality", something which Joad's dualism precludes. Accordingly, he must opt for a very weak form of emergentism, "By the doctrine of emergentism, then, I wish to assert little more than is implied in the general notion of life as a spontaneous and creative force, a notion with which Bergson has made us sufficiently familiar."[70]

[69] C. E. M. Joad, "Emergence to Value" (1928), p. 75
[70] ibid, p. 78

The reference to Bergson is revealing, since Bergson believed in a dualistic ontology and a creative ontogeny. For Bergson, the élan vital is present at the very start of evolution; subsequently its creativity is limited by the passivity of matter. However, for Joad, life arises as a creation out of nothing: "This is to assert that something can come out of nothing, and it is precisely this assertion which to my mind the conception of life's creativity involves."[71] This is a startling assertion, to say the least.

There is a gap, or gulf, between matter and life. Life is not present at the outset of evolution. Further, it does not share any qualities of materiality. This discontinuity between matter and life is quite foreign to emergentism. Where emergence does occur is in the evolution of mind from life. "But mind is merely life's expression at a particular level of emergence, and is only to be distinguished.... from life in general in terms of the objects upon which its activity is directed."[72] There is thus a level of emergence within life, even if life is not an emergent level from matter.

Over and above the level of life, there is that to which life tends to as its goal, the realm of values. For Joad, following Plato, these are fixed and changeless, ideal forms divided into the three categories of truth, goodness and beauty. Our experience of these absolute values is "fleeting and intermittent" and our talk of them necessarily "metaphorical". Thus, in addition to the division between the realm of matter and that of life and mind in the real world, there is the distinction between the real world and the ideal world consisting of the values or forms of

[71] ibid, p. 78
[72] ibid, pp. 81-82

good, truth, and beauty. However, Joad does not accept Plato's theory of the relation between the two, since the theory of participation involves a causal relation. Joad substitutes instead a theory of imitation with no causal relation. "Thus the physical world imitates or reproduces a particular sub-section of the world revealed to thought, without owing to it the fact of its existence."[73] A work of art, for example, is a "sign-post pointing towards reality", i.e. the form of beauty. But there is an element of emergence in all this, for the artist who is able to produce such a work of art, is himself a higher emergent within the level of life. "The artist may be described as an evolutionary sport, in whom life has emerged at a higher level than in the rest of the species."[74]

In conclusion, Joad reiterates that he accepts that the universe is not continuous but rather contains three different types of entities: matter, life and value, between which there are gaps of "real discontinuity". Life initially appears in the world of matter, but manifests itself as awareness, first in terms of sense-data, then feelings, followed by awareness of external objects and abstract ideas ("non-material objects of thought"). In humans, there is in addition awareness of objects of value. This is the highest level and includes awareness of truth, beauty, goodness and in religious thought, deity as well. "Thus, by the phrase emergence to value, I mean the progress of life from the awareness of the material world, which is the world of becoming, to the awareness of the world of value, which is what Plato called the world of being."[75] Referring to the emergence of mind, Joad

[73] ibid, p. 85
[74] ibid, p. 87
[75] ibid, p. 91

concludes: "The object of evolution may be conceived to be the emergence of life at a level at which it is continuously aware of objects of value."[76]

Joad developed these views further in his book **Matter, Life and Value** (1929). He examines Broad's compound theory of mind according to which mind is an emergent from a of a bodily factor (the brain) and a psychic factor (as manifested in paranormal phenomena). However, Joad does not share Broad's belief in the paranormal. Moreover, he is also dissatisfied with the other half of Broad's view: that mind at least partially emerges from body, since this commits Broad to recognizing at least some mental qualities as being material. Joad therefore proposes an alternative theory of emergence. It must respect the following three conditions: (a) Mental and material events are radically different; (b) they are not distinct and parallel series of events; and (c) they develop in a connected way. This connected development applies to each of the mental and physical series. The upshot is the acceptance of

> ... a double emergence, an emergence, that is to say, of progressively higher levels of mind in an entity essentially vital, though only in the most rudimentary sense mental, from the beginning, and an emergence of more refined and complex cerebral tissue from the comparatively simple and crude material substance with which this vital entity was originally associated."[77]

Life has an incipient mental aspect, but this can emerge only through its interaction with matter. Life plays the leading role in the emergence within itself of the mental, brought about through its struggle with a limitative matter. In more general terms, Joad defines his concept of emergence as follows:

[76] ibid, p. 95
[77] C. E. M. Joad, **Mind, Life and Values** (1929), p. 169

> I can put the position most clearly by resorting to the use of symbols. If X be a rudimentary psychic factor and Y a rudimentary bodily one, then both X and Y are continually developing, X through a series of emergents X', X'', X''' and so forth, Y through Y', Y'', Y'''. X' is not an emergent upon X and Y, but upon X only. Nevertheless, it is only through interaction with Y, which provides the stimulus to transcend the limitations imposed by Y, that X is enabled not only to develop higher emergents of itself, but to effect in Y such such modifications as will render Y a less limiting and obstructive associate to these higher emergents. It is these modifications which transform Y into Y', and Y'', concurrently with the development of X into X' and X''.[78]

Mind, considered as the capacity for thought and self-consciousness, is not a distinct substance, but one emergent from life. As in his 1927 article, Joad does, however, admit a third substance, as the title of his book indicates, that of values. His belief in objective, rather than subjective values leads him to accept these as unchanging ideals, distinct from matter and life.

> The universe contains entities of three distinct kinds, life, matter and immutable non-material objects. Each type of entity is irreducible and cannot be resolved into entities belonging to either of the other types. Life is initially unconscious but is characterized from the first by the potentiality for consciousness, the distinction between consciousness and unconsciousness being one of degree not of kind.[79]

From the above brief résumé, it is clear that emergence in Joad's view is limited to a far greater extent that in traditional, non-pluralist accounts. Though emergence occurs within each of the major distinct substances, mind does not arise from matter, but rather emerges from the pre-existing vital substance. Such emergence is stimulated by the interaction of the substances.

[78] ibid, p. 169
[79] ibid, p. 375

(v) Process and Emergence: A. N. Whitehead

Whitehead's **Process and Reality** was delivered as the **Gifford Lectures** for 1927-28. The influence of Alexander and Lloyd Morgan on Whitehead is little mentioned in recent studies on Whitehead, but he was himself more candid in this respect, especially as concerns Alexander. Prima facie evidence is provided in at least two volumes of Whitehead's pre-1926 writings. In the preface, dated June 1925 to his collection of essays, **Science and the Modern World** (1926),[80] Whitehead says:

> There has been no occasion in the text to make detailed reference to Lloyd Morgan's **Emergent Evolution** or to Alexander's **Space, Time and Deity**. It will be obvious to readers that I have found them very suggestive. I am especially indebted to Alexander's great work.[81]

The actual content of that influence, especially that of Alexander, is clearly stated in Whitehead's next volume, **Religion in the Making** (1926), which was the **Lowell Lecture** given in February of 1926. Of particular interest for present purposes is Chapter 3, "Body and Spirit". In section 6 of that chapter, Whitehead criticizes the Cartesian distinction between two separate substances of mind and body. Whitehead's move is typical of neutral monism: he starts with an element more primitive than mind or matter, and then derives these latter as complications or developments of it:

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80 The essays are mainly based on his Lowell lectures of February 1925, along with a number of additional chapters (chapters 2, 10, 11 and 12). Chapter two deals with mathematics and its role in the history of thought, chapter 10 with the method of abstraction, and chapters 11 and 12 with God, and the relation between religion and science.

81 A. N. Whitehead, **Science and the Modern World** (1926), p. xi

> Now, according to the doctrine of this lecture, the most individual actual entity is a definite act of perceptivity. So matter and mind, which persist through a route of such occasions, must be relatively abstract; and they must gain their specific individualities from their respective routes.[82]

This is followed by section 7, "The creative process". Not only are mind and matter based on different routes from perceived events, but there is an element of creativity manifest in the sequence of events. "The birth of a new instance is the passage into novelty"[83]. This is Bergsonian with the dualistic metaphysics left out. But moreover, it is Alexander, and explicitly so, for the paragraph concludes as follows:

> A great philosopher (cf. Alexander, **Mind, Space and Deity,** Vol. II. p. 43 et passim) has said that time is the mind of space. In respect to one particular new birth of one center of experience, this novelty of ideal forms will be called the "consequent". Thus we are now considering the particular relevance of the consequent to the particular ground supplied by one antecedent occasion.[84]

The novel consequent is distinguished from its antecedent ground, but it must have some relevance to its ground, as well as a certain contrast. Translated into emergent evolutionary terms, there arise new things as complexes of resultant and emergent properties, with the resultant properties the base upon which the emergent ones arise. Whitehead, however, claims that every succeeding event has an element of novelty (emergence is ubiquitous), which is a stronger claim than that of Alexander or Lloyd Morgan. Moreover, he does not consider the problem of levels of reality.

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82 A. N. Whitehead, **Religion in the Making** (1926), pp. 108-109
83 ibid, p. 111
84 ibid, p. 114. The words in brackets after 'philosopher' appear as a footnote referenced to that point. The title of Alexander's book is misquoted in Whitehead's text.

In **Process and Reality**, the influence of emergent evolution is still visible, but. Whitehead has moved to a definitive statement of his own process philosophy. The influence of Alexander is most clearly present in Part I, chapter II, entitled the "Categorial Scheme". Like Alexander, Whitehead considers that a theory of categories is the basis upon which his philosophy arises. The categories are divided into four parts: (1) the category of the ultimate, (2) categories of existence, (3) categories of explanation, and (4) categoreal obligations. The first set is basic: "The category of the Ultimate expresses the general principle presupposed in the three more special categories."[85] The fact that it is here that Alexander's influence is the greatest is therefore of considerable importance.

Whitehead states that the category of the Ultimate is made up of three ultimate notions: 'creativity', 'many' and 'one'. "These three notions complete the Category of the Ultimate and are presupposed in the more special categories."[86] 'One' stands for the singularity of an entity, while many stands for the diversity of entities, which when united form a whole. One and many are related by the relation of creativity, which Whitehead calls the "universal of universals":

> 'Creativity' is the universal of universals characterizing ultimate matter of fact. It is that ultimate principle by which the many, which are the universe disjunctively, become the one actual occasion, which is the universe conjunctively. It lies in the nature of things that the many enter into complex unity.[87]

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85 A. N. Whitehead, **Process and Reality** (1929), p. 31
86 ibid, 31. Whitehead notes that 'creativity', 'many' and 'one' are "involved in the meaning of the synonymous terms 'thing', 'being' 'entity'." (ibid)
87 ibid, p. 31

The point of view of creativity productive of novelty as expressed in his earlier **Religion in the Making** is still present in this later text:

> 'Creativity' is the principle of novelty. An actual occasion is a novel entity diverse from any entity in the 'many' which it unifies. Thus 'creativity' introduces novelty into the content of the many, which are the universe disjunctively. The 'creative advance' is the application of this ultimate principle of creativity to each novel situation which it originates.[88]

It was seen that the concept of 'togetherness' plays a major role in Alexander's system. Here is what Whitehead has to say about this term:

> 'Together' is a generic term covering the various special ways in which various sorts of entities are 'together' in any one actual occasion. Thus 'together' presupposes the notions 'creativity', 'many', 'one', identity' and 'diversity'. The ultimate metaphysical principle is the advance from disjunction to conjunction, creating a novel entity other than the entities given in disjunction.[89]

The evolutionary emergent background to the above is evident, to which is added a logical terminology (disjunction, conjunction), combined with a strong version of the emergent claim (every whole, or conjunction of parts, has novel properties relative to its components). Togetherness unites these parts, it is a relation of immediate synthesis:

> The novel entity is at once the togetherness of the 'many' which it finds, and also it is one among the disjunctively 'many' which it leaves; it is a novel entity, disjunctively among the many entities which it synthesizes. The many become one, and are increased by one. In their natures, entities are disjunctively 'many' in process of passage into conjunctive unity. This Category of the Ultimate replaces Aristotle's category of 'primary substance'.[90]

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88 ibid, pp. 31-32
89 ibid, p. 32
90 ibid, p. 32

The technical term 'concrescence' is introduced at this point to express the "production of novel togetherness". Moreover, the processes productive of novelty cannot be explained as cases of higher laws or deduced from component parts, a theme characteristic of emergent evolution as well:

> These ultimate notions of 'production of novelty' and of 'concrete togetherness' are inexplicable either in terms of higher universals or in terms of the components participating in the concrescence. The analysis of the components abstracts from the concrescence. The sole appeal is to intuition.[91]

Whitehead's system has therefore an implicit emergentist component, most evident in his treatment of the categories.

(vi) Emergence and Sociality: G. H. Mead

The role of the social in emergence was a concern of George Herbert Mead in his various writings, including **The Philosophy of the Present** (1932), and his posthumously published **Mind, Self and Society** (1934), and **The Philosophy of the Act** (1936).

Mead, like Bergson and others before him, is concerned with the problem of time, and in particular, the relation of past, present and future. As the title of his 1932 volume suggests, he privileges the present. The matter is stated quite boldly at the outset of lecture 1: "The subject of this lecture is found in the proposition that reality exists in a present. The present of course implies a past and a future,

91 ibid, p. 32

and to these both we deny existence".[92] This belief in reality as a present only is combined with acceptance of the emergence of novelty. The emergent appears in the present, and at the instant of its appearance is a break with the past. But since reality is merely the present, the appearance of the novel brings about a rewriting of the past so that the breach is done away with:

> It is that there is and always will be a necessary relation of the past and the present but that the present in which the emergent appears accepts that which is novel as an essential part of the universe, and from that standpoint rewrites the past. The emergent then ceases to be emergent and follows from the past which has replaced the former past.[93]

This is a startling proposition: the present "rewrites" the past, and in so doing, the present emergent ceases to be emergent. Mead argues that this is in accord with the rationalistic frame of mind of science: the philosopher may speak of life and consciousness as emergent, but science aims at describing a universe from which they arise "inevitably out of that which preceded them."[94] This does not eliminate emergence, however, as future presents will still display such novelty, once again to be rationalized away, and so on without end. Mead makes the further claim that emergent events are what determine our perception of the present. The chief reference of a present is to an emergent event.

Mead situates his unusual view of emergence in what he terms a "social" context. A thing must be considered in its environmental context, and each perspective on the thing/environment complex is what he calls a system. A plant

[92] George Herbert Mead, The Philosophy of the Present (1932), p. 1
[93] ibid, p. 11
[94] ibid, p. 11

or animal, for example, may be seen by the physical scientist in the mechanistic sense as a physico-chemical complex interacting with its energy environment, or by the biologist in the teleological sense as a goal-directed form of life. Here, both mechanism and teleology can be accepted as particular points of view, though they cannot be admitted as general standpoints. Thus, a thing may, in Mead's sense of the term, be part of two systems (or perspectives) at once. This is what he means by "sociality", the presence in different systems of the same thing. Sociality, like emergence, is then a pervasive characteristic of the present, and indeed, forms the condition for the appearance of the novel.

> The conduct of the conscious organism is determined both by a physiological system from behind and also be a consciousness which reaches into the future. This can of course take place only in a present in which both the conditioning past and the emergent future are to be found; but, as these problems indicate, what is further called for is the recognition that in the present the location of the object in one system places it in the others as well. It is this which I have called the sociality of the present.[95]

Mead distinguishes three levels of reality, which he calls fields: the physical, the biological and the mental (which introduces meaning and values into life), with sociality in the above sense the condition for the appearance of each field:

> But in all three of these fields the principle of sociality nevertheless obtains. In all three there is emergence, and the character of this emergence is due to the presence in different systems of the same object or group of objects. Thus we find that in one system with certain space, time and energy characters, an object moving with a high velocity has an increased mass because it is characterized by different space, time and energy coefficients, and the whole physical system is thereby affected. In like manner it is because an animal is both alive and a part of a physico-chemical world that life is an emergent and extends its influence to the environment about it.

95 ibid, p. 63

> It is because the conscious individual is both an animal and is also able to look before and after that consciousness emerges with the meanings and values with which it informs the world.[96]

(4) Related Biological Views

The biologists discussed in this section include J. Arthur Thomson, a popularizer of Darwinian evolution even during the period of its "eclipse" during the first quarter of the 20th Century; W. M. Wheeler, the entomologist who emphasized the social level of emergent reality; Joseph Needham, the chemical embryologist and historian of science, who along with J. H. Woodger developed an organicist view of integrative levels; Alex Novikoff, who popularized the notion of integrative levels during the 1940s; and Julian Huxley, one of the artisans of the modern synthesis of evolutionary theory and genetics.

(i) Biology and emergence: J. Arthur Thomson

The biologist J. Arthur Thomson's work is of interest since his **Gifford Lectures** of 1915-16, entitled **System of Animate Nature** set out views on qualitative novelty in evolution before either of Alexander or Lloyd Morgan delivered their own lectures on the same subject. Thomson distinguishes three major stages of evolution, or becoming in nature, proposing distinct terms for each. The first is that of inorganic evolution, or 'genesis'; the second phylogeny of species in the organic domain, or 'evolution' proper, and the third, the evolution of societies through 'history'. Becoming is a continuous process, but one marked by successive steps of 'creative synthesis':

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96 ibid, p. 67

> No matter how convinced we may be as to Continuity, we must not assume that the processes that have led to the inorganic domain being what it is are those which account for the becoming of organisms, or that human history is nothing more than a continuation of organic evolution. A staircase is continuous, but there are successive steps, and so in evolution there seems to have been epoch-making steps of 'creative synthesis'.[97]

Thomson compares evolution as the phylogeny of species to embryology as the ontogeny of individuals. Just as epigenesis involves the deployment of novelties at the level of individual development, so in evolution there is also the creation of genuine novelty. There are two problems which he examines in his analysis of evolution: the problem of continuity and the problem of progress. Continuity is taken to involve the the absence of breaks, leaps, gaps, or intrusions. Despite claims for such leaps or discontinuous variations by the supporters of genetic mutation (such as William Bateson), Thomson maintains that there is no more discontinuity in the emergence of new forms than in the metamorphosis of a caterpillar into a butterfly. As concerns progress, Thomson notes that evolution is a process of differentiation and integration (as in Spencer), and as such is progressive. Differentiation leads to greater complexity and integration to increased correlation; the net result, despite occasional lapses (e.g. parasitism) is a forward movement.

In this process of evolutionary progress, characterized by differentiation and integration there are a number of what Thomson calls "great steps". These great steps are in fact the emergence of new forms of organization in the animal world. They include the initial act of abiogenesis, by which life appeared from a

[97] J. Arthur Thomson (1920): **The System of Animate Nature**, vol. 2, p. 355

non-living matrix, the "emergence and divergence of green plants", the transition from unicellular to multicellular organisms, sexual differentiation, the development of brains and the origin of vertebrate animals, leading to the last step when "finally, Man emerged, the 'summit of the whole.'"[98] Thomson's emphasis on the emergence of novelty in the context of continuous evolution is similar to Lloyd Morgan's point of departure in his 1912-15 period, and Thomson' makes numerous references to Lloyd Morgan[99].

Thomson confirms his support of emergent evolution in **Concerning Evolution** (1924) given at Yale University, as the inaugural volume of the **Terry Lectures** series on natural theology.[100] Thomson begins his lectures with a discussion of evolution in the physical sphere (or genesis in his specialized

[98] ibid, p. 404

[99] Thomson refers to Lloyd Morgan's Spencer lecture of 1913, which has been identified as his key writing initiating emergent evolution as a theory, and in particular, Lloyd Morgan's reference to to Nernst's distinction between additive and constitutive properties, and the need to transcend the mechanism/vitalism distinction with an alternative, non-dualist theory. Thomson also refers to Lloyd Morgan's **Instinct and Experience** on the distinction between instinctive and intelligent behaviour (pp. 203-204), and refers to his **Scientia** article of 1915 on the mind/body relation, emphasizing the neutral monist aspect . The articles referred to are precisely the ones where Lloyd Morgan develops his concept of emergent evolution. The importance of Lloyd Morgan to Thomson is clear when one considers that Thomson refers to him almost as frequently as the most cited authors in his book: 15 references to Lloyd Morgan, compared with 15 for Darwin as well, and 19 for Jennings (who also adopts emergent evolution in the 1920s), these three being the only authors cited more than 10 times (according to the index of the 2 volumes).

[100] The Terry Lectures were established by the bequest of Dwight H. Terry of Plymouth Connecticut, for the delivery of a series of "Lectures on Religion in the Light of Science and Philosophy". The bequest stipulates: "The lecturers shall be subject to no philosophical or religious test, and no one who is an earnest seeker after truth shall be excluded because his views seem radical or destructive of existing beliefs." [in **The Dwight Harrington Terry Foundation**, a brochure included as a supplement to Thomson's set of **Terry Lectures**.] These presentations, like the Gifford Lectures, were then published in book form. Besides Thomson's inaugural 1925 lecture **Concerning Evolution**, relevant **Terry Lectures** include the following: R. A. Millikan, **Evolution in Science and Religion** (1935), Joseph Needham, **Order and Life** (1936) ,H. S. Jennings, **The Universe and Life** (1938), G. G. Simpson, **The Meaning of Evolution** (1949).

terminology); he then goes on to discuss organic evolution in chapter two and the evolution of man in chapter three.

Thomson once again sets out the dual desiderata of novelty and continuity. He notes that man is an emergent novelty: "When we say that Man is an outcome of evolution, we mean that he is the highest expression of a process that began with simple forms of life and has continued for many millions of years, a process in which novelties are continually emerging and being sifted."[101] This leads to a problem. On the one hand, he does not want to do away with a strong claim to continuity, and the ensuing notion that rudiments of mind were present in the earliest of organisms: "The firmer our grasp of the idea of continuity, the more we must allow to the original endowment of the simplest organisms"[102] On the other hand, he wants to recognize that evolution is creative, in the sense set out by Lloyd Morgan:

> There is something to be gained by considering what Professor Lloyd Morgan calls "emergent evolution". The whole ascent of life, not to speak of the genesis further back still, is studded with puzzling "emergences" - outcrops of genuine novelties.[103]

Thomson's illustrations of emergents include the standard one of the combination of hydrogen and oxygen to form water, a genuine novelty whose properties cannot be predicted from antecedent knowledge of the properties of the components. At the inorganic level he accepts whole-heartedly the concept, but less so the term 'emergence': "Using the word 'emergence' does not explain

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[101] J. Arthur Thomson (1925): **Concerning Evolution**, p. 204

[102] ibid, p. 205

[103] ibid, p. 205. Like Lloyd Morgan, he tries to combine a biopsychist view of mind with an emergentist one.

anything, but it lays emphasis on the difference between an additive resultant and an outcome that is a new synthesis."[104] The case is even stronger at the level of the organism and mind:

> But the fact of emergent evolution, so brilliantly expounded by Professor Lloyd Morgan, is more conspicuous in the realm of organisms than in the domain of things. All the great steps of evolution - the making of a body, the establishment of a brain, the beginning of the blood, the differentiation of sense-organs, and so on - were new syntheses, with new intrinsic and new extrinsic properties.[105]

This applies all the more to the origin of man and the onset of mental evolution: "His was a new synthesis, if ever there was one; no mechanical resultant, but a vital new creation; not involving any breach of continuity, or any interpolation of supra-mundane influence, but making a fresh disclosure of the unending riches of reality."[106] The full adherence to the tenets of Morgan's emergent evolution is summed up as follows :

> The evolutionist does not interpret the higher in terms of the lower, the man in terms of the beast, for that would be to deny the newness of emergence. He sees antecedent pre-human stages with less of certain characteristics, such as intelligence and self-consciousness; out of which emerges Man, a new creature, not rising at once, of course, to the height of his calling, but with a new chord that is a fresh start in what Lotze called "the onward advancing melody". Into the new fabric there pass no doubt strands of the old, but some threads are new and the pattern is new. Explain it who can, but that is the way the loom of time works. The religious interpretation is a reverent acknowledgement of God as the spiritual source of all, as "the nisus through whose activity emergents emerge, and the whole course of emergent evolution is directed" (Lloyd Morgan)[107].

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104 ibid, p. 205
105 ibid, p. 206
106 ibid, pp. 206-207
107 ibid, p. 209

Note two characteristic dilemmas of Lloyd Morgan which Thomson here accepts as his own: (1) the tension between qualitative discontinuities introduced by emergence, and the need to harmonize this with quantitative continuity considered essential for evolution, and (2) the fact that evolutionary emergence is a fact of science which cannot be interpreted within science, but must call in the help of religion.

(ii) Emergence and the Social: W. M. Wheeler

The Harvard entomologist W. M. Wheeler was one of the discussants of emergent evolution at a colloquium held on that subject at the 1926 **World Congress of Philosophy.** Wheeler's 1926 article "Emergent Evolution of the Social" was reproduced twice, once in **Science**, and then with an additional chapter on holism as a pamphlet entitled **Emergent Evolution and the Development of Societies** (1928). His interest in the social insects is the immediate background to his discussion of societies as a level of reality. Wheeler notes that comparative sociology has largely been neglected, the sociologists leaving insect and animal societies to the biologist, and the biologists being little concerned with the collective dimensions of life, limiting themselves to the characteristics of individuals. But nonhuman societies "....no less than human society, are as superorganisms obviously true emergents, in which whole organisms function as the interacting and determining parts."[108]

[108] W. M. Wheeler, **Emergent Evolution and the Development of Societies** (1928), p. 36

In his taxonomy of social aggregates, employing 'social' in the widest sense, he distinguishes homogeneous and heterogeneous groups. Heterogeneous social aggregates correspond to what we would today call eco-systems of various different species, involving relations of predatism, parasitism, symbiosis, association and others. These groups "constitute a vast series of emergents varying from those of very low to those of very high integration."[109] In homogeneous societies, which are the only true societies in a more narrow sense of the term, nutritional, reproductive or defensive reasons may predominate in the development of emergent social behavior. A higher sort of emergence is that of multi-species societies where mixed colonies are formed by the association of different species of ants amongst themselves or with parasitic organisms. In the cases of mixed colonies where one of the social components becomes a predator or parasite with respect to the others, there is now a role differentiation not only within the species, but between species, "so that a new emergent arises - a super-superorganism, or superorganism of the second degree."[110]

Because of the pervasiveness of the social of this very weak sort, Wheeler concludes "We may say, therefore, that the social is a correlate as well as an emergent of all life in the sense in which Morgan speaks of the mind as being both a correlate and an emergent of life."[111] This can be extended even lower, to the inanimate: the structure of the atom involves association of electrons and other constituent particles in some sort of a collective organization. In this sense, "association may be regarded as the fundamental condition of emergence" On

109 ibid, p. 37
110 ibid, p. 40
111 ibid, p. 41

Wheeler's view, no entity outside of time and space is required (in opposition to Driesch's entelechies, Bergson's élan vital, and Alexander's deity).

Wheeler therefore proposes a level order which goes as follows: matter, life, mind and society, as Roy Wood Sellars' also proposes the next year. Wheeler is the first person to have noted the absence of the social in Lloyd Morgan's and Alexander's systems. "I fail to understand why Alexander and Morgan select deity as the supervenient level next to mind, since their general scheme of emergent evolution most naturally demands the social as the next level in ascending order."[112] Wheeler notes that the next emergent level after that of the social cannot be predicted, for there may be an end to the series, "supervenient extinction". But should human society not destroy itself, emergents that may still arise (though not necessarily constituting a level) including "greater solidarity and higher ethics."[113]

A danger Wheeler notes is that of the degeneration of the individual as social organization advances. This is evident in the social insects (decrease in brain size in mature kings and queens of termites, loss of role differentiation in parasitic groups, return to nonsocial life in some species). He is concerned that this may occur in humans too, where signs he notes include decline in the sense-organs, absence of demonstrable increase in intelligence during historic time, greater emotivity, insanity; criminality and mob psychology in large cities. He wonders whether this may not lead to "a society of lower intelligence of the

[112] ibid, pp. 41-42
[113] ibid, p. 42

individuals combined with an intense and pugnacious solidarity of the whole"[114] as has happened with the social insects. Further social "progress" may also lead to that paradigm of biological inadaptation: extinction. He concludes on this pessimistic note.

Wheeler was the first supporter of emergentism to include the social as a level, preceding by one year the publication of Sellars' four level system. Moreover, he developed many of the themes later taken up by E. O. Wilson in his sociobiology. Indeed, Wilson explicitly mentions Wheeler as the precursor of his thought.[115]

(iii) Organicism and levels of Organization: Joseph Needham

The biochemist and historian of science Joseph Needham combined organicist, emergentist and dialectical notions. In his work, Needham clearly sets out a concept of levels of organization which was to influence other theorists. Needham's article "Organicism in Biology" appeared in 1928. He traces the origin of the term "organicism" to various sources, including Whitehead in **Science and the Modern World** (1926), and Lloyd Morgan, in his article "The Concept of Organism as Emergent and Resultant" (1927).

> Thus, on the organic theory of nature, all the universe is seen to consist of wholes, or organisms, whose parts, as Lloyd Morgan would say, go together in substantial unity, or in other words, are only themselves so long as they remain in their natural places within the whole to which they belong. For the constitutive relationships or parts are not entities having an existence in their own right, but

[114] ibid, p. 43
[115] This is noted by Wilson in both his **Insect Societies** (1971) and his **Sociobiology: The New Synthesis** (1975)

only by virtue of their position and function in the organism of which they form parts. This relatedness or going-togetherness is the hallmark of an organism, and it may be noted that it can interlace with other organisms, just as a living organism and its environment is inextricably intertwined. The universe, in this view, is a vast array or organisms, mounting up from the simplest atomic wholes to the world-organism, that modern translation of "anima mundi" itself. Biology, as Whitehead says, is thus the study of the larger and more complicated organisms, physics that of the smaller and simpler organisms.[116]

Needham's conception of organism differs from emergentism in the following respects: (1) For emergentism, the parts may exist separately from the whole, whereas for organicism, they are essentially dependent upon the whole; (2) all entities are organisms, even physical and chemical entities. Needham's subsequent intellectual evolution is most interesting. The notion of levels was not present in his early work, as evidenced by the above article, but becomes the keynote of later work. Moreover, in between, like J. B. S. Haldane (son of J. S. Haldane), he became one the group of English scientists influenced by Marxism and dialectical materialism.

The 1937 **Spencer Lecture** by Needham was entitled, "Integrative Levels; A Re-evaluation of the Idea of Progress". Needham defines his theme as "the existence of levels of organization in the universe, successive forms of order in a scale of complexity and organization".[117] Each level is characterized by a specific form of evolution, and he mentions the cosmological, biological and sociological types, with mental development included in the latter. Increase in complexity of organization is manifested by increase in the number of parts, greater complexity of their structure and inter-relations, centralization and greater efficiency of

[116] Joseph Needham, "Organicism in Biology" (1928), p. 34
[117] Joseph Needham "Integrative Levels: A Re-evaluation of the Idea of Progress" (1937), p. 234

control, increased flexibility and versatility of interaction with the external environment, and concurrently, greater independence with respect to it.

Needham combines elements of organicism, dialectics and emergentism in his philosophy of biology. As to the origin of the term 'levels', in the context of 'integrative levels' Needham notes (in a footnote added to a 1943 re-publication of the essay): "I am not quite sure where the term 'levels' was first used in this way, perhaps in S. Alexander's **Space, Time and Deity...**". He also refers to The Brown-Conger debate (discussed in section 2 of this chapter), as well as works by the American biologist E. G. Conklin, **The Direction of Human Evolution** (1921) and the English anatomist, F. Wood-Jones, **Design and Purpose** (1942).[118]

In an article devoted to Whitehead's philosophy, Needham states that the organic conception of the world involves the notions of "succession in time and envelopes in space",[119] within an overall framework of integrative levels. Needham's analysis of the level structure of reality includes the following transitions: (1) from sub atomic particles to atoms and molecules; (2) from cell constituents to cells, organs, tissues, to bodies; (3) the combination of animals and especially humans into social communities, and (4) the emergence of mental phenomena from complex nervous systems. He notes that "There is a sense in which minds include and envelope bodies, for the boundaries of thought are far wider than those of what the special senses can record, and minds interpenetrate as bodies cannot..."[120] Evolution takes the form of "a continuous rise in level of

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[118] ibid, p. 239

[119] Joseph Needham "A Biologist's View of Whitehead's Philosophy" (1941), in **Time, The Refreshing River**, p. 184

[120] ibid, p. 185

organization." The emergentist character of Needham's notions are obvious; he himself footnotes Smuts, Lloyd Morgan and Sellars as authors of similar points of view.

Needham combined not only emergentist and organicist conceptions; he reappears with a contribution to a Marxist theory of levels of reality. In the early 1930s he was influenced by the political radicalism and dialectical materialism of Marxism. In his **Terry Lectures** of 1936, entitled **Order and Life**, Needham refers to the Marxist biologists J. Hecker, M. Prenant and J. Schaxel, and goes on to say "...that biological order is a form of order different from those found in physics, chemistry, or crystallography, yet not impenetrable by the human mind or ruled by unintelligible spiritual entities. Translated into terms of Marxist philosophy, it is a new dialectical level."[121]

During and after the Second World War, Needham's interest shifted to Chinese science; he lived and worked for many years in China, and has been producing the multi-volume **Science and Civilization in China** since. As a result of his researches into ancient Chinese science and philosophy, he realized that an organismic conception had arisen with the work of Chu Hsi in the 12th century AD, following up on the tradition of Chinese correlative thinking. Through the Jesuits, word of this and other Chinese theoretical developments reached the West, and in particular Leibniz, whose conception of pre-established harmony and monads is, on Needham's view, strongly influenced by Confucian

121 Joseph Needham, **Order and Life** (1936), p. 45.

thought and the work of Chu Hsi. The following quote illustrates Needham's attempt to link the Western and Eastern organicist schools of thought:

> Here it is not possible to do more than mention the great movement of our time towards a rectification of the mechanical Newtonian universe by a better understanding of the meaning of natural organization. Philosophically, the greatest representative of this trend is undoubtedly Whitehead, but in its various ways, with varying acceptability of this statement, it runs through all modern investigations in the methodology and the world-picture of the natural sciences - the numerous and remarkable developments of field physics, the biological formulations which have put an end to sterile strife between mechanism and vitalism [Woodger, von Bertalanffy, Meyer, Needham and Gerard] while avoiding the obscurantism of the earlier 'Ganzheit' schools, the Gestalt-psychology of Kohler; then on the philosophical level the emergent evolutionism of Lloyd Morgan and S. Alexander, the holism of Smuts, the realism of Sellars, and last but by no means least the dialectical materialism (with its levels of organization) of Engels, Marx and their successors. Now if this thread is traced backwards, it leads through Hegel, Lotze, Schelling and Herder to Leibniz (as Whitehead constantly recognized), and then it seems to disappear. But is that not perhaps in part because Leibniz had studied the doctrines of the Neo-Confucians school of Chu Hsi, as they were transmitted through the Jesuit translations and despatches?[122]

A major reinforcing influence on Needham's conception of organism and the level structure of reality was J. H. Woodger (University of London, Biology), whose **Biological Principles: A Critical Study** appeared in 1929. His thinking is guided by the methodological principle that the antitheses of biological thought have to be superseded. Among the old antitheses to be overcome, he notes those between vitalism and mechanism, structure and function, preformation and epigenesis, teleology and causation, mind and body. Of particular interest for present purposes is his Chapter VI of Part II devoted to "The Theory of Biological Explanation". The key concept, and the one basic to overcoming the old antitheses,

[122] Joseph Needham, **Science and Civilization in China** (1956), vol. 2, **History of Scientific Thought**, p. 291

is that of organization, which he references to the writings of E. B. Wilson on the cell. Organization involves not only a part/whole relationship, but a hierarchical part/whole relationship, with distinct levels of organization that cannot be reduced one to the other[123]:

> "But from what has been said about organization it seems perfectly plain that an entity having the hierarchical type of organization such as we find in the organism requires investigation at all levels, and investigation of one level cannot replace the necessity for investigations of levels higher up in the hierarchy. And this remains true irrespective of the question of a remote future possibility of being able to state the properties of all higher levels in terms of the relata in the lowest one, if indeed the very nature of the case does not exclude such a possibility.[124]

Woodger went on to develop this theory in a series of three articles appearing under the title "The 'Concept of Organism' and the Relation Between Embryology and Genetics" (1930-31). In Part I, he continues his analysis of organism into the subsidiary notions of 'organic whole', 'organic part', 'organic relation' and 'hierarchical order'. With respect to this latter notion, he provides exact definitions of its component concepts: 'level', 'highest level', 'lowest level', 'next highest level', and 'assemblage' (the parts out of which a given organic whole, except those of the lowest level, are constituted). His definition of level is as follows: "A level is a class of members of [a set] W and is such that no member of the class stands in the relation R_H [the fundamental hierarchical relation] to any other member of the class. In any hierarchy there are at least two levels."[125] Part II develops those logical methods needed for a system of postulates and

123 This is likely the direct influence on Needham in his later formulation of "integrative levels".
124 J. H. Woodger, **Biological Principles: A Critical Study** (1929), p. 316
125 J. H. Woodger, "The 'Concept of Organism' and the Relation Between Embryology and Genetics" (1930), p. 8

assumptions for embryology and genetics.[126] It includes a systematic study of the logical structure and graphical representations of hierarchical systems. Part III applies these formal methods to specific cases.

The organicist conception was also defended in an article by Ritter and Bailey (1928): "The Organismal Conception", especially part I: "Place of the Conception in Science". The affinities with holism are clear from the outset, with the authors placing special emphasis on the aspects of unification of parts and wholeness. The accent is on reciprocity between whole and parts, a "reciprocally generative and mutually constitutive" relation between the two:

> "A natural whole stands in such a relation to its parts as to make it and its pars mutually constitutive of each other. Structurally, functionally, and generatively, they are reciprocals of each other."[127]

The difference between merely physico-chemical systems and biological ones is a matter of organization, and though not explicitly so formulated, Ritter and Bailey admit the vital as a level of organization above that of the physical and chemical. At any rate, the debt and influence of emergent evolution is clear: emergent evolution provides the theory of the historical development or evolution of vital organization, which the organismic conception considers systematically:

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126 Woodger has already begun to use the technical methods of logic to frame definitions of terms and develop theories which forms the subject matter for his later work, **The Axiomatic Method in Biology** (1937).One of the few, perhaps only, works in theoretical biology to use the notation and technique of Russell and Whitehead's **Principia Mathematica**. It includes an appendix by the logician Alfred Tarski. See also Woodger's **Biology and Language: An Introduction to the Methodology of the Biological Sciences including Medicine** (1952), which were given as the Tarner lectures for 1949-50.

127 Ritter and Bailey, "The Organismal Conception" (1928), part I, p. 308.

However, so far as our information goes, no professional psychologist has yet fully espoused the organismal conception of living beings, though C. Lloyd Morgan's advocacy of emergent evolution seems to commit him to the conception. Emergent evolution and the organismal conception applied to living nature are the same thing looked at from different directions. "Emergent evolution" is what that "same thing" is called when the origin and development of living things are of central interest, while the "organismal conception" is what it is called when their morphology and physiological functioning are considered.[128]

The organismic conception is therefore a relative of emergentism, clearly indicated by both Needham and Ritter/Bailey; at the hands of Woodger, the concept of level was for the first time formulated in symbolic terms.[129] This "migration" or "cross-fertilization" is typical of the history of ideas, with one current of thought (emergentism) influencing another (organicism). Moreover, the matter is of some historical importance for the emergentist trend itself. During the 1940s, and even from the mid 1930s on, the development of emergent evolution as a trend slowed down. Some of the main defenders had died: Lloyd Morgan in 1933, Samuel Alexander a few years later. Roy Wood Sellars continued

128 ibid, p. 334

129 A later author in this trend is Ludwig von Bertalanffy, especially in his **Problems of Life: An Evaluation of Modern Biological and Scientific Thought** (1952). The same preoccupation with organization, hierarchy and organism are present in his work, which is directly related to that of Woodger, who in turn had translated von Bertalanffy's earlier work, **Modern Theories of Development** in 1933. Von Bertalanffy summarizes the basic principles of the organismic conception as follows: "The conception of the system as a whole as opposed to the analytical and summative points of view; the dynamic conception as opposed to the static and machine theoretical conceptions; the consideration of the organism as a primary activity as opposed to the conception of its primary reactivity." (in **Problems of Life**, p. 32). In his discussion of the levels or organization, von Bertalanffy admits the following: (a) atoms and molecules, (b) cell and protoplasm, (c) individual organisms, and (d) supra-individual organizations, from small eco-systems to the whole of life on earth. Von Bertlanffy's original contribution to the organismic conception is his notion of organisms as open systems: "From the standpoint of physics the characteristic state in which we find the living organism can be defined by stating that it is not a closed system with respect to its surroundings but an open system which continually gives up matter to the outer world and takes in matter from it, but which maintains itself in this continuous exchange in a steady state, or approaches such steady state in its variations over time." (ibid, p. 123). For more on systems theory see his **General System Theory: Foundations, Development, Applications** (1968). Von Bertalanffy was the founder and until his death, editor of **General Systems: Yearbook of the Society for General Systems Research.**

to adhere to emergentism, and went from a naturalist to a materialist position, but, this can be considered as a working out of positions he had begun to develop in the 1920s. No new systems of emergentism, at least in the Anglo-American world, were developed until the 1950s. Yet emergentism led a "subterranean" existence in the concept of level structure of reality propounded by Needham, Woodger and the authors to be examined next: Alex Novikoff, R. W. Gerard and Julian Huxley. This was a residual influence of Lloyd Morgan's work in biology, combined with a further momentum provided by organismic and holistic concepts.

The theme of integrative levels was the subject of a symposium organized in 1941 in connection with the 50th anniversary celebration of the University of Chicago, bringing together biologists and sociologists; the proceedings were titled **Levels of Integration in Biological and Social Systems** (1942). The opening articles dealt with the early, intermediary and higher levels of biological and social organization. The higher levels were dealt with by R. W. Gerard (Dept. of Physiology, Univ. of Chicago) in his article "Higher Levels of Integration". This article was the most general of the group, developing a theory of the part/whole relationship and the notion of levels which had considerable affinities with emergentism.

In Gerard's terminology, an organized entity consisting of parts is termed an "org", on analogy with the organism studied in biology, but considered as more general and applying throughout nature. Orgs differ in terms of degree of integration and level of organization. Advancing integration in the series of orgs appears as (1) greater control of the parts by a whole and (2) greater differentiation of the constituent units. This results in the appearance of new levels, marked off by the fact that orgs of one level are constituent parts of orgs of a higher level. An example given is that of molecules, which are orgs composed of atoms, themselves orgs composed of electrons and protons. Orgs which manifest the characteristics of life - metabolism, growth, reproduction and so forth, are termed "animorgs". Finally, there is a third meta-level of integration, that of "epiorganisms", where animorgs are organized in social relations.

Gerard concludes by noting that epiorganisms function just as animorgs, i.e.. that the social group can be regarded as "a single biological unit."[130] He devotes several pages to demonstrating the equivalence of epiorganism functions and the corresponding animorg ones. Speaking of nomadic tribes, the British Empire and the human race, he says:

> That such groups of organisms are truly animorgs follows from their possessing accurately the above defined criteria of this org sub class. The units composing them are built of the same substances, similarly organized; they manifest the same developmental changes in the growth of the individual group and in the evolution of group types; they manifest the same activities; and they are integrated by the same mechanisms.[131]

The articles by Needham and Gerard form the backdrop for the article in **Science** by Alex B. Novikoff (Dept. of Biology, Brooklyn University), "The Concept of Integrative Levels and Biology" (1945). Novikoff defended a four level structure of reality, enumerated as the physical, chemical, biological and sociological. These levels are the products of the "evolution of matter through successive and

130 R. W. Gerard, "Higher Levels of Integration" (1942), p. 75
131 ibid, p. 77

higher stages of integration."[132] The exposition is straight forward and based on typical emergentist formulations: new levels arise as a result of growing complexity of organization; each level is dependent on the lower level, but manifests certain unique and novel properties of its own; knowledge of lower levels is a necessary but not a sufficient condition for knowledge of the higher levels, and higher level laws cannot be predicted a priori from the lower level ones.

> The concept of integrative levels stresses the need to study living organisms at all levels - cells, tissues, organs, organ-systems, organisms and populations. It is not "organicist"; always the reciprocal relationship of elementary units to each other and to the unit system as a whole must be studied. It is not mechanistic; the detailed methods of study at higher levels will include not only some used at lower levels but new methods peculiar to the higher levels; the laws of one level will be expressed differently from those of others.[133]

Within the biological level which is of special interest to Novikoff, he identifies as sublevels those of the cells, tissues, organs, organ-systems, and organism. With the combination of organisms in populations, the social level is reached, and this is a further emergent level. Novikoff is particularly concerned to criticize failures to grasp the distinction between the biological and the social. Reading the social into the merely biological wrongly endows lower life forms with human attributes, while considering the social as merely biological amounts to the converse mistake: here the specifically human is excluded. The organism is not a society, and societies are not organisms. Novikoff states that distinguishing between emergent levels avoids the errors of anthropomorphism and organicism, and leads to a more adequate biology. In particular, he criticizes the organicism

132 Alex. B. Novikoff, "The Concept of Integrative Levels and Biology" (1945), p. 209
133 ibid, p. 211

of Gerard and one of his collaborators, Alfred E. Emerson. Novikoff argues that instead of seeking the economic basis of social relations, they attempt to make unfounded speculations of parallelism between animal and social organisms. Novikoff invokes Needham as support on the dangers of this sort of organicism.

Joseph Needham, then in China, sent in a note on Novikoff's article, applauding its emphasis on the levels or organization and complexity. He differed however in supporting Gerard's organicism, stating that Novikoff had overestimated the break between animal and human societies, and noted that organicism does not lead to the fatalism and a overly-competitive model of society favoured at that time by the fascist states, as Novikoff had feared.

Gerard and Emerson replied in a longer article "Extrapolation from the Biological to the Social" (1945) in the same issue as Needham's note. They agree with Novikoff on the formulation of the general principles for levels, but state:-"... Novikoff seems, at the psychological-sociological level, to isolate completely everything human from the rest of nature and strenuously objects to our failure to do so."[134] Their point is the following: "We have argued that, since societies are living systems, they obey those most general laws which apply to all living systems. This says, for example, that social evolution and biological evolution are both subject to any statements applicable to 'evolution', not that the two subclasses are identical."[135] They also stress the fundamental similarities of the two types of evolution: "The natural selection of whole integrated systems, for example, has

[134] R. W. Gerard and A. E. Emerson, "Extrapolation from the Biological to the Social" (1945), p. 582
[135] ibid, p. 583

led to an evolutionary advance in specialization and integration (cooperation) of the units composing individuals and super-individuals, both at the biological and the social levels."[136] To this is added a philosophical difference: "We maintain that at each superposed level of integration new unexpected properties emerge, but that the new properties must be commensurate with the old; must fit in their general framework, not violate it."[137] Therefore, these new, emergent properties must be ultimately predictable, once science has progressed further.

This debate is a foreshadowing of debate on socio-biology to come, where the issue at stake is the reducibility of the social level to the biological one. From an emergentist standpoint, Novikoff's argument is the more convincing, since he clearly distinguishes the social and the biological as irreducible one to the other, whereas Gerard's view that social organisms (epiorganisms) function just like biological organisms (animorgs) is a reductive one, despite his admission of distinct levels of reality.

Novikoff's influence can be seen in the **Philosophy for the Future: The Quest of Modern Materialism**, edited by Roy Wood Sellars, V. J. McGill and Marvin Farber in 1949. At least two articles include the term 'levels' in their titles, "A Biological Survey of Integrative Levels" by C. Judson Herrick and "Levels in the Psychological Capacities of Animals" by T. C. Schneirla. Herrick, a neurologist[138], refers to Novikoff's article cited above for the notion of integrative levels and states that:

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136 ibid, p. 584
137 ibid, p. 584
138 Herrick was editor of the of the **Journal of Comparative Neurology**, and emeritus professor of neurology at the University of Chicago.

> The key problems in all scientific enquiry are not analytic but synthetic. This is because the new properties that emerge in directive activities are unique combinations integrated from elements which lack these properties. A study of the history of creative evolution reveals successive levels of more complex and efficient integration.[139]

T. C. Schneirla, a comparative psychologist[140], began his article with the statement that "The concept of psychological levels in its modern form is due especially to the integrative attack of experimental science upon evolutionary processes."[141] He continues, referring to Novikoff's 1945 article:

> The principle of levels has come into current usage through a recognition of important differences in complexity, the degree of development, and the interdependent organization of behavior functions through the animal series. The evidently superior properties that appear on a new level of organization are not be explained as due to a new kind of energy or new vital properties, but as functional properties arising from a new system of organization which differ in given ways from "lower" and "higher" systems.[142]

Once more citing Novikoff, Schneirla cautions that reductionism must be avoided. Psychological properties cannot be reduced to physical/chemical ones, nor even to bio-chemical ones. Moreover, the whole/part relationship is transformed with the appearance of higher levels. The wholes of lower levels may appear as parts of wholes at higher levels, but they may have different qualities as subsystems of larger wholes than they have as wholes at their own level.

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139 C. Judson Herrick, "A Biological Survey of Integrative Levels" (1949), p. 226
140 Schneirla was curator of the Department of Animal Behavior at the American Museum of Natural History.
141 T. C. Schneirla, "Levels in the Psychological Capacities of Animals" (1949), p. 243
142 ibid, p. 245

(v) Evolutionary Ethics: Julian Huxley

Julian Huxley, the biologist who coined the phrase "modern synthesis" to designate the merger of Darwinian evolution and Mendelian genetics, argued in his own **Romanes Lecture** of 1943 that the problem his grandfather T. H. Huxley had faced in his **Romanes Lecture** of 50 years previous could be resolved on the basis of a modern approach to evolution. Huxley's discussion of the possibility of an evolutionary ethics contains a section entitled "Evolutionary Levels and Directions", where he states:

> Evolution, from cosmic star-dust to human society, is a comprehensive and continuous process. It transforms the world-stuff, if I may use a term which includes the potentialities of mind as well as those of matter. It is creative, in the sense that during the process new and more complex levels of organization are progressively attained, and new possibilities are thus opened up to the universal world-stuff.[143]

The normally gradual process of evolution is punctuated by the rapid emergence of new levels, of which Huxley mentions the two transitions from the inorganic to the organic, and the animal to the human:

> Increase in organization is for the most part gradual, but now and again there is a sudden rapid passage to a totally new and more comprehensive type of order of organization, with quite new emergent properties, and involving quite new methods of further evolution. The two major breaks which concern us are that between inorganic matter and life, and more particularly, that between pre-human life and man.[144]

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[143] Julian Huxley, "Evolutionary Ethics" (1943), in **Evolution and Ethics** (1947), p. 120
[144] ibid

Physical evolution, biological evolution and human evolution can therefore be distinguished in terms of the factors operant at each level. It is through this recognition of the distinction between natural selection at the biological level, and other processes at the social level, that Huxley hopes to make a place for evolutionary ethics. At the human level, conscious design and social cooperation are conditions for the development of such an evolutionary ethic. Huxley argues as follows:

(1) Evolution is multi-factor, and not exclusively based on the factor of natural selection alone. Intra-specific selection involves the struggle for existence of a group against the environment and other species, and introduces elements of cooperation among the group. Excessive inter-specific competition (struggle between individuals of the same species) may in fact be deleterious to the species as a whole.

(2) Social anthropologists have described a great variety of different ethical systems, not limiting themselves to the apriori notion that there is only one true system of ethics. Further, they have noted a diversity of social systems and a correlation between types of ethical systems and types of societies.

(3) On an emergentist view of evolution, objective values emerge as society develops and becomes more complex. These values not only arise at a definite stage of evolution, but play a real role in the further development of that evolutionary process, at least as concerns social development. Huxley formulates his own principle of evolutionary ethics as follows:

> In the broadest possible terms, evolutionary ethics must be based on a combination of a few main principles: that it is right to realize ever new possibilities in evolution, notably those which are valued for their own sake; that it is right both to respect human individuality and to encourage its furthest development; that it is right to construct a mechanism for further social evolution which shall satisfy these prior conditions as fully, efficiently, and as rapidly as possible.[145]

A number of different elements of his theory are:

1. A defense of diversity and pluralism: It is right to help realize new potentialities, which serve as possibilities to be preserved by selection should they warrant it. Diversity is therefore a value to be nurtured since it provides the basis for the selection operation of evolution.

2. An emergentist view of values: Values are a product of evolution, they are emergents consequent upon the appearance of the social and mental levels. Values are therefore objective, and not ephemeral. This section of Huxley's argument remains vague, and could have been aided by a discussion of tertiary properties and values as Alexander did.

3. A meta-ethical principle of conduct: This is the Kantian principle that it is right to act in such a way as to treat other persons as ends and not as means. The content of the act is not specified, nor need it be specified, since the maxim is a formal one, unlike the following one, which specifies a certain content in negative utilitarian terms.

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145 ibid, p. 124. C. D. Broad criticized Huxley's article in his review of it for **Mind**, "Huxley's Evolutionary Ethics" (1944), but does not deal with the aspect of the emergence of values.

4. A normative ethical principle of conduct: Act so as to minimize the distress, discomfort and suffering of others: An example of such an act is the replacement of charity towards the underprivileged by measures to do away with poverty as a social condition. This component of Huxley's theory is a type of negative utilitarianism.

(5) Further Philosophical Positions

This section will discuss two philosophers who, independently of explicit reference to Lloyd Morgan and the earlier emergentists, expounded emergentist conceptions of the level structure of reality: James Feibleman in the USA, and Nicolai Hartmann in Germany. Then three more recent discussions of emergentism in philosophy of science will be reviewed in the work of Mario Bunge, Karl Popper and Jonas Salk. As emergentism has returned to the mainstream of philosophy of science, is has also been discussed in scientific reviews[146] and become an element of related scientific worldviews[147].

146 The debate over emergentism was a central feature of a series of articles which appeared in the review **Neuroscience**. Initiated by Bunge's "Emergence and the Mind" (1977), the debate eventually included Roger Sperry (1980): "Mind-Brain Interaction: Mentalism, Yes; Dualism, No", Donald Mackay (1978): "Selves and Brains", Smart's "Physicalism and Emergence" (1981), as well as articles by D. O. Hebb and Patricia Smith-Churchland. Emergence, from a theory developed in the context of lectures on natural theology, was now being discussed in a journal devoted to neuro-science.

147 As in the 1920s and 1930s, there are parallel developments to emergentism. Important relatives in the period from the mid 1960s on are hierarchy theory and systems' theory. In such volumes as **Hierarchy Theory: The Challenge of Complex Systems** edited by Howard H. Pattee in 197[illegible], attempts were made to relate the developing mathematical theories of hierarchies with the problem of complex systems in biology, physics and technology. Related to this was the notion of systems' theory, largely the result of the efforts of Ludwig van Bertalannfy in its initial stages. His **Problems of Life** (1953) defends the notion of a hierarchical level structure of reality, and this was continued in his other writings on systems theory. His later writings, particularly **Systems Theory**, however, do not return to a discussion of levels of organization, but refer exclusively to the

(i). Axiologic Realism: James Feibleman

James K. Feibleman (Tulane University), published his **Ontology** in 1951, though he indicates in the foreword that he had begun work on it in 1945, and published parts in article form between those two dates. He terms the system he will develop "axiologic realism". Feibleman argues that ontology can be done independently of epistemology; indeed, he treats epistemology as a subdivision of ontology. Ontology sets itself the following task: "Given all the theories and facts of modern knowledge, to find the explanatory system which could best account for them."[148] The problem is to ground knowledge on a set of postulates, based on ontological categories: "The ontological problem, logically stated, is then the discovery of the proper number of primary categories into which can be classified all kinds of being."[149] The ontological system must be the most inclusive (to encompass all knowledge) but the most compact (in order to integrate those fields, and achieve the unity of knowledge).

Feibleman holds that there must be three and only three basic categories. One category will not suffice for the multiplicity of reality; two are inadequate, since there is need of a third to decide between them as to the problem of primacy, and so three is just the number required. Four or more are unnecessary, since

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distinction between open and closed systems. Hierarchy theory has also been integrated into philosophy of biology. An attempt is being made to develop a philosophical framework for the punctuated equilibrium theory of Stephen Jay Gould and Niles Eldredge. This is evident in works such as **Unfinished Synthesis: Biological Hierarchies and Modern Evolutionary Thought** (1985) by Niles Eldredge, and Stanley Salthe's **Evolving Hierarchical Systems: Their Structure and Representation** (1985)

148 James K. Feibleman, **Ontology** (1951), p. 126

149 ibid, p. 127

this would detract from the intermediary role of the third. Kant had four categories: quantity, quality, relation and modality; but, says Feibleman, he should only have had three, since quantity can be reduced to relation (no proof given), leaving the magic number of three. The inadequacy of this argument should be evident, and Feibleman is repeating Kant's a priori deduction of the "right" number of categories in a way more Kantian than Kant.

In his own system, Feibleman identifies the three fundamental categories as essence, existence and destiny. The first two are considered as distinct universes, the first that of possibility, the second, that of actuality. Destiny is the relation linking the two. (1) Essence is defined as the "power to affect or to be affected"; the universe of essence is complete and consistent, independent of things that exist and forming the whole of which they are but parts. It is also may be described as "that from which things come into existence and that into which they pass away."[150] (2) Existence is described as "the temporal and historical dialectic of actuality", and is defined as "whatever affects or is affected"; it is made up of things which interact with each other; (3) Destiny is "the direction of existence toward essence" , the "essence-vector of existence". In full, destiny is defined as "the direction which the temporal and historical dialectic of actuality follows in its efforts to get back to the perfect conditions of the axiological order of possibility."[151]. It is not a separate universe, but the tendency of movement from the one to the other. Feibleman notes that because of this, destiny is a subordinate category within the primary categories. He also notes the following applications of the three categories to the concept of being:

150 ibid, p. 221
151 ibid, p. 215

(a) The ontological connection: being consists of essence insofar as it derives its ground in essence.

(b) The epistemological connection: being is known through existence, which is the "base-line" for knowledge.

(c) The teleological connection: being is approached through destiny; there is a purposive activity going from essence to existence.

Besides the logical connection of essences, there is also an axiological consideration. Value is "the attraction or desire of things for things", a definition which Feibleman himself admits to be unusual. He defines value as the beautiful, the good and the holy, derives each from the logical distinction between parts and wholes. Value in terms of the relation of wholes and parts may be distinguished as intrinsic, extrinsic or symbolic. (1) "Intrinsic value is the value of any whole to its parts."[152] This corresponds to the beautiful: "Beauty is the quality which emerges from the perfect relation of part in the whole"[153]; (2) "Extrinsic value is the value of any whole to another whole"; this corresponds to the good: "Goodness is the quality which emerges from the perfect relation of an;y whole to other wholes..."[154] (3) Symbolic value is the value of any part or any whole to the total whole of being" [155] It is another name for the holy: "Holiness is the quality which emerges from the perfect relation of all parts and wholes in the largest finite whole of being as symbolized by any part or whole."[156]

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[152] ibid, p. 230
[153] ibid, p. 231
[154] ibid, p. 231
[155] ibid, p. 230
[156] ibid, p. 231

These values attach in various coordinations to each level in the graded series of being (as described in the universe of essence). The graded series of being is divided into two systems, the theoretical and the empirical. The theoretical is divided into three domains: the ontological, the logical and the mathematical, and the empirical into five domains: the cultural, the psychological, the biological, the chemical and the physical. Each domain is in turn divided into levels, and levels are divided into sublevels. The domains are arranged in a hierarchy as follows:

Ultra-ontological (if any)
Ontological
Logical
Mathematical
Cultural
Psychological
Biological
Chemical
Physical
Infra-physical (if any)[157]

According to Feibleman, there is an element of discontinuity between any two grades when the graded series is read downwards, with the accent here on the distinctness of each higher domain relative to the lower domains; but there is an element of continuity when the graded series is read upwards, with the accent on integration of the lower domain leading on the one next above it.[158] The relation R between domains is irreflexive (if xRy then $\neg yRx$), exhaustive (if $x \neq y$ then xRy or yRx), and transitive (if xRy and yRz then xRz). The relation R may be most simply read as "higher in complexity than".

157 ibid, p. 268. The infra-physical and ultra-ontological are included as hypothetical.
158 See also his Feibleman's article "The Theory of Integrative Levels" (1954) which develops the same points.

In the universe of existence, there are three basic processes of change: emergence as coming-into-existence, endurance (or duration) as remaining-in-existence, and transience as passing-out-of existence. There is a level structure in this universe as well, but with some differences relative to that in the universe of essence. In the universe of existence, we are dealing with integrative levels, starting from the bottom-most level (the electromagnetic forces of the physical, according to Feibleman), and working up through the chemical, biological, psychological and cultural. This is a universe of change and of flow of energy, not a static one of universals and values as in the universe of essence. Secondly, levels are divided into fields which are not all related in a linear way, but may include branchings. and joinings: "By the branching of the integrative levels is meant that certain levels build up into two or more fields which may continue to divide or come to a more or less abrupt end of level-building"[159]. Feibleman's diagram of his branching structure of integrative levels for the empirical levels is the following[160]:

159 James K. Feibleman, Ontology, p. 334
160 ibid, p. 336

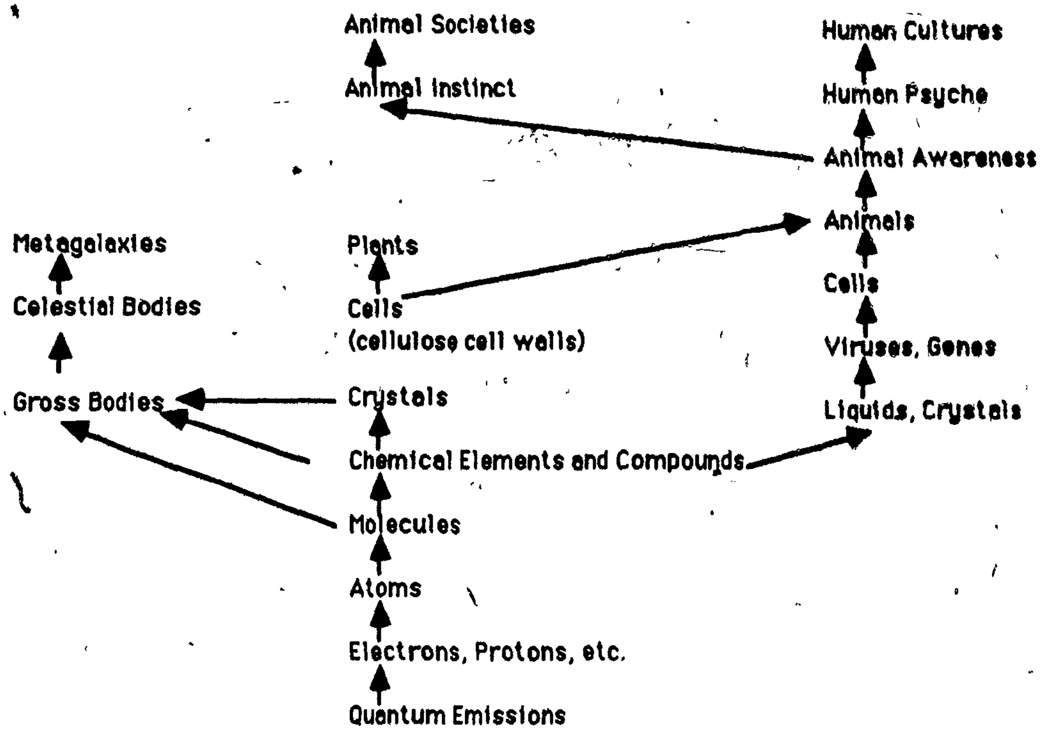

Diagram 1: Feibleman's Representation of the Levels of Being

Feibleman developed further his theory of levels in his "Theory of Integrative Levels" (1955) as follows:

1. Each level organizes the level or levels below it plus one emergent quality
2. Complexity of the levels increases upward.
3. In any organization the higher level depends upon the lower.
4. In any organization, the lower level is directed by the higher.
5. For an organization at any given level, its mechanism lies at the level below and its purpose at the level above.
6. A disturbance introduced into an organization at any one level reverberates at all the levels it covers.
7. The time required for a change in organization shortens as we ascend the levels
8. The higher the level, the smaller its population of instances
9. It is impossible to reduce the higher level to the lower.
10.. An organization at any level is a distortion of the level below.
11. Events at any given level affect organizations at other levels.*

12. Whatever is affected as an organization has some effect as an organization.[161]

Finally, in the universe of destiny, the same basic levels appear in their historical dimensions showing how they have become what they are and what they may become in the future. Here the accent is on the teleological aspect of change.

(ii) Strata of Reality: Nicolai Hartmann

In his **New Ways of Ontology** (1951)[162], Nicolai Hartmann developed a theory of levels and a theory of categories, though the system is weak concerning the question of evolution. Hartmann is concerned to break with what he calls the "old ontology", based on the distinction, dominant from Aristotle through to the scholastics, of a dual world of things and essences. Essences are universals and are considered as the guiding force, or the teleological principle of things. According to Hartmann, Kant made a contribution in both his first and third critiques, the first marking the culmination of the critique of speculative metaphysics begun with Descartes, and the third important because of its critique of teleology on its home ground. But thereafter, according to Hartmann, problems arose. Neo-Kantians rejected ontological thinking, and Hegelians returned to a scholastic mode of thought. Both neglected the critique of teleology. Hartmann is

161 James K. Feibleman, "Theory of Integrative Levels", pp. 59-63. In his **Ontology**, five of the above are included as "properties of fields" at p. 353.
162 The volume is a translation of **Neue Wege der Ontologie**, which appeared in 1949, and according to Hartmann develops work he had begun with his **Der Aufbau der Realen Welt** (1940).

therefore quite out of step with the dominant German philosophies, and moves toward his new ontology in a way strongly influenced by emergentist views.[163]

The new ontology is concerned with being and becoming, which are not separate but related concepts. "Becoming is no opposite of being but is a form of being."[164]. Becoming is the universal mode of being of all things, and ontology must address itself to the "Being of Becoming". Since Hartmann rejects an essentialist view of being, he cannot ground it in "natures", forms or other universals of that sort. He does, however, ground being on the categories. These are not, however, strictly Kantian categories, but "fundamental assertions about being", "universal constitutive principles". The inspiration is Kantian, but differs in that Hartmann rejects the notion of an a priori deduction of the categories, since for him this would mean that ontology requires an epistemological foundation. Ontology is dependent, not on epistemology, but on the categories:

> Just as in regard to the problems of being it is today no longer a question of substantial forms and of the teleological determination of actual processes by these forms, so also the problem at issue is no longer that of a post factum justification of a priori principles. The categories with which the new ontology deals are won neither by a definition of the universal nor through derivations from a formal table of judgments. They are rather gleaned step by step from an observation of existing realities. And since, of course, this method of their discovery does not allow for an absolute criterion of truth, here no more than in any other field of knowledge, it must be added that the procedure of finding and rechecking is a laborious and cumbersome one. Under the limited conditions of human research it requires manifold detours, demands constant corrections, and, like all genuine scholarly work, never comes to an end.[165]

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[163] Unfortunately, he does not footnote any emergentist thinkers and it is not possible to reconstruct the influences on him.

[164] ibid, p. 28

[165] Nicolai Hartmann, **New Ways of Ontology** (1953), p. 14

Up to now, Alexander, Sellars and Feibleman have used a concept of categories in their emergent systems. Hartmann is the fourth to do so. His point is a delicate one. He wants to have his ontology independent of epistemology, yet dependent upon the categories. "But ontology is not concerned with knowledge, much less with mere judgments, but with the object of knowledge in so far as this object is at the same time "trans-objective", that is, independent of whether or to what extent being is actually transformed into an object of knowledge."[166] There is a problem with this formulation, since the categories are a field of knowledge, yet he wants his ontology, which is based on the categories, to be independent of any field of knowledge. Much of his chapter on the "categories of being" is concerned with a way out of this dilemma, which if maintained, would be a logical contradiction corrosive and destructive of his system.

Hartmann's move is to relativize the categories not to knowledge, but to experience. The way of the new ontology is that of "categorial analysis", and this latter presupposes the "whole breadth of experience", including everyday life and practical existence, as well as science and even what he terms "philosophical experience": "This whole sum of accumulated experience furnishes the starting level of actual data."[167]. The order he admits would then be: (1) experience, which is (2) analyzed into the categories, which (3) provide the basis for ontology, so that this latter can be done independently of (4) epistemology. The categories are then a form of knowledge independent of epistemology. They are arrived at inductively:

> The categories themselves must first be attained by induction. So the new way does not lead from them downwards but in every case first upwards to them. And there

[166] ibid, p. 14
[167] ibid, p. 20

always remains in that which is reached by this sort of procedure an element of the hypothetical which in turn needs to be verified by other data.[168]

What are these categories? Hartmann mentions a number of them as the fundamental categories:

> The categories are as follows: unity and multiplicity, concord and discord, contrast and dimension, discretion and continuity; substratum and relation, element and structure. Here also belong: form and material, inner and outer, determination and dependence. Also, qualitative contraries can be added, such as identity and difference, generality and individuality; likewise the modal categories: possibility, actuality, necessity, and their negative counterparts.[169]

Hartmann's theory of categories is related to his theory of levels of reality. In his theory of levels, there is an underlying dualism present. In his concept of reality, Hartmann stresses time and individuality, and considers space and matter as secondary. Time is said to run through all the strata of reality, but space is applicable only to physical and biological objects. Mental and spiritual things are outside of time and independent of matter. "The true characteristics of reality do not depend on the categories of space and matter, but on those of time and individuality".[170] In this respect, Hartmann is quite close to a dualistic theory, and indeed, he does accept a Cartesian dichotomy of two realms: the material (distinguished by extension) and the mental (distinguished by thought). But he does not accept the further claim that the two realms are distinguished as separate substances, since they are united in human beings and the higher animals.[171]

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168 ibid, p. 60
169 ibid, p. 66
170 ibid, p. 25
171 Thus the person as a category combines elements of all four strata: the material, biological, psychical and spiritual. Hartmann, however, has no theory of how the material and mental

The realms are really a starting point for the division of reality into strata. Each may be divided as follows: The spatial realm is divided into the two strata of inanimate things and animate ones; and the realm of the non-spatial into the psychic and the spiritual. The spiritual is manifested in speech, knowledge, evaluation, legal order, and so forth."[172] The psychic realm is individual while the spiritual is one is collective: "Consciousness divides, the spirit unites."[173]

The four strata are the material, the biological, the psychological and the spiritual. He concludes: "In this manner we obtain four main strata which embrace the whole sphere of the real world with the multiplicity of its ontic structures."[174] Hartmann does not see the distinction between the spatial and the non-spatial realms as an "unbridgeable chasm", and says "At most, a wider hiatus may be assumed to exist between the organic the psychic" than within the realms.

Different strata are distinguished by different dominant ontological categories. Hartmann's view of the relationship among difference strata is an emergentist one, with typical formulations: a higher level emerges from lower ones, and cannot be reduced to it. What is interesting is the way in which he expresses the regularities of the level structure in a series of five laws based on

combine other than a vague reference to "... the dovetailing, mysterious and yet so natural, of inorganic and psychic processes in human life." (ibid, p. 121)

172 ibid, p. 45

173 ibid, p. 80

174 ibid, p. 46. There corresponds to this level structure of reality a division of the sciences into the physical, biological, psychological sciences, and the science of spirit (Geisteswissenschaften) which considers history, language, literature, arts, laws and so forth.

his theory of categories: (1) the law of superimposition, (2) the law of recurrence, (3) the law of superinformation, (4) the law of novelty, and (5) what may be called the "law of demarcation":

> (1) In the superimposition of ontological strata, there are invariably present those categories of the lower which recur in the higher. But never are there categories of a higher stratum which recur in the lower. The encroachment of categories of one stratum upon another is upwards only, not downwards.
>
> (2) The recurrence of categories is always a limited one. It does not hold good for all categories of the lower stratum and does not in every case include all higher strata. At a certain level there is also a cessation of recurrence.
>
> (3) With their encroaching upon higher strata the recurring categories are modified. They are superinformed by the character of the higher stratum. Only a basic categorial moment goes through the change without suffering alteration.
>
> (4) The recurrence of lower categories never determines the character of the higher stratum. This character always rests on the emergence of a categorial novelty which is independent of the recurrent categories and consists in the appearance of new categories. The modification of the recurring elements is contingent upon the emergence of novelty.
>
> (5) The ascending series of ontological forms constitutes no continuum. Since, at certain points of incision in the series, the categorial novelty affects many categories at a time, the ontological strata are clearly marked off against each other. This demarcation is the "distance of strata" - a phenomenon characteristic of their hierarchical order.[175]

For example, time, process and causality penetrate all the categorial levels, but space does not penetrate into the two highest levels, and "Consciousness, even at its lowest stage, is completely non spatial".[176] On the basis of the strata laws, Hartmann develops a series of categorial laws: (1) the law of strength, (2) the law of indifference, (3) the law of basis and (4) the law of freedom:

> (1) Categorial dependence is dependence only of the higher categories upon the lower, not conversely. Hence, the lower categories, measured by their

175 ibid, pp. 69-70
176 ibid, p. 77

determinative power, are the stronger ones. Strength and height in the order of strata stand in an inverse relationship.

(2) Although the categories of a lower stratum afford the basis for the being of the higher, they are indifferent in regard to them. They admit of superinformation or superimposition without requiring them. The higher ontological stratum cannot exist without the lower, but the lower can exist without the higher.

(3) The lower categories determine the higher ontological stratum either as matter or as a basis for its being. So they only limit the scope of the higher categories but do not determine their higher form of peculiarity.

(4) The novelty of the higher categorial stratum is completely free in relation to the lower stratum. Despite all its dependence, it asserts its autonomy. The superior structure of the higher stratum has no scope "inside" the lower stratum, but "above" it.[177]

On the basis of the above analysis of the four strata and their associated categories, Hartmann criticizes other philosophical systems which universalize the categories of one level at the expense of the others, and neglect the emergence of new levels and categories. Materialism is seen as "metaphysics from below",deductively elaborating the characteristics of higher levels from that of the lowest level. Idealism is the converse problem of "metaphysics from above". Biologism and psychologism base themselves only on one of the intermediate levels, and commit the same type of mistake. Hartmann characterizes his position as one combining multiplicity and unity (two of the basic categories). His ontology may be described (exception made of the problem of the two realms) as a monistic pluralism, with a single substance divided into many levels.

[177] ibid, pp. 87-88

(iii) Emergence and Reduction: Mario Bunge

The key figure of current emergentist thinking is the philosopher of science Mario Bunge, whose interest in emergentism dates back to the 1950s, and who includes it as a prominent concept in his metaphysics of "scientific materialism" and in his on-going multi-volume **Treatise on Basic Philosophy** (1973 to date). This section will examine his views on the relation between emergence and reduction, the level structure of reality, and his views on emergentist materialism as an ontology.

(a) Emergence and Reductionism

As of **Causality** (1959), Bunge recognized emergence as one of the modes of change; his interest in the problem goes back to the early 1950s.[178] However, he criticized one important aspect of previous emergent evolutionary systems, the thesis of unpredictability which he associates with an irrationalist view:

> The recognition of the emergent or "creative" character of evolution does not entail a commitment to the irrationalist doctrine of emergent evolution, which negates the possibility of understanding the phenomenon of emergence of a new quality. Determinacy (that is, lawfulness and productivity) accounts for emergence, at least in principle - and provided scholastic notions of change are not retained.[179]

The principle of emergence which he does accept is taken to involve the aspects of lawful occurrence (determinism), explanation (rationalism) and the involvement of more than one determining factor (pluralism). In Bunge's view,

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[178] See the discussion of his background in the first section of the conclusion to this dissertation.
[179] Mario Bunge, **Causality** (1959), p. 213

change does not involve only a single causative factor , but may involve external causes, self-determination, and chance factors, all of these resulting in the emergence of novelty.

In his later writings, Bunge distinguishes between holism, emergentism and atomism. According to atomism, properties of a whole are just hereditary properties of its parts. Holism asserts that the totality transcends its parts and that the properties of the whole are independent of those of the parts. The emergentist view takes a via media between these two extremes: some system properties are hereditary, others are emergent; consideration of the properties of the parts is necessary, but not sufficient, condition for understanding the system, and must be supplemented with an examination of the properties of the whole.[180] A formal definition of emergence is given in Bunge's **Treatise on Basic Philosophy**, vol. 3. In the following, p(x) stands for the set of properties of the thing x, and C(x) stands for the set of components of the thing x:

> Let $P \in p(x)$ be a property of an entity $x \in S$ ... Then P is a resultant or hereditary property of x iff P is a property of some components $y \in C(x)$ of x other than x; otherwise P is an emergent or gestalt property of x. That is,
> (i) P is a resultant or hereditary property of x
> $=_{def} [P \in p(x) \;\&\; \exists y (y \in C(x) \;\&\; y \neq x \;\&\; P \in p(y)]$;
> (ii) P is an emergent or gestalt property of x
> $=_{def} [P \in p(x) \;\&\; (\forall y)[\neg(y \in C(x) \;\&\; y \neq x \;\&\; P \in p(y)]$.[181]

In his **Treatise on Basic Philosophy**, vol. 4, Bunge accepts what he calls "rational emergentism": "The philosophy that combines an acknowledgement of

[180] Discussed in vol. 4 of the **Basic Treatise** (1979), pp. 250-251.This approach is applied to societies in "A Systems Concept of Society: Beyond Individualism and Holism" (1979).
[181] **Treatise on Basic Philosophy**, vol. 3, **Ontology I: The Furniture of the World** (1977), p. 97

emergence with the thesis that emergence is explainable and predictable within bounds may be called rational emergentism. This philosophy, foreshadowed by Sellars (1922), supersedes both atomism (though not its allegiance to science) and holism (though not its insistence on emergence), and it incorporates a critical realist theory of knowledge..."[182]

A major development in the concept of emergence is the distinction Bunge makes between ontological emergence and epistemological reduction. While it has been traditionally held that emergence and reduction are incompatible, Bunge has combined them in an innovative way. The incompatibility holds, but only between ontological emergence and ontological reduction, and not between ontological emergence and epistemological reduction. Epistemological reduction is a theoretical operation which does not alter the basic ontology: "In other words, reduction does not imply levelling: it relates levels instead of denying that they exist. Reduction, then, is a theoretical question that does not alter the level structure of the world."[183] There are three possible views of reduction: (a) anti-reductionism, according to which previous levels are not required to understand facts of a higher level; this is holism; (b) radical reductionism, the claim that any level can be fully reduced to facts and laws of the previous ones; this is physicalism or atomism when the basic level is that given by mechanics, and (c) moderate reductionism, "or the strategy consisting of reducing whatever can be reduced without however either ignoring emergence or persisting in reducing the irreducible."[184] Again, Bunge opts for the intermediary position between the two

182 Mario Bunge, **Treatise on Basic Philosophy**, vol. 4; **Ontology II: A World of Systems** (1979), p. 251
183 Mario Bunge, "Levels and Reduction" (1977)., p. 79
184 ibid, p. 80

extremes. This means that some theories may be fully reducible to others, while some are only partially reducible. In formal terms, the difference is expressed as follows:

> Let T_1 and T_2 be two theories or hypotheses and let S be a non empty set of assumptions not contained in either T_1 or T_2. Then (i) T_2 is fully reducible to T_1 if and only if T_1 entails T_2 (i.e., T_2 follows logically from T_1); and (ii) T_2 is partially reducible to T_1 if and only if T_1 jointly with S entails T_2 (i.e. T_2 follows logically from the union of T_1 and S.[185]

A second development in Bunge's concept of emergence is the systems theory point of view in which emergence is analyzed.[186] A system is defined as the ordered triple <C(x), S(x), E(x)>, where C(x) is the composition of the system (its component parts, of which there must be at least two for a thing to qualify as a concrete system), S(x) is the structure of the system, consisting of the relations entered into by any and all of the parts, and E(x) the environment of the system, i.e. those parts of the external world which some part of the system is in contact with. The internal relations of the system are termed the connections of the system.

(b) The level structure of reality

Bunge has produced a large number of articles and sections of his books

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[185] ibid, p. 80

[186] This is developed in articles which initially appeared in **Int. J. Gen. Systems**, including "Things" (1974), "The GST Challenge to the Classical Philosophies of Science" (1977), "A Theory of Properties and Kinds" (1977, with A. Sangalli), "Analogy Between Systems" (1981). It is discussed at length in chapter 1, "System" of vol. 4 of the **Basic Treatise**, which is subtitled "A World of Systems".

dealing with the level structure of reality.[187] Perhaps the most interesting of his early work is the 1960 article, "Levels: A Semantical Preliminary", where he distinguishes nine distinct concepts of levels[188] as follows: (1) level as degree, modelled as a linear or serial ordering, (2) level as increase of quantitative complexity, to the exclusion of qualitative differences, (3) level as degree of analytical depth, as in the analysis of levels in a knowledge domain, (4) levels as emergent wholes, a series qualitatively higher and lower levels, (5) levels as intersecting groups of qualities, without any specific order, (6) levels as ranks in a hierarchy, (7) levels as layers which emerge over time (8) levels in a rooted hierarchy of layers with one level constituting the base, and (9) levels as ordered in one or more evolutionary series. The last is the concept adopted by Bunge, and following an earlier paper he gives the following schema for the level structure of reality[189]:

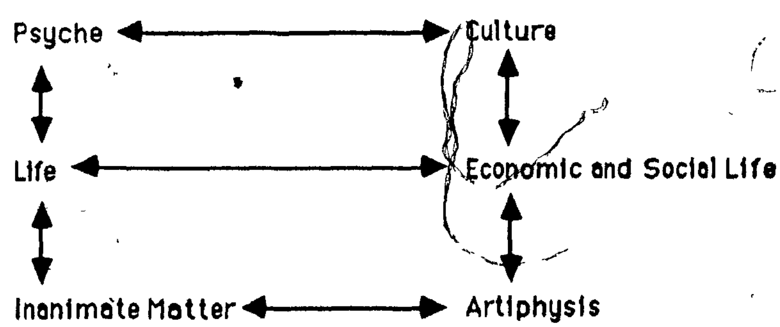

Diagram 2: Bunge's Early Model of the Level Structure of Reality

[187] These include ch. 5 "Do the Levels of Science Reflect the Levels of Being" in **Metascientific Queries** (1959) "Levels: A Semantic Inquiry" (1960), reprinted with modifications as ch. 3: "Levels" of **The Myth of Simplicity: Problems of Scientific Philosophy** (1963), "On The Connections Among Levels" (1960), "The Metaphysics, Epistemology and Methodology of Levels" (1969), reprinted with modifications as chapter 9 of **Method, Models and Matter** (1973).

[188] Authors cited include Needham (1943), Novikoff (1945), Schneirla (1949), Hartmann's **Philosophie der Natur** (1950) and his **Neue Wege der Ontologie** (1949), as well as Bailey (1945), Alexander's **Space, Time and Deity**, Lloyd Morgan's **Emergence of Novelty**, and Roy Wood Sellars' **Evolutionary Naturalism**.

[189] Mario Bunge, "Levels: A Semantic Analysis" (1960). ", p. 404. See also "On the Connections Among Levels" (1960), p. 63. Artiphysis is the level of technological artifacts.

In this schema, the left side of the diagram represents nature, and the right hand side represents society. The arrows indicate the directions of emergence and in the case of double-headed arrows, interactions. A level is defined as "a section of reality characterized by a set of interlocked properties and laws, some of which are thought to be peculiar to the given domain and to have emerged in time from other (lower or higher) levels existing previously".[190] In **Scientific Research** (1967), Bunge recognizes four basic levels: the physico-chemical, biological, psychological and socio-cultural. A total of 15 possible sorts of laws are admitted, four of them intra-level, and the remaining 11 inter-level. [191]A level structure of reality is defined in "The Metaphysics, Epistemology and Methodology of Levels" (1973) as follows:

> L is a level structure if and only if L is an ordered pair L= <S, E> where S is a family of sets of individual systems and E is a binary relation in S, such that
>
> L1. Every member of S is a set of systems that are equivalent in some respect...
>
> L2. E is a one-many, reflexive and transitive relation.
>
> L3. E represents (mirrors) emergence or coming into being of novelty of qualitatively new systems in a process.[192]

Moreover, he sets out five related theses for a metaphysics, epistemology and methodology of levels. He argues that each of the metaphysical theses about the level structure of reality implies the corresponding epistemological thesis about our knowledge of the levels of reality, each of which in turn implies the

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[190] Mario Bunge,"Levels: A Semantic Analysis", p. 405

[191] Mario Bunge, **Scientific Research** (1967), vol. 1, p. 326

[192]Mario Bunge, **Method, Models and Matter** (1973), p. 160. The same graphical representation of the levels of reality as in the 1960 articles is given on p. 162

methodological principles concerning the procedures to use in order to analyze levels. The theses may be summarized as follows[193]:

Ontological theses	Epistemological theses	Methodological theses
1. Reality is a level structure and everything belongs to some level.	The level structure is knowable and science itself is a level structure	Start be examining one level by itself and only then proceed to the others.
2.Some properties are gained and others lost in the course of emergence	Every science has its peculiar objects as well as retaining some but not all of the objects of other sciences	Try to explain emergence away, and failing to do so, take it seriously
3. Newer levels depend on older ones for their emergence and continued existence	The understanding of one level is aided by research into the adjacent ones, particularly the lower one.	Explain the emergence of every level in terms of some of the older levels, without skipping any intermediary levels
4. Every level has a degree of autonomy and stability	Every level of science has a degree of autonomy and stability	Begin with the examination of facts at one level; only then go to other levels.
5. Events are primarily determined by laws of their own and contiguous levels	Events should be explained primarily in terms of their own and adjoining levels	Start with intra-level laws, then proceed to inter-level laws.

With his **Treatise on Basic Philosophy**, Bunge modifies once more his level schema of reality. He now recognizes five system genera, the physical, the chemical, the biological, the social and the technical, ordered in four levels, with the social and the technical branching from the biological[194]:

[193] This is a slightly summarized version of the theses as formulated in Bunge's **Method, Model and Matter**, pp. 162-166.
[194] The diagram on the left is from **Basic Treatise**, vol. 4, p. 250; that on the right from the same volume, p. 46

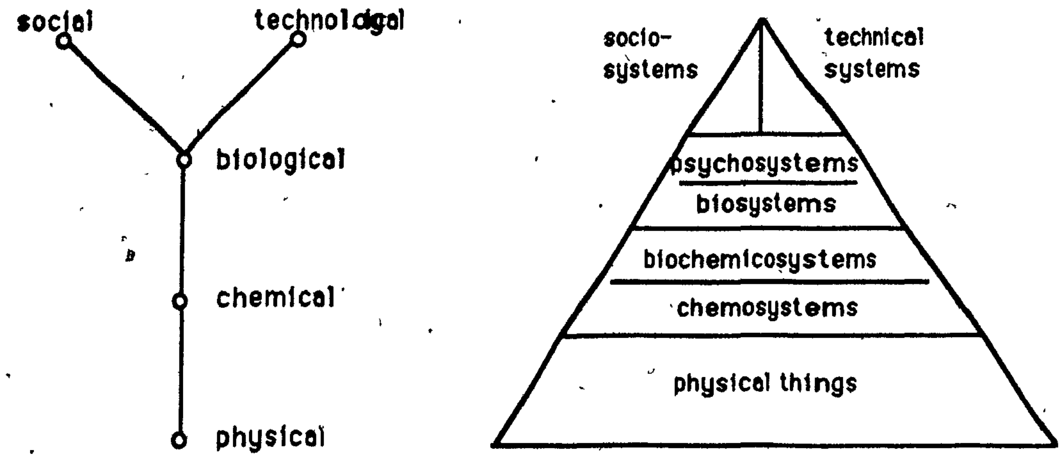

Diagram 3: Bunge's Recent Models of the Level Structure of Reality

In the **Treatise**, the following is given as the formal definition of a level structure:

Let $L = \{L_i \mid 1 \leq i \leq n\}$ be a family of n non empty sets of concrete things. Then

(i) one level precedes another iff all the things in the latter are composed of things in (some or all of) the former. I.e. for any L_i and L_k in L,

$L_i < l_k =def\ (x)[x \in L_k \text{ implies } (\exists y)(y \in L_i \ \&\ y \in C(x)]$;

(ii) a thing belongs to a given level iff it is composed of things in (some or all of) the preceding levels. I. e. for any $L_i \in L$:

For any x in Li: $x \in Li =_{df} C(x)$ is a subset of $\bigcup_{m=i-1}^{m=1} L_k$;

(iii) $L = < L, < >$ is a level structure.[195]

It is evident that there has been a development in Bunge's thinking on the level structure of reality. He has gone from a three level version in the early 1960s, to a four level version in the later 1960s, and now has a five genera, four level structure in his **Basic Treatise**. The most significant change has been the dropping of mind (or the psychological) as a level, which is now included at the intersection of the social and the biological. However psychology as a science is not

195 Mario Bunge, **Basic Treatise**, vol. 4, p. 13

fully reducible to sociology and psychology, and therefore has a certain autonomy. Moreover, in his writings on the the mind/body relation in recent books Bunge recognizes an emergent aspect to mind, even if minds do not constitute a distinct level of emergent reality.[196] Bunge defines his own view as "emergentist psycho-neural monism" as follows:

> (i) All mental states, events and processes are states of, or events and processes in, the central nervous system of vertebrates;
> (ii) these states, events and processes are emergent relative to those of the cellular components of the CNS;
> (iii) the so-called psycho-physical relations are interactions between different subsystems of the CNS, or between them and other components of the organism.[197]

The first clause is a statement of materialism which would be acceptable to a strict mind-body identity proponent; the second introduces the emergentist element. Individual neurons do not think, but the whole brain does; thought is an emergent property of the complex system formed by the central nervous system.[198] The third clause specifies the element of mind/body interaction. Bunge's overall view of the mind/body relation is nicely summed up in the ontological theses as follows:

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[196] Bunge's writings on the mind/body problem include "Emergence and the Mind" (1977), which was the first article in a multi-author debate in the pages of **Neuroscience**, "The Mind-Body Problem in an Evolutionary Perspective" (1978), "From Neuron to Behavior and Mentation: An Exercise in Levelmanship" (1980), "The Psychoneural Identity Theory" (1980), as well as his books **The Mind-Body Problem: A Psychobiological Approach** (1980) and the recently published **Philosophy of Psychology** (1987, with R. Ardilla)

[197] Mario Bunge, "Emergence and the Mind" (1977), p. 506

[198] Bunge's position on the emergence of mind may be termed a weak, rather than a strong one. On the weak emergentist view, there are certain mental properties of the whole brain not possessed by any of its parts, but there is no distinct mental level of reality. The strong version of the emergence of mind, to be defended in the conclusion of this dissertation, admits a distinct mental level of reality. Bunge's weak emergentist position is clearly consistent with his overall materialism; the challenge is to develop a strong emergentist position which is not at the same time epiphenomenalist or dualistic.

(1) Psycho-neural identity: Mental processes are brain processes. Put negatively: Mind is not separate from body, anymore than digestion is detachable from the digestive tract.

(2) Emergentism: The subsystems of the nervous system that control behavior or perform mental functions have properties that their components lack. They have emerged in the course of evolutionary or developmental processes, and some of them submerge as a result of sickness or aging.

(3) Mind is causally efficient: Mental processes influence other brain processes, and occasionally they have motor outlets. As well, they affect (and are affected by) the other two regulatory systems of the body: the endocrine and the immune.

(4) Localization cum integration: Except for memory and learning, which are capabilities of all plastic neural systems, every mental "faculty" is the specific function of a special brain subsystem. However, because the various subsystems are anatomically linked to another another, no behavior or mental 'faculty' is separate from all the others. In particular, cognition is fueled by motivation and it can steer movement. Put negatively: Neither behavior nor mind is modular.

(5) Interaction with society: Behavior and mind- particularly learning, perception, thought and social behavior - are strongly influenced by special circumstances and, in turn, they contribute to shaping the latter through behavior and language.[199]

(c) Scientific Materialism

Bunge has gone through a number of different terms to describe his ontological position: from integrated pluralism (or analytic monism)[200] in his early writings, through exact metaphysics in the early 1970s, to scientific

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[199] Mario Bunge, **Philosophy of Psychology** (1987), p. 282

[200] "Whereas both causal determinism and monism provide ready-made solutions to the problems of newness, pluralism discourages an approach to it in rational terms. Integrated pluralism -or, if preferred, analytical monism- should on the other hand be a fruitful working hypothesis. For, after all, is not philosophy a search for unity amid difference, and a disclosure of difference within unity." from Mario Bunge, "On the Connections among Levels", p. 70. Hartmann's influence - a combination of monism in substance with pluralism of levels, is evident in this early formulation.

materialism[201]. In his **Scientific Materialism** (1980), Bunge describes his ontology as exact (concepts are formulated in logical terms), systematic (hypotheses belong to axiomatic theories), scientific (hypotheses are consistent with science), materialist, (every entity is material),[202] dynamicist (all entities undergo some change), systemist (all things are systems or components of a system), emergentist ("every system possesses properties absent from its components") and evolutionist ("every emergence is a stage in some evolutionary process"), and concludes:

> Because the new ontology is supposed to possess all of the attributes listed above, it is hard to find a suitable name for it. 'Emergent materialism' would do no better than 'exact (or logical) materialism'. However, a name is needed for practical purposes. If pressed to choose we should pick the most comprehensive. This one seems to be scientific materialism...[203]

The materialist aspect of the ontology is based on the following innovative definition of a material object: "An object is a material object (or entity) if, and only if, for every reference frame y, if Sy(x) is a state space for x, then $S_y(x)$ contains at least two elements. Otherwise, x is an immaterial object (or nonentity)".[204] This definition does not presuppose any concept of "matter", but is based on the notion that something is a material body just in case it can have two distinct states in a state space. This implies that the thing has at least one property which can vary over time, and links materialism with a dynamic conception of ontogeny. Matter

201 The term "scientific materialism" is first due, to the best of my historical research, to John Tyndall in his 1868 presidential address of the same title to the Mathematical and Physical Section of the British Association.

202 "Every entity is material (concrete), and every ideal object is ultimately a process in some brain or a class of brain processes" Mario Bunge, **Scientific Materialism** (1980), p. 30

203 ibid, p. 31

204 ibid, p. 22

is then defined (definition 2) as "the set of all material objects."[205] The definition of reality then follows: "An object is real if, and only if, either (a) there is at least another object y whose states are (or would be) different in the absence of x, or (b) every component of x modifies the states of some other components of x"; reality being "the set of all real objects".[206] Two postulates are central to Bunge's system: (1) "A system is real (material) if, and only if, it is composed exclusively of real (material parts)" and (2) "Every real (material) object is either a system or a component of a system.[207]

Note that matter, though a basic term in his ontology, is not a conceptually simple term, but depends on other concepts, such as state-space, space-time, change, part/whole and so forth. Bunge states that ontological analysis is based on ontological categories and hypotheses:

> In the case of ontology, analysis bears on any metaphysical concepts or propositions or candidates for either role. Ontological analysis bears, in particular, on ontological categories - such as those of quality and society - and ontological principles - such as the hypothesis that every concrete thing is in flux. The analysis we expect from scientific ontology concerns, in particular, but not exclusively, the ontological categories and hypotheses that occur, either in a heuristic or in a constitutive capacity, in scientific research. Some such categories are those of thing, property, fact and value. As for the ontological principles inherent in science, suffice it to mention the assumption that a society, far from being an amorphous set of individuals, or a totality transcending individuals, is a system of interacting persons.[208]

[205] ibid, p. 22
[206] ibid, p. 23
[207] ibid, p. 25
[208] Mario Bunge Treatise on Basic Philosophy, vol. 3, p. 10

(iv) Evolution and Three Worlds: Karl Popper

Karl Popper's views on evolution have themselves undergone an evolution. He was quite critical of Darwinism in his **Poverty of Historicism** (1944/45, English translation 1957), arguing that the evolutionary hypothesis could not achieve the status of a scientific law because it was based on set of events for all we know unique to our planet. "This hypothesis is not a universal law, even though certain universal laws of nature, such as laws of heredity, segregation and mutation enter with it into the explanation."[209] The evolutionary hypothesis is similar to an historical statement, and no more.

During the 1950s, Popper was largely (though not exclusively) concerned with the philosophy of physical science[210], issuing in **Conjectures and Refutations: The Growth of Scientific Knowledge** (1963). An important transition in his thinking occurs in the 1960s, culminating in his **Objective Knowledge** (1972), significantly subtitled, "An Evolutionary Approach". His theory of the growth of scientific knowledge had been one of "bold conjecture" and "ruthless refutation"; he now indicates that this is an instance of a more general evolutionary process of trial and error. Organisms have to solve the problem of their relation to the environment, and their efforts to do so are so many trial solutions, with natural selection acting as an "error-elimination" mechanism.

209 Karl Popper, **The Poverty of Historicism** (1957)., p. 107

210 His work of the first part of the 1950s, originally intended as a **Postscript** to his **Logic of Scientific Discovery** (1934), were published in 1982 in three volumes: **Realism and the Aim of Science, The Open Universe: An Argument for Indeterminism**, and **Quantum Theory and the Schism of Physics.**

The trials correspond to conjectures, and the error-elimination mechanism to refutations. The schema for such a process is the following[211]:

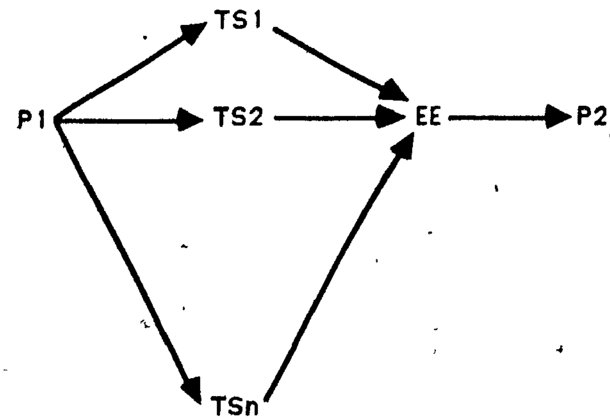

Diagram 4: Popper on Evolution as Trial and Error

Here P_1 stands for the original problem to be solved (be it the biological problem of survival, or a problem in science); the TS_i stand for the various trial solutions, and EE for the error-elimination mechanism. The error-elimination mechanism does not produce a definitive solution to the problem, since this would be an absolute truth unacceptable in Popper's theory of fallible, tentative knowledge. But it does winnow out the wrong solutions, and leads, not to a definitive solution, but to some new problem P_2. It is of interest to note that it is in discussing the problem P_2 that Popper first endorses a rationalized concept of emergent or creative evolution:

> The theory here proposed distinguishes between P1 and P2, and shows that the problems (or the problem situations) which the organism is trying to deal with are often new, and arise themselves as products of evolution. The theory hereby gives implicitly a rational account of what has usually been called by the somewhat dubious names of 'creative evolution' or 'emergent evolution'.[212]

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211 Karl Popper "Of Clouds and Clocks" (1965), in Objective Knowledge, p. 243
212 ibid, p. 244

In the 1970s and 1980s, Popper accepted natural selection as a scientific theory. In his "Natural Selection and the Emergence of Mind" (1978), Popper accepts natural selection as a scientific theory of evolution, since he now recognizes that Darwin never intended it to be the sole factor of evolution, and did not consider it identical with evolution as such. As one among several factors of evolution, natural selection is testable and refutable, and so has the status of a scientific theory.

Popper also adopts the concept of emergence and a level structure of reality. In the same article, he recognizes four levels of emergence: (1) the emergence of atomic nuclei and particles, (2) the emergence of life, (3) the emergence of conscious states, and (4) the emergence of the products of mind. He also identifies four stages in the emergence of consciousness: (1) the warning state when pain or discomfort first appear, (2) a stage where imagined or vicarious trial and error replace real trial and potentially fatal error, (3) the stage of conscious aims, and (4) the stage of language and the critical attitude towards one's own hypotheses. This meshes well with the conjecture and refutation model of knowledge and the evolutionary theory of trial and error he has developed.[213] However, it seems in contradiction to his theory of three worlds, which recognizes

[213]Popper has also been instrumental in the development of the evolutionary epistemology, according to which there is a nested hierarchy of selective-retention processes in the process of knowledge generation and acquisition, involving three mechanisms: (a) mechanisms for introducing a variety of knowledge candidates, (b) selection mechanisms, and (c) mechanisms for preserving and/or propagating the selected variations. See Donald T. Campbell (1974). "Evolutionary Epistemology" in the **Library of Living Philosophers** volume, **The Philosophy of Karl Popper**, and Popper, Karl (1984). "Evolutionary Epistemology"

what appear to be three distinct, and non-emergent substances: matter, mind and culture.

Popper's non-monistic ontology was present in earlier writings, but was not a dominant focus of his work. His interactionist dualist position on the mind/body problem is clearly stated in his "Language and the Mind/Body Problem" (1953), which is subtitled "A restatement of interactionism". Popper holds that the existence of distinct linguistic terms for talk about the mental and physical is a clue to the irreducibility of the two domains, which, nonetheless, can interact. The implicit dualism is developed into a full-blown pluralism in Popper's more recent work.

The thesis of the three worlds is that there exist distinct but interacting substances: World 1 of physical bodies and forces, World 2 of our minds, and World 3 of the products of human minds or culture. World 3 is objective, and though some of its elements are inventions of the human mind (i.e. natural numbers), propositions about these mental products are discovered (theorems about the natural numbers). Mind interacts not only with the brain, but with culture as well. Moreover, given the three world thesis, mind can interact with culture without any mediation by the brain. This pluralist theory of the mind, brain and culture is developed in collaboration with the neurophysiologist John C. Eccles in the jointly written **The Self and its Brain** (1978). Eccles, however, does not share Popper's enthusiasm for an emergentist evolutionary point of view.

Indeed, it can be argued that emergent evolution is inconsistent with a pluralist ontology of the three world sort (or at least redundant). For having admitted the emergence of life from matter, and mind from living matter, it is not necessary to then postulate three distinct substances: matter, mind and culture, as the three world theory, on any non-metaphorical interpretation, does.

(v) Conceptual Maps of Emergent Levels: Jonas Salk

Jonas Salk develops his ideas on emergent levels in his 1985 **Anatomy of Reality: Merging of Intuition and Reason**[214]. In accord with the modern synthesis thesis, Salk sees evolution as composed of two aspects: mutation and selection, the former random, the latter causal. In accord with evolutionary philosophy, he accepts evolution in the more general sense as pervasive of all nature. Evolution occurs not only at the biological level, but also at the pre-biological and the post-biological level. This trichotomous distinction is similar to that of Spencer who distinguished the pre-organic, the organic and the super-organic. Salk believes the diagrams are not only aids to comprehension, but essential to ideation.[215] The following is his representation of the three great emergences in the course of universal evolution.[216]

[214] The book appeared in the **Convergence Series** edited by R. N. Anshen, and as a popular exposition, does not contain footnotes or a bibliography indicating Salk's sources.
[215] In this, his view is similar to that of Rudolf Arnheim in **Visual Thinking**, who argues that perception is not merely the antecedent to cognition, but essentially co-present with it.
[216] Jonas Salk, **Anatomy of Reality** (1985), p. 29. Presumably, despite the graphical discontinuities between the rectangle representing each sphere, there is a continuous evolution between them, as indicated by the arrow for universal evolution at the bottom of the diagram.

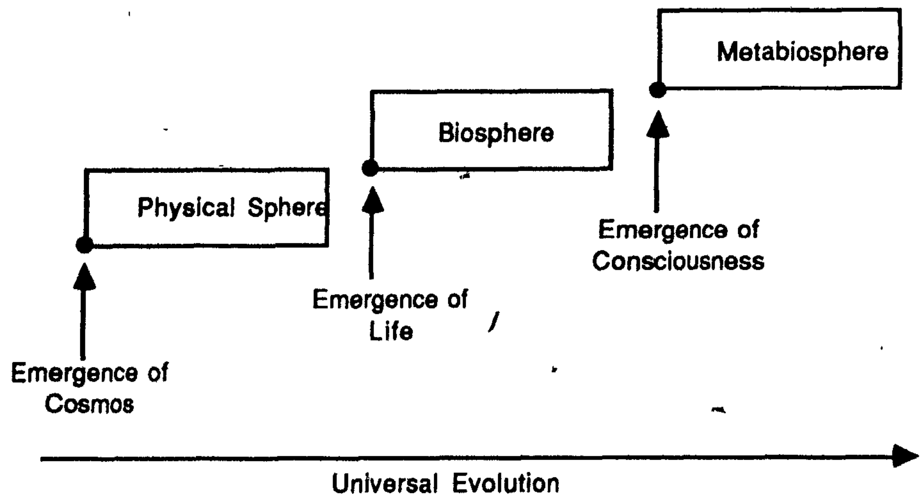

Diagram 5: Salk's Representastion of the Levels of Reality

The mechanism of evolution is not the same in each sphere. Salk does not have much to say about the physical sphere, but notes that biological evolution is largely Darwinian natural selection, while metabiological evolution involves an element of Lamarckian use inheritance:

> It is clear that Darwinian evolution better fits the facts of biological evolution, even though it may not answer all the questions concerning its nature. It seems, however, that the Lamarckian explanation, while originally proposed for biological evolution, may better fit metabiological evolution. Metabiological traits can be acquired and then passed on to successive generations. The genetic mechanisms described by Mendel, when combined with Darwinian ideas, do not apply directly to metabiological evolution though they do apply to biological evolution.[217]

Each sphere is subdivided into various levels: (1) The physical sphere into the elementary particles, atoms and molecules; (2) the biosphere into replicating molecules, cells and organisms; (3) the metabiosphere into the human mind and

[217] ibid, p. 61

human culture. Each level represents an increase of complexity of organization leading to the development of new qualities.

Salk adds the notion that emergence at each level is due to the interaction of polar opposites (reminiscent of Montague's attempt to analyze the two factors behind emergence at each level.) The binary relationship is a generalization from the binary mutation/selection relationship at the organic evolutionary level:

> These illustrations are intended to suggest the universality of the binary relationship, of the asymmetric binary pattern in all of the interactive dynamic relationships in nature, in physical matter (energy/mass, nucleus/electrons), in living matter (gene/soma, individuals/species), and in human matter (essence/existence, intuition/reason). The human mind is of an order of complexity that appeared in the course of evolution, in which matter may be said to have become conscious of itself. The phenomenon of consciousness and self-consciousness, as well as of intuition and reason, manifests the same pattern of functional binary relationship which characterizes all matter, and all natural phenomena, from the simplest to the most complex.[218]

Salk argues that the cosmos emerges from non-manifest order to manifest order. Entities in the cosmos are characterized, at the level of form, by the dichotomy between the continuous and the discontinuous. The manifest/nonmanifest and continuous/discontinuous dichotomies are studied by metaphysics and mathematics respectively; the other major disciplines study the major units of evolution and their binary components as follows[219]:

[218] ibid, p. 41
[219] ibid, p. 31

Unit	Binary Components	Discipline
Collective mind	Culture/Society	Sociometabiology
Mind	Intuition/Reason	Metabiology
Organism	Species/Individual	Sociobiology
Cell	Gene/Soma	Biology
Atom	Nucleus/Electrons	Chemistry
Particle	Energy/Mass	Physics
Form	Continuous/Discrete	Mathematics
Order	Non-manifest/Manifest	Metaphysics

This element of his theory is less satisfactory, and in order to fit concepts into the categorical framework, he has to resort to oversimplifications. Mathematics, for example, clearly deals with more than the continuous and discontinuous. In addition, the units mentioned in the above list are not quite the same as that given in the levels of evolution over the three major domains. Moreover, psychology is left out (replaced by "metabiology"), while the ill-defined notion of "group mind" is included as a unit corresponding to the social/cultural dichotomy. The weakness of this presentation is mitigated in a more economical one which immediately follows. Here Salk provides a résumé of his analysis of the emergence of each domain, the resulting unit of evolution, its binary components, specific attributes or defining characteristics, and mode of development[220]:

	Prebiological evolution	Biological evolution	Metabiological evolution
Emergence	Matter	Life	Consciousness
Unit	Atom	Cell	Mind
Components	Nucleus/Electrons	Gene/Soma	Intuition/Reason
Attributes	Interaction	Procreation	Creativity
Determinants	Probability	Selection	Choice

220 ibid, p. 32

Reading consciousness for mind under metabiological evolution, Salk has come full circle back to Lloyd Morgan's matter/life/mind level structure of emergent evolution. This is probably unintentional, but it does indicate the presence of the emergentist trend (even unacknowledged) as an active component in current philosophizing about science; and constitutes an appropriate moment to end this historical survey of emergentist views.

Conclusion

This conclusion will discuss two issues: (1) emergent evolution as a philosophical trend, summing up the historical analysis of chapters one, two, and three, and (2) a proposal for an emergentist analysis of the level structure of reality based on the four levels of matter, life, society and mind.

(1) Emergent Evolution as a Philosophical Trend

Three periods may be distinguished in the history emergent evolution, The first is the period of the emergence and development of emergentism from the mid 1910s following its synthesis by Lloyd Morgan, through to the mid 1930s. The second is the period of the eclipse of emergentism, especially by the reductionism of the logical positivist movement, from the mid 1930s to the early 1950s. The third is the period from the early 1950s to the present, when emergentism as a concept incorporated in the systems of some major philosophers of science.

(i) The emergence of emergentism

Emergent evolution during its first period was a philosophical trend. This claim is based on the following observations:

(1) Besides the original system of Lloyd Morgan, other systems of emergent evolution were developed by Samuel Alexander, Roy Wood Sellars and C. D. Broad. The main point of contention among these authors was the specification of the level structure of reality, and a large part of their originality lies in attempts to define distinct structures. Though Broad dropped his interest in emergent

evolution after his major volume on the question, the others maintained theirs, and constituted the core of a philosophical trend.

(2) Further attempts to analyze a concept of emergence were made by George Conger (emergence as repetition at higher levels of common structures), Oliver Reiser (emergence as the result of stochastic processes) and W. P. Montague (emergence as the result of the interaction of two factors at each level).

(3) Emergent evolution was a sufficiently widely held position as to attract the critiques of a number of philosophers and scientists. Of these critiques, at least one, that of Charles Bayliss was a contribution to the debate, since he introduced the concept of submergence. William McDougall subjected emergent evolution to a global critique from the point of view of interactionist dualism, while Bertrand Russell considered and rejected it as an alternative to his neutral monism.

(4) Emergent evolution had an influence on other, related, philosophical systems. Its influence can especially be seen in Smut's holistic evolution and Boodin's cosmic evolution. Some emergentist theses were incorporated in the systems of G. H. Mead (the emergence of novelty in the present), A. N. Whitehead (process and novelty), C. E. M. Joad (emergence in a pluralistic ontology), and, to a lesser extent, in the work of J. S. Haldane (the notion of a hierarchy of levels of interpretation).

(5) More significantly, the thesis of the emergence of distinct levels of reality was maintained in the biological trend of thought associated with theorists such

as J. Arthur Thomson, Joseph Needham, J. H. Woodger, Alex Novikoff and Julian Huxley. Their work, especially in the period of later 1930s and through the decade of the 1940s kept alive the key notion of integrative levels, even while emergence was not being developed by other philosophers.

Emergent evolution was at its height of influence in the period of the 1920s, with the publication of Lloyd Morgan's systematic works **Emergent Evolution** in 1922 and **Life, Mind and Spirit** in 1925. In 1926, the question was discussed at a session of the **VIth World Congress of Philosophy** held at Harvard University, with interventions by C. Wildon Carr, Hans Driesch, Arthur O. Lovejoy and W. M. Wheeler. The subject of emergent evolution was also debated at a meeting of the **Aristotelean Society** by E. S. Russell, W. M. Morris and W. L. Mackenzie. By the mid 1930s, however, no new emergent systems were forthcoming, and commentary was episodic and retrospective.

(ii) The "eclipse" of emergentism

The second period is that from the mid 1930s to the beginning of 1950s a period during which no new emergentist systems were developed. A survey of the literature of the period from the mid 1930s to the mid 1950s shows this to have been a period of decline of influence of emergentism, and its eclipse as a philosophical trend. Though some articles were published in Anglo-American reviews, these were survey articles, and did not contain new developments.[1] A number of factors are relevant to this phenomena:

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[1] **Among articles published from the mid 1930s to the end of the 1940s are: Ablowitz, Reuben (1939): "The Theory of Emergence", Malisoff, William (1939): "Emergence Without Mystery", Stace,**

(1) The logical positivist movement, associated with the Vienna Circle, was the dominant influence in philosophy of science in the period from the 1930s through to the end of the 1950s. The logical positivists favored a reductionist approach and directed all philosophical interest to physics, with the understanding that if problems at that level could be cleared up, all others would soon and even automatically follow.[2] Such a perspective was obviously in opposition to emergentist views, which concentrated on problems from the biological and psychological fields, and held that these levels could not be reduced to those of physics.

(2) Evolutionary theory, particularly Darwinian evolutionary theory, from whose problematic evolutionary emergentism had issued, was in a period of crisis just as emergent evolution was at its apogee. Particularly in the United States, the mutationist school (T. H. Morgan and others) proposed a new Mendelian basis for evolutionary change.[3] Though there is a common aspect to mutationism and emergentism - namely, the denial of gradual, quantitative change as the source of

W. T. (1939)" Novelty, Indeterminism and Emergence", Garnett, Campbell (1942): "Scientific Method and the Concept of Emergence", Gotschalk, D. W. (1942): "Causality and Emergence", Henle, Paul (1942): "The Status of Emergence", Bergmann, Gustav (1944): "Holism, Historicism and Emergence", a series of short articles written by Archie Bahm in 1947-48: "Emergence of Purpose", "Organic Unity and Emergence", and "Emergence of Values".

[2] Rudolf Carnap was one of the foremost members of the logical positivist trend; his reductionist views are evident in such works as **Logical Syntax of Language** (1937). and the earlier **Logical Structure of the World** (1926). Logical positivism is characterized as a movement in comparison to emergent evolution as a trend not only because of the greater number of adherents of the former, but because of the its greater impact in philosophy and science. The logical positivists were the main force behind the journal **Erkenntnis**, and the two volume **International Encyclopaedia of Unified Science**.

[3] The differences between mutationists and selectionists, and related issues concerning continuous and discontinuous evolution are discussed in William Provine, **The Origins of Theoretical Population Genetics** (1971). The eclipse of Darwinism in the first part of the 20th Century is discussed in Peter Bowler, **The Eclipse of Darwinism** (1983).

evolutionary process - there was no contact between the two schools of thought. The new school of genetic evolutionists was entirely experimental and had little use for philosophical theories, while the emergent evolutionists paid scant, if any attention to current developments in genetics.

(3) A weakness internal to emergentism was its lack of mathematical or logical formalism - it was a theory expounded in ordinary language, with little or no technical symbolism. The 1930s was an extremely active period of the development of philosophies of science based on a formal logical symbolism, and emergent evolution fared poorly in comparison.

(iii) The re-emergence of emergentism

The period from the 1950 on is that of the re-emergence of emergentism, with a renewed discussion of the concept of emergence in the academic mainstream, and the use of the concept as an important part of the philosophical writings of authors in the philosophy of science. The first new emergentist system was that of the German philosopher Nicolai Hartmann - though some of his ideas go back to the 1940s, his **New Ways of Ontology** appeared (in English) only at the beginning of the 1950s. An echo of Hartmann's views are included by Konrad Lorenz in his **Beyond the Mirror** (1969). James K. Feibleman, in his **Ontology** (1952) developed a metaphysical system, called axiologic realism, which attempted to unite metaphysics, epistemology and axiology. His system traces systematic relations between being, existence and essence, considered as three related realms each characterized by a level structure.

One of the first articles of the 1950s arguing for a legitimate place in philosophy for emergentist ideas was Arthur Pap's "The Concept of Absolute Emergence" (1952). Pap argued that a law correlating quantitative changes in physical conditions with sensed qualities must have an emergent aspect, at least insofar as semantic correlations of quantity/quality are concerned. Of greater significance for the return of emergentist philosophy to mainstream philosophy was the article by W. Sellars and A. Pap, "The Concept of Emergence" (1956) which appeared in the **Minnesota Series on the Philosophy of Science**, a widely read one volume annual. Their aim is not to show that emergentism is true, but rather to merely show it to be a logically consistent concept. They comment upon Pepper's 1926 article which was particularly extreme in arguing that emergentism was an incoherent concept. That this was necessary gives an indication of the depths to which the emergentist views had fallen during the period of eclipse of the trend.

From the Sellars-Pap article, discussion on emergentism was picked up in Herbert Feigl's important pamphlet **The Mental and the Physical** (1958)[4].Again, Feigl did not endorse emergentism, but merely considering it as a possible basis for a philosophy of the mind/body problem was a distinct improvement in emergentism's philosophical status. From Feigl, emergentism passed into Ernest Nagel's **Structure of Science** (1961), where it is again discussed as a possible alternative to the then dominant reductionism.

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[4] The essay originally appeared in volume II of **Minnesota Studies in the Philosophy of Science**.

Mario Bunge is the central figure in the reintroduction of emergentism as a philosophy of science. He is the first philosopher of science in the Anglo-American tradition since the 1930s to defend emergentism as a key component of his metaphysics. His first major work, **Causality** (1959) accords a major place to emergentism in the scientific world view.[5] He carried this interest into an extensive examination of the concept of levels of reality and the problem of emergentism in a series of articles, in in his book **Scientific Materialism** (1982), and in his multi-volume **Treatise on Basic Philosophy**.

Among the other major emergentists today are Karl Popper, the noted philosopher of science, R. W. Sperry, the Nobel laureate in neuropsychology, Konrad Lorenz, the Nobel laureate in ethology, Ernst Mayr, one of the leading figures of the modern synthesis of evolutionary theory and Jonas Salk, medical researcher and Nobel laureate as well.

This dissertation has traced the development of emergent evolution as a trend, from its origin as a problem concerning the mode of evolution to its latest presentations in current philosophy of science. The following diagram highlights the major influences in this history, with special emphasis on the pivotal roles

[5] Prof. Bunge notes in a letter of 04/07/88 on the subject of the origin and development of his interest in emergentism that he had become interested in the question as of the early 1950s when he wrote an article "What is Chance" (1952) dealing with the relation between probabilistic and non-probabilistic laws in physics. He further developed this topic in exchanges with David Bohm, whose **Causality and Chance in Modern Physics** appeared in 1959. Bunge was reinforced in his study of levels through his reading of Hartmann's **New Ways of Ontology** in 1954, though he disagreed with Hartmann's disconnection between levels. Of greater influence were Roy Wood Sellars, and Alex Novikoff, as well as the articles on levels in the 1949 volume co-edited by Sellars, **Modern Materialism**.

played by Darwin as concerns the theory of evolution and Lloyd Morgan as concerns the philosophy of emergentism.

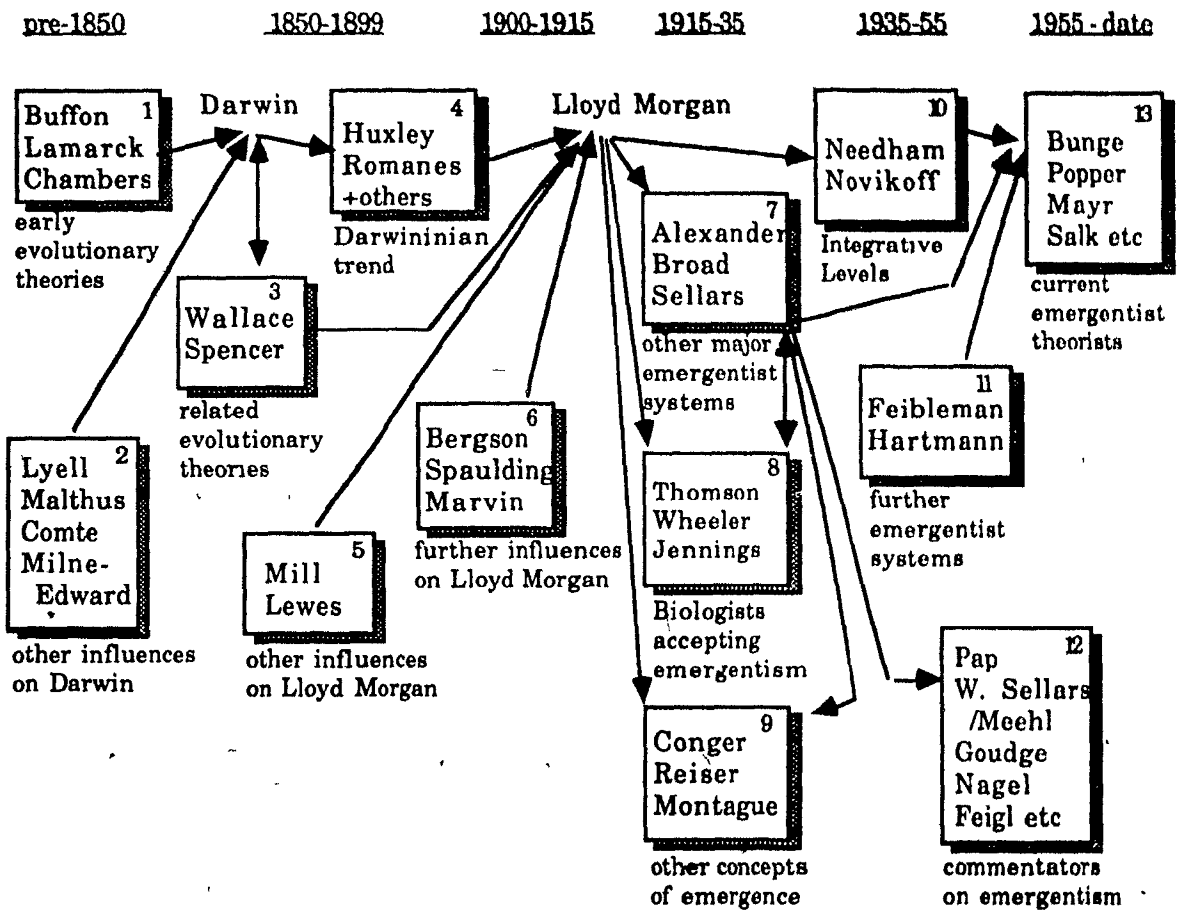

Diagram 1: Relations of influence

The explanation of the various arrows connecting different groups of thinkers, with Charles Darwin and Lloyd Morgan as focal points, is as follows:[6]

[6] Numbers in what follows refer to the respective boxes in the above diagram.

(a) Early evolutionary theorists [1] to Darwin: This includes the influence of Buffon, Lamarck, Chambers and other pre-1859 authors on Darwin. Of these, the greatest influence was Lamarck. Darwin's theory, the first to propose a scientific mechanism for evolution, was based on the two principles: (i) natural selection is the chief, though not the main factor of evolution, being supplemented by sexual selection, use-inheritance and other factors; (ii) evolution is a continuous, gradual and quantitative process which can be generalized, within a monistic ontological framework, to other domains of nature, specifically, the social, psychological and ethical. This latter proposition forms the problematic from which emergent evolution develops, in particular, the attempt to include qualitative novelty within a continuous and monistic framework.

(b) Other influences [2] to Darwin: As discussed in the section on the influences on Darwin, these include Lyell and his principle of uniformity, Malthus' theory of population, Comte's positivism, and Milne-Edward on divergence of character. Darwin's theory of evolution is a creative synthesis, involving an element of continuity with these immediate influences (and some elements of his general background, especially the principle of the continuity of life), along with an innovative element (the theory of natural selection).

(c) Related evolutionary theories [3] to Darwin: Further influences include Wallace, both through his letter of 1857 and probably his writings of 1855 as well (reinforcing the concept of divergence of character through natural selection), and Spencer, whose philosophy of evolution preceded Darwin's work, and from whom Darwin borrowed the term "struggle for existence". The double headed arrow indicates the return influence of Darwin on these authors, more so as concerns Wallace than Spencer.

(d) Darwin to Darwinian trend [4]: This indicates the establishment, not of a Darwinian paradigm accepted by all, but of a point of reference centered on natural selection as the major factor of evolution. The Darwinian trend included Huxley and Romanes in England, along with Asa Gray and Joseph le Conte in the United States.. Wallace also is part of this trend, though he differed with Darwin on the philosophical basis of evolution, opting for a dualism of the natural and the supernatural, this latter being the source of qualitative change in the evolutionary process. Le Conte also accepts qualitative novelty in the evolutionary process, with a saltationist view of the appearance of novel and distinct 'planes' of reality. Wallace and le Conte are more strictly Darwinian as concerns their scientific views of the factors of evolution than as concerns their philosophical views of change.

(e) Darwinian trend [4] to Lloyd Morgan: Lloyd Morgan was a student of Huxley for a short period of time, and a colleague of Romanes', editor of his scientific remains. Lloyd Morgan developed his interest for the mind/body problem through his studies with Huxley, though he disagreed with this latter's epiphenomenalist view. Rather, he adopted Romane's double-aspect monism as a constant feature of his philosophy, maintaining it even after he had developed his own emergentist theory. Spencer was also an important influence, particularly on Lloyd Morgan's early philosophy of evolution as presented in his **Monist** articles.

(f) Other 19th Century influences [5] to Lloyd Morgan: These are the two 19th Century theorists, J. S. Mill and G. H. Lewes, who had developed emergentist ideas - Mill with his concept of heteropathic laws, and Lewes, with the distinction between emergent and resultant causes. Both Mill and Lewes recognize qualitative novelty in the evolutionary process, but the concept is a minor one in both their systems. Lloyd Morgan's later theory will place the concept at the center of a philosophical system for the first time.

(g) Further influences [6] to Lloyd Morgan: These are the early 20th century theorists who most strongly influence Lloyd Morgan: Bergson and the theory of creative evolution, Spaulding on the whole/part relation and Marvin on the level structure of reality. Lloyd Morgan's creative synthesis of 1912-15 involves the joint influence of Bergson, Marvin, Spaulding, along with Mill and Lewes.

(h) Lloyd Morgan to major emergentist theorists [7]. Lloyd Morgan's influence was greatest on Samuel Alexander, but extended to C. D. Broad (who only briefly adopted emergentism) and R. W. Sellars, whose emergentism was more strictly naturalist than Lloyd Morgan's, and who eventually adopted a materialist ontology. Lloyd Morgan, Alexander and Sellars form the cornerstones of the emergent evolutionary trend in philosophy in the period from the mid 1910s to the mid 1930s.

(i) Lloyd Morgan to biologists accepting emergentism [8]: J. A. Thomson, a Darwinian during the period of the "eclipse" of Darwinism, had defended evolutionary novelty in his **Gifford Lectures** of 1915-16, and in the 1920s adopted emergentism; the influence of Lloyd Morgan on Thomson is the clearest for the members of this group of biologists. W. M. Wheeler, writing in the United States, was also influenced by the emergentist thought of Lloyd Morgan, but interacted more strongly with R. W. Sellars. Both Wheeler and Sellars, unlike Lloyd Morgan, argued for the social as the highest level in the emergent level structure of reality.

(j) Lloyd Morgan to other philosophers of emergentism [9]. The work of Conger. Reiser and Montague was an attempt to analyze emergence: Conger working through his theory of epitomization, Reiser looking for the source of emergentism in thermodynamic and stochastic processes, and Montague arguing for a polar opposites underlying each emergent level. These American theorists were to a greater extent independent of Lloyd Morgan than Broad or Alexander.

(k) Lloyd Morgan to biological theorists of integrative levels [10]. Joseph Needham combined Lloyd Morgan's emergentism with Whitehead's organicism and elements of dialectical materialism in his theory of integrative levels. This was the major strand of emergentist thinking at a time when that theory was in a period of "eclipse". Needham influenced other biologists, including Alex Novikoff, who was in turn an influence on Bunge.

(l) Relation of other major emergentist systems [7] to various commentators on emergentism [12]: R. W. Sellars was the major influence on authors such as Pap, W. Sellars/H. Meehl, T. A. Goudge and others, whose writings from the early 1950s on reintroduced discussion of emergentist ideas within the mainstream of philosophy. These authors cannot be considered as emergentist theorists, since they did not adopt the concept in their own philosophies. Rather, their contribution was to assert the legitimacy of emergentism as a concept, and to consider it as having a place in current philosophical debate.

(m) Influences on current emergentist theorists [13]. The central figure of current philosophical debate on emergentist is Mario Bunge. Influences on him include Roy Wood Sellars, Alex Novikoff and to a minor extent, Nicolai Hartmann . Bunge goes beyond these predecessors in his view of the relation between emergentism and reductionism, arguing for the consistency of ontological emergentism and epistemological reductionism. Other philosophers of science and scientists who presently include emergentist concepts in their systems include Karl Popper, Ernst Mayr, Jonas Salk and others.

(2) Emergence and the Level Structure of Reality

An emergentist philosophical system requires only one substance, rather than two or more. What in other philosophies are considered as distinct substances, such as the Cartesian body and mind, or the Popperian three worlds, can be explained as emergents from matter at higher levels of complexity of organization. A monistic ontology is a basic assumption of emergentism and is a core proposition of that philosophy. The major problem for dualism (or pluralism) is the nature of the interaction between material bodies and immaterial minds. In the Cartesian formulation, bodies are essentially characterized by extension, minds by thought. How then do they interact, given that there defining characteristics are diametrically opposed? Attempts at solving the problem, from

Descartes to Bergson are well known, though none have won universal assent even among dualists.

The advantage of the dualist position is that it fully recognizes the existence of minds and the mental. Eliminative positions, such as that of the behaviorists in psychology, are unable to serve as a basis for a general philosophy. With minds eliminated, such a philosophy is unable to account for epistemology (how the subject, characterized by his or her mind, comes to know the objective), or ethics (the category of the person cannot be constructed from a view of humans as mindless automata). The disadvantage of dualism is an ontological one: how to account for mind/matter interaction.

It is in this respect that emergentism demonstrates its advantages, combining, as it were, the best of both worlds: substance monism and property pluralism. It starts from a monistic assumption - in the version here defended, with matter as the single substance - and then goes on to derive a non-reducible mental level from the emergence of qualitative novelty in the course of an evolutionary process. Here, a materialist ontology allows as full a recognition of the existence of mind as a dualist one, without, however, requiring a second substance and the associated problem of explaining the interaction between them.

Matter is the substance from which all things arise. Substance is here considered as the stuff or substratum of things. All things are characterized by changeability and the ability to interact and form compounds or systems, and it is in this way that the level structure of reality is built up. An analysis of the concepts "interaction" and "change" which characterize matter leads on to a consideration of space and time. Interaction between two material units presupposes that they are distinct in space; change of state in a material unit presupposes that this change occurs in time. The relativity theory in physics has shown space and time to be united in a four-dimensional space-time. Superstring theories postulate a primordial space-time of up to 11 dimensions, 7 of them "curled up" to make four dimensional space-time as we know it[7]. Whatever its dimensionality, space-time is the framework through which matter develops; it is not the container for matter or a substance apart. All things, at whatever level they may appear, are in space-time; nothing is outside of it. In what follows, space-time is one of the two components or elements entering into the definition of a thing. This is an attempt to reconcile the problem of choosing between matter and space-time as the basic level. It seems that both are necessary, neither is sufficient. Matter is the basis or content, space-time the form or context; things are formed by the combination of both.

A thing is a differentiated emergent from matter (as content or basis) in space-time (as form or framework). Things have individuality and properties. By 'properties' is meant the characteristics of things as they are independently of our knowledge of them. Qualities are representations in our minds of these properties of things. 'Property' is an ontological category, 'quality' the corresponding epistemological one. It is the goal of an emergent evolution theory to describe in

[7] See Daniel Z. Freedman and Peter van Nieuwenhuizen (1985) "The Hidden Dimensions of Spacetime" for a discussion of Klein-Kaluza theories which postulate a space-time with from 5 to 11 dimensions.

metaphysical terms the process whereby new properties of things and the associated levels of reality are generated.[8]

A property q is an emergent property of a thing x when it is a member of the set of properties of a thing x, but not of the property set of any component of x. Symbolically, where P(x) stands for the set of properties of x, and $y \sqsubset x$ stands for the fact that the thing y is a part of the thing x:

$$Emg(q, x) =_{def} [q \in P(x) \text{ and } (\forall y)(y \sqsubset x \rightarrow q \notin P(y))]^{9}$$

Conversely, a quality q is submergent relative to x when it is a quality of some part of x but not of x itself.

$$Smg(q, x) =_{def} (\exists y)[(y \sqsubset x) \,\&\, (q \in P(y)) \,\&\, q \notin P(x)]^{10}$$

The number of components and relationships in a thing, and the variety of their combinations, is a measure of its complexity. The emergence of novel properties is considered as a function of the increase of complexity of the structure of things and their development over time. The world is the sum total of things, and its history, the sequence of the states of the things composing it.

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8 Things may be considered as systems when, with the exception of some sub-atomic particles (at present, the leptons and quarks), they have components. In this case a system consists of the set of components, the set of properties, and the set of relations of the thing and its components, i.e.. S = <C, P, R>, where each of P and R consist in turn of two parts: the properties and relations of the whole, and the property and relations of the parts. The relations of the whole comprise the connections between the system and its environment.

9 This is the formal definition of Bunge (1982) in **Scientific Materialism** and in his **Treatise on Basic Philosophy**.

10 This follows the suggestion by Charles Bayliss (1929) in "The Philosophic Functions of Emergence" that submergence, as the converse process of emergence, should also be included.

Evolution is a period of the history of the world (or part of the world) when change is characterized by the appearance of novel properties in at least some part of the world. In this case, complexity increases over time, and emergence takes precedence over submergence of qualities. When there is a loss of novelty, involution is said to occur. The fact that evolution occurs in one part of the world does not imply that it necessarily occurs elsewhere.

A novel property class B is a class of things such that there is some time t in the evolution of the world W (or part of the world) when each thing in B possesses some property not possessed by anything belonging to the complementary set W-B. The characteristic properties of a novel property class are those which differentiate it from the rest of the world. A novel property class may be defined by one or more properties.

Two property classes A and B are levels when the characteristic properties of A are preserved (perhaps with some modifications) in the class of properties of B and are a necessary condition for the appearance of the characteristic properties of B.

Level B follows level A when either B contains the characteristic of A or B's own characteristic property presupposes that of A, but not conversely. A level B immediately follows a level A when B follows A, and there is no level C which follows A and which is followed by B. A level structure is a series $L_1, L_2, L_3, \ldots L_n$ of levels such that L_{i+1} immediately follows L_i. Things of a level L_i are included among the components of things of level L_{i+1}, which may include things of other levels as well. The ranking of levels is based on that of their characteristic properties; so that a thing is placed in the highest level to which one of its properties admits it.

The thesis of emergent evolution is that a level structure is generated in the course of evolution, and everything is a member of some level. In other words, according to emergent evolution, there is a level structure $L_0, L_1, L_2, ..., L_n$ such that the World W = the union of the things of the levels L_i: $W = \bigcup_{i=0}^{n} L_i$. Here L_0 stands for the substance which serves at the same time as the first level of the reality structure. Moreover, the history of the world is essentially that of the emergence of the levels L_i over time, with level L_{i+1} appearing later than level L_i.

Once an emergentist ontogeny is accepted, the problem is to determine an adequate level order of reality. The following level order of reality is proposed: matter, life, society and mind. Matter is the substance and first level of the system. Mind is considered as the result of the joint development of both life and society, and expresses itself at the collective level as culture:

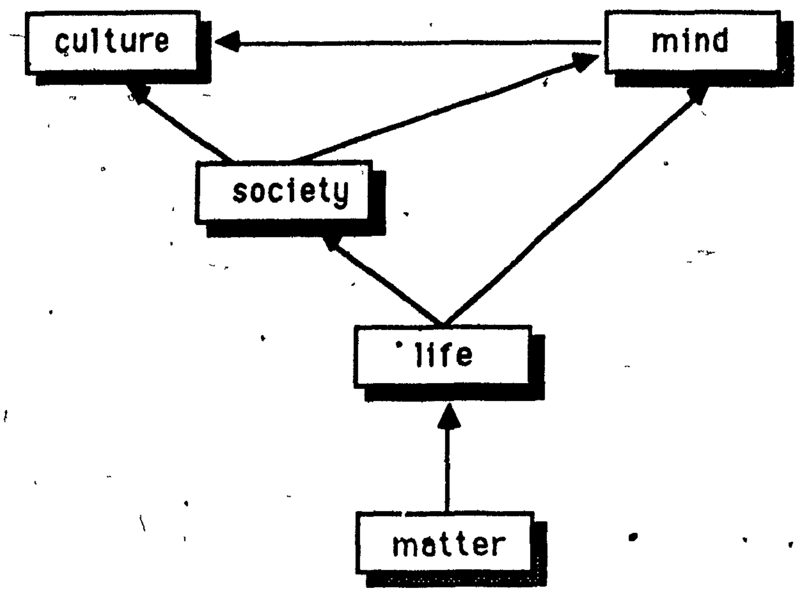

Diagram 2: Emergent Levels of Reality

The basic level of the proposed structure of reality is that of matter. Modern science has shown that matter is more complex than originally believed by the 19th century theory of atoms. Dalton and Lavoisier, founders of the modern theory of atoms thought that atoms were indivisible. The discovery of radioactivity suggested that atoms themselves are complex, composed of the nucleus and and electrons, and the nucleus itself is further divisible into protons and neutrons. Current theories hold that sub-atomic particles are divided into two basic groups: the hadrons and the leptons. The hadrons, which participate in the strong nuclear force are further divided into the two subgroups of baryons (with non-integral spin, including the neutron and proton) and mesons (with integral spin, including the pions and other related particles). The leptons do not participate in the strong interaction, and include the electron, positron, muon and neutrinos. The atom in terms of the above classification is composed of two types of baryon in its nucleus (neutron and proton), surrounded by the leptons (electrons).

Recent particle theory has further introduced the category of quarks, which are sub-atomic particles with fractional electrical charges (±1/3 or ±2/3) as the constituents of the hadrons. On this analysis, baryons are composed of three quarks and mesons are composed of quark / anti-quark combinations.[11] Thus, both the proton and neutron would themselves be complexes of quarks. Further, there has been some recent discussion of constituents to the quarks themselves, though this is still at the speculative stage.[12]

Of relevance to this conclusion is the notion that matter itself has a level structure. Harald Fritsch (1981) in his **Quarks: The Stuff of Matter,** argues that there are at least five levels of matter: (a) the molecule, (b) the atom, (c) the nucleus, (d) the nucleon (proton or neutron), (e) the quark, along with the presently structureless electron. The following is a slightly modified version of his graphical representation of this state of affairs[13]:

[11] See Harald Fritzsch (1981) **Quarks: The Stuff of Matter**, B. G. Duff (1985) **Fundamental Particles: An Introduction to Quarks and Leptons**, Sheldon Lee Glashow (1975) "Quarks with Color and Flavor", Chris Quigg (1985) "Elementary Particles and Forces". For each type of force, current particle theories postulate not only particles that "feel" that force, but particles that carry that force. For quarks, the postulated particles are gluons, just as photons carry the electromagnetic force, intermediate vector bosons the weak nuclear force, and postulated gravitons for the gravitational force.

[12] See Haim Harari (1983) "The Structure of Quarks and Leptons". Harari suggests that quarks are composed of pre-quarks called "rishons", with diameters of less than 10^{16} cm. On this model, quarks (of which there are now six sorts) would be made up of combinations of two sorts of rishons, one with electrical charge +1/3 and the other neutral, along with their corresponding anti-rishons. A different theory, that of superstrings, suggests that the ultimate components of the universe may be multi-dimensional (10 or more) superstrings, with sub-atomic particles being particular states where only the familiar four dimensions of space and time are apparent. See Michael B. Green (1986) "Superstrings".

[13] Harald Fritzsch (1981) **Quarks: The Stuff of Matter**, B. G. Duff (1985) **Fundamental Particles: An Introduction to Quarks and Leptons**, p. 263. The question marks leading from the quarks and electrons is meant to suggest the possibility of further components to these particles, and the possibility that the same components will be common to both.

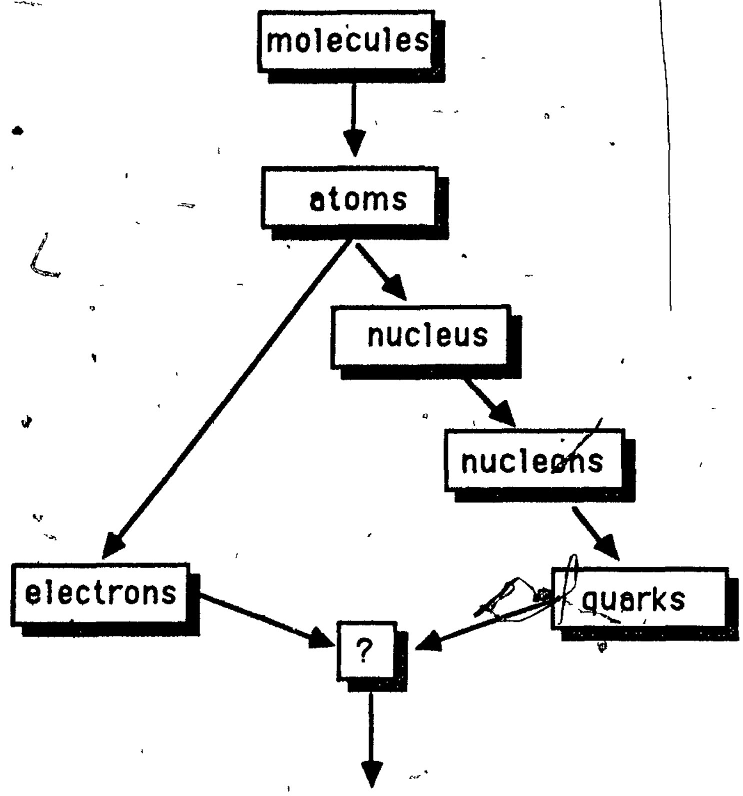

Diagram 3: The Sub-Levels of Matter

Matter may be defined as the union of the entities at its various levels, i.e. $M = \bigcup_{i=1}^{3} M_i$, where M_1 is the level of molecules, M_2 the level of atoms and M_3 the sub-atomic level comprising nucleons, electrons, quarks and any more elementary particles that may exist. Emergent evolutionists have repeatedly noted that there are properties of one level of matter, that of molecules, which are emergent from those of the preceding level, that of atoms. This claim has been reinforced by the realization that it is not presently possible to deduce the properties of molecules from quantum mechanical considerations alone.[14] It is an

14 See Mario Bunge (1982) "Is Chemistry a Branch of Physics?". Bunge argues that extra assumptions must be made in order to derive quantum chemistry from quantum mechanics, in particular assumptions concerning the nature of chemical reactions and the composition of molecules (p. 220).

interesting speculation, consistent with emergent evolution that each level of matter has some emergent properties. In this conclusion, however, the major concern will be with the emergent properties of levels above that of the molecule. The levels of matter may be termed micro levels, to distinguish them from the macro levels of things, life, society and mind. It is from the molecular micro-level that the macro-levels emerge. The following are the micro-levels of matter:

M_3. The sub-atomic level: dozens of different particles, from quarks through neutrons, protons and electrons (some of which are components of others)

M_2. The atomic level: some hundred types of atoms, each made up of protons, electrons and neutrons.

M_1. The molecular level: many thousands of types of molecules, composed of combinations of atoms.

The following is a classification of the members of the macro-levels of matter:

L_1. The biological level: cell-based organisms composed of organic (carbon based) molecules

L_2. The social level: some organisms (the social insects, perhaps the cetaceans, the primates and humans)

L_3. The mental level: some socially organized organisms (the higher primates and humans). Combining the graphics for the micro and macro-levels, the following representation results:

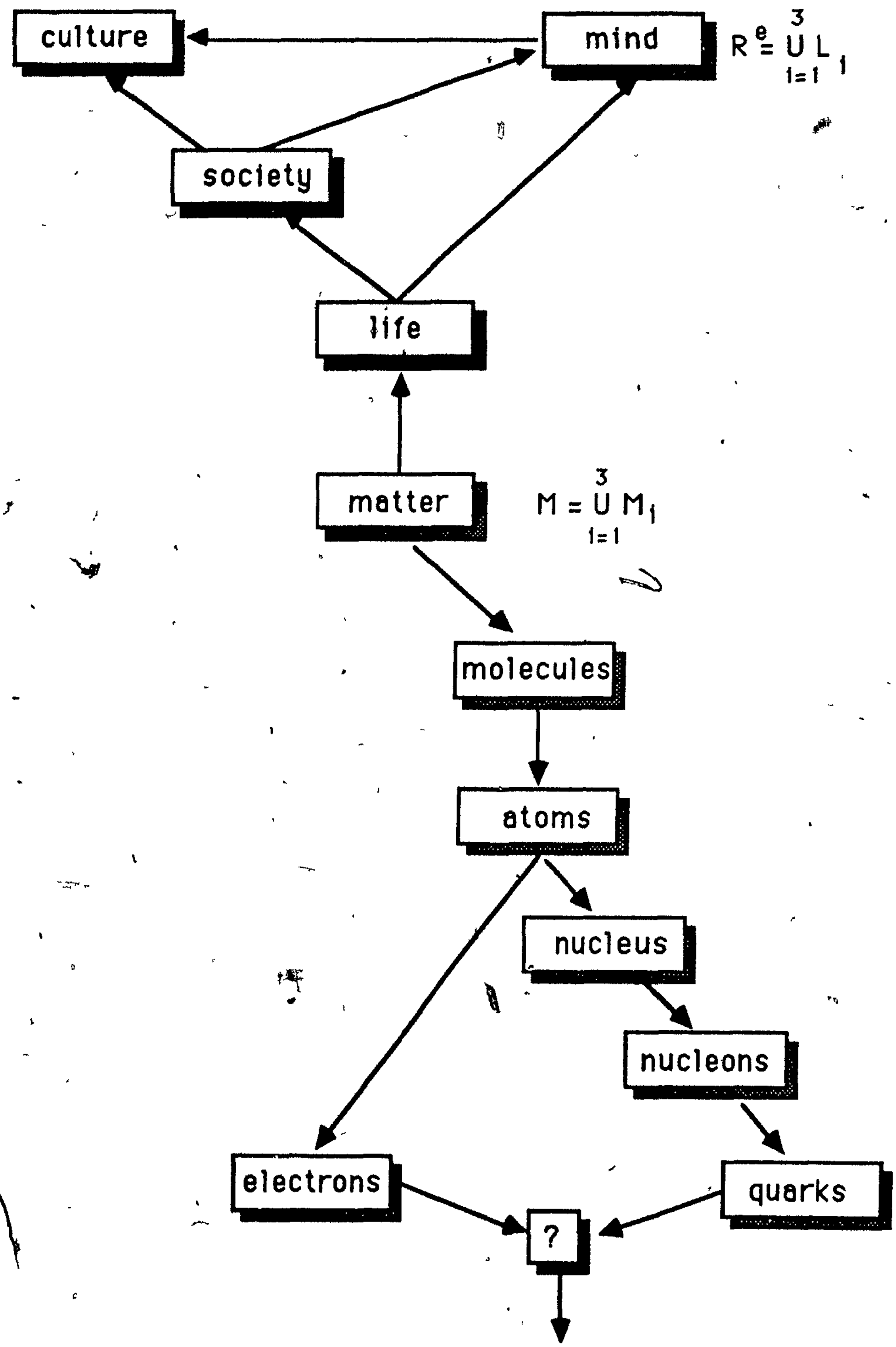

Diagram 4: Overall Level Structure of Reality

On this model, the things in the world are ranked according to their possession of certain common properties emergent relative to those properties of things at the preceding level. That is to say a thing belongs to the level L_i if and only if it has at least one property of the ith level, and no property of the i+1th level.[15] Since the level ordering is a property-based one, the social and mental, which are properties of certain sorts of organisms, can be accorded the status of levels of reality.

The components of all the macro-levels are things, composed of molecules (level M_1 of matter). This is the materialist aspect of the theory. Let $\underline{L}_i$ stand for the set of all things at macro-level L_i, and let $\underline{M}_i$ stand for the set of all things at micro-level M_i. According to the theory of evolution, some carbon-based things evolved into organisms (level L_1) while some organisms are socially organized (level L_2) and some socially organized organisms have mental capacities (level L_3). Thus (1) $\underline{L}_3 \subset \underline{L}_2 \subset \underline{L}_1$, (where a $\subset$ b says that a is a subset of b) since each higher level is composed of a restricted set of things from the lower level. Let $\underline{M}_i^*$ stand for the power set of the set $\underline{M}_i$. Now, (2) $\underline{L}_1 \subset \underline{M}_1^*$, since all things are made up of combinations of molecules. Therefore, (3) it is the case that $\underline{L}_3 \subset \underline{L}_2 \subset \underline{L}_1 \subset \underline{M}_1^*$ Let $R^e = \bigcup_{i=1}^{3} \underline{L}_i$, where R^e stands for emergent reality. Then $R^e \subset \underline{M}_1^*$ by (2) and (3).

Thus R^e is a subset of the power set of molecules, showing that emergent reality is material in nature, where 'material' is now specified to mean 'composed of combinations of molecules'.

15 In the case of objects at the mental level, there is no higher level in this model, and so this latter condition is trivially fulfilled.

That R^e (the union of the macro-levels) is a subset of the power set of the molecular level is in line with the relationships among the micro-levels of matter, where each succeeding level is a subset of the power set of the components of the preceding level. Here, $\underline{M}_i \subset \underline{M}^*_{i+1}$ (i= 1, 2) since the molecules of level M_1 are made up of combinations of atoms of level M_2 (i.e. are a subset of the power set of M_2), and similarly for the relation between the atoms of level M_2 and the sub-atomic particles of level M_3.[16]

This materialist aspect of the theory is complemented by the emergentist aspect, since each organism at a higher level has some properties not possessed by organisms of preceding levels: Only some things evolve into organisms, only some organisms form societies, and only some social organisms have minds. Here 'society' and 'mind' stand for the social and the mental considered as novel properties characteristic of organisms at successively higher levels. This is the emergentist aspect of the theory. In greater detail, the levels may be analyzed as follows:

Things are macroscopic combinations of molecules, which emerge to the macroscopic level. Inanimate things at this level include both very large objects such as stars, galaxies and other celestial things, as well as smaller entities such as rocks or clouds. According to the modern nebular hypothesis, stars are formed from the gravitational accretion of the lighter atoms and molecules. Supernovae

[16] Note that the relation among the macro-levels of reality is slightly different from that among the micro-levels where $L_4 \subset L_3 \subset L_2 \subset L_1$ for the macro-levels, without any need to use power sets.

are the source of the heavier atoms and more complex molecules, including organic ones. It is from here that evolution proceeds to the organic level, which is may be represented as a subset of the power set of the molecules, specifically, of the organic molecules.

Life is the level consisting of chemical matter composed of carbon, hydrogen, oxygen and nitrogen, united in biochemical combinations. As organic chemistry has shown, the possibility of the formation of complex carbon-based molecules is due to the outer shell of the carbon atom, which is only half filled. This explains the possibility of increase in complexity of organization, but does not specify the new, or emergent properties that certain combinations of organic compounds in fact do possess. The basic unit of life is the cell, which in the case of eukaryotic cells is composed of the nucleus (in which the DNA and RNA necessary for reproduction are found), various intra-cellular organelles with specific functions of protein synthesis, mitochondria which carry out energy transformations, and the cell wall, which allows certain macro-molecules to enter and leave the cell.[17]. Life is characterized by metabolism and the capacity for growth and reproduction. Living things are organisms, composed of tissues and organs themselves made up of cells of bio-chemical components. However, the organic molecules which make up the cells are not themselves alive.

Society is a level which is the outcome of the evolution of some organisms, in particular, the social insects, primates and humans. Society may be conceived of in a large or a restricted sense. In its widest sense, any association of like

[17] See Salvador E. Luria, Stephen Jay Gould and Sam Singer (1981). **A View of Life**, pp. 162-173

organisms constitutes a society. At the very least, all sexually differentiated organisms must mate, and in addition, many animals have some rudimentary division of labour for the upbringing of offspring. However, this enlarged view of the social fails to distinguish between different kinds (or levels) or social interaction. William Morton Wheeler, in his study of the social insects, distinguished between the infrasocial, the quasisocial and the strictly social.[18] At the lowest grade of the infrasocial level, the mother merely scatters her eggs in areas where the population normally lives, in some cases near supplies of food; at the highest grade of the infrasocial level, the insect mother deposits the eggs in a specially prepared nest with a nearby supply of food . At the quasisocial level, the insect mother stays with her progeny to protect them, and also continuously supplies them with prepared food. At the strictly social level, the progeny are not only protected and fed by the mother, but previous generations of progeny cooperate with her in this task, leading to the existence of a multi-generational extended family.[19] In insect societies, there is a further morphological differentiation leading to castes among the insects, with specialization of various castes in food supply and nursing (the workers) or defense and attack (the soldiers).

A restricted definition of society should limit it to species where role differentiation and hierarchical structure are clearly established. In this sense, a

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[18] In William Morton Wheeler (1928). **The Social Insects: Their Origin and Evolution**, pp. 12-13.
[19] E. O. Wilson (1980), in his **Sociobiology**, discusses this hierarchy of social evolution among the insects. He distinguishes three aspects of social life: cooperative brood care, reproductive castes and overlap between generations. In his terminology, the quasisocial insects are characterized by cooperative brood care only, the semisocial by the further addition of reproductive castes, and the eusocial by the final addition of overlap between generations. (p. 190 of the abridged edition). See also his earlier (1981) **The Insect Societies**, p. 21 where he discusses Wheeler's classification of the stages of evolution of the social wasps.

society is characterized by a specialization of labour (diversification) and a social hierarchy (stratification) among its members. Society is a level resulting from biological development, but is not itself biological. The social level has been reached only by comparatively few species, indeed, a rather small number: the social insects (ants, termites, some bees and wasps), perhaps the cetaceans (whales, porpoises, dolphins) and the primates (including humans).

Mind is the joint outcome of biological and social development, and minded organisms constitute the highest level. Again, a loose and a strict definition of mind can be given. According to a wide definition of mind, any organism which can make choices can be said to have a mind. This is the view that Darwin and Romanes[20] defended, according to which all animals could be said to have some sort of mind. A more narrow definition of mind restricts it to animals which are conscious and capable of thoughts with respect not only to the present and past, but the future as well (Lloyd Morgan among others). A refinement of this definition specifies that an animal must possess self-consciousness as well in order to qualify as having a mind. It is this definition which will be adopted here, for reasons similar to that motivating the adoption of a strict definition of society: a lax definition, by allowing too much scope to the term, fails to distinguish between precursors to the phenomenum in question, and the phenomenum in its fully developed form. Minded individuals are characterized by their capacity to think (have ideas), and by self-consciousness. This definition is more rigorous than one which mentions only consciousness, since more animals (including some only partially social ones) are conscious.

[20] See George Romanes (1883) **Mental Evolution in Animals** and (1888) **Mental Evolution in Man**.

The mental, as a level composed of minded organisms, depends on both the biological and social levels preceding it. On the one hand, the mental is a characteristic, or property, of the primate and human cerebral neo-cortex; on the other hand, the mental is a dependent on the development of social organization as manifested in primate and human societies. Indeed, minds have arisen only among some socially organized animals. Minds are individual and perish with the death of the individual.

One argument for the emergence of the mental is analogical: just as no vital principle or substance is required in order to produce living organisms, so no psychic principle or substance is required in order to produce thinking organisms. Biology, admitting no more than material entities, studies the emergence of life, and is able to characterize in physico-chemical terms the cell as the unit of life. In the same way, physiological psychology and social psychology should be able to characterize the mind. This analogy is a strong one, not a metaphorical or allegorical one.

Finally, the diagram includes culture, not as a distinct level, but as the collective product of the social organization of minds. The products of minds, preserved in cultural objects (books, films, statues, etc) survive the death of the individual mind which produced them by being made accessible to other minds at later times.[21] Note that there is bifurcation after the biological level. Thereafter, the left side of the diagram represents collective organization (the social) and

[21] Thus, the Popperian third world as a distinct substance is not required, although Popper is quite correct in stressing the importance of culture in understanding the human condition.

collective productions (the cultural), while the right hand side represents individual existents (minded organisms).

The ranking of societies before and not after mind is an innovation in this level structure of reality in comparison to others discussed in the text. Societies arise as the result of the evolution of some biological species, specifically the social insects (ants, termites, social bees and wasps), and the higher primates (gorillas, chimpanzees, and humans). It is believed by some that the cetaceans (porpoises, dolphins and whales) form societies as well, but this is not yet conclusively demonstrated. Though many mammals and birds form pair bonds, and even the fish associate in schools, the high degree of inter-organism interaction found in the social insects, primates and humans is qualitatively more developed. Once the decision is made to include the social, the problem arises as to where to include this level. Clearly, it must follow the biological level. The question remains as to the order relation of society and mind.

If society, which is a social grouping of organisms is placed above mind, this implies ~~that~~ mind is a precondition for the appearance of society. This, however, is not the case with the social insects, whose communication system is entirely based on chemical cues, and whose members are not characterized by self-consciousness or the ability to think. This shows that evolution in some species achieves the social level without having first achieved that of mind. So mind must be placed after the social level. The social is a condition for the mental, preceding and not following it. Mind, considered as the capacity for thought and self-consciousness, does not occur in any but some of the social animals.

The ordering of the social as preceding, and not following the mental level, has some important axiological considerations as well. The social level is characterized by collectivity, whereas the mental is characterized by individuality. Thus, if the social level were followed by the mental level, the individual mind would merely be a means to a collective end. To the contrary, in the above schema, the social collective is a condition for the emergence of individual minds characterized by consciousness and self-consciousness. The collective is not underestimated, for it is recognized as a distinct level; neither is the collective overestimated, since it is situated as means to an end - the emergence of the individual minded organism.

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