FROM GRAMMAR TO SCIENCE

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NEW FOUNDATIONS FOR GENERAL LINGUISTICS

VICTOR H. YNGVE
The University of Chicago

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PREFACE

HOW IS IT THAT when I open my mouth and some sound comes out that you can, most of the time, understand what I am saying? How does it work? This book is addressed primarily to professionals who confront these and related questions in a wide range of disciplines in the humanities and the social, psychological, and biological sciences. However, since the book is concerned with foundational issues common to all of these disciplines, I have not wanted to assume a background in any one of them. Although some of the chapters will require careful attention and close study, everything needed is explained in the text. No prior special knowledge of either linguistics or science is required. For professionals and those who have worked through the text, a summary of the major findings may be found at the end of the last chapter (pages 308–11).

Efforts have been under way for two centuries in linguistics, at the very center of this whole area, to treat language scientifically, but the endeavor has not been completely successful for reasons that have often been obscure. Linguists and others who work directly with language, speech, or communication have not found an adequate scientific foundation in current linguistic theory. Work has inevitably been hampered also in the many other disciplines where linguistic and communicative issues play a critical role. And because the human ability to communicate underlies nearly every practical and social endeavor we engage in and nearly all our intellectual, cultural, and artistic pursuits, the rest of us, who live our lives every day by communicating, have been deprived of an adequate insight into what has often been pointed to as the essence of our humanness. One can only conclude that a proper scientific understanding of how people communicate would repay considerable effort.

This book takes up the challenge anew. The proposals advanced here have been subjected at every step to critical examination and careful test against the evidence to ensure that they are scientifically sound. A

scientific program of research rigorously carried out sometimes arrives at surprising results. I have found that when the results seemed surprising it was a reflection of my own earlier state of ignorance or, more often, my previous misconceptions rooted in the conventional wisdom that I had accepted without question. I think open-minded readers who are willing to question tradition and conventional wisdom will be led to concur with the major results of the book if they work through the material conscientiously and hold firmly to the standard criteria of science in deciding what to believe.

In a book that represents the culmination of several decades of research focused on linguistic phenomena and linguistic theory it is difficult to acknowledge properly all the many influences that have shaped my thought. I should first like to acknowledge the great debt of gratitude I owe to my father for introducing me to a scientific way of thinking, to my teachers in physics and chemistry at Antioch College, who sharpened my appreciation for science, and to my dissertation advisor and other professors in the Department of Physics at the University of Chicago, who in teaching and by example showed me how scientific investigations are carried out, and thus made it possible for me to undertake the research reported here.

To the members of the mechanical translation group at M.I.T. in the decade around 1960 I owe more than they might think. They helped to heighten my awareness of a number of unanswered linguistic questions. To my many associates at the University of Chicago I owe thanks for their broadening and deepening influence in my intellectual development during the long search for answers and for their continuing friendship that knew no bounds of academic discipline or linguistic doctrine. To colleagues at the annual LACUS meetings I owe many thanks for providing helpful feedback on a series of progress reports. And to a number of authors who entered into the discussions in Communications of the Workshop for Scientific Linguistics, I owe thanks for astute comments and criticisms.

To the many alert and talented students who have been exposed to earlier versions of some of the material in the form of class notes I owe thanks for their insightful comments and probing questions that have helped me to clarify the exposition and have sometimes opened my eyes to new issues and new ways of thinking.

I should specifically like to acknowledge my debt to the late Thomas R. Hofmann for his unselfish colleagueship over the years and to thank William J. Sullivan and Alfred L. Putnam for valuable comments that helped me with this presentation. Arnold W. Satterthwait provided important feedback during the formative period of many of these ideas and W. Keith Percival will have my continuing gratitude for awakening in me an interest in the history of linguistics, which holds important insights into the source and nature of our current difficulties.

Thanks are due to D. Kathryn Weintraub and Dr. David Yngve for working through the page proofs and providing valuable comments and to members of my spring quarter 1996 course who used the page proofs as a text and provided me with feedback from that perspective. Any remaining errors or infelicities are my own responsibility.

THE principle of science, the definition, almost, is the following: *The test of all knowledge is experiment.* Experiment is the *sole judge* of scientific "truth." But what is the source of knowledge? Where do the laws that are to be tested come from? Experiment, itself, helps to produce these laws, in the sense that it gives us hints. But also needed is *imagination* to create from these hints the great generalizations—to guess at the wonderful, simple, but very strange patterns beneath them all, and then to experiment to check again whether we have made the right guess.

—Richard P. Feynman

1 PEOPLE, SOUND WAVES, AND ILLUSIONS

MANY WILL REMEMBER the childhood conundrum, "If a tree falls in the forest and nobody is there, does it make any noise?" The answer, of course, is that the falling of the tree causes a disturbance in the air (sound waves). A schoolboy in the forest might hear the sound waves and interpret them as the sound of a tree falling.

We need to distinguish four things here:

(1) the physical source of the sound waves;
(2) the physical sound waves themselves;
(3) the person's hearing the sound waves;
(4) the person's interpreting what was heard.

Science already provides a general understanding of the first of these, the physical source of the sound waves. The subdiscipline of acoustics in physics covers vibrations and sound and studies the physical processes involved in sound production. In many cases, such as the falling of a tree or a gun discharged by a hunter, we can observe the source of the sound visually and study it by videotape and other instruments.

The science of acoustics also covers the second topic, the properties of the sound waves themselves and their propagation through the air and other materials as well as their reflection, diffraction, and absorption. Sound waves can be studied instrumentally with microphones, tape recorders, and spectrum analyzers by which we can measure their changes with time and their energy spectra.

The third topic, the person's hearing or sensing the sound waves, is studied in the psychophysics of hearing. This discipline understands a great deal about the sensitivity of the human ear, how it varies with the frequency of the sound, and how hearing varies from person to person. A related topic deals with echoic memory by which a person remembers for

a few moments the exact sound heard and is then able to compare it with another similar sound a short time later. This is undoubtedly important in learning to talk because it allows the child to compare a model sound heard with an attempted imitation.

Less is known, however, about the fourth topic, the person's interpreting what was heard. This involves more complex operations of the equipment or mechanisms in the person's head aided, in the case of the schoolboy, by structures in his head reflecting his experience in interpreting noises and his suggestive awareness that he is in a forest. We can study these processes in the hearer by observing the hearer's subsequent linguistic and nonlinguistic activity: for example, the boy may say he heard a tree fall.

§1.1 A word of caution

Although the boy might say he heard a tree fall, he might have been mistaken about the unseen source of the sound. A scientist would say more accurately that the boy sensed (3) a physical sound (2) which he then interpreted (4) as caused by a tree falling (1). As scientists we must be careful not to be misled by the ordinary way of speaking (he heard a tree fall, etc.). This way of speaking does not distinguish between sensing and interpreting; it merely reports the result of the interpreting even though it might be mistaken. This way of speaking accords with the ordinary psychological process of projection and externalization by which sounds sensed by the ears and light waves focused on the retina give rise to the illusion of not being in the head at all, but direct perceptions of the real world out there. Such projections onto the real world, though sometimes mistaken, undoubtedly serve us well in interacting with the world, but they are a likely source of the childhood confusion. They are useful illusions, but they are illusions nevertheless.

Saying that a person heard a tree fall is also incorrect if it is understood as implying that the interpretation is somehow carried by or is inherent in or is a property or feature of the physical sound waves. Interpreting is something a person may do on sensing a physical sound and it depends on the equipment and momentary state of the person as well as on the sound heard.

But is this way of speaking really a problem? One might object that no one except the uneducated or incautious would actually ever be misled by

the seeming implications of this everyday-language expression just as no educated person would actually believe, just because we say that a sincere person speaks from the heart, that speech literally has its source in the heart. Although these expressions may reflect ancient beliefs fossilized in our everyday language, we know today that the function of the heart is to pump blood, not generate speech, and it is not the heart that is literally the seat of love. Surely no scientist would ever be misled by the everyday-language expression that someone heard a tree fall into confusing the sensing of the noise with interpreting it or into believing that the sound waves caused by a tree falling somehow carry their interpretation.

Besides, it might be contended, even if there were a problem, it would actually be irrelevant to the science of linguistics, which is our central concern here, for linguistics does not study noises: it studies utterances (sometimes called texts, discourse, or processes, spoken or written), which differ from mere noises in that they are symbolic, carry meaning, have grammatical structure, and are hierarchically organized in terms of phonemes, words, phrases, clauses, and sentences. Do we really need to be concerned with a schoolchild's confusion about noises? Perhaps not, but there is a suspicion that utterances may also be illusory. Consider the following examples.

§1.2 On interpreting noises

A runner on the women's Olympic team is at the starting mark. A gun is discharged and she hears the noise. With as short a delay as possible she starts to run. In this case the equipment in her head has been set to interpret the noise from the starting gun as a starting signal and to act on it as quickly as possible.

If a spectator throws a lit firecracker on the track behind the runners, there may be a false start. The runners start running before they have time to interpret the noise as not coming from the starting gun.

Now compare a closely related example of what would normally be taken as an utterance, and therefore presumably be a legitimate object of study in linguistics. A schoolboy is about to start in a race. The starter says "Go!" The boy starts to run with as short a delay as possible. Here the boy is set to start when he hears a different sounding noise.

We see that *different* noises may be interpreted in the *same* way. Such observations are easily replicated.

There are also clear cases of *similar* noises being interpreted in *different* ways. After dinner the boy and his sister are considering playing a board game. "What game should we play?" he asks. "Go!" she says. Here the equipment in the boy's head is set to interpret the noise as the name of a game, like checkers or chess. He does not start running with as short a delay as possible. Such observations are also easily replicated.

So we have examples of different noises being interpreted in the same way and similar noises being interpreted in different ways.

If this seems paradoxical, remember that the interpretation of a noise spoken or heard depends not only on the noise, but also on the equipment in the head of the speaker or hearer and the momentary state of the speaker or hearer and how the state changes reflecting the tasks in which the noise plays a part. This is where the linguistic action is.

We need no further analysis of the sound waves spoken or heard than that given by their physical measurement in acoustics and acoustic phonetics. The sound waves do not carry their interpretations from a speaker to a hearer as ancient theory would have it. To speak of sounds in a scientific context as carrying meanings is to invite continuing confusion and error.

We must thus conclude that the common conception of utterances as having grammatical structure and carrying meaning conceals false assumptions from the tradition that will not stand up to even elementary scientific examination and are in fact incorrect. We find in nature only the physical sound waves; their interpretation is entirely in the heads of the speakers and hearers. A scientific analysis must include, besides the study of the physical sounds themselves, a careful and detailed study of the people who produce and interpret the sounds and of what they are doing at the time. As scientists we would also like to understand the source of the compelling illusions that utterances and the parts of utterances do exist in nature.

§1.3 Insulting and being insulted

Suppose person *A* makes a noise and person *B* becomes insulted. Perhaps *A* referred unfavorably to *B*'s ethnicity, or perhaps he simply made a loud noise with his lips. What we actually have is that *A*, intending to insult *B*, produces certain noises. In this the equipment in his head and its structuring and changes reflecting his experience and his awareness of the situation are involved. Then *B* senses and interprets the noise made by

A and becomes insulted. In this the equipment in his head and its structuring and changes reflecting his experience and his awareness of the situation are involved. Where is the insult? It is not in the sound waves, which are quite neutral in the matter. With the sound waves alone from a tape player in an empty room, there is no insult. Neither would a tape recorder recording the sound in the room become insulted. It takes a person to insult someone and a person to interpret something as an insult.

Perhaps *A* merely laughed. A laugh, by itself, is not insulting, but *B* may interpret it as a laugh and become insulted because *B* had just referred quite proudly to his country of origin. The laugh is interpreted as an ethnic slur. *B* might become insulted even if *A* did not even make a noise. *A* might have simply smiled after *B* expressed grief at the death of a loved one. Here we have light waves involved instead of sound waves. But a smile by itself is not insulting. Or *B* might even become insulted if *A* remained silent when *B* would expect a polite response. But silence in itself is not insulting.

Evidently when a person becomes insulted some of his properties change. We know this because the changed properties can affect his subsequent communicative and noncommunicative behavior (he may complain to the other about the insult, or even strike out at him). Similarly, when a person intentionally insults someone, some of his properties change and these changed properties can likewise affect his subsequent observable communicative and noncommunicative behavior.

We cannot attribute the insult to the sound waves or the changed light waves reflecting *A*'s behavior (or their absence). These are quite neutral. *A* is either insulting *B* or not and *B* either becomes insulted or not. Without the people involved there is no insult, or better, no insulting and no becoming insulted. *A* may in fact not intend to insult *B* but *B* nevertheless becomes insulted, or *A* may intend to insult *B* but *B* not interpret it that way and not become insulted. Since it takes at least two to misunderstand, such cases require that we also analyze a system including both *A* and *B*, which will then show properties of understanding or misunderstanding.

§1.4 OK, George Washington

Suppose *A* says, "I'm sorry, I didn't intend to insult you." *B* might reply, "OK."

At a birthday party, *A* might say to *B*, "Would you like some punch?" *B* might reply, "OK."

Suppose the older sister at the party looks at her mother with raised eyebrows. Her mother might say, "OK," and the sister then goes to the kitchen and brings out the birthday cake.

Suppose that after the party, one of the guests is asked, "How was the party?" The guest might answer, "OK."

In each of these cases and in many others that will easily come to mind, the only thing that passes between the two people is the sound waves produced by one of them saying "OK." Their interpretation is entirely in the heads of the people and involves changes in their properties the consequences of which may be observable. Ordinary ways of speaking about these things are misleading and cannot be made the basis for a scientific description. The interpretation of sound waves is without exception relative to a context in some person's head, and hence to the linguistically relevant properties of that person.

Some might argue that there are institutional ways of interpreting *OK*, and these should be taken as features or properties of the sound waves themselves. However, if many people say or interpret *OK* similarly, that is strictly a property of those people. There is always the possibility of different interpretations by different speakers or hearers, or by the same person at different times.

"Come now," someone might object, sensing a possible exception, "that may be true for *OK*, but how about proper names? Clearly *George Washington* refers uniquely to the father of our country, the first President of the United States, doesn't it?" (Other frequently cited examples are *Napoleon* and *Sir Walter Scott*.) If this really were the case, one might think that the sound waves actually do somehow carry a meaning, in conformance to ancient tradition. Not true.

There may well be other individuals by the same name. The one referred to would depend on contextual factors in the heads of the people involved. Then suppose *A* is in a play and refers to another actor as *George Washington*. And how about this? *A* tells the truth about an embarrassing escapade, and *B* says, "OK, George Washington." We have to conclude that the sound waves associated with someone saying *George Washington* do not have a unique reference either and their interpretation also depends on contextual factors in the heads of the persons involved.

The common illusion of one-word-one-meaning apparently arises from the fact that speakers and hearers almost always interpret the sound waves of speech appropriately in context by means of processes that are quite automatic and below the level of consciousness.

A proper scientific linguistic theory ought to elucidate these automatic processes of producing and understanding speech in context.

§1.5 Jack and Jill

Leonard Bloomfield was being a careful scientist in his well-known example of Jack and Jill walking down a lane. Jill is hungry and sees an apple in a tree: "She makes a noise with her larynx, tongue, and lips. Jack vaults the fence, climbs the tree, takes the apple, brings it to Jill, and places it in her hand" (1933:22). Later Bloomfield added quite accurately, "The individuals in a human society co-operate by means of sound-waves" (1933:28).

What is really going on here, departing now from Bloomfield's subsequent account, is that Jack hears the sound waves and interprets them, possibly under the influence of his suggestive awareness of the apple tree and the thought that Jill might like an apple. In his interpretation he could have been mistaken as to what Jill actually intended in making the noise. But Jack acts on his interpretation anyway, and as scientists *we can observe his act and infer his interpretation*. We could also ask him about it. We might go further with other observations and experiments and infer something of the equipment and structurings in his head and how they operate in interpreting the noises (sound waves) of speech. We might then go on with observations and experiments and infer something also of the equipment and structurings in the head of Jill and how they operate in her producing the sound waves of speech. We would be interested in what ways Jack's properties are different from and in what ways similar to Jill's. We could also consider the system of the two of them and their physical environment and how it operates in this case to get the apple picked and into Jill's hand. Note that these are all studies of objects in the real physical world: Jack, Jill, their surroundings including the tree and the apple, and the sound waves of speech. Specifically, the linguistic properties of a person, like the person's muscular strength or immunity to mumps, are properties of a physical reality on a par with other properties of biological organisms studied in biology.

§1.6 Bloomfield's 'man' and Sapir's candle

A woman *A* moves to the Boston area from Chicago and is interested in exploring the shopping facilities near her new home. She spends considerable time trying unsuccessfully to find Carmen Street. (This is a true story.) Only later does she learn that *B*, who had told her about the

shopping street, had been saying all along "Common Street," which *A* had heard and interpreted as "Carmen Street." The difference in interpretation by *A* and *B* resides entirely in the equipment in their heads and the results stored there of their experience in speaking and in interpreting the sound waves of speech, that is, in their linguistically relevant properties.

Let us now reexamine and update an example used by Bloomfield in introducing his chapter on phonology (1933:76): A linguist has two recordings of speech that he could identify as the sound waves of someone saying *man* using two different pitch schemes: If he plays the recordings to a typical American listener, the listener interprets them as two examples of what he would write down as "man." The linguist then plays the recordings to a listener from China. This person interprets them as different, and writes down two different things which the linguist translates as "deceive" and "slow." Our conclusion differs somewhat from that of Bloomfield. We conclude straightforwardly that since the sound waves in the two cases come from the same recording and are thus alike, the difference in their interpretation by the two listeners is entirely due to the different properties of the different listeners.

Edward Sapir (1925) pointed out that the sound waves made by a person blowing out a candle may be identical to the sound waves produced by a person beginning to say *when* (with aspirated *wh*). A hearer could not distinguish them out of context. What we can take from Sapir's insightful example is somewhat different from the point he was making. We note from his example that the interpretation of a sound is not carried by the sound itself: The interpretation of a sound by the person making it depends on what that person is doing, here either blowing out a candle or saying *when*. That is, the interpretation depends on that person's changing properties. The interpretation of a sound by a hearer also depends on that person's changing properties, here reflecting the hearer's ongoing activities of interpreting sound waves, and these activities would have to reflect internal information or assumptions about the circumstances of their production.

This opens the way for a treatment of phonological questions in the physical domain. We can develop a theory of the person that takes into account what the person is doing in terms of postulated properties of the person, some of them changing dynamically with time as the person speaks and understands. We can then test the theory against observational

and experimental investigations of the real person that are sensitive to what the person is doing.

Trained linguists know how long it takes for them to learn how to interpret the sounds produced by natives in the field and how difficult it is for them to overcome habits of interpretation learned earlier in their own or other communities. This is strong evidence that the interpretation of sound waves lies entirely in the heads of speakers and listeners. The fact that a linguist can successfully tape-record speech and that a tape recorder records only the physical pressure or velocity changes in the air and therefore reproduces only the changing energy spectrum of what was recorded is strong evidence that the sound waves themselves do not carry any linguistic interpretation, whether it be in terms of phonemes, features, words, or any other interpretation beyond the physical energy spectrum and its changes with time, which linguists have correctly insisted is never exactly the same from utterance to utterance and from speaker to speaker.

§1.7 Utterances reflect an illusion

There can really be no serious question that the usual concept of an utterance cannot be scientifically justified. It reflects an illusion probably arising in ancient and modern times by normal processes of projection and externalization, perhaps also partly under the influence of writing. There is no such thing in nature as an utterance that carries with it a linguistic segmentation or structure of any sort, whether in terms of phonemes, syllables, words, sentences, or any other of the constructs usually invoked to describe them. Instead we have in nature only the physical sound waves themselves and the people producing, sensing, and interpreting them.[1]

And if the usual concept of an utterance reflects an illusion, we are also led to doubt the scientific validity of the entire conceptual framework and system of grammatical terminology developed to talk about utterances, their parts, and their properties. We are driven to examine the scientific appropriateness and justification of such concepts as *sentence*, *meaning*, *word*, *phoneme*, *phrase*, *form*, *content*, *noun*, and many others well known to every linguist. We must examine carefully whether the whole enterprise of grammar is a proper framework for a scientific linguistics, whatever its other merits may be.[2]

Some linguists might respond to such suggestions with disbelief and denial: Surely the doubts are misplaced. Besides (still laboring under the

illusion), there really are utterances, sentences, meanings, words, phonemes, phrases, forms, contents, and nouns. Everyone knows that. It's beyond question. And anyway, what alternative is there? Grammar is all that we have. Perhaps; but we need to examine the matter further.

Others may agree that utterances segmented into phonemes, words, sentences, and the like do not exist in nature but think there is no need to worry on that account because linguistics does not study utterances, it studies language—linguistics is the scientific study of language.

§1.8 How about language?

But what is language? And does language exist in nature or does it, too, reflect an illusion, as some linguists have suspected? Here one finds a bewildering array of often contradictory views. For a preliminary survey of informed opinion about what language is, we can turn to the first issue of a linguistics newsletter, where the term *language* appears about thirty times in short contributions from six different linguists. The word seems to be used in several senses and it is not clear that all the senses are compatible with one another. We find that language is seen as a natural phenomenon, the object of a science, a type of faculty, a kind of module, a type of object, a type of stuff, a type of system, as voluntary behavior, as something used, as something taught and learned, as having learned elements, as having patterns, as something spoken, heard, and learned, as something processed, as something organized and structured, as something produced and comprehended, and as data.[3]

In the wider literature of linguistics one finds an even wider range of opinion about the nature of language: Some say that language is essentially mathematical or logical, or an abstract sign relation between sound and meaning given by grammar and lexicon. Some see it as a system of relations, some as a network of relations between what can be signified and the medium of signifying. Some say that language is a mechanism for commuting some experience into something said. Some hold that the term *language* names both the process of the creation of discourse and the result of that process. Some say that grammar is neutral between speaker and hearer, while others speak of separate grammars for speaker and hearer. Some say that language does not exist; it is an illusion, and that we should study instead the linguistic system of the human being, a portion of the overall cognitive system of the human being. But some say that the language faculty has its own independent properties quite unrelated to

other mental faculties. Some say that people use language when they speak, that they use words, sentences, and other linguistic objects to carry meaning from a speaker to a hearer. But some aver that the communicative function of language is incidental; more important is that it represents experience and shapes and structures our understanding of the world. Some say that we should not study mere performance, which may suffer from errors, memory lapses, etc., but that we should instead study the linguistic competence of the idealized native speaker. Some add that competence underlies and directs performance, although the relation of competence to performance is still not at all understood. Some say that language belongs both to the individual and to society but that it is not complete in any speaker; it exists perfectly only in a collectivity. Some say we should be concerned not with a collectivity but with an ideal speaker-listener in a completely homogeneous speech-community who knows its language perfectly. These are just a few of the views found in the literature. Since they are all fairly widespread, they have not been attributed here to any particular authors. The point is simply that the discipline of linguistics has a serious problem.

All of the many theoretical positions that I have examined in trying to make sense out of linguistic phenomena have turned out to be disappointingly unacceptable. My experience is apparently widely shared; many of the most creative linguists have felt impelled to reinvent linguistic theory. With numbing regularity new proposals march out onto the intellectual battlefield to wave colorful banners of X-linguistics or Y-grammar or the Z-model of language and vie for the allegiance of the rank and file. Perhaps the continuing march of new and inevitably unsatisfactory grammatical positions should lead us to suspect that there is something basically wrong with how the problem has been formulated.

A crucial difficulty is that there seems to be no scientific way of deciding among the many contenders or among the various ways they propose for analyzing linguistic materials.

Instead we find positions and methods being promoted like a new movie or defended with withering polemics or taken up like the latest fad. Or they are followed because of the charisma of their author, or out of personal regard for a friend or a revered teacher, or in allegiance to a clique, university, city, or country of origin. The ensuing schools of linguistics tend toward insularity, not reading or citing each other's publications. This is not what one would expect to find in a science; it is more like

literature, philosophy, politics, or religion, which do not pretend to be scientific.

§1.9 Others also have doubts

I'm not the first to have remarked on conceptual problems in linguistic theory. Probably every one of the traditional linguistic and grammatical concepts on which doubt has been reflected here has been questioned at one time or another by some other linguist. Of the many examples to be found in the literature let me give just three from three quite different areas of linguistics.

In post-Bloomfieldian phonemics, Twaddell (1935; 1957:67) points out that all attempts to associate the term *phoneme* with either a mental or a physical reality appear open to serious if not unanswerable objections and that it is probably impossible (at present) to associate the term with a reality. He suggests therefore that the phoneme be regarded as an abstractional, fictitious unit. With his "(at present)" he seems to hold out hope that despite the problems it might eventually be possible to associate some reality with the phoneme and that his suggestion to treat it as a convenient fiction could be regarded as only a temporary expedient to save the concept pending that eventuality. This would be in accord with Bloomfield's earlier temporizing ("Until that time . . ."). See Bloomfield 1933:78.

In cognitive linguistics, Langacker, in his impressive rethinking of linguistic theory (1987:1–2), says that although every linguist relies on the basic and traditional grammatical concepts such as *noun, verb, modifier, subject,* and *subordination*, few if any are prepared to define them in an adequate, explicit, and revealing way and that the linguistic community has not yet achieved general, workable, deeply revelatory characterizations of these constructs in terms of more fundamental notions in the context of a coherent overall conceptual framework. By saying "has not yet achieved" he also appears to temporize and hold out hope for future adequate characterizations of these constructs.

Linguists in the areas of variation and pidgin and creole studies are often led to acknowledge the weaknesses in the discipline. John Holm, in his scholarly comparative survey of all known pidgins and creoles (1988:4), says that there are problems in defining the most basic concepts in language: *word, sentence, dialect,* and even *language* itself and that our definitions fail to account for the endless variety of reality; yet a clear

understanding of concepts is important: they are the building blocks we use to construct our theories to account for that reality. But he seems to take the position that despite the problems with our most basic concepts we have no alternative but to keep on using them as the basic building blocks of our theories while yet candidly pointing out their weaknesses.

The conclusion is inescapable that there are serious difficulties at the core of linguistic theory. While agreeing with these authors on this point, I think we must no longer temporize. The implicit task of trying to make scientific sense out of traditionally given constructs may in fact be impossible. We should instead meet the problem head on. Perhaps we should consider giving up the traditional concepts as simply reflecting common illusions and seek new, more scientifically acceptable foundations for linguistics.

In order to proceed, we need to ask some probing questions and try to answer them: How did linguistics get into a situation where serious doubts are continually being raised about its basic conceptual structure? Are these doubts in fact well founded, as I believe they are? If so, what should be done about it? Is there any merit to the view that in nature we find only the physical sound waves, their interpretation being entirely in the heads of the speakers and hearers? And does it not then follow that a scientific analysis must include the study of the physical sounds themselves and a careful and detailed study of the people who produce and interpret the sounds? I think there is merit to this suggestion, but it needs further study. And finally and above all, in the midst of illusions and suspicions of illusions, how are we to decide what to believe in linguistics?[4]

2 TRADITIONS OF GRAMMAR AND SCIENCE

How did linguistics get into a situation where serious doubts arise about its most basic theoretical constructs and the scientific adequacy of the foundations of linguistic theory? This question can be answered in the light of the history of the discipline. The related question of how we are to decide what to believe in linguistics can also be answered in part by examining critically this same historical record to see how linguists in the past have decided what to believe and in part by examining the history of science to see how related questions have been handled in other sciences.

History is always selective. The best that can be done here is to select those items that seem to throw the clearest light on the issues facing us. The reader is encouraged to supplement this material by reading further in the history of linguistics and the history of science.[5]

§2.1 The physical and the logical domains

The origins of linguistic theory can be recognized in Plato and Aristotle, but most clearly in the early Stoics from about 300 to 150 B.C.[6] The study of the Stoics is both fascinating and eye-opening. Their conception is breathtakingly elegant and it has had a strong influence on philosophical and linguistic thought that continues to this day. Their study should be included in the background of every serious linguist.

The Stoics saw fit to divide philosophy into three parts, the physical, the logical, and the ethical (39).[7] It is the distinction between the physical and the logical that will engage our attention.

The physical part of philosophy (132–159) was concerned with an understanding of the real world and was a predecessor of modern science. This part of philosophy included their views of nature and the physical universe, living things (and the gods), and most important for our topic the human *psyche* or soul. The Stoics understood much about the physical

world, realizing, for example, that the earth is a sphere and that sound is propagated as spherical waves in the air like the ripples in a pond spreading in ever wider circles after a stone has been thrown in. But they also had a number of misconceptions that had to be corrected by later scholars and scientists. For example, they thought that the ruling part of the psyche from which rational speech issues had its seat in the heart and that the cosmos is a living being, rational, animate, and intelligent.

The Stoics taught that the psyche or soul has eight parts: the five senses, the faculty of speech, the intellectual faculty or the mind itself, and the generative faculty concerned with reproduction, regeneration, and healing (110). Since the faculty of speech was discussed in the physical part of philosophy, and the psyche was considered to be corporeal because it was a causative agent, one would expect that the modern scientific discipline treating speech would have developed in the physical part and would stand alongside astronomy, geology, and physics, perhaps subsumed under biology like the physiology of reproduction and regeneration.

The logical part of philosophy, on the other hand, was concerned with an ideal of perfection and included a theory of knowledge (41–83). This part of philosophy taught how the Stoic ideal, a perfectly rational wise man or *sage,* could come to know and speak the truth (83). It was often divided into rhetoric and dialectic (41). Rhetoric dealt with speaking well in matters set forth in plain narrative, and dialectic dealt with correctly discussing subjects by question and answer (42) or subjects true, false, and neither true nor false (42, 62).[8] Both in dialectic and in rhetoric the Stoics maintained a thoroughgoing distinction between the subject matter expressed and the expression. Chrysippus, perhaps the greatest logician of ancient times and a major architect of the Stoic views, took the subject of dialectic to be signifiers and things signified (62), a view that has been influential in modern linguistics.

The Stoics took the logical part of philosophy to be central, for without it, they said, the physical part and the ethical part could not express themselves (83). Thus we see that the logical part was at a metatheoretical level with respect to the physical part. Theirs was a philosophy informed by reason and governed by dialectic, a metatheoretical discipline concerned with an ideal of perfection in the logical domain. The Stoic wise man or sage was an ideal of godlike perfection to which mere mortals could only aspire (117 ff.); it was hortatory and did not pretend to be a theory of real people in the physical domain.

§2.2 Stoic foundations of linguistics

Because of a series of historical accidents, all of linguistics except phonetics has developed out of Stoic dialectic in the logical part of philosophy rather than as a discipline treating the faculty of speech as part of the real world in the physical part. And the choice of dialectic from the logical part ensured a narrow focus on knowledge, logic, and truth and excluded consideration of plain narrative in rhetoric and such topics as the invention of arguments, their expression in words, their arrangement, and delivery (43). This choice also separated grammatical topics from the treatment in rhetoric of the proper tone of the voice, facial expressions, and hand motions for the orator (Arnim 1903:2.297; Pohlenz 1950:25).

Stoic dialectic is the most highly developed ancient predecessor of the modern triadic theories of the sign that figure currently in semiotics, the theory of knowledge, and the philosophy of science. One finds in Stoic dialectic a well-developed theory of knowledge that, according to Sextus Empiricus (Adv. Math. 8.11; Bury 1933–49; Arnim 1903:2.166), recognized three things: the things in the real world; the knowledge of the things in the real world; and the sound of the voice by which the knowledge is expressed. The sound of the voice was the signifier; the knowledge was the signified; the things in the real world were, in modern terms, the referents. Compare (49) and Aristotle *On Interpretation* 1. Both the things in the real world and the sound of the voice were considered to be corporeal, having a physical existence, but knowledge was incorporeal and could be true or false. Stoic dialectic incorporated a highly developed propositional logic far superior to Aristotle's logic and unrivaled until modern times (Mates 1953).

Stoic dialectic contained many of the features found in current semantic and linguistic theories: Connecting the things in the real world to the propositional knowledge of them were levels of sensation and perception by which one could ideally come to know the truth about the world (49–54). Connecting the sound of the voice to the knowledge expressed were first a level of sound sequences with the 24 letters (phonemes) as elements and next a level of speech with the parts of speech as elements. By 150 B.C. five parts of speech were recognized. Expressions at the level of speech were then related to propositional knowledge by a relation of signification. In providing an ideal of perfection in speaking Good Greek, Stoic dialectic treated the excellences and faults of speech. Barbarism was a fault at the level of sound sequences, like a foreign accent, and solecism was a fault at

the level of speech. A fairly clear summary of what may be the earliest grammar in the Western tradition, the book *On Voice* by Diogenes the Babylonian, is summarized by Diogenes Laertius (55–59).[9]

§2.3 Stoic criteria of truth

We have seen that in Stoic philosophy, as also in other ancient philosophies, there was a fundamental conceptual split between a physical domain and a logical domain: a split between the domain of knowledge about the world, out of which modern science has grown, and a domain of dialectic or the theory of knowledge, which was the predecessor of modern logical and philosophical disciplines. It was a relation of theory to metatheory, of science to the philosophy of science.

The criterion of truth for knowledge about the physical world was observation by the senses (49, 54). This criterion was given in detail by Stoic dialectic in its account of the levels of sensation and perception. Thus dialectic in the logical part of philosophy ruled the physical part because it provided the criterion for the acceptance of knowledge about the physical world. In its concern for ideals of perfection it showed how a sage could come to perfect knowledge in the physical part of philosophy.

The question came up as to what the criterion of truth was for knowledge in the logical part of philosophy. How would a sage know valid reasoning from invalid reasoning? Confronted with *If it is day it is light; but it is day, therefore it is light,* how would one judge its validity? How would the sage judge the validity of the architecture of dialectic itself and the concepts of speech sounds and parts of speech that figured in it? The Stoics were divided on what the proper criteria of truth were here in the logical domain, a debate that has not been resolved in philosophy to this day. Some suggested Right Reason or a gift of nature, a sort of innate knowledge (54).

But they did agree on this: The criterion of truth for knowledge in the logical part was not evidence from the senses. That conclusion stands to this day.

So we see that the most highly advanced lore dealing with speech was in the logical domain, a part of philosophy concerned with an ideal of perfection and a logical theory of knowledge. It was not centrally concerned with the faculty of speech in the physical part, the predecessor of modern science. Thus the conceptual framework out of which modern linguistics has grown did not from the beginning answer ultimately to evidence from the senses like the predecessors of the other sciences. This

is an historical accident that has had major repercussions as linguists have tried to make their discipline scientific.

§2.4 The rise and spread of grammar

The second accident of history is that by this time Alexander the Great had conquered a large area of the world around the eastern Mediterranean and into India. There was a need in this empire for teaching Greek to non-native speakers and for promoting a particular form of Greek as standard over the other dialects. It happened that Stoic dialectic offered the most advanced lore about speech at this time. Normative grammars of Greek were written based on the Stoic conceptual structure with an admixture of ideas from the methods of textual criticism worked out by the Librarians in Alexandria, the Greek colony at the mouth of the Nile (Pfeiffer 1968).

It happened that Diogenes the Babylonian, whose grammar was discussed above, became head of the Stoic school late in life. He was one of three philosophers who served as envoys to Rome in 156–155 B.C. and it is thought that he took his grammar with him. And it happened that the Romans tended to prefer Stoicism over other Greek philosophies and Stoicism flourished in Rome. One of the later Roman emperors was a Stoic. So it transpired that when the Romans wanted to promote a standard language over their own empire, they produced Latin grammars on the Stoic model,[10] with adjustments mainly in the parts of speech they recognized. The Greek grammatical tradition thus became a Graeco-Roman grammatical tradition.

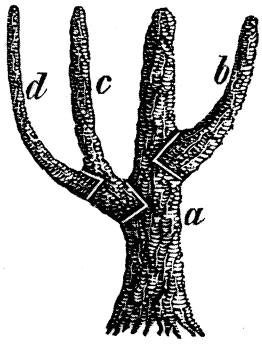
It is also an accident of history of far-reaching importance to the development of linguistics that Latin became the language of scholarship throughout Europe. The road to knowledge was through literacy, and the road to literacy was through Latin grammar well into the seventeenth and eighteenth centuries. Isaac Newton wrote in Latin.

When the various nationalist movements in Europe stimulated desires for national languages supported by normative grammars, these were inevitably written on the pattern of Latin grammar, again often with adjustments in the parts of speech. Since grammar was in the logical domain, not the physical, there were no criteria of acceptance for parts-of-speech systems through observation by the senses. Lacking objective scientific criteria for deciding between competing systems, the organization of grammar remained unconstrained. Although all the grammarians provided parts-of-speech systems as the tradition dictated, they were free

to introduce any arbitrary innovations they wished in their choice of system, and they did. Ian Michael (1970) reports on 273 grammars of English written or printed in England between 1586 and approximately 1800. They represent 56 different systems just in terms of what parts of speech they recognize! This indeterminacy in the parts of speech foreshadowed related problems in modern linguistics and is a major clue to their causes.

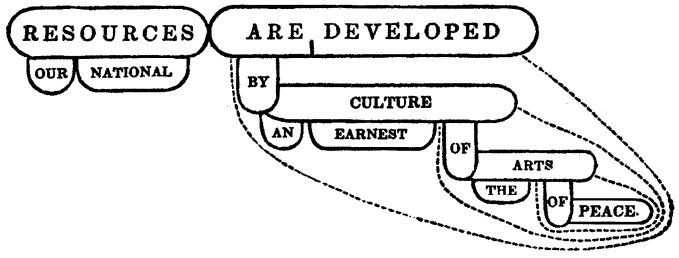
The diagramming of sentences has had a long history in the school-grammar tradition. Gleason (1965) exhibits and discusses an interesting variety of methods of sentence diagramming. The use of tree structures for this purpose is quite old. The oldest syntactic tree diagram I know of, shown in (1), is in Brown (1840). This antedates by many years the

(1)



appearance of tree diagrams in historical linguistics. In this tree the letters *d c a b* represent the sentence *Very high trees fell.* A few years later there appeared the highly worked-out 1847 system of Clark (1848), shown in (2).

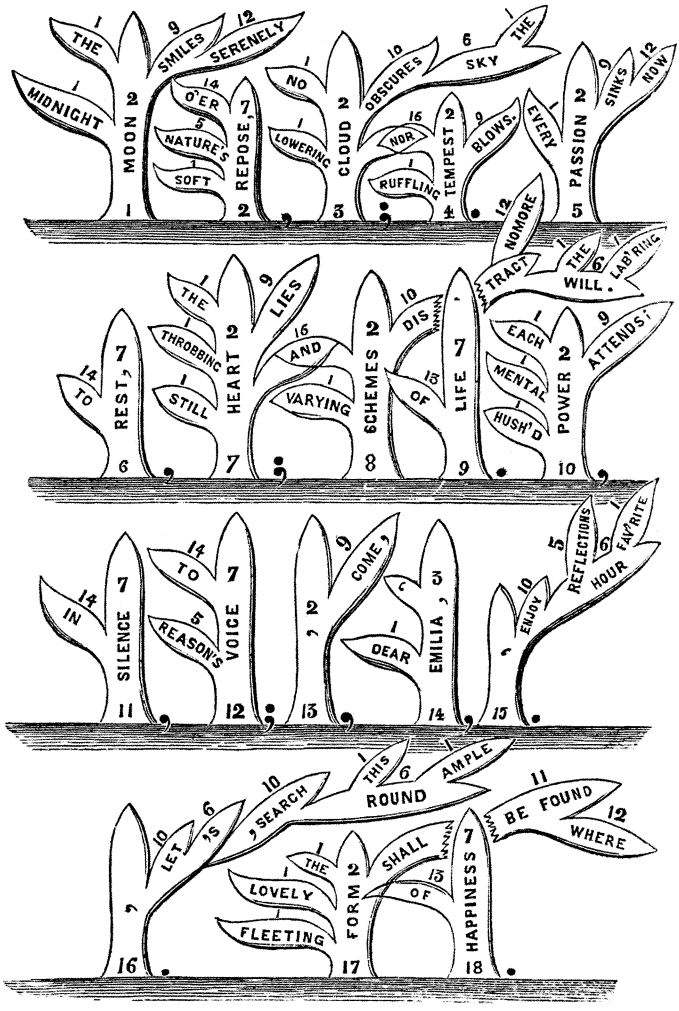
(2)



An interesting early example probably dating to 1848 (Barrett 1858) is a veritable forest of trees, (3) overleaf, used to analyze a poem.[11] Authors of school grammars often cited earlier authors and sometimes criticized them vehemently. It would be interesting to investigate possible influences in either direction between school grammars, particularly Brown (1840), and more scholarly works. Brown was linguistically innovative in

other respects in addition to publishing perhaps the first syntactic tree diagram. His linguistic views were surprisingly forward-looking compared with other earlier and later teaching grammars.

(3)



§2.5 Doubt and the rise of modern science

It is also an important accident of history that around the beginning of the seventeenth century there developed an increased interest in coming to a more perfect understanding of nature and in separating out the wisdom from the nonsense in ancient lore concerning the physical

domain. In this endeavor all three of the greatest intellects of that time, Francis Bacon, René Descartes, and Galileo Galilei, emphasized that one must begin by doubting received opinion.

Bacon's doubt in his *Novum Organum* of 1620 advocated ridding one's mind of all prepossessions or prejudices that distort the truth, among them received opinion. He would have us turn from the study of Aristotle to a study of things in order to discover nature's laws. Although Bacon's thought was influential in the development of science, it is realized today that he would have us rely too much on the blind collection of data in the hope that truths would spring forth from them by processes of induction.

Descartes's doubt in his *Discourse on Method* of 1637 led him to discard initially all propositions that were not indubitably true. This left him with only one, his famous "I think, therefore I am," from which he would deduce everything, even the existence of God. His test of truth was that which we clearly and distinctly conceive as true. A rationalist logical-domain criterion of truth like this, however, is inappropriate for investigations of nature in the physical domain, as the Stoics had already known. Consequently Descartes's science was flawed in that it relied too heavily on intuition and did not grant sufficient priority to the results of observation by the senses.

Galileo's doubt is clear in most of his writings from before the *Siderial Messenger* of 1610 to the great *Discourses and Mathematical Demonstrations Concerning Two New Sciences* of 1638, which laid the foundations of statics and dynamics in physics. Galileo would admit nothing into science that could not be shown by observations by the senses or that could not be shown by valid reasoning from observations by the senses. And the truths about nature were essentially mathematical. This position pitted him against the Aristotelians of his day who would give priority in what to believe about the physical world to ancient writings and the philosophical tradition.

Of these three, Galileo's view has been most influential in the development of science. The whole point of modern science is to increase our knowledge of the natural world through a program of observation, experiment, and the development and testing of theories, where the criterion of acceptance of observational facts is their public reproducibility when questioned, and the criterion of acceptance of theories is their ability to pass appropriate tests against observational evidence when challenged. These criteria can be applied only in investigations in the

physical domain, the domain of the natural sciences, where observation by the senses is possible.

It is also a characteristic of modern science, following from initial doubt, that it accepts no special subject-matter assumptions: no assumptions special to physics, chemistry, biology, or any other particular department of knowledge, for special assumptions are arbitrary, and different people are free to make different assumptions. Science accepts only the most general assumptions that have proved through four centuries of scientific progress to be the absolute minimum needed for carrying out any successful program of scientific investigation. Rejecting special subject-matter assumptions and insisting that theories be tested against the evidence are the principle means by which science has rejected mistakes, false guesses, myths, and superstitions from the past.

These processes of doubt and reexamination of foundational issues using the criteria of science led to the rise of modern science. First, the work of Galileo and his contemporaries in the seventeenth century moved physics to a scientific rather than a philosophical way of deciding what to believe. Next, chemistry emerged as a science in the late eighteenth and early nineteenth centuries with the work of Lavoisier, Dalton, Berzelius, and their contemporaries. Later the biological disciplines moved into science, making possible the modern advances in physiology and medicine, genetics, evolution, and most recently molecular genetics. The behavioral and social sciences are currently moving into science, but their full integration into science has not yet been accomplished.

In each historical case the transition from philosophy to science has not been easy because of difficulties in setting aside ancient preconceptions. In many cases this required questioning and abandoning deep-seated and unanalyzed assumptions and beliefs from the past. The associated controversies have become legendary, but the disciplines have emerged stronger in the end.

During the first 200 years of the development of modern science, the semiotic-grammatical tradition and normative grammar were scarcely touched at all by science. It was not until around the end of the eighteenth century that the growing familiarity of European scholars with Sanskrit writings and with the remarkable ancient Hindu grammar became the accident of history that finally catalyzed efforts to try to develop a scientific linguistics. Problems showed up almost immediately.

3 SHOULD WE STUDY LANGUAGE OR PEOPLE?

THE SITUATION IN LINGUISTICS at the beginning of the nineteenth century can be characterized by an extremely strong tradition of normative grammar taught in grammar schools and traceable back to the Stoics and a continuing high regard in philosophy for a triadic theory of signs also traceable back to the Stoics and other ancient philosophers including Aristotle. One cannot overemphasize the strength of this double tradition. It has provided nearly the only view of speaking and writing in the Western world through twenty centuries. It has contributed nearly all the concepts and terminology in everyday language concerned with speaking, writing, and the understanding of speech and writing. It has given us our everyday ideas of language, words, sentences, meanings, nouns, verbs, and all the rest. It is nearly impossible today to talk about or even to think about talk, either in nontechnical contexts or in technical linguistic contexts, without invoking the concepts and vocabulary of this powerful tradition. The semiotic-grammatical tradition has so infiltrated Western thought over the millennia and has become so ubiquitous, that it has remained unquestioned as a foundation for linguistics, even stubbornly unquestionable.

Thus the difficult struggles usually experienced by sciences in their efforts to move away from philosophy have been especially traumatic for linguistics. Because of the accidents of history that linguistics developed from disciplines in the logical domain rather than the physical, it remained a study of "language" rather than a study of sound waves and people in the physical domain. Consequently, linguistics as the study of language rested on traditional and arbitrary assumptions that had no necessary connection with the real world. Theories of language therefore could not be tested against the real world at the most basic level.

It should not be surprising, then, in light of the extreme tenacity of the grammatical and semiotic traditions, that as linguistics tried to move into

science a number of problems started surfacing. These were to appear again and again and come to dominate the quest for appropriate linguistic theory. Indeed, many of these problems have not yet been resolved. Most of the difficulties have been caused by confusions between the logical and the physical domains such as how to understand the relation of language to people, how to mediate between the constraints of grammar and the freedom of the will, and how to resolve the tensions between an ideal of uniformity and the observed lack of uniformity in the community and between an ideal of perfection and the observed deviations of actual speech.

§3.1 The scientific aspirations of linguistics

Modern scientific linguistics began with an effort to come to terms with observed partial correspondences between Latin, Greek, Sanskrit, and various modern languages. It had been suggested that various of these languages might have descended from older extinct languages. It was hoped that one might be able to reconstruct these postulated parent languages by comparing in detail the languages that were thought to have descended from them. This work led to the development of the comparative method, a method of reconstruction taking into account the details of the observed similarities and differences between known languages.

The idea that one could have a science of linguistics was exciting and filled many with enthusiasm. Rasmus Rask, one of the pioneers of modern scientific linguistics, invoked the names of Linnaeus and Newton. He said that language is an object of nature and the science of language resembles natural history. Its study has two objects: the comparison between the individual natural objects—the system; and the structure of the individual bodies and what appertains to that—the physiology (Rask 1830). Thus language was seen as a natural object. Its comparative and structural scientific study would then be coordinate with the study of rocks, plants, and animals in the other sciences.

Rask turned his back on the philosophy of language, explicitly warning against any approach through logic and meaning. This warning was right on target from the point of view of moving linguistics away from philosophy and into science. No amount of logical reasoning would be able to take the place of examining the actual linguistic data and considering carefully what they might imply. If linguistics were to be a part of natural philosophy, i.e., a natural science, it would certainly have to give actual data first place over theory.

Rask's discipline borrowed heavily from the descriptive phase of practical normative grammar in identifying the items to be compared, but he took pains to dispute the idea that the discipline was merely mechanical like the paradigms of school grammar. This insistence was also on target in distancing his linguistics from the powerful normative school tradition and moving in the direction of science.

§3.2 Where does language belong?

Toward the middle of the nineteenth century, August Schleicher, the leading theoretician of his day, set about to lay the foundations of a science of linguistics and to choose a name for the new discipline. Schleicher also carefully distinguished scientific linguistics from linguistic philosophy:

> Linguistics has to do immediately with language; the object of linguistics is thus a concrete reality; namely the specific given languages, that of linguistic philosophy on the contrary is an abstract ideal. [Schleicher 1869:119]

While emphasizing that it would not be appropriate for a scientific linguistics to take an abstract ideal as its object, Rask, Schleicher, and other early linguists nevertheless accepted the concepts and methods of language and grammar from the normative tradition. They apparently forgot or ignored the fact that the original source of that tradition lay in the ideals of perfection in the logical or metatheoretical part of philosophy, which did not treat concrete realities, rather than in the physical or natural part that did.

Following Bopp and the other pioneers, Schleicher focused on the comparative method as a means for historical reconstruction. He summed up the method in the striking phrase (1848:5) "das Nebeneinander des Systems in das Nacheinander der Geschichte" (the juxtaposition of system into the sequence of history). Schleicher actually drew family trees of languages (1861:7; 1869), taking seriously the family metaphor of parent languages and daughter languages that had been used on occasion for many years. He also introduced the asterisk to mark reconstructed forms. He has with good reason been called the father of comparative linguistics.

In trying to conceive of linguistics as a science, Schleicher ran into another problem. He was influenced in the beginning by the then prestigious philosopher Hegel, who was emphasizing a distinction between disciplines dealing with *Natur* and disciplines dealing with *Geist* (spirit).[12] This was not a physical-logical distinction, nor a body-mind