NOAM CHOMSKY
New Horizons in the Study of Language

NOAM CHOMSKY (b. 1928) is probably the most famous linguist living today. He is known for his work in language studies, philosophy, and cognitive studies and for his political activism. Born to Jewish parents who spoke English, Russian, Yiddish, and Hebrew, Chomsky grew up in a Philadelphia neighborhood where he was often threatened by anti-Semitism. He was aware of the evils of the Fascist government of Spain during the Spanish Civil War in the late 1930s, and he began thinking and writing about anti-Fascist politics when he was in grade school. Chomsky is famous today in the popular press for championing libertarian Socialist principles and for taking radical positions that have sometimes proven dangerous. A professor at the Massachusetts Institute of Technology since 1955, when he gives lectures he is often under police protection because of the threats he receives. When Theodore Kaczynski, "the Unabomber," was at large and sent bombs in the mail to important scientists engaged in computer and cognitive studies, Chomsky was one of his targets. For years Chomsky did not open any of his mail himself.

Chomsky completed his undergraduate and graduate work at the University of Pennsylvania, moving early into linguistic studies. He began to develop some of his basic theories about language in his doctoral dissertation, published as *Syntactic Structures* (1957). He concerned himself, not with the surface features of language, but with what he thought of as its deep structure. Chomsky's most important contribution to the study of linguistics is sometimes called generative or transformational grammar. The concept is that all languages differ on the surface but that they are essentially

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alike in their deep structure. One of his key points is that while the words and the order of the words may change profoundly, all languages can express the same idea, such as "the sun rises in the east," in many ways. The semantic level is the same no matter how diverse the lexical qualities of the statements are.

Ultimately, this led Chomsky to postulate a language faculty in the brain that is found in people but not in animals. The fact that no animals possess language has led Chomsky's followers to suggest that evolution has somehow produced a "linguistic organ" that permits children to learn whatever language or languages are common to their environment. This, in turn, implies that people are not born with tabula rasa—with brains that have no content—but that they are hardwired in advance to acquire language. Chomsky's theory suggests a proposed single universal grammar that human brains begin with and by which they form individual languages. The deep structure is the same, but the surfaces—the words and the specific grammar of the given language—are diverse. All languages follow complex rules that originate in a universal grammar.

Chomsky's theories have been studied widely and with considerable interest, but not every linguistician accepts them. Most linguists feel that it is true that only people possess language but believe that this has to do with the various cognitive capacities of different portions of the brain combined with biological structures that permit humans to utter, hear, and distinguish meaning in distinctive sounds. In other words, some linguists see that the various systems in the human brain and body, which may have developed through evolution for other purposes, are uniquely appropriate for language also. There is no special language organ; rather there is a system of faculties that adapt to the production of language.

Chomsky's Rhetoric

The purpose of this piece is as a brief introduction to what Chomsky considers the most important current thinking in linguistics. Naturally, it focuses essentially on his theories and the researchers who have made progress working out the details. The structure of the piece is basic. It begins with a historic overview telling us that the study of language has been of concern for many centuries and that the result has been to declare it a "true 'species property'" (para. 2), which is to say that it is common to all in our species, *Homo sapiens*. As he says, quoting René Descartes (1596–1650), it marks "the true distinction between man and animal" (para. 2).

Chomsky introduces a technical term, the property of "discrete infinity" (para. 4), by which he means the process by which a limited number of discrete linguistic elements can be combined in infinite ways. The same property is true of our number system, which has discrete numbers that can be combined in infinite ways. Chomsky says this language property is "biologically isolated," which means it is not learned by children but rather it is something that "the mind already possesses" (para. 4).

One of the key rhetorical strategies Chomsky uses is metaphor, itself a high-level linguistic device. For example, he tells us that the "faculty of language can reasonably be regarded as a 'language organ' in the sense in which scientists speak of the visual system, or immune system, or circulatory system, as organs of the body" (para. 6). The power of this metaphor, comparing the ability to acquire language with the ability of organs to function in the body, is meant to be rhetorically convincing. Chomsky's basic claim is that language is acquired because the individual is uniquely equipped with a built-in biological mental faculty residing in the brain, there even before the baby-babble stage. Thus, the metaphor is not just a description of the faculty of language; it is also designed to convince us that the faculty exists.

Having established the language faculty, Chomsky connects it to our genes, which control all our organs and are the product of evolution. Interestingly, our genes also possess the quality of discrete infinity since they can rearrange themselves in infinite patterns, which is one reason DNA testing can identify individuals accurately. This part of his argument implies that evolution somehow produced the language faculty in us but not in other animals.

By paragraph 7, Chomsky is able to become more technical in his description and to suggest there are many ways to "investigate the genetically determined 'initial state' of the language faculty" (para. 7). He admits that it will take time and a great deal of research to clarify how genes create or modify the "initial state," but he explains that language is acquired by individuals as a result of the "initial state" (the language organ) in contact with experience. In this case, experience may consist of the actual language being spoken in the presence of the individual, whether it is Japanese, Chinese, English, or Spanish. If the deep structure of language is the same for all humans—the genetic "organ" must be universal—then all humans should be able to grow up learning any language. And Chomsky admits that his own children, were they to grow up in Japan, would speak Japanese. This, he suggests, proves "there is strong reason to believe that the initial state is common to the species" (para. 8).

The essay up to this point is clearly an argument structured to convince us of the truth of his research that establishes an inborn faculty in the brain produced by evolution that all healthy individuals possess at birth. That claim is bolstered by the analysis of the faculty of language as we know it in its expression. The fact that a child will learn any language just by growing up in an environment in which it is spoken is a powerful piece of evidence supporting the claim.

Once he feels this point is established, Chomsky introduces new terms. The phrase *infinite use of finite means* was first used by Wilhelm von Humboldt (1767–1835), and it connects with *discrete infinity*. Von Humboldt used the term in relation to language, noting that with a finite number of terms one could create an infinite number of combinations. Children, for example, can create an infinite number of sentences from even a limited number of words. They do not need to be taught to do so; they have a natural grasp of the grammar of their language that permits them to create sentences that may never have been uttered by anyone before. Chomsky takes this fact as further evidence of an inborn language faculty. He calls this ability generative grammar because a child can generate sentences without having been taught how. That child is not working from rote, or from memory, but from a creative ability that is inborn. Explaining how this is so in every language is a job for researchers.

It is in paragraph 19, however, that Chomsky introduces one of his most striking metaphors. It seems to be related to the computer and it echoes the idea of a hardwired system in the brain. He describes the "initial state" of language (with no words, no surface details) as a "fixed network connected to a switch box." Once that idea is clear, then it is just a matter of turning on the switches that will produce Japanese or Swahili or any other language. This is a proposal that Chomsky says will need a great deal of research to clarify, but he feels it is one of the most profitable directions of study.

Chomsky's views have been equally controversial and equally influential. He has tried to examine a human faculty that has fascinated us for millennia, and he has forced us to focus on our biology and our evolutionary development in order to begin to understand the issue.

PREREADING QUESTIONS: WHAT TO READ FOR

The following prereading questions may help you anticipate key issues in the discussion of Noam Chomsky's "New Horizons in the Study of Language." Keeping them in mind during your first reading should help focus your attention.

- What is discrete infinity?
- What is the initial state of language?
- Why is generative grammar important?

New Horizons in the Study of Language

The study of language is one of the oldest branches of systematic 1
inquiry, tracing back to classical India and Greece, with a rich and fruitful history of achievement. From a different point of view, it is quite young. The major research enterprises of today took shape only about forty years ago, when some of the leading ideas of the tradition were revived and reconstructed, opening the way to what has proven to be very productive inquiry.

That language should have exercised such fascination over the 2
years is not surprising. The human faculty of language seems to be a true "species property," varying little among humans and without significant analogue elsewhere. Probably the closest analogues are found in insects, at an evolutionary distance of a billion years. There is no serious reason today to challenge the Cartesian[1] view that the ability to use linguistic signs to express freely formed thoughts marks "the true distinction between man and animal" or machine, whether by "machine" we mean the automata that captured the imagination of the seventeenth and eighteenth century, or those that are providing a stimulus to thought and imagination today.

Furthermore, the faculty of language enters crucially into every 3
aspect of human life, thought, and interaction. It is largely responsible for the fact that alone in the biological world, humans have a history, cultural evolution and diversity of any complexity and richness, even biological success in the technical sense that their numbers are huge. A Martian scientist observing the strange doings on Earth could hardly fail to be struck by the emergence and significance of this apparently unique form of intellectual organization. It is even more natural that

[1] **Cartesian** A reference to the theories of René Descartes (1596–1650). *Discourse on the Method* (1637) is his most well-known work. He was early to discuss natural phenomena in mechanical terms.

the topic, with its many mysteries, should have stimulated the curiosity of those who seek to understand their own nature and their place within the wider world.

Human language is based on an elementary property that also seems 4
to be biologically isolated: the property of discrete infinity, which is exhibited in its purest form by the natural numbers 1, 2, 3, . . . Children do not learn this property; unless the mind already possesses the basic principles, no amount of evidence could provide them. Similarly, no child has to learn that there are three and four word sentences, but no three-and-an half word sentences, and that they go on forever; it is always possible to construct a more complex one, with a definite form and meaning. Such knowledge must come to us from "the original hand of nature," in David Hume's[2] phrase, as part of our biological endowment.

This property intrigued Galileo,[3] who regarded the discovery of 5
a means to communicate our "most secret thoughts to any other person with 24 little characters" as the greatest of all human inventions. The invention succeeds because it reflects the discrete infinity of the language that these characters are used to represent. Shortly after, the authors of the Port Royal Grammar[4] were struck by the "marvellous invention" of a means to construct from a few dozen sounds an infinity of expressions that enable us to reveal to others what we think and imagine and feel—from a contemporary standpoint, not an "invention" but no less "marvelous" as a product of biological evolution, about which virtually nothing is known, in this case.

The faculty of language can reasonably be regarded as a "language 6
organ" in the sense in which scientists speak of the visual system, or immune system, or circulatory system, as organs of the body. Understood in this way, an organ is not something that can be removed from the body, leaving the rest intact. It is a subsystem of a more complex structure. We hope to understand the full complexity by investigating parts that have distinctive characteristics, and their interactions. Study of the faculty of language proceeds in the same way.

We assume further that the language organ is like others in that its 7
basic character is an expression of the genes. How that happens remains

[2] **David Hume (1711–1776)** One of the most influential English philosophers; his *A Treatise on Human Nature* (1739) has been credited by the philosopher Jerry Fodor as a "founding document" of cognitive science.

[3] **Galileo Galilei (1564–1642)** Astronomer, mathematician, and philosopher of wide-ranging influence. Chomsky refers to his book *Dialogue Concerning the Two Chief World Systems* (1632). The two systems are the Copernican, which said the earth went around the sun, and the Ptolemaic, which said all heavenly objects circled the earth. Galileo's book was banned.

[4] ***The Port Royal Grammar* (1660)** Book that held that grammar was universal because it was a natural property of the mind.

a distant prospect for inquiry, but we can investigate the genetically determined "initial state" of the language faculty in other ways. Evidently, each language is the result of the interplay of two factors: the initial state and the course of experience. We can think of the initial state as a "language acquisition device" that takes experience as "input" and gives the language as an "output"—an "output" that is internally represented in the mind/brain. The input and the output are both open to examination: we can study the course of experience and the properties of the languages that are acquired. What is learned in this way can tell us quite a lot about the initial state that mediates between them.

Furthermore, there is strong reason to believe that the initial state 8
is common to the species: if my children had grown up in Tokyo, they would speak Japanese, like other children there. That means that evidence about Japanese bears directly on the assumptions concerning the initial state for English. In such ways, it is possible to establish strong empirical conditions that the theory of the initial state must satisfy, and also to pose several problems for the biology of language: How do the genes determine the initial state, and what are the brain mechanisms involved in the initial state and the later states it assumes? These are extremely hard problems, even for much simpler systems where direct experiment is possible, but some may be at the horizons of inquiry.

The approach I have been outlining is concerned with the faculty 9
of language: its initial state, and the states it assumes. Suppose that Peter's language organ is in state L. We can think of L as Peter's "internalized language." When I speak of a language here, that is what I mean. So understood, a language is something like "the way we speak and understand," one traditional conception of language.

Adapting a traditional term to a new framework, we call the the- 10
ory of Peter's language the "grammar" of his language. Peter's language determines an infinite array of expressions, each with its sound and meaning. In technical terms, Peter's language "generates" the expressions of his language. The theory of his language is therefore called a generative grammar. Each expression is a complex of properties, which provide "instructions" for Peter's performance systems: his articulatory apparatus, his modes of organizing his thoughts, and so on. With his language and the associated performance systems in place, Peter has a vast amount of knowledge about the sound and meaning of expressions, and a corresponding capacity to interpret what he hears, express his thoughts, and use his language in a variety of other ways.

Generative grammar arose in the context of what is often called 11
"the cognitive revolution" of the 1950s, and was an important factor in its development. Whether or not the term "revolution" is appropriate, there was an important change of perspective: from the study of

behavior and its products (such as texts), to the inner mechanisms that enter into thought and action. The cognitive perspective regards behavior and its products not as the object of inquiry, but as data that may provide evidence about the inner mechanisms of mind and the ways these mechanisms operate in executing actions and interpreting experience. The properties and patterns that were the focus of attention in structural linguistics find their place, but as phenomena to be explained along with innumerable others, in terms of the inner mechanisms that generate expressions. The approach is "mentalistic," but in what should be an uncontroversial sense. It is concerned with "mental aspects of the world," which stand alongside its mechanical, chemical, optical, and other aspects. It undertakes to study a real object in the natural world—the brain, its states, and its functions—and thus to move the study of the mind towards eventual integration with the biological sciences.

The "cognitive revolution" renewed and reshaped many of the 12
insights, achievements, and quandaries of what we might call "the first cognitive revolution" of the seventeenth and eighteenth century, which was part of the scientific revolution that so radically modified our understanding of the world. It was recognized at the time that language involves "the infinite use of finite means," in Wilhelm von Humboldt's[5] phrase; but the insight could be developed only in limited ways, because the basic ideas remained vague and obscure. By the middle of the twentieth century, advances in the formal sciences had provided appropriate concepts in a very sharp and clear form, making it possible to give a precise account of the computational principles that generate the expressions of a language, and thus to capture, at least partially, the idea of "infinite use of finite means." Other advances also opened the way to investigation of traditional questions with greater hope of success. The study of language change had registered major achievements. Anthropological linguistics provided a far richer understanding of the nature and variety of languages, also undermining many stereotypes. And certain topics, notably the study of sound systems, had been much advanced by the structural linguistics of the twentieth century.

The earliest attempts to carry out the program of generative gram- 13
mar quickly revealed that even in the best studied languages, elementary properties had passed unrecognized, that the most comprehensive traditional grammars and dictionaries only skim the surface. The basic properties of languages are presupposed throughout, unrecognized

[5] **Wilhelm von Humboldt (1767–1835)** German linguist who studied the Basque language and wrote about language in Java. He was among the first linguists to realize that languages had careful rules governing their structure and expression.

and unexpressed. That is quite appropriate if the goal is to help people to learn a second language, to find the conventional meaning and pronunciation of words, or to have some general idea of how languages differ. But if our goal is to understand the language faculty and the states it can assume, we cannot tacitly presuppose "the intelligence of the reader." Rather, this is the object of inquiry.

The study of language acquisition leads to the same conclu- 14
sion. A careful look at the interpretation of expressions reveals very quickly that from the earliest stages, the child knows vastly more than experience has provided. That is true even of simple words. At peak periods of language growth, a child is acquiring words at a rate of about one an hour, with extremely limited exposure under highly ambiguous conditions. The words are understood in delicate and intricate ways that are far beyond the reach of any dictionary, and are only beginning to be investigated. When we move beyond single words, the conclusion becomes even more dramatic. Language acquisition seems much like the growth of organs generally; it is something that happens to a child, not that the child does. And while the environment plainly matters, the general course of development and the basic features of what emerges are predetermined by the initial state. But the initial state is a common human possession. It must be, then, that in their essential properties and even down to fine detail, languages are cast to the same mold. The Martian scientist might reasonably conclude that there is a single human language, with differences only at the margins.

As languages were more carefully investigated from the point of 15
view of generative grammar, it became clear that their diversity had been underestimated as radically as their complexity and the extent to which they are determined by the initial state of the faculty of language. At the same time, we know that the diversity and complexity can be no more than superficial appearance.

These were surprising conclusions, paradoxical but undeniable. 16
They pose in a stark form what has become the central problem of the modern study of language: How can we show that all languages are variations on a single theme, while at the same time recording faithfully their intricate properties of sound and meaning, superficially diverse? A genuine theory of human language has to satisfy two conditions: "descriptive adequacy" and "explanatory adequacy." The grammar of a particular language satisfies the condition of descriptive adequacy insofar as it gives a full and accurate account of the properties of the language, of what the speaker of the language knows. To satisfy the condition of explanatory adequacy, a theory of language must show how each particular language can be derived from a uniform initial state under the "boundary conditions" set by experience.

In this way, it provides an explanation of the properties of languages at a deeper level.

There is a serious tension between these two research tasks. The search for descriptive adequacy seems to lead to ever greater complexity and variety of rule systems, while the search for explanatory adequacy requires that language structure must be invariant, except at the margins. It is this tension that has largely set the guidelines for research. The natural way to resolve the tension is to challenge the traditional assumption, carried over to early generative grammar, that a language is a complex system of rules, each specific to particular languages and particular grammatical constructions: rules for forming relative clauses in Hindi, verb phrases in Swahili, passives in Japanese, and so on. Considerations of explanatory adequacy indicate that this cannot be correct. 17

The central problem was to find general properties of rule systems that can be attributed to the faculty of language itself, in the hope that the residue will prove to be more simple and uniform. About fifteen years ago, these efforts crystallized in an approach to language that was a much more radical departure from the tradition than earlier generative grammar had been. This "Principles and Parameters" approach, as it has been called, rejected the concept of rule and grammatical construction entirely: there are no rules for forming relative clauses in Hindi, verb phrases in Swahili, passives in Japanese, and so on. The familiar grammatical constructions are taken to be taxonomic artifacts, useful for informal description perhaps but with no theoretical standing. They have something like the status of "terrestrial mammal" or "household pet." And the rules are decomposed into general principles of the faculty of language, which interact to yield the properties of expressions. 18

We can think of the initial state of the faculty of language as a fixed network connected to a switch box; the network is constituted of the principles of language, while the switches are the options to be determined by experience. When the switches are set one way, we have Swahili; when they are set another way, we have Japanese. Each possible human language is identified as a particular setting of the switches—a setting of parameters, in technical terminology. If the research program succeeds, we should be able literally to deduce Swahili from one choice of settings, Japanese from another, and so on through the languages that humans can acquire. The empirical conditions of language acquisition require that the switches can be set on the basis of the very limited information that is available to the child. Notice that small changes in switch settings can lead to great apparent variety in output, as the effects proliferate through the system. These are the general properties of language that any genuine theory must capture somehow. 19

This is, of course, a program, and it is far from a finished product. The conclusions tentatively reached are unlikely to stand in their 20

present form; and, needless to say, one can have no certainty that the whole approach is on the right track. As a research program, however, it has been highly successful, leading to a real explosion of empirical inquiry into languages of a very broad typological range, to new questions that could never even have been formulated before, and to many intriguing answers. Questions of acquisition, processing, pathology, and others also took new forms, which have proven very productive as well. Furthermore, whatever its fate, the program suggests how the theory of language might satisfy the conflicting conditions of descriptive and explanatory adequacy. It gives at least an outline of a genuine theory of language, really for the first time.

Within this research program, the main task is to discover and clarify the principles and parameters and the manner of their interaction, and to extend the framework to include other aspects of language and its use. While a great deal remains obscure, there has been enough progress to at least consider, perhaps to pursue, some new and more far-reaching questions about the design of language. In particular, we can ask how good the design is. How close does language come to what some superengineer would construct, given the conditions that the language faculty must satisfy? 21

The questions have to be sharpened, and there are ways to proceed. The faculty of language is embedded within the broader architecture of the mind/brain. It interacts with other systems, which impose conditions that language must satisfy if it is to be usable at all. We might think of these as "legibility conditions," in the sense that other systems must be able to "read" the expressions of the language and use them as "instructions" for thought and action. The sensorimotor systems, for example, have to be able to read the instructions having to do with sound, that is the "phonetic representations" generated by the language. The articulatory and perceptual apparatus have specific design that enables them to interpret certain phonetic properties, not others. These systems thus impose legibility conditions on the generative processes of the faculty of language, which must provide expressions with the proper phonetic form. The same is true of conceptual and other systems that make use of the resources of the faculty of language: they have their intrinsic properties, which require that the expressions generated by the language have certain kinds of "semantic representations," not others. We may therefore ask to what extent language is a "good solution" to the legibility conditions imposed by the external systems with which it interacts. Until quite recently this question could not seriously be posed, even formulated sensibly. Now it seems that it can, and there are even indications that the language faculty may be close to "perfect" in this sense; if true, this is a surprising conclusion. 22