# Generative Grammar in Thomas Kuhn's Paradigm and Structure of Scientific Revolution

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*Abstract:* This research aims to justify that generative grammar, an approach of linguistic study started by Nome Chomsky, is a Kuhnian paradigm. By reviving previous academic writings, two methods, or two sets of components that were thought to be present in Kuhnian paradigms, were employed: the first set included symbolic generalization, model, value, and exemplar; the second set included methodological component, theoretical component, and empirical components. The research also discussed the scientific revolution between generative grammar and North American Descriptivists, which came before generative grammar, as well as the scientific revolution between generative grammar and construction grammar, which came after generative grammar. For the events of emerging of generative grammar and construction grammar, though one of them may even be referred to as a "revolution", and both of them may also share some feathers of the Kuhnian scientific revolution, they both appear to have fallen short of fully completing the paradigm-replacement process. It was decided that the recent history of linguistics might not fit under Kuhn's original framework of scientific revolution.

*Keywords:* linguistic development, generative grammar, Thomas Kuhn, paradigm, scientific revolution

## 1.    Introduction

Thomas Kuhn's *the Structure of Scientific Revolution,* published about five decades ago, made long-lasting influences on many different scientific fields. The theological framework that is based on it is vastly employed for analyzing developments of academic disciplines, and its vocabularies are widely adopted by many scholars from different fields of study.

For many scholars from the field of linguistic study, including those that will be mentioned later, they consider that the generative approach of linguistic analyzing, started by Noam Chomsky in the late-1950s, has at least several shared features with "paradigm" in Thomas Kuhn's term, which was introduced in his *the Structure of Scientific Revolution* (*SSR*) [1-3]. The appearing of generative grammar, along with the following event that it (at least partly) replaced the previous dominant approach of linguistic field, is also similar to Kuhnian "scientific revolutions". "Chomskyan revolution" was the title of a 1972 article, and was the name of a book from 1980; both of them addressed that event [4].

The most well-known descriptions for "paradigm" and "scientific revolution" were in Thomas Kuhn's *SSR*. In this research, it will review post studies that debated whether generative grammar fits

to Thomas Kuhn's description of paradigm and whether its emerging results in a scientific revolution. Two methodologies in the latter section will be presented to justify the claim that generative grammar is a Kuhnian paradigm.

## 2. Methodology, Kuhnian "Paradigm" and "Scientific Revolution" in *the Structure of Scientific Revolution*

Generally speaking, in Kuhn's original discussion of the history of science in his *SSR*, he identified most scientific activities (like operating researches, inventing practical applications, etc.) are guided by traditions provided by a dominant school of certain academic field; the dominant school that he refers as "paradigm" [2]. Those tradition includes rules, methodologies, values, example-problems and example-solutions, etc., that can guide latter scientific activities; and the activities under the guide of paradigm are referred to as activities of "normal science" [2]. Those activities of normal science are usually accumulation of details for the paradigm, or "puzzle-solving" of problems whose results are expected to be foreseen by the traditions of the paradigm [2].

If, for example, unexpected results come from the process of problem-solving or other kinds of activities under a paradigm, it creates "anomalies" of problems that might be unable to be solved by traditions of a paradigm [2]. M If the latter activities make anomalies fit into the paradigm (though it might make minor changes in the paradigm or sub-paradigms), anomalies disappear (as it fit into the paradigm, and become what can be predicted by the traditions of the paradigm), and the paradigm remains still; but if anomalies continue to exist and constantly attract attentions to the exposed problems of the paradigm [2]. It further generates "crisis" which leads to even more questioning on the validness of the dominant paradigm [2]. As the crisis cannot be solved by scientific traditions provided by the paradigm, and if there emerges a scientific achievement outside the paradigm which is able to explain the existing of unexpected anomalies that the previous paradigm cannot explain, solve the problem that led to the crisis that the previous paradigm cannot solve; based on that achievement, with its innovative traditions that at least partly different from the traditions of previous paradigm (as it is outside of the previous paradigm), it leads to the funding of a new paradigm to dominant the scientific field [2]. For Kuhn, every new paradigm are emerged with a certain scientific achievement; and this kind of events that new paradigm replacing the old paradigm are referred by him as "scientific revolution" [2].

## 3. Methodology, Two Methods for Determining "Paradigm"

When Kuhn was presenting "paradigm" in his *the Structure of Scientific Revolution*, the definition that he presented was relatively vague; thus, it caused Kuhn himself, during the following years, to publish further works to clarify the definition of "paradigm" and other relative definitions; which caused further modifications of those concepts [1]. Even the terminology uses were changed for Kuhn's latter works; for example, "paradigm" was the original term he used in *SSR*; and it became a word that Kuhn was trying to avoid using after 1974; later, he even introduced a new terminology "disciplinary matrix" in order to clarify the definition and other terminologies that relates to it [1,2]. But the term "paradigm" seems to have already made huge influence in academical vocabularies-uses and seems still being a widely used terminology for today. So the earlier parts, as well as the following discussions of this research will mainly use the term "paradigm", instead of "disciplinary matrix" or "discipline".

Another effect was that, for those who discussed or criticized Kuhn's theoretical framework of "paradigm", they might have had different definitions of the term depending on their own understanding and the published works that were available at the time, and, therefore, generated different standards for determining whether a scientific school was a Kuhnian paradigm. In 1976, a

few years after Kuhn published *SSR*, Percival discussed whether generative grammar was a Kuhnian paradigm for linguistics [3]. By the Kuhnian definition that was available in his time, which has relatively more reflection to the original description from Kuhn's *SSR*, he identified four components to form a "paradigm": "symbolic generalization" (which is the most abstract and fundamental expressions and laws in a logical form that can be used in further specific activities under the guild of a paradigm), "model" (which provides an ontological framework for activities of a paradigm), "value" (which is evaluation standards of a paradigm to determine "available problems for scientific scrutiny" , "admissible problem", "legitimate problem-solution", and to justify their methodology of practicing research), and "exemplar" (of typical problems and solutions that act as standards for followers of the paradigm to practice in future activities) [2,3].

A more recent discussion from 2013 by Stephan Kornmesser, however, employed another more complicated and more clarified set of components, which was introduced by Gerhard Schurz in 1998; it includes theoretical component, methodological component, and empirical component. [1]

The Theoretical component, consisting theory-core and theory-specializations, acts "to explain and to predict phenomena" during future activities of the paradigm. [1] Theory-core acts as the fundamental theoretical assumptions, including basic principles and the most fundamental laws of the paradigm (which is similar to "symbolic generalization" that was earlier mentioned) and model idea (which is similar to "model" that provides ontological framework for the paradigm, and to explaining and clarifying during the operation). [1] Theory-specializations act to "strength the theory-core in a logical sense". [1]

Methodological component is similar to "value" in the previous method, which acts as criteria of researches. [1] It is further clarified as three kinds of elements: methodical elements, epistemic elements, and normative elements. [1] Methodical elements are criteria for instructing investigating during scientific researches or other kinds of activities under a paradigm; epistemic elements are epistemological assumptions for evaluating the accessibility of objects and operating conditions of those operations; normative elements are the interests of researches or operations that are expected to be achieved by those activities. [1]

Empirical component includes three domains of applications of a paradigm: paradigmatic application, intended application, and programmatic application. [1] The paradigmatic application is similar to "exemplars", which are provided to be the typical applications and problem-solving examples of a paradigm; it also motivates further developments and extensions of the paradigm and generates new applications, examples, and new standards for the paradigm. [1] The intended applications are those applications that can be accessed by means of paradigm during a certain time point. [1] The programmatic applications are those that are expected to be accessible for the paradigm. [1]

In order to determine whether generative grammar is a paradigm, the latter section will use both sets of components that are thought to make up a Kuhnian paradigm, and, therefore, capable of determining whether a scientific school is a Kuhnian paradigm. If generative grammar contains feathers that meet all components of any of the two sets, generative grammar is a Kuhnian paradigm, at least according to that method.

## 4.　　Result, Generative Grammar as "Paradigm"

The school of generative grammar was started by Noam Chomsky in the late-1950s after he published *Syntactic Structures*. [1] The generative approach of linguistic study emphasizes the ability to create new sentences based on sets of grammar rules that allow users of certain languages to do so. [5] Chomsky considers there is a set of finite rules of language that can potentially generate infinite sentences from it. [5] For example, by the grammar rule that allows adding adjectives, there can be a sentence like "there is a long river"; and there can be sentence like "there is a long, blue river"; there

can be theologically infinite newly generated sentence by keeping adding adjectives. What makes those grammar rule exists, as Noam Chomsky assumed, is the innate predisposition of language knowledge that is shared by every person since their birth. By that innate predisposition, it follows that the underlying level of every kind of language, or the "deep structure" of every language, is generally similar to each other, and it makes every person have the "universal grammar" from the very beginning of their life to learn and use languages. [5] As Chomsky made the appearing of late-50s, it influenced other researchers and scholars of linguistic study to commit to generative grammar, as Kuhn expected; also, as Kuhn expected, they practiced activities based on the assumptions made by Chomsky, under the methodology that he presented, aiming the goals that Chomsky considered as important. [2]

The shared considerations for the followers of generative grammar, like the assumption of the innateness of universal grammar and the ability to create an infinite quantity of sentences by finite rules, were expressed and justified in logical form; therefore, it is a symbolic generalization in the method that employed by Percival. [3] People who commit to generative grammar hold the belief that language is made up of strings of elements that are generated by grammar; this belief created a framework for members to share during normal scientific activities, an ontological model from generative grammar. [3] Generative grammar also emphasizes simplicity and generality, and does not emphasize comprehensiveness of coverage or accuracy of methods; this implies the value of it. [3] "Text-books such as Langacker 1972 provide problem-solutions" for the paradigm; thus, they are the exemplars of the paradigm. [3] Therefore, generative grammar has the fore components, which, according to what was employed by Percival, a paradigm will need to have. [3] Therefore, generative grammar is a paradigm based on this method.

It also can be identified as a paradigm according to another more recent set of components to identifying paradigms employed by Kornmesser. For example, since Chomsky assumed the finite rules (or syntax) for generating potentially infinite sentences, in other words, infinite meanings (or lexicons), he identified two different elements, namely: syntactic-rules and lexical-items. He further assumed that mind functions in divided "function-special modules", and, therefore, syntax and lexicon function in disjunctive modules of the brain. [1] All of those assuming from generative grammar's view, including the previously mentioned assuming of nativism (that assumes syntactic-rules are come from human innate knowledge), are fundamental assumptions for later activities or applications under the generative grammar paradigm; therefore, they are theory-cores and are part of the theoretical component of generative grammar. [1]

For the methodological component, rationalism is one of the significant promises of all arguments made in the paradigm; and therefore, it is a fundamental epistemic element of the methodological component. [1] Additionally, Chomsky distinguished competence of language (which is the linguistic knowledge a person has) and performance of language (which is the performance of actually using language); as generative grammar places emphasis on the language's core grammar, its interest of research lies in the domain of linguistic competence". [1] The descriptive adequacy, according to Chomsky, accords with the ability from native intuitions to distinguish well-formed sentences and not well-formed sentences; explanatory adequacy accords with the ability to explain the innate structure of sentences by adopting universal rules of language; the goal of generative grammar, as Chomsky claimed, is to investigate the universal rules; therefore, the target of researchers of generative grammar is explanatory adequacy. [1] [5] What is mentioned above are all interests of researches, in other words, normative elements of methodological component of generative grammar.

For empirical components, language acquisition is an obvious application of generative grammar. [1] And since the goal of generative grammar is to investigate universal rules between languages, comparing between languages is necessary for applications of generative grammar; therefore, typological comparing is another empirical component. [1]

## 5. Discussion, Chomskyan Revolution as "Scientific Revolution"

According to Kuhn's original consideration, a paradigm and a scientific revolution—along with the paradigm-replacement that occurred during the revolution—are almost like a bi-conditional relationship with each other: (with the exception of the first paradigm of an academic field that has no previous paradigm to be replaced,) if a scientific revolution occurs, a paradigm is likely to follow; if there is a new paradigm, its funding is likely to come with a scientific revolution. "Each scientific revolution corresponds to a paradigm, and vice versa". [3] "Thus a revolution uniquely determines the character of the paradigm which is adopted in its aftermath." [3] The scientific activities under a paradigm are called "normal science", or "mature science", according to Kuhn. [2] At least understood by Percival, in order to be called "mature science", it has to be a dominant school of that scientific field, and be universally agreed by people of the field; and as one paradigm be universally agreed upon, there left no room for another paradigm.

In order to discuss the replacement of generative grammar, replacing the paradigm before it, there needs to be a scientific school of linguistics before generative grammar that is able to be considered as the Kuhnian paradigm. The group of scholars who were influential in field of linguistics before generative grammar (at least in the US) was called "North American Descriptivists". [6] And they followed the "structuralism" approach of linguistic study. [5]

Structuralism has its roots in the concept of language from Ferdinand de Saussure, who was a leading finger of linguistic study; and mainly by teaching, he did his dedication during the years of end of 19th century and beginning of 20th century, after he became a lecturer in 1881 and a full-professor in 1896. [5][7] He emphasized the approach that focuses on the structures and relationships between elements of language (for example, the logic of a sentence is a structure), rather than its contents or the element itself (for example, an object norm in a sentence, which is the name for a certain object, is a content). [5] This approach was succeeded by the American linguistic group, North American Descriptivists, in the early 20th, with major members like Leonard Bloomfield, Martin Joos, and Charles Hockett. [5] For those descriptivists, the way they practice scientific activities has certain features that a Kuhnian paradigm should have: they had succeeded model from Saussure, namely, the notion of identifying the concept of language as a "system of relations" of each element of language; their methodologies were collecting data, "establish(ing) observable regularities of form within their data sets", and "describe the distribution of each element", which also reflected that model. [5] Structuralism, with descriptivists as followers, whose members were significantly influential during the time, also made a large population of practitioners of the linguistic community commit to that paradigm.

Noam Chomsky's 1957 publication of *Syntactic Structures*, however, marked the beginning of the Chomskyan revolution and the funding of generative grammar for the latter half of the 20th century. [5] *Aspect of the Theory of Syntax*, which was published in 1965, was the "decisive break with the Descriptivists" at that time. [5] As earlier paragraphs mentioned, compared to those descriptivists, rather than to collect finite sets of linguistic data, Chomsky emphasized activities that focus on generating of grammatical sentences a language can generate. [5] In other words, generative grammar provides a value for determining the goals of its scientific activities, which acts as part of its scientific traditions, which is different compared to the scientific traditions provided by the previous paradigm.

Another common phenomenon a new paradigm can bring, according to Kuhn, is that the new paradigm comes with certain achievement that are largely recognized by practitioners of the field and let them commit to the newly founded paradigm. [2] The published work of Chomsky during 1957 and 1965 can be achievements that made the recognition in the field of linguistic study. His 1965 work did not just made impact on linguistic study; it also influenced other academical areas of human curiosities field of social science. [8] Chomsky himself became popular after the mid-60s, according

to the source from 1972,and his name was "a vogue word in intellectual circle". [9] The achievement leads to a gape between a new paradigm and a previously existing paradigm. [3] Of their differences in paradigm traditions, the Chomskyan framework moved away from the post-Bloomfieldian framework. [3] The newly emerged paradigm leads to a division between the followers of the old paradigm and followers of the new paradigm, which is another typical phenomenon. [2] There was a conflict between the followers of descriptivists and followers of the approach of generative grammar; there were writings from the early-70s about exchanging-insulting between followers of those new and old paradigms. [3]

It seems that Chomskyan revolution brought phenomena that largely shared with the Kuhnian scientific revolution, but what caused the controversy was actually the non-science part, or social part, of the generative grammar paradigm. At least understood by Percival, for non-science part, a revolution should brings a paradigm that is roughly universally agreed by practitioners of its scientific field. [3] The dominant school of linguistics, the generative grammar failed to be. [3] According to Percival's understanding, it even be required to be the "belief systems shared by all the practitioners of a scientific discipline". [3] In Percival's 1976 writing, it informed that many linguists in his time (1970) still tended to use theoretical frameworks other than generate grammar, including the structuralism approach, systemic grammar approach, string analysis approach, and European structuralism etc.; and followers of generate grammar also divided into sub-paradigms that was competing with each others. [3] Therefore, as Percival concluded, the study of linguistics during the 70s was more similar to the pre-paradigm stage in Kuhn's term, when there was not even one school to become mature science and to dominate its scientific field. [3] By Kuhn's original description in *SSR*, it is more commonly seen when practitioners of the scientific field generate their own new paradigms to respond to recognized crisis of their old paradigm; at least according to that point of time, non of those new paradigms that generated by those practitioners has the dominant status in that field, and none of them eventually become a paradigm. [2]

As Chomsky from the US made his impact on the study of linguistics with generative grammar in 50s, there was another school of linguistics with a considerably different approach in 1980s Britain: systematic functional grammar; represented by a British scholar, Michael Halliday, has its influence lasted to today. [10] And it seems that not only did generative grammar did not totally replace its previous paradigm; generative grammar also did not totally being replaced by paradigm after it. Generative grammar coexists with what Kornmesser concluded as "construction grammar" for 25 years. [1] Key point of construction grammar is that all elements, or constructions of sentences, contain forms(or syntax) and meanings (or lexicon); in other words, they are assumed to have syntax-lexicon-continuum. This is one of theoretical components differences between the two paradigms: for generative grammar, as mentioned, they assumed disjuncture of lexicon and syntax; however, constructions of language are assumed to be learned inductively from experiences of language using for construction grammar. [1] In contrast to the inductivism of construction grammar, generative grammar assumes nativism, based on the innate language knowledge assumption. It follows that construction grammar's methodological component calls for usage-basedness and empiricism rather than the rationalism, which is a methodological component of generative grammar. Actually, Chomsky was criticized for moving too quickly from the empirical level to the deductive one. [5]

To justify the existing coexisting phenomenon of generative grammar and construction grammar, one obvious fact is their shared time period. For construction grammar, it includes works from writers like George Lakoff, Ronald Langacker, and Michael Tomassello, whose works were published from the late 1980s to early 2000s. [1] For generative grammar, its influences and discussions, including its criticizes, lasted to recent years. [5] More importantly, they have largely shared empirical components, i.e., goals of operating of both paradigms, though they have largely different

methodological and theoretical components; for both paradigms, they all work on language acquisition and topological investigations. [1]

During the time period of coexisting of the two paradigms, besides those strong holders of each paradigm, there might be practitioners who are familiar with both paradigms. During their scientific activities, which paradigm's tradition should be used depends on which is more suitable. [1] For example, in the case of analyzing idioms, rather than the general rule that is shared within the whole language, a considerable quantity of idioms come with their own rules and meaning, and a considerable quantity of idioms are not based on the denoted meaning of words they contain. [1] For generate grammar, they might just exclude "idioms from the domain of intended applications". [1] But for construction grammar, they consider those elements of idioms are also self-contained form-meaning-parings; therefore, being acceptable to be analyzed within the paradigm. [1]

Not just the part of Chomskyan revolution, even larger part of the recent history of development of linguistic study seems not to share the pattern that Kuhn considered; rather, it is more common to see that traditions of different paradigms exist in the same time-point and it is hard to find a paradigm that dominant the field. It is, again, more similar to the "pre-paradigm" period, or the short time period right after the vast recognition of the crisis, when participators were inventing their own paradigm for dealing with crisis. [2]

## 6.    Conclusion

In conclusion, generative grammar can be considered as a Kuhnian paradigm according to the two methods employed by Percival and Kornmesser. Though writings from a few years after the beginning of generative grammar and from recent years tend to use the word "revolution," it did not consequent paradigm-replacement that Kuhn expected to happen in his description of scientific revolution. Instead, the historical pattern of scientific revolution that Kuhn justified seems not just inappropriate for Chomskyan revolution but also not appropriate for other appearing of new paradigms in the recent history of linguistics. Due to the limited amount of previously published material that has been evaluated in this research, it is now possible to analyze the history of science using other developed Kuhnian frameworks of scientific revolution or other theological frameworks that better incorporate recent linguistic history. Such theological frameworks may be sought out in further study, or one may be created based on earlier frameworks.

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