FORMALISM AND ECOLOGY IN LINGUISTICS

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0. Natural language is a curious blend of regularity and irregularity. The regularities are obvious: identical or analogous formal means are employed to express identical or analogous semantic content. Equally obvious, however, are the irregularities, since all too often different formal means are used for the expression of similar semantic content. Anyone remotely familiar with the study or the analysis of language will recognize this almost platitudinous truth.

Less pedestrian is the fact that the study of language has, accordingly, always been characterized by an opposition between formalistic and ecological approaches. In the formalist approach language is valued as a formal system describable in terms of rules for the acoustic or visual expression of meanings, and whatever is thought to be irregular tends to be regarded as a nuisance, attributable to jamming from unfortunate interfering outside sources. In the ecological approach, language is primarily seen as a product of nature. The expectation is therefore that language, like nature, will manifest itself in all kinds of unexpected variations on and deviations from an as yet largely unknown rule or norm system. Regularities are wonderful, but, as in nature, they are not always readily detectable and they tend to leave room for idiosyncrasies or, as they are commonly called, exceptions.

Ideally, the two approaches should be in complementary harmony. Both the formalists and the ecologists should be able to search for the best theory - the theory, that is, with the most extensive generalizations over the facts of any language under description, and of language in general, minimizing the exceptions. Thus united, the two approaches would most probably find it not too difficult to agree on the status and causal explanation, if any, of the exceptions, the drags of the rule system agreed upon.

Reality, however, has shown itself to be quite different. What one sees is two different mentalities, and a well-nigh unbridgeable gap. The formalists have a tendency to jump to formal systems, which are either borrowed from elsewhere, in particular logic, or based on an insufficient fund of observations (data). A glaring example of the latter is the following. It is well-known that English specific questions (WH-questions) are ungrammatical when the WH-word is the semantic subject of an embedded object-clause under the complementizer *that*. Such questions are grammatical only if *that* is deleted:

(1) Who do you think (*that) killed the butler?

In Chomsky/Lasnik (1977) this fact was generalized to a universal principle: no element may be moved away from a position immediately following a complementizer. This putative generalization was then adduced as corroborating evidence for a particular universal linguistic theory which soon turned out to have been conceived too hastily[1]. For unfortunately, analogous sentences with the complementizer in position are fully acceptable in virtually all other Germanic languages and their dialects. And moreover, exactly the same phenomenon is observed with questions where the WH-word has been moved from the position of predicate nominal, as in:

(2) Who do you think (*that) you are?

The putative rule or rule system thus appears to be both too narrow and too wide with regard to observable facts.

The typical formalist mentality now is to dismiss contrary evidence and to stick to the rule system that has been developed. The refractory evidence is disqualified on any of a number of grounds. Formal semanticists used to (and still often do) rule out such evidence on the ground of "not being in the fragment of the language under analysis". Such an answer, however, signals methodological danger. For to limit oneself to a "fragment" implies that the rule system devised for it can in principle be extrapolated or extended to the language as a whole. Yet to dismiss contrary evidence as "not being in the fragment" implies that there is a problem precisely with regard to the extrapolation envisaged.

More creative grounds for not taking counterevidence into account have been developed in the school of formal grammar now called "Government and Binding". There, unwelcome evidence is said to be either falsely observed, or a performance error, or substandard or dialectal or, in the case of Creole languages, Creole (i.e. "primitive"), or not covered by "core" grammar (i.e. that part of the theory that has not been plagued too much by counterexamples). Often the answer is that the latest development in the theory, not yet known to the world at large, will take care of the objection at hand. And if all that fails, a challenge is put out to provide a better theory, counterevidence being ruled out as irrelevant unless accompanied by an alternative theory of exactly the breadth, the width, and the orientation of the theory criticized, neither more nor less nor different. Such strategies for steering clear of counterevidence are methodologically aberrant. Yet they are typical, not only of certain trends in present-day linguistics, but in language studies of all times from the very beginning.

Equally aberrant is the opposite attitude of those who dismiss all rule systems and proclaim linguistic anarchy. For them, language is "simply" the free and creative expression of whatever pops up in any speaker's mind. Such extreme ecologist views are not uncommon among artists, esthetes and others with an interest in applied creativity, but are considered unprofessional in the linguistic disciplines. Less extreme but still aberrant ecologist views are, however, quite common in professional linguistics. Typical for these is an aversion to precisely formulated and generalized rules or rule systems, which are considered "dead", and an emphasis on the "living" character of natural language. For such linguists, a linguistic description is a compilation, an encyclopedia of often picturesque facts and observations. They do not see rules but only tendencies, about which they do not care too much anyway. And the highest form of scientific insight into a language is achieved, they feel, when the investigator is able to share, the deeper the better, either the linguistic experience of a native speaker, or the intuitive inspiration of a fellow linguist who has had a vision.

What we find in the real world is thus a deeply rooted and seemingly irreconcilable opposition of humours, often coupled with radically differing views on the nature and goals of linguistic science. This opposition has been with the study of language since its very inception in the days of Aristotle, a fact which makes one wonder whether it is perhaps inherent in language, when studied by human mortals, to bring out such a conflict of attitudes. In the following I shall outline some aspects of the earliest origins of this conflict and compare the ancient situation with what we have witnessed in the 20th century.

Before doing so, however, I wish to emphasize that my own position is one of extreme moderation. It is moderate in that it avoids extremes, but also extreme in being firm about its moderation. Linguistic science, in my view, cannot be allowed to rest until it has provided a fully formal, i.e. machine-implementable, and maximally generalized set of rules and principles accounting for both the synthesis and the analysis of all and only the sentences of natural languages, together with the ways in which their linguistic information is transferred to and from postulated underlying cognitive structures. It must, moreover, link up organically with adjacent disciplines such as logic, cognitive science, neurophysiology. Thus conceived, linguistics will have to cover the entire path from the first inklings of scientific intuitions to full formalization. In covering that path it must not be deflected or detained by parochial theories or proposals that preach early but unsafe bliss, whether it be in some insecure formalization, or in some dopey gate of heaven, or in the petty resignation of failure.

1. The earliest document, in Western civilisation, of linguistic analysis is Plato's relatively early dialogue "Cratylus", called after the fifth century BC philosopher of that name. Cratylus was a late follower of Heraclitus of Ephesus (6th century BC), whose doctrine of the non-fixity of all things he carried to the extreme. According to Aristotle, he was Plato's first teacher of philosophy, kindling Plato's theory that, since fixity does not exist in the sensible world, there must be a non-sensible world to account for the possibility of stable knowledge ("The Oxford Classical Dictionary" (OCD), s.v. "Cratylus"). In the dialogue, Cratylus defends the view that language is inherently true, since words are given by nature, and not by convention. They essentially depict what they stand for. To illustrate this, he goes through a long list of words and names, providing what was since then called "etymologies" (their true meaning). These are, on the whole, fanciful and in stark conflict with modern knowledge, deserving Cratylus the qualification of a "glib and unscientific etymologist" (OCD), and with the result that in modern times the dialogue has come into some disrepute. In antiquity, however, the activity of more or less speculative etymologising was not frowned upon at all, witness the many treatises on "the propriety of words" that have been preserved. It remained popular till the early Middle Ages, especially with those philosophers and students of language who had Stoic leanings.

This earliest document of linguistic analysis is clearly ecologistic: it treats language as a manifestation of nature, to be studied and understood the way nature is studied and understood. The underlying thought goes back to Heraclitus, according to whom the world, and language with it, is transient and ever-changing, and conceals its real nature. There is system in the apparent chaos, but it is not open to direct inspection. It must be unearthed by painstaking observation and theory building[2]. Through Plato and Eubulides, who will be mentioned shortly, this thought was handed down to and further developed by the philosophers of that great and long-lasting school of philosophy known as the Stoa. That the earliest theories both of language and of nature should suffer from a relative lack of solid empirical and other methodological criteria is, of course, to be expected. But that should not blind us to the important fact that the main architectural lines of the problems of linguistic analysis were beginning to show.

The important thing is the assumption of an underlying system. In due course this led to the insight that sentences as used in the processes of speech and comprehension are only surface phenomena, belonging to an ephemeral world, for much more essential and permanent structures that reflect their meaning in a direct and unveiled way, their semantic analyses (SA). Grammar is essentially a system of transformations converting surface structures into their corresponding SA and vice versa. This conception of grammar is found literally in the extant parts of "De Lingua Latina" by the Latin author Varro (first century BC). Varro, whose inspiration came in part from the Stoa, not only derives words from their presumed semantic base through etymologies, just like Cratylus (and in hardly less fanciful ways), he also relates syntactic constructions to their presumed underlying semantic analysis. The relation between semantic structures and their surface counterparts is defined, he says, "by the deletion or addition of letters, and through their permutation and modification"[3], by transformations we would say nowadays.

This and other ideas about the nature of language found their way, through authors like Varro and, later, Augustine, into the Middle Ages and thus into the traditional lore of modern thinking. Until the advent of modern structuralist linguistics, with its highly damaging semantic neurosis, which was due to behaviourism, it was commonplace to see sentences as the more or less incidental "clothing" of the more essential real stuff, the underlying thoughts, both being structured according to their own specific rules and principles. Linguistic analysis was seen as a method for establishing the relationship between thoughts and linguistic structures. This part of our traditional thinking has its roots in the etymologising activities of Heraclitean and Stoic philosophers from the fifth century BC onwards.

A different tradition started shortly after Plato's death, with the Macedonian philosopher Aristotle, likewise in Athens. Aristotle (384-322 BC) studied philosophy with Plato for about twenty years, until Plato's death in 348-347. Not being too enthusiastic about Plato's successor in the Academy, he left Athens and spent a few years in Asia Minor and Lesbos, until he was called by Philippus II, king of Macedon, in 343-342, to come and assume the task of educating the crown prince Alexander, later called "the Great" (356-323 BC). This he did till about 340, when Alexander's education became more directed at military matters. Under Philippus' reign the cities of mainland Greece were brought on and off under Macedonian authority, often against fierce resistance. Athens in particular, whipped up by the powerful public orator Demosthenes, remained an obstinate enemy of Macedonian domination. When Philippus was assassinated, in 336, Alexander, barely 18 years old, assumed power and re-established Macedonian order in Greece, leaving no doubt about his authority. The following year, in 335, Aristotle returned to Athens to set up a new college of philosophical and other studies, called the Lyceum. When news of Alexander's death reached Athens, in 323, he thought it wise to leave the city and went to live in nearby Chalcis, a Macedonian stronghold. There he died in 322.

Aristotle's philosophy of language was the opposite of Plato's. For him language was a product, not of nature, but of convention. Its sentences, he thought, were, or anyway should be, structured according to the principles of logic. There was no need to assume an underlying "hidden" level of semantic analysis, since the logical analysis said it all. Sentences, in his view, are subject to the principle of strict bivalence (or of the "excluded third"). That is, they are always either true or false, with nothing in between and nothing outside.

Truth consists in a structural correspondence between the ideas put together into a sentence on the one hand and states of affairs referred to on the other. Logic is a calculus that serves to preserve truth: it must specify, given the truth of a sentence or of a set of sentences, what other sentences are likewise necessarily true on account of structural logical principles (not of lexical properties). In other words, logic is the calculus of structural entailments. He moreover gave the first decisive impetus towards the development of an actual logic, a calculus that would specify the preservation of truth on structural principles. He produced the first formal logic in history, an achievement which, deservedly, earned him enormous prestige and lent great respectability to his views on language. Of course, language often appears not to obey the laws laid down for it by Aristotle's logic. But such improper behaviour could be attributed to its speakers' sloppiness and lack of intelligence, resulting from the moral decay of humanity since the days of old.

Along with his logic, Aristotle distinguished the notions of assertion and other speech acts, of sentence (negative or positive), of subject and predicate, and the structural classes of noun, verb, adjective and adverbs, as well as the notion of morphological modification (flection, conjugation and derivation, though not systematically distinguished). In doing so he was also the first serious theoretical grammarian in Western history. This, together with his many other achievements, made him the towering figure he is and has always been in our culture and that of other peoples.

Even so, however, he was not without critics in his own days. In the neighbouring city of Megara the philosopher Eubulides, originally from Miletus in Asia Minor, ran a school of philosophy while Aristotle was teaching at his Lyceum. This Megarian school had been founded by Euclides, a pupil of Socrates and the teacher of philosophers who laid the foundations for what later became the Stoa. Eubulides shared many of Aristotle's views, in particular that about the nature of truth. Yet he opposed Aristotle's principle of strict bivalence (the excluded third). And he succeeded in casting his criticisms regarding this particular point of Aristotelian doctrine into so-called "paradoxes", examples taken from daily life or from mythology, often earthily formulated, showing up specific problems arising from Aristotle's insistence on the strict bivalence principle. Seven such paradoxes are attributed to him, but some can be seen as variants of others. The list reduces to four, each presenting a distinct problem for strict bivalence (Kneale/Kneale 1962: 114):

(3) (a) *The Liar.* 'A man says that he is lying. Is what he says true or false?'
(b) *The Hooded Man, the Unnoticed Man, or the Electra.* 'You say you know your brother. But that man who came in just now with his head covered is your brother, and you did not know him.'
(c) *The Bald Man, or the Heap.* 'Would you say that a man was bald if he had only one hair? Yes. Would you say that a man was bald if he had only two hairs? Yes. Would you ..., etc. Then where do you draw the line?'
(d) *The Horned Man.* 'What you have not lost you still have. But you have not lost your horns. So you still have horns'.

In the light of modern semantic theory this list is remarkable: it recapitulates just about the entire research programme of 20th century semantics. The first paradox is, of course, the (in)famous Liar Paradox, which has caused so many anxieties to so many generations of logicians and philosophers. The second shows up the problem of intensional contexts and their blocking of the principle of substitution salva veritate, i.e. the general rule, directly

entailed by Aristotle's definition of truth, that truth-values should not be affected by the substitution of one term for another provided both refer to the same object. (Electra knows that the man who has his head covered is eating soup in the kitchen; this man is her brother Orestes though she does not know that; is it now true or false to say that she knows that her brother is eating soup in the kitchen?) The third paradox, usually called the "sorites" (heap paradox), underlies all modern attempts at devising so-called fuzzy logics, now successfully applied in a number of industrial products. And the fourth puts a finger on the much debated question of presupposition as a semantic property of sentences, an account of which in logical terms inevitably leads, as is well-known, to a violation of the principle of strict bivalence.

The enormous relevance of Eubulides' paradoxes has, by and large, escaped the historians of philosophy who recorded these facts. Fortunately they did their job faithfully enough for us to be able to recognize the significance of these paradoxes. But that recognition is coming about only in our days. In the books of history Eubulides' name is all but forgotten, due in part to his (and his successors') failure to provide a logic to go with these paradoxes, but also, no doubt, to Aristotle's irritation at these troublesome objections and his subsequent policy of ignoring them.

Aristotle had no answer to the paradoxes that Eubulides sent across to Athens, and he therefore found himself considerably embarrassed by them. Bitter hostility then developed between Aristotle and his school on the one hand and the Megarians on the other. Kneale/Kneale (1962: 115) inform us:

> Diogenes Laertius says that he [i.e. Eubulides] was strongly opposed to Aristotle and attacked him at length. We do not know whether this was the beginning of the hostility between the Peripatetics and the Megarians; but it is certain that, inherited by the Stoics from the Megarians, the quarrel continued for many centuries and had a bad effect on the development of logic. For although Aristotelian and Stoic theories are in fact complementary, they were treated as alternatives. By the time it became clear that they should be amalgamated, the intellectual impetus of the ancient world was spent, and there was no one of the requisite status for the task.

A factor that must have played an important role in this whole episode is no doubt the political opposition between the Aristotelians on the one hand, protected as they were by Alexander's power and authority, and the democrats in the Greek cities on the other. It cannot but have been significant that, according to ancient sources, Eubulides taught dialectic and rhetoric to Demosthenes, the great defender of democracy and the formidable opponent of Alexander's father Philippus II (OCD s.v. "Eubulides").

In any case, we see here the beginnings of an academic conflict that, as Kneale and Kneale say, was unnecessary but lasted for centuries, to the detriment of the advancement of knowledge and insight. The conflict was, as we now clearly see, one between formalists and ecologists, the Aristotelians representing the former, and the Megarians and Stoics representing the latter. In antiquity they bore different names: the Aristotelian formalists were called "analogists", after the Greek word *analogia* ("regularity"), and the Stoic ecologists had to put up with the unflattering title of "anomalists", derived from *anomalia* ("exception").

The opposition between the two schools of philosophy was compounded by a further factor. Having pacified Greece, Alexander started on the greatest military expedition in his-

tory, his conquest of all the land between the Indus and the Nile, including Egypt and the Persian empire. Within less than ten years he became master of the Eastern world and rose to mythical proportions. He died, however, in 323 from the effects of an injury incurred during his many battles, before he could realize his dream of conquering Arabia and even Italy. After his death there was a great deal of strife about his succession. In the end the great empire was split up among some of his generals. Ptolemy, probably Alexander's elder bastard half-brother, took Egypt and became the founder of the dynasty that ended, almost three centuries later, with Cleopatra.

The relevance of Alexander's campaign in the present context lies in what happened to the Greek language as a result of it. Before the campaign Greek was one of the many languages spoken, in more or less garbled versions, in markets throughout the Near East. But after the campaign Greek had become the language of government, and hence the language of status. Whoever was to climb the social ladder had to know decent Greek. Inevitably therefore, parents who wanted their children to occupy a position of importance in the new political order were on the lookout for Greek language teaching. A sudden and massive demand thus developed for the teaching of Greek as a foreign language, especially in Egypt, which was the most powerful and the most strictly organized of the new Hellenistic kingdoms. Ptolemy, being an enlightened monarch, then decided to establish a university in his capital Alexandria (founded by Alexander a few decades earlier) and he appointed professors in different subjects, some with the explicit task of developing teaching material for the new schools. This marked the beginning of what we now call "linguistics", which thus began, strictly speaking, as applied linguistics.

These early Alexandrian linguists, or "philologists", found themselves in a predicament, since they needed a certain amount of linguistic, in particular grammatical, analysis for the preparation of the required teaching methods. But, apart from what could be culled from Aristotle's writings on language, nothing existed. Beyond the Aristotelian input, both the notions and the terminology needed had to be developed from scratch. Moreover, a model had to be chosen for what was to be considered "proper Greek", to be described or at least approximated by the rules of grammar to be developed. A sudden and lively research activity thus came about directed, on the one hand, at establishing what could be taken as the "purest" form of Greek, and, on the other, at the normative grammatical description of that language variety. The variety of Greek settled upon after a while was, perhaps surprisingly, the Attic Greek used in Aristophanes' comedies of the late 5th century BC, which continued to serve as the normative model for "pure Greek" throughout antiquity. The grammatical descriptions that followed were used and interpreted as "prescriptions" for the proper use of Greek.

It is easily understood that the Alexandrian linguists who were set to work by the first Ptolemy and his successors were under severe pressure to produce, quite unlike the leisurely philosophers in far away Athens, who had all the time in the world to think up pretty arguments and engage in academic battles. Equally understandably, our Alexandrians had neither time nor sympathy for exceptions and other niceties in the language they were employed to analyse and describe. What has been described above as the formalist attitude thus came to them quite naturally: they hardly had any choice but to stick to whatever rule system they first hit upon and to dispose of exceptions and irregularities in as expeditious a

manner as possible. In this respect they had to have a natural preference for the formalist, analogist attitude developed earlier by Aristotle, whom they justly regarded as their illustrious predecessor anyway. This preference was no doubt reinforced by the political significance of the fact that Aristotle was a Macedonian, and clearly an exponent of Macedonian power and glory.

It thus came about that "amongst the Greeks, the quarrel was most keenly pursued, on the side of analogy, by the grammarians of Alexandria, and on the side of anomaly by the Stoics" (OCD, s.v. "Analogy"). Later on, especially in the days of Roman domination, the dispute shifted largely from grammar to literature. Defenders of analogy insisted on straightforward soberness and conservatism in matters of style and composition, whereas the anomalist school was in favour of startling ploys, neologisms and far-fetched expressions. Grammar proper had, by that time, practically settled on a compromise, a blend of Alexandrian and Stoic scholarship, which became the source of what we now regard as "traditional grammar".

2. Having paid a brief visit to the glorious but distant days of ancient Greece and Rome, let us skip a few centuries and land again in Western Europe about a hundred years ago. Here we find a landscape where linguistics flourishes as a mainly historical discipline under the name of comparative philology. A product of Romanticism, with its luxurious interest in anything remote, either in time or in space[4], comparative philology had achieved the monumental reconstruction of the Indo-European language family and had thus opened the academic public's eye to the intriguing facts of historical relatedness of often very different languages.

This work of linguistic reconstruction was supported by a rather standard set of general notions about language, grammar and meaning. Contrary to the daring and innovative concepts and techniques developed for the purpose of historical reconstruction, these general notions were, on the whole, quite traditional and conventional. Only in hindsight does one detect the first buds of what was to become 20th century structuralist linguistics. Ferdinand de Saussure was already brooding over his dual distinction between "langue" and "parole", and between diachronic and synchronic language studies. And across the Atlantic, in the United States of America, the German anthropologist Franz Boas and some of his students, quickly joined by the linguist Leonard Bloomfield, would soon be starting to draw certain non-standard conclusions from their study of American Indian languages. A new linguistics would thus come about, which, as we shall see, was strictly ecologistic in its general orientation.

Meanwhile, things were happening in psychology. Psychologists and philosophers like Wilhelm Wundt, William James or Max Müller, had been developing, in the later years of the 19th century, theories of mental processes meant to unite psychology with linguistics and logic, an eminently ecologistic enterprise. These theories did have some effect on what was to become modern linguistics, but only in certain limited respects[5]. Overall, however, this interesting and potentially very fruitful development in psychology failed to have an adequate impact on either linguistics or logic, both disciplines being carried along by their own independent and strong currents.

Linguistics, in the narrow sense of the theory of grammar, went through a long period of enthralment by the new doctrine of behaviourism, which made it impervious to influences from earlier, more traditional paradigms of psychology. This behaviourist yoke was shed around 1960, when behaviourism was replaced by "cognitivism", the cognitive science approach according to which the mind is a gigantic computing plant. This new cognitivist orientation fitted in well with the new development of generative grammar as a rule system generating all and only the well-formed sentences of a language. But even so, the behaviourist past still continues to cast its long shadow in that the study of meaning has remained badly underdeveloped. Despite all these vicissitudes, however, linguistics has managed to remain, till the present day, largely ecologistic in its methodological orientation: most linguistic theories are realist and claim psychological reality, under a sufficiently cautious formula of interpretation, while striving for the widest possible generalizations in view of the available facts, and for the most organic integration with adjacent disciplines. Yet formalism has made important inroads. Feeling the otherwise legitimate need for formalization, some schools of thought in linguistics have fallen for the temptation to canonize a particular method of analysis, with the result that recalcitrant facts had to be weeded out by all kinds of expedients. This applies in particular to the school called "Government and Binding", under the leadership of Noam Chomsky, as was illustrated in section 0. An unduly formalistic approach likewise characterizes most analyses set up in the context of language technology, with a view to computer-mediated application of linguistic rule systems. Here, the constraint of having to provide computer programs "that work" inevitably leads to an inadmissible disregard for linguistic facts that disturb the patterns adopted.

The most outspoken manifestation of formalism, however, is found in what is nowadays called "formal semantics". Formal semantics is a direct offshoot of logic and thus clearly stands in the logical, not the linguistic, tradition. It is, in fact, an application to natural language of model-theoretic techniques developed in logic around the middle of this century. The main point in formal semantics is a calculus that yields a truth-value for any sentence of a language L, given an independently defined state of affairs W and an interpretation I of L in W, i.e. independently defined extensions for terms and predicates of L in W. I and W together are normally called the "model" for L. The calculus makes use of tree structures assigned to sentences, one branch of each set of sister branches being a function, and the others the input. The dominating ("mother") node receives the value. The final value for each sentence must always be a truth-value, given the model, of course. A generalization of such a calculus over all possible worlds, I being kept constant, ideally yields for each sentence S the set of possible worlds in which S is true.

This approach does not profess realism, i.e. a claim to psychological reality, but is instrumentalist in the accepted sense of that term: the calculus serves to characterize the object under investigation, in this particular case by defining the truth-conditions for sentences. Natural languages are treated and analysed as formal, mathematical objects, not as communication systems in their natural setting. The natural setting, in so far as it is not entirely forgotten, only serves as escape clause for cases where the formal analysis fails to apply to the facts. Such phenomena are ascribed to the vitiating influence of "pragmatic" factors. The joint effort of pragmatics and formal model theory should thus provide a satisfactory account of the facts of language, though, typically, the formal semanticists' interest remains

restricted to model theory and does not extend to language as such. Pragmatics, moreover, is considered to be of a less precise nature, not really subject to the same principles of rigorousness and precision that hold for formal semantics.

The formalist attitude of formal semanticists is directly inherited from modern logic, which became anti-ecologistic around the turn of the century. Whereas, traditionally, logic had been considered to be somehow the study of those aspects of human thought to do with correct reasoning, about a hundred years ago its scope narrowed. It became the study of the formal language most suitable for mathematical proofs. Traditional Aristotelian predicate calculus now really had to be replaced by a better system, since the well-known defects that had plagued it for centuries were now coming to a head with the application to mathematics. The two most obvious defects were brought about by the traditional theory of, respectively, quantification and reference.

The traditional Aristotelian theory of quantification leads to a paradox when applied to empty classes. For it licenses an inference from universally quantified sentences to their existentially quantified analogs. Thus, Aristotelian logic licenses the inference from "all A is B" to "some A is B" (the affirmative subaltern consequence), and hence to the non-emptiness of the class characterized by the predicate "A". At the same time, however, the falsity of "all A is B", and hence the truth of "not all A is B", leads to "some A is not B" (equivalence of negated contradictory), and hence again to the non-emptiness of the class characterized by the predicate "A". Now suppose the class characterized by the predicate "A" is in fact empty: there are no A's. Then, if "all A is B" is considered true, the non-emptiness of this class follows in virtue of the affirmative subaltern consequence. But if "all A is B" is considered false, then again the non-emptiness of this class follows, this time in virtue of the equivalence of the negated contradictory. In the absence of any A's the sentence "all A is B" can thus be neither true nor false, which violates Aristotle's principle of strict bivalence. Or, put differently, the existence of at least some A should be logically necessary, which is, of course, absurd.

The problem of traditional logic with regard to reference consists in its paradoxical results when reference is made to non-existing entities. There is, first, a parallel with universal quantification, in that a sentence like

(4) The present king of France needs to be brave.

entails that there actually is a king of France now, while its negation:

(5) The present king of France needn't be brave.

likewise entails that there actually is a king of France now[6]. In a strictly bivalent logic this means that the present existence of a king of France should be logically necessary, which is, again, absurd. But there is also an ontological problem in that, given the non-existence at present of any king of France, it should be true to say that nothing exists that sentence (4) is about, so that sentence (4) should be about nothing. That, however, is clearly false, since it is about the present king of France, whether he exists or not. To escape this dilemma one would seem to be forced to distinguish somehow between 'existence' and 'being'. However, in the context of 20th century positivistic trends in philosophy and elsewhere, such a distinction was, and in many circles still is, absolutely anathema[7].

In devising a solution for these and similar problems, Bertrand Russell had to redraw traditional Aristotelian predicate calculus. He did not, however, wish to attack Aristotle's axiomatic principles. On the contrary, he was adamant that Aristotle's definition of truth (known as the "correspondence theory"), as well as the principle of strict bivalence, should be kept entirely intact. The new logic, in particular the predicate calculus as devised by Russell in the early years of the century, together with his "theory of descriptions", seemed to provide a viable solution for these problems within the boundaries of Aristotle's axiomatic principles, at least for strictly mathematical language. But, as we shall see, it emphatically did not work for natural language, which sits uncomfortably in Russell's ill-fitting harness.

A further, strictly philosophical, motivation for Russell to embark on his logical enterprise was provided by the philosophical embarrassment caused by the great Kantian dilemma of the essential and analytical impossibility of knowing the world "an sich", independently, that is, of human knowledge, and of proving the adequacy of our knowledge. It seemed to him that a good second best solution was to study the knowledge end of the uncertifiable relation of mind and world: a systematic analysis of the logical structure of human sentences would reveal the smallest structural elements, the "logical atoms", of the human way of dealing with the phenomena. This logical atomism would, in his view, get us as close to what we may surmise the real world to be as is humanly possible.

In the early years of this century Russell thus developed his new logic. He tackled the problem of universal quantification over empty classes (taking his inspiration from earlier work by Frege) by giving quantifiers the status of higher order predicates over classes (of classes (of classes, etc.)) of individuals. The existential quantifier in a sentence like:

(6) Some men are mortal.

says that the class of all x such that x is a man and x is mortal is non-empty. The universal quantifier in the analogous sentence:

(7) All men are mortal.

says that the class of all x such that if x is a man x is mortal equals the totality of all individuals in the universe of discourse (U). If a sentence contains universal quantification over an empty class, as in:

(8) All werewolves are mortal.

then, in virtue of the truth-table for implication, every individual in U will vacuously fulfill the condition "if x is a werewolf x is mortal", since no individual is a werewolf. The only condition left is that U itself be non-empty. If that condition is fulfilled, and if there are no werewolves, sentence (8) will be true. This theory has since been known as "Classical Quantification Theory" (CQT).

CQT was also used by Russell, especially in his (1905), to solve the problem of reference to non-existing entities. For this purpose he developed his so-called "theory of descriptions", which meant to circumvent this problem by imposing a quantificational

structure on sentences with definite descriptions. Sentence (4) would thus be analysed as if it were equivalent to:

(9) Exactly one king of France needs to be brave.

or, in terms of CQT,

(10) $\exists x\,[\mathrm{KoF}(x) \wedge \text{need to be brave}(x) \wedge \forall y[\mathrm{KoF}(y) \supset y = x]]$

to be read as "the class of x such that x is now king of France and x needs to be brave and such that the class of all y such that if y is now king of France y = x equals U, is non-empty", or, in a more current dialect of logical Angloid, "there is an x such that x is king of France and x needs to be brave and such that for all y, if y is king of France y is identical with x". The advantage of this analysis is that (10) is now unequivocally false, given the absence of any king of France, and the logical negation of (10), i.e. (10) preceded by the negation sign:

(11) $\neg\,\exists x\,[\mathrm{KoF}(x) \wedge \text{need to be brave}(x) \wedge \forall y[\mathrm{KoF}(y) \supset x = y]]$

is now unequivocally true. The fact that speakers of English tend to interpret (5) as though the negation sign stood just in front of "need to be brave":

(12) $\exists x\,[\mathrm{KoF}(x) \wedge \neg\,\text{need to be brave}(x) \wedge \forall y[\mathrm{KoF}(y) \supset x = y]]$

should be attributed to the innate sloppiness and deficient logical knowledge of the human race, and need thus not disturb the logician. The principle of strict bivalence thus seemed to be saved.

The linguists did not like Russell's analysis at all. To begin with, they were not impressed by the urgency of the problems that this analysis was meant to solve. After all, had mankind, and linguistics with it, not lived with traditional logic for two millennia? Why should the specific needs of mathematics affect the analysis of language? It would not have been so bad if the analyses proposed by Russell gave the linguists a feeling of improved insight into the nature and structure of natural language sentences. But that was clearly not the case. In their view, to propose (10) as the analysis of (4), and (11) or (12) as alternative analyses of (5) amounted to nothing less than an outrage. The familiar, time-honoured subject-predicate structure of sentences like (4) and (5) had been turned into an unrecognizable mince pie of symbols defying pronunciation in ordinary English.

And to say of a sentence like (8) that it is true in the absence of any werewolves is doubtful to say the least. Suppose I, who have a car with a diesel engine (and therefore without any spark plugs) go to a garage for a servicing and, being presented with an exorbitant bill, ask the mechanic how my bill can be so high. Suppose the mechanic replies:

(13) All the spark plugs of your engine have been renewed, sir.

Can one now reasonably say that he is speaking the truth? It takes a strong logical conviction to maintain that he is.

In short, the Russellian analysis, and with it the whole of the new logic, was felt by linguists to constitute such a blatant violation of all principles of sound linguistic analysis that

a breach was inevitable. Logic and grammar, which had been united for over 20 centuries in close, though not always harmonious, partnership, now parted company. It was henceforth considered unscientific for a linguist to invoke logic, and, by reciprocation, unlogical for a logician to invoke linguistics.

Not until much later, after 1965, did this situation change, when a group of linguists of the generative transformational school discovered that it makes good sense for a theory of syntax to assume a level of syntactic deep structure formulated in the language of (a variety of) CQT. This became the theory of what was then called "generative semantics" (now rather "semantic syntax"). Yet, although this led to a reconciliation and a renewed interest of logicians and at least this group of linguists in each other's activities and concerns, these new grammarians never accepted Russell's treatment of definite terms (his "theory of descriptions"). And many, perhaps most of the linguists who have acquainted themselves since then with the theory of quantification have felt that, even though the logical syntax of CQT may, in principle, be reflected in the syntactic deep structures of natural language sentences, the logic associated with it will, in all likelihood, have to be non-classical, incorporating, for example, presuppositional phenomena. Even though they re-established the old contacts with logic and allowed themselves to be strongly inspired by it, this group of linguists thus remained strictly ecologistic in orientation. Paradoxically, it was the Chomsky-led school, where the influence of logic was hardly felt, that practically gave up ecologism and became predominantly formalistic.

At the same time, Anglo-Saxon philosophy did not as a whole follow the formalist trend with regard to the study of language set out by the new logicians. It was in Russell's own Cambridge that an opposition formed itself, during the 1930s, as a result of the teaching activity of Ludwig Wittgenstein. In his later life, Wittgenstein turned away from positivism and formalism with the same force and energy that he had shown in his younger years in endorsing them. Like Russell, he was inspired by the Kantian dilemma of the unknowability of the world "an sich" and of providing proof for the adequacy of knowledge. And again like Russell, Wittgenstein felt that a good second best solution would be for us humans to analyse ourselves and see how we deal cognitively with the world and its phenomena. But here he left Russell and went his own way. In his view, the philosopher's best source of information on mankind's mental fabric was not the logical structure of natural language sentences but, rather, the living phenomena of linguistic use in everyday contexts, since nowhere else are human ways of dealing with the world so visible and so observable. Philosophical insight is thus enhanced by careful and precise observation of what he called the "language game". He rejected the notion of a language as a formal, rule-governed system, favouring the idea that the use of language is guided rather by trends and often vaguely defined general principles that are derived from and follow the mental make-up that humans are naturally endowed with.

Perhaps surprisingly, Wittgenstein's influence was felt much more at Oxford than at Cambridge. Immediately after the end of World War II, a number of Oxford philosophers decided to develop further the ideas that Wittgenstein had been presenting at Cambridge during the preceding years. This led to the highly influential movement usually called the "Ordinary Language Philosophy" (OLP), which lasted from 1945 till 1970.

The Ordinary Language Philosophy was characterized by a desire to do full justice to the natural facts of language and its use. It was through a careful observation and study of such facts that the real structure of the world, and also of philosophical questions about reality, could be best approximated. It was even hoped, for some time, that a meticulous and subtile analysis of the facts of language would reveal that most of the old and often all too vaguely formulated philosophical questions were in fact the product of unclarity in the use of language. It was also felt that the old Aristotelian doctrine of truth by correspondence alone and the concomitant principle of strict bivalence (the "excluded third") were too restrictive since they failed to take into account the elements imported by the properties of human perception and human cognition, and the consequent projections from preception and cognition onto what is perceived and thought to be the phenomena of the world. Here again, the OLP philosophers felt, detailed scrutiny of linguistic facts would bring greater clarity.

Undermining the Aristotelian principles of truth and bivalence thus became a favourite activity at Oxford. The Oxford philosopher John Austin, for example, drew attention to speech act phenomena by presenting speech act sentences ("I hereby name thee 'King George'"), which cannot properly be said to be either true or false. And Peter Strawson revived the old debate on presuppositions (1950; 1952), attempting to incorporate presuppositional phenomena into an extension of traditional Aristotelian logic where strict bivalence is given up in favour of a bivalent logic with truth-value gaps (a "gapped bivalent logic"). Strawson rejected Russell's proposed solutions for both the Aristotelian problem of universal quantification over empty classes and the problem of reference to non-existing entities, in favour of a treatment in terms of a presuppositional logic that preserved the old subject-predicate structure and remained generally much more Aristotelian than the new logic devised and defended by Russell. It must be added immediately, however, that Strawson's logical proposals achieved nothing like the formal depth and precision that characterized the new Russellian logic. This was no doubt one of the reasons behind the widespread uproar among logicians during the 1950s and 1960s at what they saw as Strawson's tinkering with logic, and the almost universal refusal of logicians to look more closely at the phenomena at hand and at possible non-bivalent treatments for them[8].

The outspoken ecologistic approach cultivated at Oxford with regard to the facts of language thus constituted an attack on the time-honoured Aristotelian axioms of truth and bivalence, much to the dismay of Bertrand Russell who was a formidable and staunch defender of these principles at Cambridge[9]. One can draw a curious historical parallel between, on the one hand, Eubulides and his followers shooting their paradoxical arrows across from Megara to Athens during the years of Aristotle's teaching there, and, on the other, the Oxford philosophers putting spokes in Russell's logical wheels during the immediate postwar years of our own century. In both cases ecologists attacked formalists, partly with the same weapons (presuppositions), and in both cases the formalists had the advantage of a well worked out formal logical system to back up the general principles.

Now, in the early years of the last decade of the century, we are fortunate in witnessing a general mellowing of attitudes. The rediscovery of logic by linguists in the 1960s, their increased interest in, and decreased fear for, semantic phenomena, together with the daring inroads made by formal semantics into the study of language (formerly thought to be ex-

clusively linguistic territory), have made for a much improved understanding of the mutual goals, concerns and methods. It is in the spirit of this rapprochement that this paper has been written and, hopefully, will also be read.

Notes

1 The idea is (was) that nominal constituents can be moved about by some rule only if they are "lexically governed", and that, furthermore, subject constituents are not lexically governed, unless in an object clause without complementizer.

2 Two of Heraclitus' favourite sayings were "Nature likes to hide herself", and "Invisible harmony is stronger than visible harmony".

3 Literally: "litterarum enim fit demptione aut additione, et propter earum traiectionem aut commutationem" (V,6).

4 The great movement of Romanticism, which started in the 18th century, should be seen in the context of the enormous wealth and power, and the colonial expansion, of the nations of Western Europe in the 18th century. The bourgeoisie of those days thus had not only the leisure and the means, but also the incentive to indulge in their natural curiosity about the past and the distant. At the same time they were helped by the technological innovations that were beginning to shape up. Typically, archeology came about in the late 18th century, which was also the time of Captain Cook's travels, the first publicly financed exploratory expeditions in history not set up for the purpose of economic gain but merely for the furthering of knowledge and the widening of horizons. Comparative philology likewise saw the light of day in that period, and is clearly of the same Romanticist ilk. A factor, of particular relevance for linguistics, was the enlightened attitude, current in those days, of regarding members of the coloured races as "noble savages", and no longer as subhuman beings. This helped early comparativists to treat exotic as well as ancient languages on a par with the familiar European languages. Even so, however, the notion of "primitive" language survived for a long time.

5 In a very special way, Wundt has influenced linguistics through the American linguist Leonard Bloomfield (1887-1949). Bloomfield's early work (1914) was strongly inspired by Wundt, from whom he took the notion of sentences as structures consisting of hierarchically ordered constituents, the well-known so-called tree structures (Wundt 1880: 53-71, 1900 II: 320-355), clearly without realizing, at first, its overriding importance. This only gradually became clear to him as he grew older. In his (1914) the notion is barely present (61/110), but in a form which is strongly reminiscent of Wundt. In Bloomfield (1933), however, it is present all over, despite the fact that Bloomfield had turned away from traditional psychology and had embraced the new doctrine of behaviourism lock, stock and barrel. Nowadays, of course, tree structures are an indispensable ingredient in every branch of linguistics. In logic, tree structures made their appearance in the 1930s, when Ajduciewicz introduced his categorial grammar, based on notions developed by Gottlob Frege.

6 Russell's original (1905) sentence was, of course, "The present king of France is bald". This example, however, illustrates the problem less clearly than (4) above, since the negation of Russell's sentence, "The present king of France is not bald", can be interpreted, if need be and with strong accent on n o t , as not implying the existence of the king of France. Sentence (5), however, does seem to have the necessary implication that there is a king of France. The difference is due to n e e d n o t being a negative polarity item (see Seuren 1985: 232).

7 The classic paper in defence of this positivist position is Quine's "On what there is", in Quine (1953).

8 A notable exception was the logician and philosopher Bas van Fraassen, who in various publications (e.g. 1968/1971) tried to adapt Strawson's ideas and fit them into a workable logical system deviating only minimally from classical logic.

9 See, for example, Russell (1957), a bitter reply to Strawson's criticism of his theory of descriptions.

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