THE KUHNIAN ASPECTS OF THE CHOMSKYAN SCIENTIFIC PARADIGM

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Abstract. *This paper analyzes Chomsky's system of grammatical description seeking elements that might prove that his approach, started in 1957 with the publication of Syntactic Structures, actually marked a scientific "leap" in the sense that Thomas Kuhn described 'a scientific revolution'. The author considers the latest, level-free, developments in Chomsky's theory as similar to his earlier work and analyzes the internal structure of his theory up to the appearance of the Government and Binding approach.*

Key Words: *Chomsky, Kuhn, transformational-generative grammar, scientific revolution, paradigm, empiricism, rationalism.*

When Noam Chomsky's first book, *Syntactic Structures*, came out in 1957, no one, including the author, expected that only a year later, in 1958, a reviewer would write about it saying that if Chomsky's book did only a tenth of what it could do "it will have accomplished a Copernican revolution" (Voegelin 1958: 229)[1]. We should note the particularly strong and significant term *revolution* here. That there was something new in the Chomskyan approach was beyond doubt and one could witness a distinguished British linguist C.E. Bazell remarking that after Chomsky's book "linguistics will never be the same" (cf. Newmeyer 1980: 19)[2]. Not only linguists talked about a Chomskyan revolution; John Searle (1972)[3] and Lawrence Sklar (1968)[4] used the same term too. The conclusion seemed inescapable though: after the publication of *Syntactic Structures*, in the late fifties and throughout the sixties, and the better part of the seventies, linguistics

[1] Voegelin, C. F. (1958) Review of Noam Chomsky, Syntactic Structures (The Hague: Mouton, 1957). *International Journal of American Linguistics* 24.229-231
[2] Newmeyer, F. J. (1980) *Linguistic Theory in America: The first quarter of transformational generative grammar.* New York. Academic Press.
[3] Searle, J. (1972) *Chomsky's Revolution in Linguistics*. In Harman (1982). Harman, G., ed. (1982). *On Noam Chomsky: Critical Essays*. Amherst, MA, University of Massachusetts Press
[4] Sklar, R. (1968) "Chomsky's Revolution in Linguistics." In Otero, *Noam Chomsky* 3: 27 - 37. Otero, Carlos P. ed. *Noam Chomsky: Critical Assessments*. 4 vols. London: Routledge, 1994.

'underwent a Chomskyan revolution' and as P.H.Matthews said "ever since we are supposed to be working within the new paradigm of generative grammar "(1974: 216).[5]

What are, then, briefly, the components of the new linguistic paradigm? First of all, instead of the taxonomic and descriptive method of structuralist linguistics, the Chomskyan model offered a strategy of unraveling the time-honored philosopher's distinction between the superficial sentence-structure and the deep or logical structure. In the new model of transformational generative grammar (TG), the sentence is represented at different levels where the only level representing the surface structure is the phonetic level, whereas the phonological, syntactic and semantic levels embody the deep structure. Such a structural dichotomy enables TG to explain ambiguous sentences of the following type: *John is easy to please; John is eager to please.* According to the traditional taxonomic approach, these two receive the same structural description in terms of grammatical categories because both *easy* and *eager* belong to the same part of speech – adjectives. However, there is an evident difference between the above sentences which the taxonomic theory could not account for. According to TG, although the superficial phrase marker will be the same for both, their underlying, deep structure phrase marker will be different. Apart from this advantage in terms of *symbolic generalizations* (Thomas Kuhn's term), TG also offers a superb way of dealing with some possible taxonomic *ad hoc auxiliary hypotheses* in connection with the above sentences. Namely, a taxonomy-minded, structurally-oriented linguist might say that the ambiguity could be resolved in her/his model *if* a distinction were made between *intentional* and *non-intentional* adjectives (*eager vs. easy*). TG shows that this cannot be true because the same logical disparity may be found in the following pair: *The sugar is easy to dissolve; The sugar is slow to dissolve* (see Katz 1971: 66)[6]. Thus we have an issue where neither *easy* nor *slow* are intentional. Hence the only way to explain the difference is by postulating the levels of deep and surface structures. TG also enables the researcher to explain the logical implications which arise from the pairs: a. *John is easy to please* and b. *John is eager to please*. The implications here are that a. *one pleases John easily* and b. *one pleases John eagerly*. It is evident that implication (b) is not true and this fact can be handled *only* if some deeply-rooted language mechanism is postulated. Thus, contrary to Wittgensteinian doubts about ever unveiling the language disguise of logical form, TG sets up the grounds for studying logical form (LF) as part of sentence grammar.

If we view TG as a new scientific paradigm in the Kuhnian sense[7], then it ought to have the elements of a paradigm: symbolic generalizations, a value-system, exemplars and the ontological model. Keith Percival made a fine analysis back in 1976, and his analysis is still valid, regardless of the significant changes in TG which occurred meanwhile[8]. Thus, if we look for *symbolic generalizations* the rules of generative grammar (the base and transformational rules of the classical TG approach), which are internal to it, qualify nicely. Even though the transformation which maps some phrase structures onto some other phrase structures has almost disappeared in the version of the *Govern-*

[5] Matthews, P.H. (1974), *Morphology: an Introduction to the Theory of Word-Structure*. Cambridge University Press.

[6] Katz, J. J. (1971), *Linguistic Philosophy: The Underlying Reality of Language and Its Philosophical Import*, London, George Allen & Unwin Ltd.

[7] Kuhn, T.S. (1970), *The Structure of Scientific Revolutions*, Second Edition, Chicago, Chicago University Press; prior to it was: Kuhn, T.S. (1957), *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought*, Cambridge (Mass.), Harvard University Press, reprinted in 1985.

[8] Percival, W. K. (1976), 'The Applicability of Kuhn's Paradigms to the History of Linguistics', *Language* 52, 285-294.

ment and Binding Theory[9], the only remaining transformation (*Move–X*) does represent a symbolic generalization[10]. The *value-system* in TG has the features of simplicity and generality. Factuality, comprehensiveness of data-coverage and general correctness are de-emphasized. The *exemplars* are usually embodied in problem-solutions found in different forms in analyses of various languages. The fourth internal component of TG, the *ontological model*, is, most likely, the greatest obstacle to handle. In a provisional setting, one may think of a natural language as a set of strings generated by a finite set of rules (of grammar) which possess well-defined mathematical properties.

The question of the ontological model is surely the crucial issue of the scientific paradigm of TG. The shift of viewpoint regarding the nature of the ontological model reflected the shift in the philosophy of linguistics. At the time of Bloomfield's heyday, in the thirties of the 20th century, the ontology of speech, or the air disturbances, were the ones to watch. The idea which Keith Percival had, that the set of strings with mathematical properties was the proper ontological model is simply wrong. It is based on a mathematical and autonomous conception of Chomskyan linguistics. However, apart from the initial stumbling, Chomsky never postulated such mathematically-definable autonomy. As a matter of fact, Chomsky strove for a clearer understanding of the notion of 'language' because the orthodox outsider's idea of TG is frequently related to an almost purely mathematical inquiry. This view was promoted by Chomsky himself who wrote about abstract entities that were part of the mind of a speaker/hearer. Therefore, people often misunderstood Chomsky, emphasizing his phrase 'abstract entities' and his description of language as a set of utterance types, or a set of (utterance, meaning) pairs, where meanings are construed in set-theoretic terms. This kind of language description was later named 'E-language' by Chomsky[11]. "E" stood for 'externalization' or extensionality. E-languages can be simple catalogues of sentences, both actual and possible. Grammars of E-language are theories of abstract objects (sentences, languages) and there can be no place for imposing any *size constraint* on the sentences of natural objects[12]. According to such E-language theories, the number of all sentences is greater than countable (enumerable) infinity which in practice means that the number of conjuncts in a co-ordinate compound is impossible to enumerate in terms of finiteness.

Actually, Chomsky thought that the notion of E-language does not have any status in the theory of language. His ontological model allowed only the concept of rules and treats natural languages as evasive. This was so because he claimed that the formal properties of the E-language (if formalizable at all) have *no empirical relevance* to *learnability* and *parsability* . Therefore, there is *nothing in the real world corresponding to language* (E-language). In this way Chomsky shifted the focus from language to grammar. Language became an epiphenomenon – 'it is whatever is characterized by the rules of the

[9] Chomsky, N. (1981), *Lectures on Government and Binding*, Dordrecht, Foris, 3rd revised edition 1984.
[10] This paper will tentatively assume that Chomsky's *Lectures on Government and Binding* (1981) actually marked some sort of a (third) terminal cycle in his scientific paradigm. It looks more and more convincing to view the recent level-free developments in the so-called 'minimalist program' as highly reminiscent of Chomsky's earliest model of grammar contained in his *Logical Structure of Linguistic Theory*, 1975 (see James McGilvray (ed.) (2005), *The Cambridge Companion to Chomsky*, Cambridge University Press, especially the paper by Howard Lasnik "Grammars, levels, and biology").
[11] Chomsky, N. (1986) *Barriers*. Cambridge: MIT Press.
[12] Langendoen and Postal revived the notion that the essence of language is in fact a Platonic object, such as numbers, geometrical figures and other abstract entities. See Langendoen, T., & P. M. Postal. (1984), *The Vastness of Natural Language*, London, Blackwell.

grammar (perhaps in conjunction with other systems of mind, or even other factors, depending on how we chose to conceive of the notion 'language'. The grammar in a person's mind/brain is real; it is one of the real things in the world. The language (whatever that may be) is not' (Chomsky 1982: 5)[13].

Chomsky's complementary term, I-language, is, as a matter of fact, grammar in the new sense. Still, there are theoreticians who state that I-languages are strictly *formal objects* which consist of abstract mechanisms generating an infinite collection of bracketed strings (see George 1987: 158)[14]. In light of this, George goes on to say that such an I-language cannot be an *internalized* language pertaining to statements which are at the same time statements about *actual* states of the mind/brain. In his opinion I-language is a *set of potential objects of a speaker's knowledge*. "Thus while an I-language is not 'an actual state of the mind/brain' *knowing* an I-language is" (George, ibid. 158).

It is true that Chomsky made some vague statements about the *potential* ontology of his I-language. However, he also tried to clear up things later: "It is true that I-languages are not parts of *brains*; rather, they are components of the mind…: That is, they are elements of the theory of mind, abstracted from states of knowledge as explained"[15]. Apart from being internalized, I-languages are also *intensional*.

This means that they (languages) should be regarded as a specific function considered in intension: a function where a status is assigned to a vast range of physical events, including the utterance such as 'John seems to be sleeping', 'John seems sleeping', a sentence spoken in Hindu, and, possibly, the squeaking of a door (a paraphrase of Chomsky, private communication). Although the concept of I-language is abstract it does lead to empiricalness because Chomsky simply uses *theoretical entities* just like any other natural science. Since his inquiry into the nature of the knowledge of language is contingent, he sees no obstacles in using mentalistic terminology as he is not burdened with metaphysics. Regardless of his interest in brain mechanisms he claims that mentalistic inquiry is justified because it yields insight and theoretical understanding of phenomena that are of concern to us. These brain mechanisms are now largely unknown, but it should not bother us, claims Chomsky, pointing out that something similar happened in the natural sciences of the 19th century.

Thus Chomsky's theory today is Democritean; it is in direct opposition to appearance, to which taxonomic and structuralist linguistics clung steadily for quite some time. I-languages are real entities, claims Chomsky, as real as chemical compounds. They are in the mind, ultimately in the brain, in the same sense as chemical elements, organic molecules, neural nets and other concepts that we construct and discuss at some appropriate abstract level. Thus grammar refers to I-language, while the theory of an I-language is the theory of grammar or TG. Of course, this theory of grammar specifies the components of a mind/brain in the so-called *steady state*, as opposed to the *initial state*, before the initiation of language acquisition. This part of grammar may be called *universal grammar* and its main task is to specify what it really means to label an entity a human language.

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[13] Chomsky, N. (1982), *Some Concepts and Consequences of the Theory of Government and Binding,* MIT Press.
[14] George, A., Brody M. and Chomsky N., "Review Discussion: Knowledge of Language: Its Nature, Origin and Use" in *Mind and Language*, 2 (1987).
[15] Chomsky, N. (1986), Knowledge of language: its nature, origins, and use, New York: Praeger.

It is by now evident that Chomsky is a *scientific realist* who postulates the existence of a true *natural kind,* a true species property which, in his view, is *the initial state.*[16] Chomsky claims that *it is what it is* and the theories about it may be either true or false. The goal of such, cognitive, linguistics is to discover the true theory of universal grammar, which will deal with the factors that make it possible to acquire a particular I-language and that determine the class of human I-languages and their properties.

In this kind of scientific paradigm which bears complete resemblance to physics, or chemistry, it is rather pointless to insist on *actual physical mechanisms.* One should first analyze the I-language and the abstract entities that make up the human mind and only then should one try to relate the results obtained to the *ontology* of the mind. Chomsky wisely reminds us that the same process occurred in the 19th century chemistry which provided a guide for subsequent breakthroughs in physics; this was also the case with the then new neural net theory in neuropsychology. It is only to be expected that some abstract schemes would be put forward in order to explain that inner workings of the mind/brain. However, Chomsky stressed the fact that the neural net theory could not deal with concrete instances of molecules and their arrangement and that it only represented *a map of a high order of abstraction.*

The scientific methodology which Chomsky used is in all respects close to the methodology employed by Galileo Galilei, back in the 17th century and Chomsky makes sure to explicitly mention a possible Galilean revolution in linguistics. The hypothetico-deductive scientific framework was apparent in his work: "One may arrive at a grammar by intuition, guess-work, all sorts of partial methodological hints, reliance on past experiences, etc. It is no doubt possible to give an organized account of many useful procedures of analysis, but it is questionable whether these can be formulated rigorously, exhaustively and simply enough to qualify as a practical and mechanical discovery procedure… We are thus interested in describing the forms of grammars (equivalently, the nature of linguistic structure) and investigating the empirical consequences of adopting a certain model for linguistic structure, rather than in showing how, in principle, one might have arrived at the grammar of a language".[17]

The Galilean style of analysis was marked by an evident shift of intellectual attitude from concern for coverage of data to concern for insight and depth of explanation, Chomsky pointed out later. It seems that there are three central mechanisms in the Galilean style of inquiry: abstraction, mathematization and epistemological tolerance[18]. TG idealizes its objects of inquiry, it studies only one of the factors affecting the grammaticality of sentences – *the grammatical factor.* The linguistic model does not have explanatory principles which are *linked* by direct inference to the data that they strive to explain. Just as the physical model mathematizes physical reality so the rules that come out of the linguist's smithy posses "the same degree of reality as the physicist ascribes to his mathematical models of the universe" (Chomsky 1980: 223)[19]. In a similar vein, Galileo stated that universe is written in the language of mathematics, and its characters are triangles,

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[16] The theory of mind attempts to determine the properties of the initial state *So* and each attainable state *SL* of the language faculty, and the brain sciences seek to discover the mechanisms of the brain that are their physical counterparts.

[17] Chomsky, N. (1957) *Syntactic Structures,* The Hague, Mouton., p. 56

[18] Parret, H. (1984), "Regularities, rules and strategies", *Journal of Pragmatics*, 8, 569-592

[19] Chomsky, N., (1980), *Rules and Representations*. New York: Columbia University Press.

circles, and other geometrical figures, without which it is humanly impossible to under-stand a single word of it.[20]

It seems that Chomsky, having accepted Galileo's views on science, echoes back Galileo's ability to rule out 'various empirical complications in order to work with ideal concepts' such as free fall in a vacuum, ideal pendulum and the 'frictionless motion of a ship through the ocean'. The third component that makes up the Galilean style of inquiry is the so-called *epistemological tolerance* which states that certain empirical inadequacies should not lead to abandoning theories which already possess a degree of explanatory depth. Again, this reminds one of Galileo's dismissal of conflicting evidence. When, for example, he obtained the results from his experiments with falling bodies – balls from a tower – then he attributed the failure to confirm his mathematical expectation to 'unnatu-ral accidents'. He did the same with his theory of tides when he dismissed conflicting evidence explaining the divergence of theory and fact by trifling irregular causes (in-dented coastline, unexpected depth of sea, etc.).

Chomsky claims that in scientific work one searches for evidence that will support tentative hypotheses and this 'evidence' is regularly regarded as adding to their credibility. Typically, in such cases, observation is ignored or put aside, to be explained later if it does not fit a plausible theory. In his own words " the world is a very complicated place, with most of what happens poorly understood. The scientist tries to carve out some area where a degree of *insight* is possible, without understanding, generally, just why the boundaries are placed where they are. Even within those boundaries, unexplained effects commonly intervene…" (Chomsky, personal communication). This is not the case in the most advanced sciences, there this fact is obscured "since they are no longer attempting to deal with the phenomena of the world directly but only with the highly selected set of exotic phenomena which occur under refined conditions of experiment and specialized equipment " (Chomsky, personal communication). Implicit in Chomsky's model is the idea that there have always been strictures in science but this fact has been largely irrele-vant to the practice of the sciences. It is an interesting sociological fact that these stric-tures are imposed only in the 'soft sciences', such as psychology, linguistics, etc. On the other hand, in physics strictures are not imposed and nobody thinks about them.

It is an obvious fact that Chomsky *equates* speakers' judgments about language with observation sentences in physics. According to him, the speaker's judgment that in the sentence "the men expected that we would like each other" the segment "each other" re-fers to "we", and not to the "men" has the same status as the statement/sentence "the cloud chamber has a straight line across it". This is a *par excellence* observation sentence in physics dealing with the conduct of Beta-particles in Wilson's cloud chamber with ra-dioactive substances. If linguists put on white coats, established a rigorous experimental procedure and elicited observations of this kind from people, they would resemble physi-cists, claims Chomsky (Chomsky, personal communication). However, all of this is bor-ing, and is not done. Even in the advanced sciences experimental techniques are refined just to the extent required to obtain better data, if existing data does not suffice for pur-poses at hand.

Transformational generative theory is actually an empirical enterprise and there is *no* issue of *norms* or normativity which means there is no place for mystical forms of her-

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[20] *Dialogue Concerning the Two Chief World Systems*, translated by Stillman Drake, University of California Press, 1953 (revised 1967).

meneutics in it. The judgments of speakers are subject to investigation and they have *no privileged status* in any absolute sense.

First they are corrigible, and second, it might in principle be possible to find all sorts of other kinds of evidence bearing on the initial state and steady state, which are existents, states of an organism existing in the physical world.

It seems that Chomsky employs a combination of two scientific metaphors: the physical and the biological, in formulating his stand on the methodology of linguistic science. Some of the analogies between the initial state of the language faculty and the biology of living organisms that he makes can illustrate this point, especially his idea that the biochemistry of life is similar from yeasts to humans, but small changes in timings of regulatory mechanisms of the cell and the like can yield what to us seem to be vast phenomenal differences, the differences between a whale and a butterfly; a human and a microbe, and so on. Chomsky goes on to say that, viewed from an angel's point of view, with numerous other possible though not actual physical worlds under consideration, all life might appear identical apart from trivialities. Chomsky goes on to say that, similarly from an angel's point of view, *all languages would appear identical*, apart from trivialities, their fundamental features determined by facts about human biology.

Thus I-language itself is nothing more than a set of choices for different parameters selected from the options provided by universal grammar. (Since there are a finite number of parameters, each finite-valued, probably two-valued, it follows that there are a finite number of possible languages.) It is easy to see why questions concerning the formal properties of natural languages are mostly irrelevant as there are only few questions of mathematical interest that one can raise pertaining to finite sets. In Chomsky's view there are two parts of an I-language: the core and its periphery (metaphorically speaking, of course). The core is made up of an array (or set) of value-parameters while the periphery encompasses the lexicon, irregular verbs, idioms and the like. This is a real world distinction, not a matter of convenience. Chomsky describes his analogy, stating that the periphery is of much less interest for the basic *psychological-biological* questions to which linguistics is directed.

It seems that Chomsky advocated a reducible psychology aiming at the identification of the mind and the brain in the long run. The involvement with biology links such an approach to a physical metaphor in which the three mechanisms mentioned previously (abstraction, mathematization and epistemological tolerance) could probably be easily adopted by linguistics. Thus the future of linguistic inquiry may lie in terms of such notions like *unifiedness, principledness, elegance* and especially *naturalness* and *deductive depth*.[21]

To conclude: one may look at Chomsky's scientific paradigm from the point of view of already well-entrenched conceptions of natural and social sciences. His formalism (the parameters and principles; the value-setting of parameters; the manifestation of the rule *move-X*, etc.) probably stemmed from: logical positivism (in which explanations of phenomena are deductive-nomological in form); the realization of the impossibility of neutral observation after his analysis of the logic of discovery as a potential model for hypothesis-formation; finally, we may even maintain that Chomsky accepted two superficially incompatible theses: the classical empiricist thesis that a methodological unity exists between natural and human sciences, and, on the other hand, the idea that classical

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[21] Parret, H. (1984), ibid.

socio-psychological phenomena require the postulation of mentalistic states (which, as we have just seen, he hopes to have reduced to the states of mind, ultimately the brain). Furthermore, Chomsky apparently exhibited a degree of equivocation regarding the rationalistic (nativistic) conception of the language faculty and the corresponding traditionally-labeled 'empiricism' as embodied in the works of people such as David Hume and James Harris[22].

KUNOVSKI ELEMENTI U NAUČNOJ PARADIGMI NOAMA ČOMSKOG

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Ovaj rad bavi se analizom Čomskijeve paradigme pokušavajući da nađe elemente koji bi pokazali da se njegov pristup, započet 1957. godine, označen pojavom knjige Syntactic Structures, treba smatrati "paradigmatskim skokom" u smislu deskripcije koju je stvorio Tomas Kun kada je govorio o revolucijama u nauci. Autor razmatra najnovije koncepte takvog, nehijerarhijskog, razvoja u teoriji Noama Čomskog, držeći da su oni slični njegovom ranijem radu. Pored toga analizira se interna struktura njegove teorije sve do pojave pristupa Upravljanja i vezivanja (government and binding).

Ključne reči: *Čomski, Kun, transformaciono generativna gramatika, naučna revolucija, paradigma, empirizam, racionalizam*

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[22] This equivocation has proven the target of many a critic. One of the foremost critics of the Chomskyan model from the evolutionary perspective is Terrence Deacon, whose book *The Symbolic Species* is an attempt to show that language must have evolved in stages, and that the underlying rules were learned without the aid of a special module, through mere child's play (Deacon, T., (1997), *The Symbolic Species: The Co-evolution of Language and the Brain*, London, The Penguin Press.)