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MACCOLL'S EVOLUTIONARY DESIGN OF LANGUAGE

The account of logical form underlying MacColl's modal system is not only due to his mathematical approach to logics. Algebra, analysis and probability theory provide the formal context in which it develops. Likewise, however, MacColl's dualistic understanding of natural and human evolution in terms of purpose and chance shape his account and layout of a modal logic. His metaphysical beliefs and, especially, the conception of language they comprise articulate his religious reaction to major progress in the empirical sciences of his century. Statements of ever increasing complexity articulated with the help of conventional signs are the genuine subject of MacColl's logic. His concept of a statement essentially recapitulates the notion of a root in 19th century linguistics.

1. Introduction

In one of his last letters to Bertrand Russell Hugh MacColl sums up the important stages of his later intellectual development. His report confirms what the dates of publication of his major works already indicate. After the public discussion of his "Calculus of Equivalent Statements" MacColl refrains from investigating basic issues in logic and mathematics for more than ten years. The letter to Russell written on the 17th of May 1905 comments on this lengthy period:

When, more than twenty-eight years ago, I discovered my Calculus of Limits, or as I then called it, my "Calculus of Equivalent Statements and Integration Limits", I regarded it at first as a purely mathematical system restricted to purely mathematical questions. ... When I found that my method could be applied to purely logical questions unconnected with the integral calculus or with probability, I sent a second and a third paper to the *Mathematical*

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Society, which were both accepted, and also a paper to *Mind* (published January 1880). These involved me in a controversy with Venn & Jevons, of which I soon got tired, as I saw it would lead to no result. — I sent a fourth paper (in 1884) to the *Math. Soc.*, on the "Limits of Multiple Integrals", which was also accepted. This I thought would be my final contribution to logic or mathematics, and, for the next twelve or thirteen years, I devoted my leisure hours to general literature. Then a friend sent me Mr. Dodgson's ("Lewis Carroll's") *Symbolic Logic*, a perusal of which rekindled the old fire which I thought extinct. My articles since then I believe to be far more important from the point of view of general logic than my earlier ones; but unfortunately the views which they express are far more subversive of the orthodox or usually accepted principles in symbolic logic. I feel myself an Ishmael among logicians, with my hand against every man, and every man's hand against me; but it is hardly my fault; I follow the natural development of my method in the direction of truth, and according to my lights, whatever be the consequences. (MacColl 1905)

It is easy to misunderstand the regretful heroism of these lines. They are not just articulating the professional disappointment of an elder man who spent more than half of his life as a private teacher of mathematics and languages at Boulogne-sur-Mer. The desperate pride has more pertinent reasons than a want for personal recognition:

On various occasions MacColl presents himself as a "peacemaker" (1880, p. 47), who intends to "bridge the gulf between Symbolic Logic and the Traditional" (1906a). However, a close inspection of his writings soon reveals a different stance. The principal assumptions and basic intuitions on which his mature system relies are not set forth as instruments for tolerant cooperation in theoretical matters. He rather presents them as natural proposals that require neither detailed exposition nor diligent justification. In a sense this trouble-free radicalism seems justified. For all in all he sets out from then fairly well received views on man's evolution and, in particular, on the development of language and communication. However, their forthright application to the fundamentals of logic was by no means a self-evident move. Without any discussion of traditional or modern alternatives MacColl promoted a new conception of logical form. Apparently he borrowed it from comparative linguistics, and in fact it proved itself a useful means to integrate an epistemic conception of logic with a teleological understanding of man's natural condition. Most likely, MacColl finally acquired his philosophical convictions during these twelve or thirteen years in which he "devoted [his] leisure hours to general literature."

The present paper is meant to assess the influence of this basic credo on his mature outline of symbolic logic. My investigation assumes that at least in his later works MacColl developed and kept a rather uniform understanding of human communication. By his later works I

understand the articles and books on logic and philosophy as well as the novels he published after 1889. In this year his science fiction novel *Mr. Stranger's Sealed Packet* appeared. Here, and more explicitly in *Ednor Whitlock*, a second literary work he managed to publish two years later, MacColl promotes extravagant, philosophical speculations in rather poor, literary disguise. Towards the end of his life, he revised, extended, and published these philosophical convictions in a number of articles and, finally, in a book on *Man's Origin, Destiny and Duty*.

If one wants to offer a concise picture of MacColl's intellectual development and its impact on his logical system his literary works are an indispensable source. They manifest the fact that the formation of his metaphysical beliefs preceded or at least accompanied the design of the kind of symbolic logic on which he started to publish shortly before the turn of the century. Apparently, the order of his scientific or philosophical publications does not mirror this evolution accurately. MacColl's philosophical position, in particular his understanding of language and communication developed before he started to publish on his strictly propositional account of modal logic. The limited quality of his literary works minutely evidences their impact on his later works on logic.

Man's biological and cultural evolution was among the major issues European academics and their educated public were discussing in the second half of the 19th century. Darwin's revolution of biology as well as the rise of comparative studies in various disciplines, and especially in linguistics and religious sciences, were current topics of the intellectual magazines with which MacColl was familiar or to which he liked to contribute; in particular *Chambers Edinburgh Journal*, *The Westminster Review*, *The Quarterly Review*, *The Edinburgh Review*, *The Educational Times*, *The Athenaeum* or *The Hibbert Journal*. Foremost, the theological impact of Darwin's naturalisation of the human being was anxiously discussed, especially during the sixties and the seventies of the century. In his works beyond logic and mathematics MacColl takes up this issue. He addresses himself to the general, well-educated public—in particular to those interested in the dilemma of faith and modern science. MacColl unreservedly participated in the Victorian *Zeitgeist*, apparently with the self-confidence of the educated layman.

Ednor Whitlock was not a literary success. The critics naturally opposed MacColl's unbalanced presentation of theoretical issues in a work of fiction. One cannot avoid getting the impression that this description of a young man's difficulties in establishing his professional and social standing was but an unsuitable means to contribute to almost out-dated discussions on scientific limitations of the Christian faith. The present interest in MacColl's theological views does not

result from historic curiosity. His views matter and thus will be presented in so far as they relate to his account of the linguistic form of an elementary logical structure.

Certainly, MacColl's attempt to reconcile Darwinian evolution theory with Paley's natural theology scarcely has genuine theoretical value. But any comprehensive and yet scientific understanding of man's being a part of nature affects the possibility of acknowledging language as a specific difference between man and brutes. Eminent linguists such as August Schleicher conceived of their science as a natural science, and read *The Origin of Species* as a confirmation of their stance. As we know, MacColl was familiar with this issue at least through the *Lectures on the Science of Language* by Max Müller. He, too, conceived of linguistics in contrast to philology as a physical and not as an historical science. In contrast to Schleicher, however, he still accepted Christian Theology as an appropriate basis for a theory of language.

On various occasions MacColl's later writings comment on anthropological implications in Müller's presentation of comparative linguistics. His at times critical remarks and their reference to the constitutive elements of his logical system will throw light on both the biological and the linguistic context in which MacColl conceives of *statements* as basic logical units. How their conception relates to this two-fold background is understood best if a short presentation of the system's guiding principles precedes its exposition.

2. The Conventional Articulation of Statements

In several places MacColl puts forward two philosophical principles on which the entire set-up of his account of logic relies. I quote from *Symbolic Logic and its Applications*:

> The first is the principle that there is nothing sacred or eternal about symbols; that all symbolic conventions may be altered when convenience requires it, in order to adapt them to new conditions, or to new classes of problems. The symbolist has a right, in such circumstances, to give a new meaning to any old symbol, or arrangement of symbols, provided the change of sense be accompanied by a fresh definition, and provided the nature of the problem or investigation be such that we run no risk of confounding the new meaning with the old. The second principle which separates my symbolic system from others is the principle that the complete statement or proposition is the real *unit* of all reasoning. Provided the complete statement (alone or in connexion with the context) convey the meaning intended, the words chosen and their arrangement matter little. (MacColl 1906b, pp. 1–2)

The second of these principles indeed mentions a most characteristic feature of MacColl's system. At first glance his strictly proposi-

tional founding of logic seems to be in line with Frege's position that a *Begriffsschriftsatz*, as the adequate articulation of either a true or a false *Gedanke*, is the genuine object of all logical investigation. On closer inspection, however, striking discrepancies between these two perspectives will quickly become evident. I will discuss them subsequently.

The first principle has not been advocated exclusively by MacColl. Its revisionism mildly echoes the famous variety of linguistic anarchy Humpty Dumpty sets forth in Lewis Carroll's *Through the Looking Glass* (1960, p. 269):

> "When *I* use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."
>
> "The question is," said Alice, "whether you *can* make words mean so many different things."
>
> "The question is," said Humpty Dumpty, "which is to be master—that's all."

Interestingly enough, Carroll's *Symbolic Logic*, which "rekindled the old fire", seems to admit of the same kind of conventionalism MacColl's first principle concedes:

> ... I maintain that any writer of a book is fully authorised in attaching any meaning he likes to any word or phrase he intends to use. If I find an author saying, at the beginning of his book, "Let it be understood that by the word '*black*' I shall always mean '*white*', and that by the word '*white*' I shall always mean '*black*'," I meekly accept his ruling, however injudicious I may think it. (Carroll 1896, p. 166)[1]

In MacColl's earlier outline of a "Calculus of Equivalent Statements", both principles are already at work. From his first publications in the *Proceedings of the London Mathematical Society*, he aims at an altogether propositional presentation of logical structures. Without hesitation he modifies a given notation like Boole's or his own previous conventions if only a theoretical purpose calls for a more adequate form of expression. Up to his last publications this style of writing mirrors the evolutionary prospect his first principle applies to matters of logic and language. When from 1896 onwards he presents his mature account of symbolic logic its anthropological presuppositions are made explicit. They are precisely those which are meant to justify his second principle.

[1] This quotation belongs to the introduction to a paragraph on *The "Existential Import" of Propositions*. In his comment on Humpty Dumpty's idiosyncratic stance, Martin Gardner quotes this introduction at length, and discusses the literary impact of Carroll's "nominalistic attitude". Cf. Carroll 1960, pp. 268–269.

> I define a statement as any sound, sign, or symbol (or any arrangement of sounds, signs, or symbols) employed to give information; and I define a proposition as a complex statement, which, as regards form, may be divided into two parts, respectively called subject and predicate. ... The sound of a signal gun, the national flag of a passing ship, and the warning "Caw" of a sentinel rook are by this definition statements, but not propositions; whereas "We are in danger," " This is a British ship," "A man is coming with a gun," are propositions, and therefore statements as well. ... In thus taking statements as the ultimate constituent units of symbolic reasoning I believe I am following closely the gradual evolution of the human language from its primitive prehistoric forms to its complex developments in the languages, dead or living, of which we have knowledge now. There can be little doubt that the language or languages of primeval man, like those of the brutes around him, consisted of simple elementary statements indivisible into subject and predicate, but differing from that of even the highest order of brutes in being uninherited—in being more or less conventional, and therefore capable of indefinite development. (MacColl 1906b, p. 2, or MacColl 1903, p. 131)

This comment evidences that MacColl's guiding principles have a common root. Both reflect an evolutionary concept of man.

The second principle accounts for the natural preconditions of man's intellectual ascent. The basic form of his means of communication is supposed to match those of his natural partners. Just like human beings, brutes are taken to communicate by an exchange of statements. In MacColl's view man transcends the realm of natural life. But still the means of his intellectual sovereignty are conceived of in such a way that man's interaction with brutes can be described in terms of their dispositions to produce or grasp statements.

As statements are the form in which information is transferred, this principle will be subsequently referred to as MacColl's *information principle*. The first one, however, will be labelled as his *semiotic principle*. For it accounts for man's semiotic disposition to raise himself above his natural condition.

MacColl actually assumed the existence of beings intellectually superior to man. So bold an assumption is pointless unless it presupposes man's possibility to know of them accordingly—if not to communicate with them. He firmly intended to protect religious belief against various epistemological or metaphysical incentives. However, his trust in science let him likewise acknowledge that religious beliefs should be sufficiently rational as to comply with possible scientific progress: No one should believe what, in principle, cannot be known.

When MacColl stresses that "there is nothing sacred or eternal about symbols" (1903, p. 131), he is not just advocating that their coherent choice is entirely at our disposition. His comments on his first guiding principle evidence its constitutive sense. Man's ability to

replace a given statement with an equivalent, though not synonymous, rendering foremost allows for a future increase in structural knowledge:

> ... if words were always restricted to their primary meanings no human language could ever have been developed, abstract ideas could never have been formed, and science and philosophy would never have come into existence. Words are mere symbols to which we may assign any convenient meaning that suits our argument, provided we make it perfectly clear, by definition or context, what that meaning is. (MacColl 1910, p. 198)

In the present context I have to refrain from discussing the relevant kind of epistemic progress in a more detailed manner. His various comments on the philosophical relevance and purpose of his logical system confirm the present consideration of its guiding principles. In a review of Alfred North Whitehead's *A Treatise on Universal Algebra with Applications*, Vol. I, MacColl writes:

> The ultimate units of expressed thinking, whether those units be individually communicated to ear or eye by single symbols or by many, are *statements*; and in no sphere or region of investigation can reasoning be expressed *without* those units. Since, therefore, statements, and statements alone, constitute the ever indispensable elements of all expressed reasoning, we should, in my opinion, first investigate the mutual relations of these statements, representing each by its own independent symbol, and call this process of investigation *Pure Logic*. The moment we begin (as in mathematics and in the traditional logic) to represent *things*—things which are not statements—by separate symbols, we are no longer in the domain of *Pure* (or Abstract) Logic, but in that of *Applied* Logic. A system of Symbolic Logic thus built up wholly of statements has one great advantage which no other system can possibly possess, namely, the advantage of *homogeneity of matter*. (MacColl 1899, p. 109)

In a résumé of his contribution to the *Ier Congrès International de Philosophie* at Paris he equally points to the need of a uniform set-up of logic in terms of its propositional basis:

> ... quel que soit le sujet de recherche, tout raisonnement, pour pouvoir s'exprimer, demande des propositions. Donc, pour rendre notre raisonnement parfaitement général, et nos formules universellement applicables, nous devons prendre la classification des différentes espèces de proposition et les rapports entre elles comme le premier but de notre recherche, et appeler ce travail la Logique pure. (MacColl 1901, p. 135)[2]

Man's evolution under natural conditions induces the unity of MacColl's principles. In contrast to Frege's *Begriffsschrift* a symbolic

[2] "... whatever be the subject of research, in order to articulate itself all reasoning requires propositions. Hence, in order to make our reasoning perfectly general and our formulae universally applicable, the first goal of our research must be the classification of the different kinds of propositions and the relationships between them, and we have to call this work Pure Logic." (translation M.A.)

language in MacColl's sense is by no means a "Formelsprache des reinen Denkens" under the constraints of human intuition.[3] Even as the language of Pure Logic it is an authentic record of man's intellectual evolution. MacColl never refers to a realm of pure thought. In the first instance his theory of logic is meant to identify and to investigate the invariant constituents of any form of expressed thought; i.e. statements and the inferential order in which they matter. And if, moreover, all ramifications of logic are but accurate renderings of man's epistemic development their presentation should not involve more than applications of MacColl's semiotic principle.

3. Historical Contexts

Discussing MacColl's basic design of logical form will not be sufficiently fruitful unless the historical contexts of its motivation have been introduced properly. The two principles on which his mature system relies stand in for an evolutionary conception of man's logical competence: In former periods of natural history man was indistinguishable from brutes. Slowly—by a process which Darwin's evolution theory describes in terms of natural selection—the human being has overcome the limits in reasoning and communication to which his natural peers are definitely confined. The information principle accounts for man's continuity with his natural past and present. The semiotic principle accounts for his possibilities to improve even now his future means of rational orientation. In order to understand MacColl's outline of symbolic logic we have to know what he understood by evolution and, in particular, how he conceived of the origin and development of human language.

When it comes to matters of evolution MacColl scarcely mentions and never criticizes Charles Darwin. He fiercely attacks Haeckel's monism and tries to defend Paley's creationism. But his attitude to the author whose writings instigated the debate on man's natural history remains impartial. We do not know whether chance or purpose is responsible for this reservation. However, with MacColl's literary publications man's natural and cultural evolution becomes a major subject of his writings beyond logic. He thus participates in the Victorian debate on biological evolution by natural selection and Divine Providence in Creation.[4]

In MacColl's science fiction novel *Mr. Stranger's Sealed Packet* this issue essentially conditions the imaginary plot. On Mars, Mr. Stranger

[3]Cf. Frege 1882, in particular p. 56.

[4]For a detailed presentation of this controversy cf. Roppen 1956, pp. 1–63.

encounters a form of culture morally superior to his own and the reader's familiar context. As we learn, these Martians are in fact human beings who during the earth's glacial period in a still inexplicable way were transferred to Mars.

> I found to my surprise that they now lived very happily under a form of socialism; but a socialism very different from what we commonly hear advocated, and which will only be possible on earth when science has learnt to place the means of subsistence and comfort within the reach of all. These conditions existed on this planet. Here there was no struggle for existence. There was no necessity for the sowing of corn or the slaughter of animals for the support of human life. Their science, if behind ours in some respects, was far in advance of it in others. (MacColl 1889, pp. 102–103)

In this passage Darwin's key metaphor of a struggle for existence occurs in a context of political economy. It reads as a reference to T. R. Malthus's *Essay on the Principle of Population* in which the phrase originally was coined. The Martian exception from this rule of human existence does not pertain to others living on the planet. Martian nature and the menacing tribes in the neighborhood of Mr. Stranger's hosts are still competing for the survival of the fittest.

> I soon found that here also, as on earth, cruel blots marred the beauty of nature. Here, also, the inexorable law prevailed that life must be sacrificed to sustain life: the life of many for the sustenance of one. (MacColl 1889, p. 59)

The following illustration, however, is not confined to the relation between a predator and its prey, but includes a desperate combat between rival predators: " ... the long grey tiger was still growling over his sickly meal, ... when I saw stealthily creeping up to the scene from another cluster of bushes another of the same species of carnivora" (1889, p. 60). Both animals die in the desperate combat they cannot avoid. This example clearly refers to Darwin's understanding of a "Struggle for Existence". His introduction of the metaphor in *The Origin of Species* stresses that competition is most severe between individuals and varieties of the same species (Darwin 1998, p. 59). More explicitly the discussion on evolution theory in *Ednor Whitlock* refers to Darwinian subjects. Mr. Manning, the atheist participant, considers the development of the eye as an exemplary case of accidental adaptation:

> Still higher in the scale of animal life we find the same rudimentary organ in a more forward stage of development, and conferring upon its possessor some slight advantage in the struggle for existence over animals closely resembling it in other respects but destitute of this one incipient faculty. ... there is a general balance in favour of modifications and variations that tend towards the

improvement of useful organs. This improvement going steadily on through many generations, and for ages upon ages, *though each infinitesimal onward step is purely accidental*, attains at last such an approximation to perfection in the higher types of animals that the unthinking multitude, marvelling at the grand result and ignorant of the true explanation, not unnaturally attribute the whole to a mighty and intelligent Creator. (MacColl 1891, p. 59)

Obviously, the passage refers to Darwin's discussion of *Organs of extreme Perfection and Complication*. Here, too, the visual organ serves as a possible counterexample against the working of natural selection:

When it was first said that the sun stood still and the world turned round, the common sense of mankind declared the doctrine false; but the old saying of *Vox populi, vox Dei*, as every philosopher knows, cannot be trusted in science. Reason tells me, that if numerous gradations from a simple and imperfect eye to one complex and perfect can be shown to exist, each grade being useful to its possessor, as is certainly the case; if further, the eye ever varies and the variations be inherited, as is likewise certainly the case; and if such variations should be useful to any animal under changing conditions of life, then the difficulty of believing that a perfect and complex eye could be formed by natural selection, though insuperable by our imagination, should not be considered as subversive of the theory. (Darwin 1998, pp. 227–228)

The similarities between these texts indicate that MacColl's presentation of the atheist's position was most likely inspired by Darwin's seminal book.

MacColl's strong interest in man's natural and prehistoric past includes a continuous concern with the origin and development of human language. Even before Mr. Stranger learns about the terrestrial origin of his Martian friends he infers its probability from the form of their language:

I had learnt something of philology at a college, and was now much surprised to find that the Marsian language had much in common with the Indo-European languages. This was particularly noticeable in their numbers ... Their language had only two genders; but nouns and adjectives had four cases, distinguished by inflections, which were generally at the beginning, and not at the end of words. Their verbs were very simple and regular, and had only three tenses, present, past, and future. The perfect, plusperfect, and future perfect were expressed by circumlocutions. (MacColl 1889, p. 101)

Considerations of this sort could have been inspired by Max Müller's *Lectures on the Science of Language*. In some of his later works MacColl refers to this comprehensive presentation of linguistics which occasionally presents the history of language in quasi-Darwinian terms. Müller like Schleicher refuses to speak of comparative linguistics as a branch

of *philology*. Neither of them conceives of linguistics as a historical science. Müller's text indicates, however, that *Comparative Philology* was a common, though in his view misleading, description of his subject.[5]

MacColl's attention to linguistic issues was not merely due to his writing science fiction. In 1884 he participated in a public debate on the grammatical classification of English phrases. The controversy took place in the *Educational Times* to which he contributed from 1864 until his death.[6]

Both novels refer to the religious perspectives in which MacColl conceives of man's evolution. On most occasions he defends the self-asserted stance of a natural theologian trained in logic and mathematics, but still tries to hold up the existential conviction of a fervent Christian believer. Neither in his earlier literary nor in his later metaphysical writings does he seem to aim at a reconciliation of the two apparently conflicting attitudes with one another. For his evolutionary conception of language and logic only his adherence to philosophical theology matters.

4. The Argument from Design

4.1. Paley's natural theology

Darwin discusses the "Extreme Perfection and Complication" of visual organs as a possible counterexample to natural selection. Paley's famous argument from design relies on this very case as an exemplary indication of God's purposeful creation of living beings. However, in contrast to both Darwin's discussion and MacColl's quoted reference to his argument, Paley's presentation does not cover the evolutionary aspects of the case. He merely compares the functional perfection of the eyes of vertebrates with the set-up of man-made telescopes. Interestingly enough, Darwin criticizes Paley's reasoning by analogy from a theological point of view:

> It is scarcely possible to avoid comparing the eye with a telescope. We know that this instrument has been perfected by the long-continued efforts of the highest human intellects; and we naturally infer that the eye has been formed by a somewhat analogous process. But may not this inference be presumptuous? Have we any right to assume that the Creator works by intellectual powers like those of man? (Darwin 1998, pp. 227–228)

Here, Darwin points to a weakness in Paley's presentation of the argument from design that a more sophisticated defender of a similar theological claim, for instance MacColl, certainly would like to avoid:

[5] Cf. Müller 1994, pp. 20–24, as well as Schleicher 1863, pp. 6–7.
[6] Cf. MacColl 1884a, and MacColl 1884b.

Paley's argumentation by analogy starts from man-made objects whose mechanical features exhibit contrivance and design in view of an end of their usage in daily life. The unity of their instrumental features is taken to indicate by necessity their intentional production:

> In crossing a heath, suppose I pitched my foot against a stone, and were asked how the stone came to be there: I might possibly answer, that, for anything I knew to the contrary, it had lain there for ever; nor would it perhaps be very easy to show the absurdity of this answer. But suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place; I should hardly think of the answer which I had before given, — that, for any thing I knew, the watch might have always been there. Yet why should not this answer serve for the watch as well as for the stone? Why is it not as admissible in the second case, as in the first? For this reason, and for no other, viz. that when we come to inspect the watch, we perceive (what we could not discover in the stone) that its several parts are framed and put together for a purpose, e.g. that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; ... This mechanism being observed (it requires indeed an examination of the instrument, and perhaps some previous knowledge of the subject, to perceive and understand it; but being once, as we have said, observed and understood), the inference we think is inevitable, that the watch must have had a maker: that there must have existed, at some time, and at some place or other, an artificer who formed it for the purpose which we find it actually to answer: who comprehended its construction, and designed its use. (Paley 1807, pp. 1–2)

In the sequel, living beings, and foremost their various parts, are subjected to this kind of instrumental reasoning:

> ... every indication of contrivance, every manifestation of design, which existed in the watch, exists in the works of nature; with the difference, on the side of nature, of being greater and more, and that in a degree which exceeds all computation. I mean that the contrivances of nature surpass the contrivances of art, in the complexity, subtility, and curiosity of the mechanism; and still more, if possible, do they go beyond them in number and variety; yet, in a multitude of cases, are not less evidently contrivances, not less accommodated to their end, or suited to their office, than are the most perfect productions of human ingenuity.
>
> I know no better method of introducing so large a subject, than that of comparing a single thing with a single thing; an eye, for example, with a telescope. As far as the examination goes, there is precisely the same proof that the eye was made for vision, as there is that the telescope was made for assisting it. (Paley 1807, pp. 19–20)

In a later passage of his book Paley confirms explicitly that he conceives of design foremost in mechanical terms:

> My object ... has been to teach ... that the *mechanical* parts of our frame, or, those in which this comparison is most complete, although constituting,

probably, the coarsest portions of nature's workmanship, are the most proper to be alleged as proofs and specimens of design. (Paley 1807, pp. 99–100[7])

MacColl's presentation of an argument from design does not repeat this most inadequate propensity. Its probabilistic rendering avoids any pragmatic preconception of natural design. A more detailed account of Paley's original account of "natural history applied to the proof of an intelligent Creator" (1807, p. 372) will allow for a comprehensive understanding of MacColl's *broader* notion of design and its relevance for his evolutionary outlook on language and logic. Some essential aspects of Paley's concept of design can be summarized as follows:[8]

Neither ignorance as regards an object's producer, the act and method of its production nor inability to produce or at least to reproduce the relevant object can hinder the recognition of its design (p. 4). Likewise, neither imperfections of the object itself nor an incomplete understanding of its functioning nor its partial misidentification can preclude the grasp of its purposeful composition (pp. 4–6).

In Paley's view it is pointless to account for an object's design in terms of a contingent regularity or by an assumption of creative principles. Any order the object's composition exhibits is supposed to be nothing but an intentional application of the laws of nature by its intelligent producer (pp. 6, 77–79, and 452–453). Order and design, however, are not universal:

In the forms of rocks and mountains, in the lines which bound the coasts of continents and islands, in the shape of bays and promontories, no order whatever is perceived, because it would have been superfluous. No useful purpose would have arisen from moulding rocks and mountains into regular solids, bounding the channel of the ocean by geometrical curves; or from the map of the world, resembling a table of diagrams in Euclid's Elements, or Simpson's Conic Sections. (Paley 1807, p. 79)

Natural history relies on reproduction. Hence the primarily mechanical model adopted in Paley's argument has to incorporate features which will allow that his "argument from design remains as it was" (p. 7). In fact it does only if an object's disposition to mechanical reproduction is embodied in the original design all reproductions inherit and pass on. In contrast to objects bringing about their reproduction their genuine producer is taken to be the author of their design, i.e. the cause of the relation of their parts to their use (p. 6). Production and reproduction are thus distinguished. The production of an

[7]On the relationship between law and mechanism, cf. p. 453.

[8]Page numbers in the remainder of this section refer to Paley 1807.

object or of its reproducible kind includes the design their reproduction presupposes. Whether its repeated realization is brought about by the reproduced objects themselves or by some other cause does not affect the basic distinction between *creative* and *executive* authorship (pp. 54–60). The number of intermediate reproductions, being finite or infinite, cannot abolish the difference between these two kinds of authorship (pp. 13–15).

Paley distinguishes between an object's design and the laws of nature to which it conforms in having this design. All design consists in an application of laws. There are no laws whose pertinence did not presuppose agents that proceed in accordance with them. Foremost, God's creation of living beings is an application of the laws of nature. In their intentional production of useful things, human creatures—or agents of higher ranks—may follow his very example, and being designed in this way they are able to recognize and praise him as the designer of all that lives, and, in particular, as their own creator (pp. 7 and 42–46).

Paley's natural theology assumes that God has made the laws of nature and by doing so has limited his creative powers to their application. God's reason for this twofold creation is a didactic one. He thus enables his creatures to recognize him as their thoughtful creator (p. 43). Whereas the design of individuals or of their species answers to their own needs as well as to their use for others the creation of animate nature as a whole aims at God's recognition and praise by his creatures.

Chance as an origin of evil is a major threat to any natural theology which conceives of nature as the purposeful creation of a benevolent deity. At the end of his book Paley approaches the decisive issue: At first sight his remarks on chance seem to suggest an ontological account of contingency. Chance seemingly occurs where designs interfere (pp. 558–559). However, this does not mean that they actually leave room for a contingent course of events. It rather says that they interfere for man's grasp of things. Once an observer properly knows the design of things no room for real chance is left. What is usually called chance is but apparent chance. All uncertainty about an event's occurrence or non-appearance is due to a lack in information about the design of the involved objects. Paley subscribes to an epistemic concept of chance or contingency (pp. 559–560).

The theological relevance of Paley's threefold, epistemic reference of modalities—contingency, certainty, and uncertainty—lies in his account of evil. Natural theology results in theodicy. For Paley evil is but a passing phenomenon. It is the way things *appear* to us on behalf of

our intellectual and, presumably, emotional deficiencies. To the extent that man succeeds in understanding natural design he will refrain from complaining about the world's imperfection. This intellectual exercise is by no means futile: God speaks to man through the phenomena of natural design. Man's irritation is meant to challenge him. The natural life to which he is bound is a form of *probation*. Moral improvement ultimately consists in an acquisition of knowledge (pp. 570–573).

In this final respect it is no surprise that Paley's argument presupposes a very optimistic account of man's epistemic capacities and their realistic conditions. An object's composition never counts just as a motive for believing in its intentional production, but at any rate is a proof thereof. Mere knowledge about an object's purpose is sufficient for the recognition of its being someone's product (p. 7).

4.2. MacColl's probabilistic parable

In all his later writings MacColl advocates his teleological account of evolution in a literary form frequently used for religious and moral purposes. He chooses a "parable" (1906–1907, p. 385) to present his view. Between the first presentation of this illustration in Ednor Whitlock and its final occurrence in *Man's Origin, Destiny and Duty* its content does not vary much. This last version offers the most explicit rendering of MacColl's metaphysics and thus should be quoted here:

> Every mathematician who has studied the theory of local probability and averages will admit, and even tyros in mathematics can prove by actual experiment, though the experiment would in general be long and laborious, that chance, working within the limits of prescribed conditions, can be made to evolve with almost perfect accuracy in every detail, foreseen, designed, predetermined figures of various forms, sizes and shadings. ... The advanced mathematician who prescribes the law or conditions, which the random points constituting the future shaded figure must not transgress, knows beforehand almost every detail of this figure as regards size, shape, distribution of shading; but the mathematical tyro who laboriously carries out the random, or seemingly random, process by which the figure is slowly evolved, point by point, from an apparent chaos into its final foreordained form and shading, may foresee nothing of this final and (to him) astonishing result. If two mathematical tyros carry out the random pointing independently, and the process be continued long enough, they will finally evolve two figures almost exactly alike in size, shape, and shading—provided, of course, the random points of which they are composed be subjected to the same restrictions as to laws and limits. (MacColl 1909, pp. 101–102)

If one considers that MacColl subscribes to a substance dualism of physical and psychic entities,[9] the sense of his literary image becomes

[9] Cf. MacColl 1907–1908 pp. 167–168, and MacColl 1909, pp. v and 1–27.

accessible rather easily. The advanced mathematician is to be taken as a divine designer. The laws or restrictions he sets forth are meant to specify the general frame to which any course of events in a bodily world has to conform. Divine creation consists foremost in a wilful specification of these laws. The calculating activity of a mathematical tyro stands for a possible course of natural events. As a result of his calculations and in accordance with a uniform method the person will put a series of points on a sheet of paper. Each configuration of points stands for a particular situation in a possible course of natural history. A random point his calculation allows him to add is supposed to represent a contribution to evolution. Points he may not add stand for changes that do not contribute to the articulation of the intended development. In each case the calculations allow a decision to be made about the value of the change at issue. Irrespective of the order in which the value of the points is assessed, nearly the same configuration will finally present itself—provided the procedure is carried out for a sufficient amount of time. With reference to a mathematical theory, though certainly not with reference to this theory alone, MacColl claims the following: Random alternatives in the course of natural history are not relevant unless a set of laws to which they equally conform is presupposed. Owing to their enormous length these alternative courses of events will finally lead to converging results. Each of them will *cum grano salis* exhibit the same purposeful design. Natural selection in the struggle for existence is based on a random procedure. Hence evolution theory and a teleological account of nature are not inconsistent with one another. MacColl joins the side of those naturalists, philosophers and theologians, for instance A. Gray, C. Kingsley, J. S. Mill, G. Mivart or J. M. Wilson, who argued for a reconciliation of scientific biology and the Christian Faith.[10]

The Darwinian account of natural history does not explain why biological individuals vary from their parents. The theory focuses on the transmutation of species, and explains it in terms of natural selection. Individual variation merely counts as a necessary condition of the species' instability. For the present context Alvar Ellegård's discussion of this fundamental issue is most instructive:

> . . . though several passages in the *Origin* were liable to obscure the issue, those who really followed the argument of the book could hardly be in doubt as to the nature of the new theory. It explained all the phenomena of adaptation as due to differential preservation of random variations. It is true that Darwin did not use the word *random*, and that whenever he employed such terms as *chance* or *accidental* he was careful to explain that he meant thereby that the

[10] Cf. Roppen 1956, pp. 31–34 as well as pp. 62–63.

causes were unknown: they could not be connected with any specific internal or external conditions. Still, though Darwin—like Huxley—might profess that he believed in strict determinism for all natural phenomena, it could hardly be denied that, in the ordinary sense of he word, he was ascribing the production of the variations to chance. If Darwin had admitted this—as he might have done—he would have brought out more clearly the revolutionary nature of his explanation. But he refused to admit it, and thus laid himself open to one of the commonest criticisms of his theory. It was declared to be incomplete as long as the real causes of the individual variations from parents to offspring were not indicated. Since the causes were known neither to Darwin nor to anybody else, why not then concede that they might be above the reach of mere science? ... His reluctance to entertain and to come to grips with the idea of randomness appears from the fact that he never published the results of any investigation to show that the variations were in fact wholly indefinite. He probably would not have known how to carry out such an investigation: statistical techniques were not available to him. (Ellegård 1956, pp. 186–187)

In his parable MacColl tacitly accepts Darwin's predominant concern with the transmutation of species. Individual variation is accounted for in terms of the initial values from which the mathematical tyro starts each of his calculations. Each of them determines the occurrence of a point on the sheet of paper and thus stands for an instance of natural selection. Under the presupposition of his dualistic metaphysics MacColl accepts natural selection as a means for the realization of a pre-established design. Unfortunately, he says very little about the "laws or restrictions" regulating the course of natural history. His presentation of the parable does not tell us how strict they are, or how indeterminate they may be. Otherwise it would have been easier to compare MacColl's understanding of chance and design with C. S. Peirce's account of evolution. Apparently in contrast with MacColl he intends to conceive of the natural laws themselves in statistical terms.

The main element of habit is the tendency to repeat any action which has been performed before. It is a phenomenon at least coëxtensive with life, and it may cover a still wider real realm. Imagine a large number of systems in some of which there is a decided tendency toward doing again what has once been done, in others a tendency against doing what has once been done, in others elements having one tendency and elements having the other. Let us consider the effects of chance upon these different systems. To fix our ideas suppose players playing with dice, some of their dice are worn down in such a way that the act of losing tends to make them lose again, others in such a way that the act of losing tends to make them win. The latter will win or lose much more slowly, yet after a sufficient length of time they will be in danger of being ruined and if the game is quite even, they will eventually be ruined and destroyed. Those whose dice are so worn as to reproduce the same effects, will be divided into two parts, one of which will quickly be destroyed,

the other made stronger and stronger. For every kind of an organism, system, form, or compound, there is an absolute limit to a weakening process. It ends in destruction; there is no limit to strength. The result is that chance in its action tends to destroy the weak & increase the average strength of the objects remaining. Systems or compounds which have bad habits are quickly destroyed, those which have no habits follow the same course; only those which have good habits tend to survive.

May not the laws of physics be habits gradually acquired by systems. (Peirce 1992, pp. 223)

Peirce and MacColl knew each other. In view of Peirce's high esteem for MacColl their intellectual relationship deserves further investigation.

It would be misleading to discuss the genuine value of MacColl's contentions any further. Naturally, they provoke the kind of reservation Hume expresses in his *Dialogues Concerning Natural Religion*.[11] Here, they matter only in so far as his evolutionary account of language and logic depends on a concept of design. This goal requires a number of comments on the metaphysical presuppositions of MacColl's parable. They will make clear to what extent and in what way MacColl's teleological stance differs from Paley's argument.

Just like his theological predecessor, MacColl describes animals or their parts as being well equipped for the struggle for existence. However, references to an object's pragmatic value in daily life do not enter MacColl's attempt to argue for a teleological account of natural history.

Already in 1882 MacColl firmly advocates an objective account of probability,[12] and to my knowledge he never changed his view. Even so the mathematical tyros of his parable are supposed to be "astonished" about the gradually appearing design of a figure. The illustration should be understood primarily as a parable on nature, and not as an illustration of man's way of recognizing the laws to which it conforms. The configurations of points are to be taken as an articulation of design *in things*.

In contrast to Paley, MacColl is not concerned with individuals or species showing a particular design, but with a natural course of events in which an overall design of objects gradually articulates itself. In view of the continuity of this process neither imperfections of particular objects or kinds of objects nor deficiencies in man's grasp of their purposeful set-up, are of any particular relevance.

MacColl identifies the design of objects with the laws to which they conform. In contrast to Paley, he does not conceive of design and

[11] Cf. Hume 1990, especially chapter 8.
[12] Cf. MacColl et al. 1882.

contrivance in terms of an *application* of laws. Finally, man's grasp of design consists in his discovery and mathematical rendering of the laws of nature. Consequently, MacColl does not restrict design to animate objects. His theology aims at a thorough reconciliation of science and religion.

As MacColl does not distinguish between law and design, it is not relevant for his version of creationism to distinguish between the executive authorship of natural beings and the creative authorship of a divine designer applying his laws in accordance with their particular needs and tasks. The only creative act MacColl admits of consists in the choice of laws of the Supreme Being (1909, pp. 89, 105). Nevertheless, he repeats Paley's mechanistic view on natural reproduction and even adapts it to an evolutionary account of varied reproduction (pp. 128–129). However, neither of these considerations enters his holistic account of design.

As regards the ultimate purpose of nature MacColl agrees at least in principle with Paley's didactic understanding of God's creation (MacColl 1909, p. vi). In MacColl's view the human body, i.e. the condition of man's natural existence, is an "instrument of education", a means for his gradual intellectual and moral ascent to a higher form of existence (1907–1908, pp. 167–168). Paley concedes the possibility of higher ranks of agents between man and God. MacColl is convinced of their existence and assumes corresponding forms of bodily and mental life. Although he refuses to conceive of the difference between physical and psychic entities in terms of material and immaterial units, he holds that they can exist independently of one another (1907–1908, p. 165). In his view, a soul, i.e. an entity "which is not always unconscious" (1907–1908, p. 158), is neither an abstraction from states of other, physical objects, nor is it identical with a set of special kinds of events. In this respect MacColl's understanding of "the Ego, the Soul, the real Person" obviously follows the metaphysical tradition of Joseph Butler and Thomas Reid, which in contemporary philosophy is maintained primarily by Richard Swinburne.[13]

Just like Paley's natural theology, MacColl's metaphysics is designed as a theodicy. The hazards of nature are inevitable if man or any other being is supposed to have a chance of learning by its own experience. The lasting knowledge that humans or other beings can acquire *themselves*, but only under the temporary condition of phys-

[13]Cf. MacColl 1909, pp. 74–75. For historical and contemporary debates on personal identity, cf. Perry 1975 and Shoemaker and Swinburne 1984. On contemporary discussions of the argument from design, in particular with regard to Swinburne's position, cf. Garcia 1997 as well as Taliaferro 1998, pp. 365–369.

ical or moral evil, ascertains its instrumental value not only for the improvement of the sentient individual but also for the universe of its existence.[14]

In contrast to Paley and Christian theology, MacColl approves of reincarnation. He assumes that human souls may have different lives in which they can even attain superhuman forms of existence. His understanding of evolution exceeds natural evolution. This presumably theosophist aspect of his metaphysics pertains to his understanding of language. To some extent it depends on MacColl's overall conception of *life*[15] or bodily existence. On the one hand, MacColl advocates the same traditional view as Paley and conceives of living bodies as machines. Accordingly, animal bodies are taken to be automata.[16] On the other hand, he conceives of bodies as "instruments of education" whose usage is essential for a being's intellectual and moral ascent:

> This body its guardian the ego loses sooner or later, in childhood through illness or accident, or in old age through decay. Then it receives another instrument of education, whether human or superhuman may depend upon the ego's fitness and development. This, in due course, or through accident, it loses in its turn, after which it receives another, and so on for ever—always rising in the long-run (though not always steadily and continuously) from higher to higher, and from better to better. (MacColl 1907–1908, p. 168)

For MacColl, evolution—be it natural or supernatural—is bound to forms of bodily existence, i.e. to lower or higher forms of life. Purposeful change and progress presuppose guided bodily movement. The didactic sense of God's creation depends on it, especially as regards any acquisition and transfer of information or knowledge which is part of a being's intellectual ascent. A soul may not be able or willing to express what it thinks or feels. However, all higher forms of communication, and foremost God's communication with man, finally depend on an ability to *express* information under bodily conditions. Psychic and physical phenomena as a whole exhibit God's design of an evolving and improving universe.

> These phenomena may be regarded in one sense as God's language to reveal his purpose and his will—a language which it is man's duty to study, and which he will understand more and more as the years roll on. As one generation succeeds another, each passes on the knowledge which it has acquired to the generations which follow. ... Man learns this divine language as the child

[14]Cf. for instance MacColl 1909, pp. 38–39, 77–78, 83 and MacColl 1906–1907, p. 387.

[15]Cf. for instance MacColl 1909, pp. 3–4, 10, and MacColl 1906–1907, p. 387.

[16]Cf. for instance MacColl 1909, p. 128.

learns its mother's tongue, by observation, experiment, and slow, inductive reasoning. (MacColl 1907–1908, pp. 77–78)

Obviously, MacColl draws on a traditional metaphor. Nevertheless, this *façon de parler* is compatible with his concept of a statement and the information principle that underlies his account of logic. The subsequent considerations will present MacColl's linguistic conception of logical form as being coherent with his teleological metaphysics.

5. A Linguistic Account of Logical Form

In MacColl's view man's "faculties both of symbolisation and of introspection" (1907–1908, p. 115) definitely establish his superiority over all other animals.

> ... the difference between the lowest human savage and the highest animal of any other species is a chasm which no evolutionary theory hitherto enunciated can adequately explain. It is not merely a difference of degree; it is a difference of kind. (MacColl 1909, p. 107)

As MacColl explains, this difference consists in man's ability to invent, acquire or develop "a conventional code of representative sounds or symbols" (1909, p. 114) in order to express and convey thoughts or feelings. Abstraction and reasoning presuppose a disposition of this kind. It is most likely that man's earliest varieties of language were indistinguishable from the means of communication of which higher animals dispose. Nevertheless, MacColl contends that man's form of communication is not a fruit of natural selection or, to say the least, of natural selection alone.

> ... then, as now, his language was not instinctive and inherited. *It was of his own formation.* The first real man (or woman) was the first of human or humanlike shape and structure who possessed the faculty not merely of speech but of conscious speech-development—the faculty of representing ideas (in order to remind himself or give information to others) by arbitrary sounds or symbols. (MacColl 1909, p. 115)

In MacColl's view, human language merely *occurs* in natural history. The means of communication of animals, however, *evolve* in its course. Despite the evolutionary dualism of his metaphysics, MacColl calls these means a language, and even accounts for its form as follows: Animals inherit the kind of sounds or symbols which they produce instinctively. None of these units is composed of more elementary ones. They lack any explicit internal structure. Owing to their simplicity, statements of this sort convey information rather vaguely

(1909, p. 113). Each statement an animal brings about is a *datum* from which other animals can draw elementary conclusions. Although MacColl says in other places that statements "constitute" or "form" data (ibid.), the following quotations make me assume that he conceived of data as statements:

> With birds and brutes ... each separate sound or symbol is a complete statement—subject and predicate being, as it were, rolled into one. The warning "caw" of a sentinel rook is a *datum* expressly given to the rest that they may therefrom conclude that danger of some kind is at hand. (MacColl 1909, p. 112)

> The first of human form who barked a tree or erected a heap of stone or other simple monument that he might afterwards remember by its suggestion where he had buried or otherwise hidden a provision of food for himself or his family, performed therein an act which (whatever may have been the material constitution of his brain) stamps him at once as human. ... The barked tree or stone monument (like a knotted handkerchief in modern times) was a symbol or *datum* in order to give information ... (MacColl 1909, p. 115–116)

In the sense outlined any physical or psychic phenomenon experienced by human beings can be regarded as a statement or datum that a Supreme Being expressly gives to human beings. And if it is man's duty to study and learn from natural phenomena, then he is certainly bound to draw conclusions from them. In MacColl's view all means of communication are data, thus possibly composite statements contributing to an inferential structure. Divine language is no exception to this rule. Pure logic being nothing but the logic of statements therefore may be regarded as a universal kind of logic. MacColl explicitly confirms this interpretation by his remark that logical consistence limits divine omnipotence (1909, p. 38).

His most general account of language obviously includes all phenomena that relate to the overall disposition of an animal, of a human or of a superhuman being to receive and to provide data. Accordingly, MacColl presents his most general outlook on means of communication in terms of *information* processing, and he relies on the same conceptual tools in order to introduce epistemic modalities:

> The symbol A^{ϵ} asserts ... that A is *certain*, that A is *always* true (or true in *every case*) within the limits of our data and definitions, that its probability is 1. ... The symbol A^{η} asserts ... that A contradicts some datum or definition, that its probability is 0. ... The symbol A^{θ} (A is a *variable*) is equivalent to $A^{-\eta}A^{-\epsilon}$; it asserts that A is neither *impossible* nor *certain*, that is, that A is *possible* but *uncertain*. In other words, A^{θ} asserts that the probability of A is neither 0 nor 1, but some proper fraction between the two. (MacColl 1906b, pp. 6–7)

Already in his novels he is using the term *datum* in an inferential sense. When reading a work like *Ednor Whitlock* one can scarcely avoid the impression that at least its main characters have been attending seminars in modal logic à la MacColl. The novel clearly witnesses that MacColl's epistemic account of modalities and his theological preoccupations coincide:

> "The conclusion is not far wrong; but on what grounds did you build it?" "They are very simple. Firstly, the handwriting is that of a gentleman, for I saw the address; secondly it is a very long letter, for which the sender had to pay double postage; thirdly, your eyes brightened and you got red when you received it; fourthly the reading of it absorbed your whole soul; and fifthly, you sighed a deep but not an unhappy sigh when you had finished it. Those are my data, five in number. The inference is inevitable: it is a love-letter. . . . " (MacColl 1891, p. 50)

The theist, the atheist and the agnostic whose discussion on adaptation, evolution and design young Ednor may follow are nothing but allegories for MacColl's basic modalities. They represent certainty, impossibility and variability in theological matters (MacColl 1891, pp. 54–79). Likewise *Mr. Stranger's Sealed Packet* results in a "Critical Discussion" about the *scientific* validity of Mr. Stranger's report on his voyage to Mars. Here, too, the arguments turn around the probability of the story's "fundamental data" and the consequences of their assumption (MacColl 1889, pp. 332–338).

MacColl does not offer an explicit reason as to why his further account of logical form depends on the results of comparative linguistics. However, an argument for his choice becomes evident, if one takes into account that eminent linguists of his time conceived of their discipline as a natural or physical science. Accordingly, MacColl's evolutionary dualism excludes the possibility that the phonetic and grammatical development of natural languages has to mirror any progress in man's intellectual evolution. The linguistic misunderstandings to which man's natural condition gives rise rather veil than exhibit the genuine form of expressed thought, and the language of mathematics or of science in general is not immune to such perils. However, by systematic comparison between various natural languages and by a detailed reconstruction of their ongoing development the science of language has been able to identify a uniform linguistic structure on which all natural variations in the history of language depend. Moreover, at least one language, that is Chinese, has even preserved this order. Therefore it may serve as a measure for any detailed set-up of the form in which expressed thought should present itself and accordingly should document its slow, but continuous, evolution. In Müller's *Lectures on the Science of Lan-*

guage MacColl found all the details required in order to develop a corresponding account of logical form. As Müller's general outlook on science, evolution and language converged in important respects with MacColl's own views, he could rely with little reservation on this summary of linguistic research in the first half of the 19th century.

Müller was convinced that science by a systematic gathering and classification of information finally leads to a metaphysical account of its subjects. Although he used evolutionary terminology in his presentation of linguistic developments (1994, pp. 368–371), he often defended his view on science against Darwinian evolution theory. Like MacColl he was convinced of a teleological conception of nature, and conceived of the human being as God's crowning work (pp. 17–18 and esp. p. 327). Müller equally shared MacColl's view of language as the decisive indication for man's superiority over all animals, a phenomenon evolution theory could explain.

> Language is our Rubicon, and no brute will dare to cross it. This is our matter of fact answer to those who speak of development, who think they discover the rudiments at least of all human faculties in apes, and who would fain keep open the possibility that man is the only favoured beast, the triumphant conqueror in the primeval struggle for life. Language is something more palpable than a fold in the brain, or an angle in the skull. It admits of no cavilling, and no process of natural selection will ever distil significant words out of the notes of birds or the cries of beasts. (Müller 1994, p. 340[17])

However, in several respects his account of language as the object of comparative linguistics differs from MacColl's understanding of human language. Müller concedes that natural languages are a product of human activity. He denies, however, that man invented language as "a conventional code of representative sounds or symbols" (1994, p. 331). Likewise, he rejects theories on the origin of human language which set out from man's imitation of animals or his spontaneous articulation of emotions. In Müller's view human language is of divine origin. God invested human nature with a unique creative faculty. It let prehistoric man produce all elementary constituents of all languages. But once this goal was achieved man lost this faculty.

> Man, in his primitive and perfect state, was endowed not only, like the brute, with the power of expressing his sensations by interjections, and his perceptions by onomatopoieia. He possessed likewise the faculty of giving more articulate expression to the rational conceptions of his mind. That faculty was not of his own making. It was an instinct, an instinct of the mind as irresistible as any other instinct. So far as language is the production of that instinct, it belongs to the realm of nature. Man loses his instincts as he ceases

[17] Cf. equally pp. 13–14, 333, 355, 369.

to want them. His senses become fainter when, as in the case of scent, they become useless. Thus the creative faculty which gave to each conception, as it thrilled for the first time through the brain, a phonetic expression, became extinct when its object was fulfilled. (Müller 1994, pp. 370–371)

Originally, "in the spring of speech", an immense amount of these radical elements were at man's disposition. By a process of "natural selection", their number reduces to a few hundred (ibid.). Out of these, by combination and iteration, the human mind develops the whole variety of natural languages. Müller allows at least for the possibility that all natural languages derive from one single source. The present state of appearance of most languages is due to considerable phonetic and morphological transformations. They hide their original set-up. Comparative linguistics, however, is able to discover this order. All modified and modifying components of words and utterances are shown to result from constituent elements of the same kind.

... the whole, or nearly the whole, grammatical framework of the Aryan or Indo-European languages has been traced back to originally independent words, and even the slightest changes which at first sight seem so mysterious, such as *foot* into *feet*, or *I find* into *I found*, have been fully accounted for. This is called comparative grammar, or a scientific analysis of all the formal elements of a language preceded by comparison of all the varieties which one and the same form has assumed in the numerous dialects of the Aryan family. ... The result of such a work as Bopp's "Comparative Grammar" of the Aryan languages may be summed up in a few words. The whole framework of grammar—the elements of derivation, declension, and conjugation—had become settled before the separation of the Aryan family. Hence the broad outlines of grammar, in Sanskrit, Greek, Latin, Gothic, and the rest, are in reality the same; and the apparent differences can be explained by phonetic corruption, which is determined by the phonetic peculiarities of each nation. On the whole, the history of all Aryan languages is nothing but a gradual process of decay. After the grammatical terminations of all these languages have been traced back to their most primitive form, it is possible, in many instances, to determine their original meaning. This, however, can be done by means of induction only; and the period during which, as in the Provençal *dir vos ai*, the component elements of the old Aryan grammar maintained a separate existence in the language and the mind of the Aryans had closed, before Sanskrit was Sanskrit or Greek Greek. That there was such a period we can doubt as little as we can doubt the real existence of fern forests previous to the formation of our coal fields. (Müller 1994, pp. 221–222)

Those constituent elements that the historical analysis of comparative linguistics cannot reduce to other units are called *roots*. Each of them expresses a *general* idea. There are but two irreducible categories of roots. The only constituent elements of language are *predicative* and *demonstrative* roots.

> . . . we must admit of a small class of independent radicals, not predicative in the usual sense of the word, but simply pointing, simply expressive of existence under certain more or less definite, local or temporal prescriptions. (Müller 1994, p. 255)

In Müller's view thought and language depend on one another. Language is merely the outward manifestation of human reasoning. He conceives of man's rational competence solely in terms of abstraction and classification. Accordingly, he finally identifies roots with general terms, primarily used as subjects, predicates or attributes. Originally, utterances thus consisted in series of roots whose logical relationship with one another was indicated by the order of their succession.

The analysis of language in terms of its radical constituents allows for a morphological classification of languages and of the stages of their gradual formation. During a certain phase of its development the roots of a language either occur as separate units of speech or they are joined together and result in words whose components either keep or lose their independence. All Indo-European languages show a genuine morphological evolution. Chinese, however, is a language that has preserved its radical set-up.

> There is one language, the Chinese, in which no analysis of any kind is required for the discovery of its component parts. It is a language in which no coalescence of roots has taken place: every word is a root, and every root is a word. It is, in fact, the most primitive stage in which we can imagine human language to have existed. It is language *comme il faut*; it is what we should naturally have expected all languages to be. (Müller 1994, pp. 259–260)

The radical constitution of language on which Müller reports does not depend on the philosophical predilection he shares with MacColl. Almost the same view and equally with reference to Chinese is proposed by Schleicher, who in an open letter to Haeckel proposed a monistic, and to some extent Darwinian, conception of comparative linguistics.

> Der Bau aller Sprachen weist darauf hin, dass seine älteste Form im wesentlichen dieselbe war, die sich bei einigen Sprachen einfachsten Baues (z. B. beim chinesischen) erhalten hat. Kurz, das, wovon alle Sprachen ihren Ausgang haben, waren Bedeutungslaute, einfache Lautbilder für Anschauungen, Vorstellungen, Begriffe, die in jeder Beziehung, d. h. als jede grammatische Form fungieren konnten, ohne dass für diese Functionen ein lautlicher Ausdruck, so zu sagen, ein Organ, vorhanden war. Auf dieser urältesten Stufe sprachlichen Lebens gibt es also, lautlich unterschieden, weder Verba noch Nomina, weder Conjugation noch Declination u. s. f. (Schleicher 1863, pp. 21-22)[18]

[18] "The construction of all languages points to this, that the eldest forms were in

The linguistic identification of an elementary form in which human communication and reasoning originally presented itself is essential to MacColl's evolutionary dualism. The prehistoric occurrence of this form marks the threshold where man's intellectual evolution meets the natural conditions under which it proceeds. Seemingly, MacColl agrees with Müller and Schleicher when he writes about prehistoric man:

> ... his language consisted of simple, independent, unrelated elementary sounds, each a complete statement in itself (a subject and predicate, as it were, rolled into one) and conveying its own separate information. (MacColl 1909, p. 114)

However, and the reasons for this difference have been set out previously, MacColl does not conceive of language in terms of roots, but in terms of statements. Accordingly, he criticizes Müller for his Aristotelian account of man's basic form of explicit reasoning, and recommends conceiving of a root's basic logical role not in terms of subject or predicate, but in terms of predication. In close analogy to Müller he writes:

> The fact that every word was originally a predication or statement, which, like the cries of the lower animals, first conveyed information either about a personal wish or emotion, or else about some external object, and which was afterwards employed to give similar information about similar objects, is one of the most important discoveries in the science of language. (MacColl 1909, p. 117)[19]

Applied to the results of comparative linguistics MacColl's information principle thus points to the fact that any use of signs presupposes *inferential* contexts. Müller's account of human language as incarnate thought fails to notice this basic aspect of thinking.

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reality alike or similar; and those less complex forms are preserved in some idioms of the simplest kind, as, for example, Chinese. In a word, the point from which all languages had their issue were significant sounds, simple sound-symbols of perceptions, conceptions, and ideas, which might assume the functions of any grammatical form, although such functions were not denoted by any particular expression, although they were not organized, as we might say. In this remote stage of the life of speech, there is consequently no distinction in word or sound* [* lautlich.—T.] between verbs and nouns; there is neither declension nor conjugation." (Schleicher 1869, pp. 50-51, here quoted after Koerner 1983.)

[19]Müller originally wrote, "The fact that every word is originally a predicate, that names, though signs of individual conceptions, are all, without exception, derived from general ideas, is one of the most important discoveries in the science of language" (1994, p. 369). The difference between the two texts shows clearly that MacColl rejected not only Müller's adherence to traditional term logic, but likewise his speculations on the "instinctive" generation of roots.

The *Lectures on the Science of Language* evidence that the morphological and phonetic development of natural languages scarcely depends on man's intellectual disposition. Nothing more is required than his ability to combine formerly separate units of speech. MacColl's semiotic principle, however, accounts for an aspect of man's linguistic disposition that contributes to his intellectual development. Saying the same in different ways can make noticeable what is worth repeating. Man's intellectual evolution under natural conditions depends essentially on this semiotic strategy of identification or constitution. But still it cannot be applied unless basic linguistic forms are taken for granted. Even though MacColl rejects the linguistic concept of a root he approves of the conception of a form of language to which this notion has led. In close analogy to the idea of a language without "coalescence of roots" he contends that composite statements are nothing but combinations of statements. His conception of a proposition in which subject and predicate or, additionally, attribute are separate units closely follows Müller's and Schleicher's Chinese model. In the introduction to his *Symbolic Logic* MacColl presents his concept of a proposition as follows:

> Let us suppose that amongst a certain prehistoric tribe, the sound, gesture, or symbol S was the understood representation of the general idea *stag*. ... The symbol S, or the word *stag*, might have vaguely and varyingly done duty for "It is a stag," or "I see a stag," or "A stag is coming," &c. Similarly, in the customary language of the tribe, the sound or symbol B might have conveyed the general notion of *bigness*, and have varyingly stood for the statement "It is *big*," or "I see a *big* thing coming," &c. By degrees primitive men would learn to combine two such sounds or signs into a compound statement, but of varying form or arrangement, according to the impulse of the moment, as SB, or BS, or S_B, or S^B, &c., any of which might mean "I see a *big stag*," or "The *stag* is *big*," or "A *big stag* is coming," &c. In like manner some varying arrangement, such as SK, or S^K, &c., might mean "The *stag* has been *killed*," or "I have *killed* the *stag*," &c. Finally, and after many tentative or haphazard changes, would come the grand chemical combination of these linguistic atoms into the compound linguistic molecules which we call *propositions*. The arrangement S^B (or some other) would eventually crystallize and *permanently* signify "The *stag* is *big*," and a similar form S^K would *permanently* mean "The *stag* is *killed*." These are two complete propositions, each with distinct subject and predicate. On the other hand, S_B and S_K (or some other forms) would *permanently* represent "The *big stag*" and "The *killed stag*." These are *not* complete propositions; they are merely qualified subjects waiting for their predicates. On these general ideas of linguistic development I have founded my symbolic system. (MacColl 1906b, pp. 3–4)

This introduction of the basic form of compound statements derives *à la lettre* from Müller's example of radical composition in Chinese. At

the very end of the quoted passage MacColl himself stresses that the further set-up of his system presupposes this linguistic conception of logical form. Müller's examples match exactly MacColl's explanation:

> In some languages, and particularly in Chinese, a predicative root may by itself be used as a noun, or a verb, or an adjective or adverb. Thus the Chinese sound *ta* means, without any change of form, great, greatness, and to be great.* (Endlicher, Chinesische Grammatik, § 128.) If *ta* stands before a substantive, it has the meaning of an adjective. Thus *ta fu* means a great man. If *ta* stands after a substantive, it is a predicate, or as we should say, a verb. Thus *fu ta* would mean the man is great. (If two words are placed like *fu ta*, the first may form the predicate of the second, the second being used as a substantive. Thus *fu ta* might mean the greatness of man, but in this case it is more usual to say *fu tei ta*.) Or again, *ǵin ngŏ*, *li pŭ ngŏ*, would mean, man bad, law not bad.
>
> Here we see that there is no outward distinction whatever between a root and a word, and that a noun is distinguished from a verb merely by its collocation in a sentence. (MacColl 1906b, pp. 255–256)

In MacColl's *Symbolic Logic* there is no outward distinction whatever between a statement, a subject, a predicate or an attribute. These components are distinguished from one another merely by their collocation in a statement. In one of his articles in *Mind* there is a passage on relations between statements that points to this basic feature of MacColl's system and its linguistic prototype.

> To meet the requirements of logic, especially of symbolic logic, I propose the following: Let $\phi(x, \alpha, \beta, \pi)$ and $\psi(y, \beta, \alpha, \pi)$, or their abbreviations ϕ and ψ, denote two equivalent* statements which nevertheless differ in three things: (1) that (in *position*) x in the former corresponds to y in the latter; (2) that α in the former corresponds to β in the latter; and (3) that β in the former corresponds to α in the latter—the remaining constant portion π occupying the same position in both.
>
> *"Equivalent" in the sense that each implies the other. The statements are supposed to be expressed in some non-inflectional language, symbolic or other, in which the value, effect, or meaning of a word or symbol generally varies with its position. Algebra and Chinese are good examples. (MacColl 1902, p. 360)

The impact of MacColl's understanding of logical form did not pass unnoticed. An anonymous review of *Symbolic Logic and its Applications* in *The Educational Times* points out the significance of his opposition to the traditional account of subject and predicate in terms of general nouns.[20] On 16 November 1906 Peirce writes to MacColl on the same issue:

[20] Cf. Anonymous 1906, p. 261.

Although my studies in symbolic logic have differed from yours in that my aim has not been to apply the system to the working out of problems, as yours has, but to aid in the study of logic itself, nevertheless I have always thought that you alone, so far as I know, except myself, have understood how the matter ought to be treated by making the elements propositions or predicates and not common nouns. (Peirce 1906)

6. Conclusions

In contrast to all other pioneers of modern logic MacColl proposed an evolutionary theory of symbolic reasoning. As is well known his system developed under the influence of logic's early algebraic tradition. However, the design of logical form on which the system relies stems from other sources. The guiding principles of his theory are due to an evolutionary substance dualism which was meant to reconcile theistic religion with scientific progress. The epistemic modalities of MacColl's system account for the conceptual needs of his theology. The form of predication in which they present themselves is designed with explicit reference to major results in 19th century linguistics.

The fundamentals of MacColl's modal system allow for a systematic ambiguity. What a statement means when occurring within a statement depends on the position in which it contributes to the relevant propositional context. On one occasion, for instance, the constituent "ϵ" of his symbolic language might be used as a predicate. In this case it would stand for "is necessary". Used in subject position it would stand for "the necessity" or "a necessity", and used as an attribute it would stand for "necessary". This structural ambiguity has be proven to be an intended feature of his system—and not a result of conceptual negligence. It illustrates MacColl's attempt to develop a system that acknowledges the contextual condition of human reasoning.

MacColl's theory of logic mirrors with clarity the metaphysical beliefs of his author. MacColl's literary writings evidence in detail that their formation preceded or coincided with the elaboration of his logic. The material at our disposition does not allow for a more definite reconstruction of the historical development. It should be clear, however, that MacColl's interest in logic was not a purely formal one. His work in this discipline was the focus of a comprehensive intellectual endeavor.

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