ISSN: 1817-6798 (Print)
Journal of Tikrit University for Humanities
available online at: www.jtuh.org/

Formalism: Noam Chomsky and his Generative Grammar

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***Keywords*:**
Formalism,
Noam Chomsky,
Generative Grammar,
Syntactic Theory.

A R T I C L E I N F O

Article history:
Received 17 Apr. 2022
Accepted 22 May 2022
Available online 15 Jan 2023
E-mail t-jtuh@tu.edu.iq

A B S T R A C T

For six decades generative concept dominated syntactic theory. The work on generative rules cannot simplify the concepts of the normative principles of the rules, but rather that the subject matter of the rules be considered normative. Grammar is a way to express phrases in their correct form. Grammar rules are accurate by the way they are formulated in a specific type that does not include generative grammar. The term "generative" is directly related to Noam Chomsky's tradition of grammatical research. This term and its formalities and terminology have been studied extensively within the Chomsky tradition.

DOI: http://dx.doi.org/10.25130/jtuh.30.1.1.2023.22

الشكلية: نعوم تشومسكي وقواعده التوليدية

م ايمن عادل محمود /وزارة التربية / مديرية تربية ديالى

الخلاصة:

لمدة ستة عقود، سيطر المفهوم التوليدي على النظرية النحوية. حيث لا يمكن للعمل على القواعد التوليدية وتبسيط مفاهيم المبادئ المعيارية للقواعد، بل بالأحرى أن موضوع القواعد يعتبر معياريًا. وبما ان

القواعد النحوية هي طريقة للتعبير عن الجمل في شكلها الصحيح. فان القواعد النحوية دقيقة بالطريقة التي تمت صياغتها في نوع معين لا يتضمن القواعد النحوية. حيث يعتبر مصطلح "توليدي" يرتبط ارتباطًا مباشرًا بتقليد نعوم تشومسكي في البحث النحوي. تمت دراسة هذا المصطلح وشكلياته ومصطلحاته على نطاق واسع ضمن تقليد تشومسكي.

الكلمات المفتاحية : الشكلية, نعوم تشومسكي, القواعد التوليدية, النظرية النحوية

Introduction

Formalism or generative structure is the third principal grammatical class of the 20th era. This assumption is principally influenced by Noam Chomsky and his theory of generative structure, that was 1st exhibited in Syntactic Compositions (1957). Not only grammar and syntax, but also literary instruments such as meters and tropics are used (Chomsky, 1965). The systematic approach eliminates the relevance of the historical, biographical, and cultural contexts of a text. Logic and mathematics' school of philosophy called "formalism" only relies on methods for treating strings over a small inventory of irrelevant symbols. Simply put, it sounds pointless: logic and arithmetic can definitely be anything, not meaningless games alone. But there is an argument about formalism: it is directed at ensuring the documentation of the event is formulated in a manner that is free of any questions that indicate meaning or reality (Chomsky, 1966).

Formalism refers to literary theory's critical approaches, then, if the proof suits what is semantically tautological, it can be seen that data actually do something in the syntactic context. That is, preferably we would like to see all that is logically found from valid premises and everything that is logically true to be true. To demonstrate that without a circularity this has been done, we need first of all an evidence system that does not consider sense or truth and also a way of showing that it only confirms all the logical truths. We want a clear and full

evidence approach in technical terms. Linguists working in the sense of generative grammar aim to establish a general theory that defines the rules and laws governing the structure of individual languages and the general laws and principles that regulate all natural languages. Basic subject areas include phonology (studies of language sound patterns), morphology (structure and importance study), syntax (scope study), and semantics (the study of linguistic meaning).

A characteristic of generative grammar is the opinion that people have an inherent 'language faculty' and that the basic concepts of human language embody this faculty's intrinsic characteristics. Children learn certain laws to determine the tone and meaning of the words in their mother tongue. These laws interact in complex ways, and in a very short duration and with little to no obvious effort the whole system is understood.

The most likely reason for the success of learners of the human language is that they have access to a very restrictive set of standards, which do not necessarily (or allow) several choices to be explored for a specific purpose, but instead limits them to a few potential guidelines for choosing if appropriate, without any justification (Chomsky, 1966). Because the values that describe the class of practicable laws and sets of rules are not mastered, these principles are considered to act as preconditions of language education and to form an integral part of any ordinary child's inherent ability. From this view, the concepts we aspire to discover are part of the genetic potential of all human beings. Therefore, to understand the mental structure of the human race, it is necessary to understand these concepts. It is only possible to ask questions about the various languages or the manner in which both languages are similar after the expansion of the grammars of different languages have been formulated. Therefore, a great deal of our work is committed to language detail research (for example, the interpretation of English verb phrase

ellipsis, the morpho-semantics of the Greek perfect, the syntax of multiple questions, or prosodic phrasing in Korean). The ultimate objective is not only to understand these records, but to use them as a means of understanding the faculty of the human language as a whole.

(Marr 1982) proposed that the only way to achieve an understanding of complex information-processing systems (like those found in the brain) is to simultaneously analyze them at three levels of analysis: a computational level, where one formally defines the problem the system is solving, specifying which inputs must map to which outputs; an algorithmic representational level, where one spells out a method for arriving at an output.

Generative grammar standardly proposes to analyze language cognition at the first two levels, leaving the problem of how such a system would actually be implemented in the brain open-leaving open, thus, the nature of the link between the algorithmic-representational theory and the physical implementation. Specifying and evaluating any such link is a difficult problem in itself-call it the implementation mapping problem.

Pater's (2019) proposal for closer interdisciplinary integration between generative grammar and neural network research immediately runs up against the implementation mapping problem. Neural network models-while not brains, or even brain models-are complex systems whose behavior cannot be understood just by inspecting their internal state. By contrast, representations, proposed in linguistic theories are designed so that human researchers can write and read them. They are not directly comparable with the internal states of neural networks, which are simply long sequences of numerical parameters.

Pater writes:

‘When neural network modeling is integrated with grammatical formalisms…, we may be able to go further in assessing the extent to which grammatical representations can be learned from experience’.

The sketch Pater outlines is missing a component critical to an integration of this kind. If the network is seen as the implementation, then a fundamental part of the work of ‘integration’ with grammatical formalisms consists in solving the mapping problem. In principle, feed forward networks can implement any grammar, or any formal representation, or approximate it with arbitrary precision- with the basic units of representation implemented as vectors in some numerical parameter space, and with operations manipulating these representations corresponding to information flowing through the network, changing its state (Hornik 1991, Leshno et al. 1993, Lin et al. 2017). This makes them attractive for simulating grammatical learning.

Formalism according to Noam Chomsky

In the mid-1950s Noam Chomsky introduced Formalism of context-free grammar, which was often known as a special kind of grammar (which he called phrase-structure grammars). Context-free grammar offers a simple, reliable framework to explain the methods by which phrases are formed from smaller blocks in any natural language, thereby naturally capturing the "block structure" of sentences. Its simplicity allows for thorough mathematical analysis of formalism. The natural language syntax, together with transformation laws, was illustrated in Chomsky's generative grammar system. The proposal to draw up a grammar consisting of explicit rewriting was discontinued in the later work (e.g. Chomsky, 1981). Other systems, for example, Generalized phrase structure grammar (Gazdar et al., 1985) was taken as the system for the whole syntax, avoiding

transformations of context-free grammars. A formal grammar is a collection of teaching rules for strings in a formal language (sometimes simply called grammar). The rules explain how you can construct strings that are correct according to the language syntax in the language alphabet. The sense of the strings or what they can do with is not represented in a grammar in any way alone. Formal language theory is a branch of applied mathematics which is the topic of research, formal grammars and languages. It refers to informatics of theory, linguistics of theory, formal semantics, mathematical logic and others.

A formal grammar is a collection of rewriting rules and a "start symbol" from which rewriting must begin. A grammar is thus generally known to be a generator of languages. However, occasionally it can also be used to decide whether a string belongs to the language or it grammatically wrong. Parsing involves the identification of the utterance (a string in a natural language) by splitting it down to a series of symbols, and both of these are evaluated against the grammar of the language. An emphasis on inherent universal grammar (UG) and an ignorance about the position the stimuli play may differentiate the linguistic formalism derived from Chomsky. The use of vocabulary according to this status is only important when the naïve constructs are activated. With respect to history, Chomsky's stance is a continuation of the basic concepts of Saussure's structuralist philosophy (Givón, 2001). Innateness and relaxation formalized ideas largely align with the cognitive resistance to clinical psychology.

Generative grammars according to Noam Chomsky

Avram Noam Chomsky is an American linguist, philosopher, logician, political critic, activist and cognitive scientist. He is an institute lecturer and

professor (emeritus) in MIT, where he serves for over 50 years, in the Department of Linguistics & Philosophy. He has written on war, politics, mass media and is the author of over 100 books in addition to his linguistic writing. His work has influenced subjects such as informatics, mathematics and psychology. Chomsky is the founder of contemporary linguistics and a significant figure in analytical theory.

He is known by Chomsky's hierarchy, universal grammar theory, and the Chomsky-Schützenberger the Orem as creator or co-creator. This concept is related to the grammar analysis tradition started by and influenced by Noam Chomsky's work. This concept is often understood quite loosely to refer only to Chomsky's work. It is used here more widely, even though his formalities and terminologies come explicitly from Chomsky, for work generally within the Chomsky tradition.

The discovery of the great German linguist Wilhelm von Humboldt (noted independently for over 100 years) that there are infinitely many well-constructed phrases in every natural language is one of Chomsky's most important observations. The fact that any restriction that one might place on the duration of sentences would arbitrary immediately follows:

Any so-called longest English sentence S would be two terms shorter than "I said S," which would be certainly perfect if S is. The grammar, on the other hand, should be finite as a definition of a language. How do we explain the endless? What do we do? In response to this issue, Chomsky inspired by earlier work in mathematics of logic and the basis of computer science, suggested that we think of grammar as a way of combining phrases according to precise rules, which is to "generate" well formed phrases. If certain grammar rules can refer to their own outputs, so finite grammars can create infinite languages (in scientific English, if certain rules are "contractual").

Taking a very easy (non-linguistic) example to demonstrate this. There are infinitely many well-formed expressions in the ordinary Arabic numbering system used to represent numbers (one per number) made out of 10 symbols, namely, the numbers "0" through "9." For numbers which mean positive integer the following rules can be written with a simple grammar:

- Each of the digits 1, 2, 3, 4, 5, 6, 7, 8, and 9 is a numeral.
- If N is any numeral, then N0 is a numeral.
- If N is any numeral, then NN is a numeral.

One of many possible formalizations of this would be the following:

N→1 N→5 N→9

N→2 N→6 N→N0

N→3 N→7 N→NN

N→4 N→8

This small grammar creates the infinite 'language' of numerals that denote positive integers and it includes laws that are recursive. This small grammar may be translated to mean 'can consist of' (namely, the last two). The word "grammar" implies for most people a regulatory undertaking which determines what constitutes the correct use of the language. Many trained English speakers, for instance, in the following sentence will describe a minimum of five supposed grammar mistakes:

1. I hope we can quickly find out with whom to talk. But American English speakers still understand that (1) in the ordinary debate will be absolutely appropriate and normal. In reality, the so-called "right" alternative (2) will be a complicated and impaired way of voicing one's thoughts.

1. I hope we can find out who to talk to quickly.

For this prescriptive conception of grammar, contemporary linguistics have no use. Linguists like the awareness of English more, which makes it possible for mother-tongues to assess as fully appropriate and less normal.

The prescriptions in conventional grammar are efforts to compel speakers from other classes on the habits of one region, class, race or age. They may be of interest, but they reveal very little about the essence of language to sociologists, historians, and political researchers. English, which is an integral part of all culture, is a natural phenomenon. Linguistics is about language research in general as well as scientific studies of life and living organisms in general. In this scientific viewpoint, the rules of prescriptive grammar are for the linguistic area, as the race standards of the American Kennel Club are for Biology. Therefore, linguists refer to the word "grammar," which refers to the structural characteristics of a natural development of the language and which language speakers have learned without specific training. These are in large part properties of language, although some of them are taught in foreign language, which is not even stated in conventional grammars. They include information about word order, for example, that, if the statement is not appropriate, we can, and must appear in (1) in that order. Facts regarding the correct types of terms are often given, for instance in context, which makes the sentence inappropriate by substitution of figure (1). In comparison, "grammar" requires morphology and morph syntax by linguists in more scientific jargon. The word can also be more generally understood as referring to concepts surrounding linguistic expressions (semantics) and/or sound language patterns (phonology).

Facts about individual languages should be derived, as far

as possible, from general principles applicable to all languages.

Information specified in the grammars of specific languages should be kept as low as possible. In part, this is driven by traditional statistical and empirical considerations:

both more general and more parsimonious theories than less general ones. However, psychological considerations are also partially driving it – in particular Chomsky's "stimulus poverty argument."

Perhaps the most distinctive feature of generative tradition is the creation of a general grammatical principle "universal grammar," as Chomsky dubbed it. Although there is comprehensive cross-linguistic comparison of other language traditions which leads to significant hypothesis about universal language characteristics, generative grammar treats these issues in different ways. In particular, generational grammar universals appear to be articulated as abstract grammatical organization concepts that cannot be explicitly observed in the linguistic evidence. Their identification and research require usually a dynamic mix of analytical findings, methodological hypotheses and inferential procedures. This is in stark contrast to more universals like Greenberg's (1963) that are more straightforward in their observation and even later on, the typologies of languages. Characteristic though not general, generative grammarists (Katz and Postal, 1991) believe their hypotheses to be psychological. In this regard, Chomsky was especially outspoken, saying that "a specific generative grammar is a theory that is concerned with the state of mind/brain of the individual who knows a particular language" (Chomsky, 1986).

Chomsky proposed in particular that a rich theory of universal grammar is important to take into consideration the probability of learning of the language. He

argues that the most striking truth about human languages is the difference between knowledge

and experience and that Bertrand Russell's question is true especially in the field of language:

> How is it that people who have small, personal and minimal connections with the world are still in a position to know the things they do?

The fact that any ordinary person is a language with no obvious effort or clear guidance means that people are genetically blessed with a "mentals organ." Whilst Chomsky stressed the topic of learning, others suggested that generative grammar study is in other directions related to psychography. It is also known as the "argument against the poverty of stimuli." Bresnan (1978) argued, for instance, that generative grammar can be an integral part of linguistic philosophy – mental and systematic mental processes.

In this context, it is worth explicitly drawing the comparison between Marr's program and the reflection about the cognitive reality of grammars that happens in generative linguistics. We usually tell students that the series of steps carried out on paper to derive a sentence, or a phonologicalsurface form, are not supposed to be a theory of the steps carried out in the mind-no theory of the algorithm is implied by the theory of the grammar-but that the representations (trees, feature bundles, and so on) are supposed to be cognitively interpreted; the derivational steps are interpreted as a means of stating which representations are licit structural descriptions.

Chomsky (1995) best articulates this interpretation: in his criteria for descriptive adequacy of grammars characterizing competence, he includes the criterion that the grammars yield psychologically correct structural descriptions

(representations)-not merely the (computational) criterion that they pick out all and only the grammatical sentences of the language. He does not, however, require that a grammar give us any notion of how parsing is done on-line (an algorithm). 3 Under this view, the 'operation' merge (·, ·) is an implicational relation in a system of representations (if X and Y are represented, then so is merge (X, Y)), not a theory of a real-time processing step. The theory, under this view, is not purely computational-level (this would only be concerned with defining the correct set of utterances) nor a complete theory at the algorithmic-representational level (because this would also include proposals of algorithms for generation and recognition).

Some researchers have, however, interpreted derivational steps as making empirically testable assertions about how structure is built up in time (Miller and Chomsky, 1963; Berwick and Weinberg, 1984; Phillips, 1996), while other authors have suggested that the only reasonable place to situate formal grammars is at the computational level, specifying the function computed by the mind and nothing more (Matthews, 1991). Under that view, two theories that predict the same set of possible words, sentences, or sound-meaning pairs would be equivalent; their rules, representations, and derivations are purely instrumental.

Regardless of how we use generative grammars, the spelled out reflection is what is important. For doing everyday linguistics, it may not be all that important to regularly draw up the list of which elements of the formal theory are meant to be interpreted as 'real' and which are not. This exercise is critical for doing learning in neural networks to see if the networks learn 'the same thing' as we have proposed in some theory, because it serves to explicitly delimit the success criterion. Second, of course, Marr's program asks us to spell out the details of the 'how do I recognize it' theory, making it clear that this is not trivial. The opacity of

neural network representations poses a central challenge to any attempt to use them to implement grammars.

Post-Chomskian Anthropological Linguistics

In 1957 Noam Chomsky published his groundbreaking work Syntactic Structures (Syntactic Structures, 1965), which from then on contributed to his diverging linguistic anthropology from linguistics as a discipline. The linguists were drawn away from the descriptive study of phonology and morphology and from the emphasis on syntax as a central official structure of speech by Chomsky's theoretical orientation. Though greatly modified after 1957, Chomsky's rules-based transformative generative grammar was the fundamental model for formal linguists. In most of their studies on the exploration of innate language structure comprehension and the regular use of English only, systematic linguists largely avoided language practice. In the end, systematic linguistics is treated as a branch of cognitive science under Chomsky's guidance. Chomsky argued that the syntactic structures found by linguists were direct emanations of the neuronal structures of the brain.

Anthropologist languages started to research the language used in social and cultural settings around the same time, away from researching formal linguistic systems and the study into the historical relations between language groups centered on the major field of phonology and morphology. The growing interest in the study of linguistic communication as a "unique human" phenomenon was an important development.

Discussion

To the extent that such applications motivate theoretical work, considerations of computational tractability are likely to play an increasingly

important role in theory construction. The formality is based on the rules set by a language (skill) and not on the use of this set when generating phrases (performance). The abstract ideal language speaker decides competence. Competence. Therefore, analytical evidence or business analysis is not available. Whereas language is regarded as a "tool" with versatility in functionalist approaches, it is called "a set of sentences" in formalism.

Even the advocates of other hypotheses, including the non-transformation approach drawn up in the previous section, normally regard Chomsky's study as the starting point for their suggestions. Chomsky and his teachers and associates were primarily responsible for the early years of generative grammar. But the number of generative grammars has risen exponentially over the decades. The difference between knowledge and success contributed to Chomsky's systematic approach. The structure of the language is the formal approach, which emphasizes the deductive properties of the language system: searching for trends within the linguistic elements (generational rules, algorithms). It is impressive that Chomsky has maintained his dominant position in these circumstances. This certainly would improve. It seems possible. Given a crowded university labour market, more and more language speakers are searching for work in the industry. This places emphasis on the field to concentrate further on its theory applications. In the advancement of natural language technology, the most apparent use of generative grammar is computer programming that deals with the languages of human beings, e.g. rendering machine translations, extracting knowledge from text files, summarizing texts and the like. These applications often include an overview of how people currently use language instead of exclusively relying on what is grammatically feasible. The analysis of real-world data is made even simpler by the availability of vast text files online, which can be sampled and examined using

machine software not previously available. This already has a pronounced influence on the forms of data used in theoretical statements by generative grammar. This future improvement need not be upsetting. Generative grammar has shifted the foundations of generative grammar one of several upheavals. These upheavals were followed by intense discussion of new structures and vibrant rivalry. The outcome was – and will continue to be – a robust line of research which enhanced our understanding of human linguistic skills considerably.

Conclusions

Despite the numerous generative grammar theories that have been suggested, one man, Noam Chomsky, has dominated the field throughout his history. He was the founder, his most prolific innovator, and his lead has always pursued the mainstream of generative science. Anthropologist languages started to research the language used in social and cultural settings around the same time, away from researching formal linguistic systems and the study into the historical relations between language groups centered on the major field of phonology and morphology. The growing interest in the study of linguistic communication as a "unique human" phenomenon was an important development. The structure of the language is the formal approach, which emphasizes the deductive properties of the language system: searching for trends within the linguistic elements (generational rules, algorithms). In the advancement of natural language technology, the most apparent use of generative grammar is computer programming that deals with the languages of human beings, e.g. rendering machine translations, extracting knowledge from text files, summarizing texts and the like.

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