N

Noam Chomsky

Samuel Sayantan Mandal
Concordia University, Montreal, Quebec, Canada

Introduction

Professor Noam Chomsky, born December 7, 1928, as Avram Noam Chomsky to middle-class Jewish working parents in East Oak Lane, Philadelphia, is an American linguist, cognitive scientist, logician, philosopher, and political activist. Often referred to as "the father of modern Linguistics," "the world's most important intellectual," etc., Chomsky has made pioneering contributions to multiple fields, including Linguistics (a field he is primarily credited with founding in its modern form), Logic, Abstract Algebra, Artificial Intelligence and Machine Learning, Formal Languages, Cognitive Science, Cognitive Psychology, Philosophies of Mind and Language, and Anarchist and Syndicalist political theories, and is considered to be one of the pillars of Analytic Philosophy, particularly in the Rationalist tradition. Ranked as "among the eight most cited scholars, ever," Chomsky is currently Professor Emeritus of Linguistics at the Massachusetts Institute of Technology, where he has held office for over half a century, and Laureate Professor of Linguistics at The University of Arizona.

Early Life

Avram Noam Chomsky was born on December 7, 1928, in the East Oak Lane neighborhood of Philadelphia, Pennsylvania (Lyons 1978). His father was William "Zev" Chomsky, an Ashkenazi Jew originally from Ukraine who had fled to the United States in 1913. Having studied at Johns Hopkins University, William went on to become school principal of the Congregation Mikveh Israel religious school and in 1924 was appointed to the faculty at Gratz College in Philadelphia. Chomsky's mother was the Belarusian-born Elsie Simonofsky (1904–1972), a teacher and activist whom William had met while working at Mikveh Israel (Lyons 1978).

Chomsky's primary education was at Oak Lane Country Day School, an independent Deweyite institution that focused on allowing its pupils to pursue their own interests in a non-competitive atmosphere. It was here, at the age of 10, that he wrote his first article, on the spread of fascism, following the fall of Barcelona to Francisco Franco's fascist army in the Spanish Civil War. At the age of 12, Chomsky moved on to secondary education at Central High School, where he joined various clubs and societies and excelled academically but was troubled by the hierarchical and regimented method of teaching used there. During the same time period, Chomsky attended the Hebrew High School at Gratz College. From the age of 12 or 13, he identified more fully with anarchist politics (Lyons 1978).

T. K. Shackelford, V. A. Weekes-Shackelford (eds.), *Encyclopedia of Evolutionary Psychological Science*,
https://doi.org/10.1007/978-3-319-16999-6_630-1

Education

In 1945, Chomsky, aged 16, embarked on a general program of study at the University of Pennsylvania, where he explored philosophy, logic, and languages and developed a primary interest in learning Arabic. Living at home, he funded his undergraduate degree by teaching Hebrew. However, he was frustrated with his experiences at the university and considered dropping out and moving to a kibbutz in Mandatory Palestine. His intellectual curiosity was reawakened through conversations with the Russian-born linguist Zellig Harris, whom he first met in a political circle in 1947. Harris introduced Chomsky to the field of theoretical linguistics and convinced him to major in the subject. Chomsky's B.A. honors thesis was titled "Morphophonemics of Modern Hebrew" and involved his applying Harris's methods to the language (Boeckx and Piattelli-Palmarini 2005). Chomsky revised this thesis for his M.A., which he received at Penn in 1951; it would subsequently be published as a book (Boeckx and Grohmann 2013; Boeckx and Piattelli-Palmarini 2005). He also developed his interest in philosophy while at university, in particular under the tutelage of his teacher Nelson Goodman. From 1951 to 1955, Chomsky was named to the Society of Fellows at Harvard University, where he undertook research on what would become his doctoral dissertation (Barsky 1998; Lyons 1978; Otero 1994).

Basic Ideas I. Science

Plato's Problem

In Linguistics Chomsky holds a position akin to that of Isaac Newton in Physics during and after enlightenment (Dawkins 2015). Evolutionary Psychologist Steven Pinker remarked, "Whether or not Chomsky provided all the right answers, Linguistics and Cognitive Science will always be dominated by the questions Noam Chomsky has asked." In stark contrast to the behaviorist zeitgeist fashionable in the 1940s and early 1950s, Chomsky brought about a Kuhnian paradigm shift in the study of the human mind, which he claimed is the cradle of language, by directly linking it to mainstream biology and arguing that the adult mind with all its knowledge systems is a biological organ, much like the human digestive system (Chomsky 1959a). Indeed, years after Chomsky kickstarted what came to be known as the *cognitive revolution*, immunologist Niels Jerne compared the human digestive system to Chomsky's theory of Grammar ("Niels K. Jerne – Nobel Lecture," n.d.).

Perhaps the best introduction to Chomsky's thoughts and works in Linguistics is manifest in the introductory lines of *Syntactic Structures*:

> Syntactical investigation of a given language has as its goal the construction of a device for producing the sentences of the language under investigation.... The ultimate outcome of [such] investigations should be a theory of linguistic structures in which the descriptive devices utilized in particular grammars are presented and studied abstractly.... One function of this theory is to provide a general method for selecting a grammar for each language, given a corpus of this language. (Chomsky 1957/2002)

For Chomsky one of the fundamental issues in rationalist epistemology concerns the problem of "creativity" (Aarsleff 1970; Bever 2009; Chomsky 2009). Namely, how is it that human beings whose contact with nature is so brief and transient come nonetheless to learn so much of it? Applying this general observation to linguistic phenomena, Chomsky asks how is it possible for a child to instinctively create new utterances to which it has never been exposed specifically, based only on exposure to a fraction of the possible sentences of a language. Indeed, Chomsky points out that the total number of possible sentences in a language is *infinite* and that this infinity (discrete infinity: infinite number of sentences, with discrete whole numbers of words in them, but never fractions of words) itself is made possible by the fact that users can create completely novel utterances at any given instance (Chomsky 2007). Thus, Chomsky observes, the child placed in its natural environment is exposed to a limited amount of experience, and yet what the child comes to possess in the form of knowledge from this limited environment far exceeds its experiences. This gap between what the child is

given, and what it comes to possess, and the problems concerning how the child is able to bridge this gap, Chomsky terms *Plato's Problem*, after the classical philosopher who first observed this tendency of the Sapiens' minds (Chomsky 1959b).

This program contrasts, and falsifies, Skinnerian Behaviorism (Chomsky 1959a) which held that language is a result of associations between words. Because users can create completely novel associations between words in the form of new sentences, such a theory is automatically rendered untenable. While Chomsky's devastating criticism of Skinner's Verbal Behavior (Chomsky 1959a, 1967) is often taken to be the most important cause behind the decline of radical behaviorism, the idea that prior constraints on learning space and hypotheses impose severe limits on what can be inductively learned has since spread beyond psychological nativism as evidenced in Wolpert's *No Free Lunch* (Wolpert and Macready 1997).

Principles and Parameters

Chomsky's proposed methodology to scientifically approach Plato's problem was first proposed in *Aspects of the Theory of Syntax* (Chomsky 1965), also known as *standard theory*, and later revised as the *standard extended theory* which was developed and revised throughout the 1970s during the early years of generative grammar. Within this framework it is hypothesized that the child is genetically endowed with an innate hypotheses space, a format for possible grammars of natural language, and the child in the process of growth and development constructs a number of possibilities to externalize. The selection of the ultimate externalized grammar is hypothesized to be the one that selects the least number of rules, that is, one that manifests a minimal implementation of the system to achieve discrete infinity.

However, since this approach proved too cumbersome, Chomsky and colleagues soon proposed a newer alternative in the form of *the principles and parameters approach (PnP)* (Chomsky 1993, 1995). First introduced by Chomsky in *Lectures on Government and Binding*, *or The Pisa Lectures* (Chomsky 1981/1993), and later elaborated further in *Knowledge of Language* (Chomsky 1986), PnP hypothesizes that the architecture of language is constructed through *Principles*, invariant and constant across languages, and *Parameters*, also universal but adjustable in individual languages, thereby yielding linguistic diversity. One set of principles, for example, restricts the possible distribution of pronominals, reflexives, and anaphors in sentences of the world's languages to specific predetermined hierarchical spots in phrasal structures and is referred to as *the binding principles.* All languages adhere to binding principles, either explicitly or vacuously. Parameters on the other hand, such as the PRO-drop parameter, are hypothesized to have individual preferences for how they are implemented in individual languages. For instance, Japanese is a PRO-drop language in which certain categories of pronouns are overtly omitted because they are inferable otherwise from the structure. Other languages may choose to not drop the PRO. While parameters themselves are posited to be innate, that is the total number of possible parameters are finite and limited to an universal set, not all languages must instantiate all parameters, unlike principles.

Minimalist Program and the Biolinguistic Link

The system of grammars described above is often referred to as *transformational* and *generative*, or *transformational-generative* (Chomsky 1959b, 2002), because in this framework, grammar is composed of a system of *representations* in the mind, manipulated computationally by innately specified *syntactic rules*, thus deriving structures from elementary primitives (generative) and then modifying existing structures to derive newer ones (transformation). The system can thus be conceptualized in a twofold fashion with regard to how it makes possible and then implements languages in human brains. Traditionally, theories of grammar are *computational-representational* (C-R) (Embick and Poeppel 2015; Poeppel et al. 2012) theories which assume that the human mind

is genetically endowed with a set of innate concepts and symbols (representations) which are used as constituents by algebraic computational rules to create bigger and more complex structures. Thus, the meaning (or semantic content) of a structures is derived not *just* from the combined semantic contents of its constituents but also from (a) how the constituents are combined in a given structure to make larger constituent structures and (b) how constituents and (c) constituent structures in the larger structure relate and refer to each other. For instance, in the sentence

[[John told Mary$_i$][that [Bill loves her$_i$]]]

[John, Bill, Mary, love, her, that] form a set of constituents, while [John told Mary] and [Bill loves her] form larger constituent structures capable of being complete utterances on their own but indeed are combined within a larger structure to derive our example sentence. The meaning of this final superstructure, while dependent on the meanings of the constituents, is also contingent on how individual constituents, for instance, "Mary" and "her" relate to each other. Since "Mary" and "her" carry the same index "i," we know that the "her" that "Bill" loves is in fact "Mary." Chomsky's main hypotheses is that such constituent structures, the indices (such as "i"), and the rules that compute and implement them are part of the innate mechanisms of our brains. Thus, "Mary," the intended listener of our example utterance, can listen to "John" produce the same and, in spite of the fact that linear acoustic speech signals contain neither brackets nor indices, can mentally recompute the intended structure, and therefore the intended meaning, reflexively and without ever being explicitly aware of the fact that she is doing so (Chomsky 1959b, 2007; Hauser et al. 2002; Hauser and Spelke 2004).

In the 1990s, Chomsky's research focused on what he called the "minimalist program" (Chomsky 1995), which attempted to demonstrate that the brain's language faculties are the minimum faculties that could be expected, given certain external conditions that are imposed on us independently. In other words, Chomsky began to place less emphasis on something such as a universal grammar embedded in the human brain and more emphasis on a large number of plastic cerebral circuits. And along with this plasticity would come an infinite number of concepts. The brain would then proceed to associate sounds and concepts, and the rules of grammar that we observe would in fact be only the consequences, or side effects, of the way that language works. Analogously, we can, for example, use rules to describe the way a muscle operates, but these rules do nothing but explain what happens in the muscle; they do not explain the mechanisms that the brain uses to generate these rules.

The specifics of the biolinguistic program (Bever 2003, 2009; Boeckx and Grohmann 2013; Boeckx and Piattelli-Palmarini 2005; Chomsky 2005b, 2007; Medeiros et al. 2016) concern approaching every aspect of language – sound, meaning, and structure – as functions of an organ of the mind. While Chomsky emphasizes that language itself is a function of the biological organ known as *the faculty of language*, a module of the human cognitive system devoted to language specifically, the precise nature and architecture of this module remains a hotly debated avenue of research. Chomsky himself has continuously revised his position on this issue, with the latest version of his theory making a distinction between *the faculty of language-Narrow* (FLN: the core architectural component of the faculty not attested anywhere else in the living world) and *the faculty of language-Broad* (FLB: the aspects of the faculty portions of which may be present in other animals) (Hauser et al. 2002, 2014; Hauser and Spelke 2004). In these versions of his work, along with his colleagues like Mark Hauser, Tecumseh Fitch, and Massimo Piatelli-Palmarini et al. (Berent 2016; Boeckx and Piattelli-Palmarini 2005; Medeiros et al. 2016; Piattelli-Palmarini 2013), Chomsky has claimed that the core component of FLN specific just to humans is a single operation called *MERGE*, which merely takes two constituents and creates an unordered set by merging them together. It is claimed that MERGE meets computational minimality requirements by creating simple unordered sets instead of ordered ones.

$$\textbf{MERGE}\ \mathbf{x},\mathbf{y} - - \rightarrow [\mathbf{x}, \mathbf{y}] (= [\mathbf{x}, \mathbf{y}])$$

The details of how a formal operation like MERGE is to be implemented on a biological substrate, how such hierarchical structures get linearized, and what kind of neural structures and operations are involved in doing so constitute the core of biolinguistic research carried out interdisciplinarily by psychologists, linguists, neurobiologists, and evolutionary biologists.

Politics and Activism

Robert Barsky's biography, called *Noam Chomsky: A Life of Dissent* (Barsky 1998), and published by MIT Press in 1997, contains a useful discussion of his early years and the development of his politics. Today, Chomsky is distinguished for his innovative work in the field of linguistics, but his wider public renown is due to his authoritative voice as a critic of US foreign and domestic policy (Antony and Hornstein 2003; Otero 1994).

Turning to sociopolitical issues, we mainly observe Chomsky working on ideas of free development, not unlike those underpinning his approach to language as some have claimed. Chomsky's main idea is that humans do not need much in the way of external control in order to form wholesome and productive social relationships. He has routinely advocated for a society moving toward voluntary organizations and eliminating as much as possible the structures of hierarchy and domination (Herman and Chomsky 2002; Lyons 1978). Chomsky views rigid hierarchical control by structures of authority as antithetical to the nature of human development and argues that such outside interference has a stifling effect on intellectual development and social life in general. While Chomsky maintains that social institutions are a necessity, he rigidly opposes the hierarchical organization of such structure and the privatization of means of production that leads to concentration of wealth. Chomsky argues that concentration of wealth leads to concentration of power (Chomsky 2014).

Chomsky's critique of the state is mainly directed toward his own (Chomsky 2003b). He turns his analytical anger on Washington's cruel maltreatment of third world people, its ruthless foreign policies and disregard for international law, its abuse of US citizens and residents, and its violations of democracy and Constitutional Law (Chomsky 1999; Herman and Chomsky 2002). He argues that this pattern of behavior became dominant after World War II left the US state in a position of unchallengeable power. It was US aggression against Vietnam that has usually been identified, including by Chomsky himself (Chomsky 2003a, 2005a), as the dominating factor that lead Chomsky to become a critic of US foreign policy. His essays on the war are collected in *American Power and the New Mandarins* (Chomsky 2003a) and in *At War With Asia* (Chomsky 2005a); these books remain relevant today. Chinese readers may have a particular interest in what he has written about the Vietnam War since the US invasion was justified in the USA and around the world by the need to contain China.

Chomsky's logic is to apply universal principles when judging the behavior of government. In particular, Chomsky argues that unlike relativist norms often employed by politicians, an unjust course of action is wrong irrespective of who it benefits. That is, "if its wrong when they do it, then its wrong when we do it." In *Hegemony or Survival: America's Quest for Global Dominance* (p. 4) he writes, "Those who are seriously interested in understanding the world will adopt the same standards whether they are evaluating their own political and intellectual elites or those of official enemies. . . . Truth [is] veiled by intentional ignorance that makes a crucial contribution to ongoing crimes"(Chomsky 2004). He regards the quest for truth and the struggle against official evasion and mendacity as the "responsibility of intellectuals" (Chomsky 1967).

References

Aarsleff, H. (1970). The history of linguistics and Professor Chomsky. *Language, 46*, 570–585.

Antony, L. M., & Hornstein, N. (Eds.). (2003). *Chomsky and his critics*. Malden: Blackwell Pub.

Barsky, R. F. (1998). *A life of dissent*. Cambridge, MA: MIT Press.

Berent, I. (2016). Commentary: "an evaluation of universal grammar and the phonological mind" – UG is still a viable hypothesis. *Frontiers in Psychology, 7*, 1029.

Bever, T. (2003). Deconstructing functionalist explanations of linguistic universals. In *Formal approaches to function in grammar'* (pp. 333–352). Amsterdam: John Benjamins.

Bever, T. G. (2009). Remarks on the individual basis for linguistic structures. In *Of minds and language: A dialogue with Noam Chomsky in the Basque Country* (pp. 278–299). Oxford University Press.

Boeckx, C., & Grohmann, K. K. (2013). *The Cambridge handbook of biolinguistics*. Cambridge, UK: Cambridge University Press.

Boeckx, C., & Piattelli-Palmarini, M. (2005). Language as a natural object – linguistics as a natural science.

Chomsky, N. (1959a). A review of BF Skinner's verbal behavior. *Language, 35*(1), 26–58.

Chomsky, N. (1959b). On certain formal properties of grammars. *Information and Control, 2*(2), 137–167.

Chomsky, N. (1965). *Aspects of the theory of syntax*. Oxford: MIT press.

Chomsky, N. (1967). A special supplement: The responsibility of intellectuals. Retrieved from https://www.nybooks.com/articles/1967/02/23/a-special-supplement-the-responsibility-of-intelle/.

Chomsky, N. (1986). *Knowledge of language: Its nature, origin, and use*. New York: Praeger.

Chomsky, N. (1993). *Lectures on government and binding the Pisa lectures*. Berlin: Mouton de Gruyter. Retrieved from http://site.ebrary.com/id/10597900.

Chomsky, N. (1995). *The minimalist program* (Vol. 28). Cambridge, Massachussets: Cambridge University Press.

Chomsky, N. (1999). *Profit over people: Neoliberalism and global order* (Seven Stories Press, 1st ed.). New York: Seven Stories Press.

Chomsky, N. (2002). *Syntactic structures*. Berlin: Mouton de Gruyter.

Chomsky, N. (2003a). *American power and the new mandarins*. Penguin: Penguin Books India.

Chomsky. (2003b). For reasons of state. Penguin: Penguin Books India.

Chomsky, N. (2004). *Hegemony or survival: America's quest for global dominance*. London: Penguin Books.

Chomsky, N. (2005a). *At war with Asia*. Edinburgh: AK Press.

Chomsky, N. (2005b). Three factors in language design. *Linguistic Inquiry, 36*(1), 1–22. https://doi.org/10.1162/0024389052993655.

Chomsky, N. (2007). Biolinguistic explorations: Design, development, evolution. *International Journal of Philosophical Studies, 15*(1), 1–21.

Chomsky, N. (2009). *Cartesian linguistics: A chapter in the history of rationalist thought*. Cambridge, UK: Cambridge University Press.

Chomsky, N. (2014). *On anarchism*. London: Penguin Books.

Dawkins, R. (2015). *Brief candle in the dark: My life in science*. Random House.

Embick, D., & Poeppel, D. (2015). Towards a computational (ist) neurobiology of language: Correlational, integrated and explanatory neurolinguistics. *Language, Cognition and Neuroscience, 30*(4), 357–366.

Hauser, M. D., & Spelke, E. (2004). Evolutionary and developmental foundations of human knowledge. *The Cognitive Neurosciences, 3*, 853–864.

Hauser, M. D., Chomsky, N., & Fitch, W. T. (2002). The faculty of language: What is it, who has it, and how did it evolve? *Science, 298*(5598), 1569–1579.

Hauser, M. D., Yang, C., Berwick, R. C., Tattersall, I., Ryan, M. J., Watumull, J., et al. (2014). The mystery of language evolution. *Frontiers in Psychology, 5*, 401.

Herman, E. S., & Chomsky, N. (2002). *Manufacturing consent: The political economy of the mass media*. New York: Pantheon Books.

Lyons, J. (1978). *Noam Chomsky* (Rev. ed.). Harmondsworth: Penguin Books.

Medeiros, D. P., Piattelli-Palmarini, M., & Bever, T. G. (2016). Many important language universals are not reducible to processing or cognition. *Behavioral and Brain Sciences, 39*, e86. https://doi.org/10.1017/S0140525X15000722.

Otero, C. P. (Ed.). (1994). *Noam Chomsky: Critical assessments*. London: Routledge.

Piattelli-Palmarini, M. (2013). Biolinguistics yesterday, today, and tomorrow. In Boeckx, C., & Grohmann, K. K. (Eds.) *The Cambridge handbook of biolinguistics* (pp. 12–21). Cambridge University Press.

Poeppel, D., Emmorey, K., Hickok, G., & Pylkkänen, L. (2012). Towards a new neurobiology of language. *The Journal of Neuroscience, 32*(41), 14125–14131.

Wolpert, D. H., & Macready, W. G. (1997). No free lunch theorems for optimization. *IEEE Transactions on Evolutionary Computation, 1*(1), 67–82. https://doi.org/10.1109/4235.585893.