

[Рец. на: / Review of:] **D. G. Krivochen. *Syntax on the edge: A graph-theoretic analysis of sentence structure***. Leiden; Boston: Brill, 2023. xxi + 494 pp. (Empirical Approaches to Linguistic Theory, 21.) ISBN 978-90-04-54142-9 (print), ISBN: 978-90-04-54231-0 (e-book).

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The title of the monograph under review, *Syntax on the Edge*, may sound misleading to generative syntacticians. Within the Minimalist program, there is the concept of the left periphery, or edge, of a phase, as opposed to the complement of a phase with respect to the accessibility of its material for the higher heads [Chomsky 2000; 2001; 2008]. Any constituents that must move out of the phase head’s complement carry relevant edge features and are attracted to the edge of the phase. In this sense, the term *edge* is actively used in minimalist syntax; cf., e.g., the title of Svenonius’ [2004] *On the edge*. In the monograph under review, however, *edge* is a term from graph theory — a directed or undirected arc that connects vertices (or nodes) in a graph. The term has been used in linguistic models representing sentence structure as a system of dependencies, such as Relational Grammar [Perlmutter (ed.) 1983] and its successor Arc Pair Grammar [Johnson, Postal 1980], as well as, perhaps, the better-known in Russia Meaning ⇔ Text Model [Mel’čuk 1974; 1988]. This understanding of *edge* is represented, for example, in *Edge-based clausal syntax* [Postal 2010], as well as — not taking into account the idiomatic reading — in the monograph under review. And while the specific term *edge* is not universal to the entire class of dependency-based grammars, the idea of syntactic structure as a set of nodes with the dependency relation is at its core — as in Word Grammar, a unified approach treating the lexicon, morphology, and syntax as networks of nodes connected by links [Hudson 1984; 2021].

Here we have another syntactic theory based on the dependency relation. What is the motivation for a new syntactic model provided by the author, who primarily works with data from English and Spanish — languages whose syntax has been analyzed very thoroughly within the framework of existing grammatical theories? As Diego Krivochen himself writes, this is an attempt to answer a “what if...?” question, that is, a theoretically motivated study of available options in choosing a model for natural language. The main idea is to try to simplify the syntactic description by reducing the number of entities (projections, null categories, traces) and increasing the number of connections between terminal nodes. This idea is opposite to the direction of development observed in generative grammar, where the relations are minimized (strictly binary branching) at the cost of increasing the number of syntactic objects. In principle, both approaches are equally viable in a situation where the object being modeled does not impose the

presence of either multiple entities or multiple relations on the model. The former does not seem to be the case when it comes to modeling natural language syntax; in particular, maximal projections of syntactic categories are not a concession to the formalism that minimizes the number of local relations, but rather entities objectively represented in the language system and acting, along with heads, as subjects of grammatical rules.

Let us now summarize the main provisions of the proposed approach. The theory of grammar envisioned by the author includes a definition of basic expressions; a definition of derived expressions; and a set of constraints over graphs. Using this characterization, analyzing sentences of a natural language boils down to “the identification of basic and derived expressions and relations between these, and the formulation of admissibility constraints” (p. 61).

A graph is defined, as commonly accepted, as a pair (E, V) , where E is a set of vertices (nodes) and V is a set of edges (arcs). The structures used throughout the monograph are directed graphs (digraphs), whose edges are ordered pairs of vertices. This yields a binary asymmetric relation “immediately dominates”, denoted as p ; $p(v_1, v_2)$ means “ v_1 immediately dominates v_2 ” and is true iff there is an arc from v_1 to v_2 .

The dominance set, or p -set, of a graph G is the set of all immediate dominance relations in G . Predicates always directly dominate their arguments, and p -sets are ordered with respect to a hierarchy of grammatical functions (p. 165), which allows predication and grammatical functions of arguments to be read off the edges of the graph. Furthermore, p -sets allow repetitions to accommodate parallel edges, which technically makes these data structures ordered multi-sets. These p -sets serve as structural descriptions of sentences. Linearization of graphs — mapping structural descriptions to strings — is explicitly (p. 58) taken to fall outside of the scope of the monograph.

Nodes in a graph correspond to basic expressions of the language, drawn from some set Exp . Each node is assigned a unique address that points to its semantic value and allows it to be referred to unambiguously. The building blocks of the grammar are elementary graphs, which are a special case of an arbor, a single-rooted directed graph. An elementary graph includes the smallest set of connected nodes that contains a predicative lexical basic expression (referred to as the elementary graph’s anchor), its functional modifiers (such as tense and aspect), and its arguments. Single-rooted graphs, and elementary graphs in particular, can be composed into derived graphs by means of one or more common nodes. This is formally defined as graph union; given two graphs $G_1 = (V_1, E_1)$ and $G_2 = (V_2, E_2)$, their union is given by $(V_1 \cup V_2, E_1 \cup E_2)$. Any nodes with the same address are collapsed into a single node (called a linking node), providing a built-in implementation of structure sharing.

Further characteristics of the model being developed partly follow from the main idea of minimizing syntactic entities, and partly are independent of it and specified as axioms. Minimization of entities is achieved due to the fact that the same unit can be a dependent in more than one relation (that is, one node can have more than one incoming arc). Thus, the author discards the single mother condition (SMC); moreover, for non-elementary syntactic structures, multiple root nodes are also allowed. The theory is constructed as model-theoretic, as opposed to proof-theoretic or derivational (which is characteristic, for example, of minimalism). As a model-theoretic approach, the theory must offer a way of mapping a linguistic expression to some representation and formulate constraints over such representations that characterize the grammar of a given language or natural language in general. Since the proposed representations are digraphs (i.e., directed graphs), it is necessary to determine which elements of the linguistic expression correspond to nodes of the graph and under which circumstances two nodes are connected by a directed edge. Grammatical phenomena are modeled in terms of constraints on graph structure: the availability of a trail between the two nodes representing variables in a syntactic rule.

Many axiomatic requirements for syntactic trees appear in a weakened form (and it is not entirely clear whether this is a consequence of the inevitable sketchiness of the first version of a large model or a fundamental feature of the model). Only categorematic expressions appear as nodes, which have a corresponding semantic interpretation that varies (or may vary) across

models. Syncategorematic expressions like articles, complementizers, grammatical prepositions, etc., are not represented. Moreover, only lexical predicates can serve as an anchor of an elementary tree, whereas nominal arguments are represented as single nodes without internal structure (with the exception of dependent clauses embedded in a noun phrase and *wh*-determiners and quantifiers they are headed by). Finally, there are multiword expressions, which constitute a single node, e.g. *act like*, Spanish *ser asesinado* ‘be killed’, etc.

Edges are directed from a predicate to its arguments. Functional elements, like lexical auxiliaries, and adjuncts take predicates as their arguments. That is, the basic structure of an elementary tree closely resembles the semantic representation of the Meaning $\Leftrightarrow$ Text Model. And, as in the Meaning $\Leftrightarrow$ Text Model, different linguistic expressions can correspond to the same semantic structure. Thus, Krivochen rejects the idea of a one-to-one correspondence between a linguistic expression and its structural description.

To summarize, instead of a model that permits nodes that are not represented in a linguistic expression, a model is proposed where the number of nodes does not exceed the number of words, but which departs from a whole slew of restrictions observed by traditional models: the principle of complete representation (all linguistic units are represented in the structural description), the further indivisibility of terminal nodes, the principle of distinctiveness (a linguistic expression can be unambiguously restored from its structural description, and vice versa).

One question that is likely of much interest to the more computationally-minded among the linguistic community is the expressive power of this theory. In Chapter 4, the author claims that the proposed formalism is capable of expressing context-free patterns, such as nested dependencies in Turkish, as well as mildly context-sensitive patterns, such as the crossing dependencies in Swiss German [Shieber 1985] and Dutch [Joshi 1985]. This is illustrated with the (unordered) ρ -set representation (1b) of a famous Dutch example (1a).

(1) DUTCH

- a. *Jan Piet Marie zag helpen zwemmen.*
 Jan Piet Marie saw help swim

‘Jan saw Piet help Mary swim.’ (p. 149; from [Joshi 1985: 245])

- b. $\rho = \{(zag, Jan), (zag, Piet), (zag, helpen), (helpen, Piet), (helpen, Marie), (helpen, zwemmen), (zwemmen, Marie)\}$ (p. 153)

As in the rest of the monograph, the author steers clear of the problem of linearization. However, without a defined algorithm of linearizing the graphs, the formalism is unable to distinguish between strings containing the same terminal symbols (basic expressions) in different order. The author does point this out, stating (on p. 154) that, if the ρ -sets encoded word order (which is what distinguishes cross-serial dependencies from center embedding and tail-recursion), they would differ between the Dutch example and its Turkish and English counterparts; however, this is the path taken in the present work (which we take to imply that in the current version of the theory they are indeed the same *modulo* the content of the basic expressions).

Without further clarification, this discussion seems to fall prey to the subset fallacy. While the formalism will certainly produce representations of strings with crossing dependencies, it cannot describe *just these* strings to the exclusion of others. Citing [Mohri, Sproat 2006: 434], ‘if a language L contains a subset L' which is at position P in the Chomsky hierarchy, in general this tells us nothing about the position P of L in the hierarchy.’ For example, $\{a, b, c\}^*$, the language of all strings over the alphabet $\{a, b, c\}$, does contain the mildly context-sensitive language of strings $\{a^n b^n c^n \mid n \geq 0\}$ as a subset. However, $\{a, b, c\}^*$ itself is not a mildly context-sensitive language, since it contains all the other strings that do not belong to this mildly-context-sensitive set.

At the same time, this formalism seems capable of expressing some complex patterns. For instance, it should be able to generate the context-free language $\{w \mid w \in \{a, b\}^* \ \& \ |w|_a = |w|_b \geq 0\}$ (all strings consisting of an equal number of a ’s and b ’s), but not the context-free language

$\{a^n b^n \mid n \geq 0\}$ (all strings consisting of a string of a 's immediately followed by a string of b 's of equal length). With this in mind, another path the author could have taken — and one that could align well with his desire to remain agnostic on the issue of linearization — would be to state that languages generated by this formalism are not sets of strings but sets of *multi-sets* of terminals. There exists work in formal grammar theory introducing a Chomsky-like hierarchy for sets of multisets [Kudlek et al. 2001]; examining it with respect to natural language syntax could potentially lead to an interesting direction of research.

One can certainly see the advantages of a graph-based approach that allows for multidominance (including multiple roots) and parallel edges; and certain traditionally challenging phenomena can be described in these terms quite naturally. To give a few examples, graphs are a good fit for representing constructions such as anchored parentheticals and amalgams, which involve otherwise apparently independent clauses sharing a common element. The node addressing system treats coindexation simply as node identity, allowing the author to recast binding in graph-theoretic terms. This solution deals with the basic examples rather elegantly — for instance, reflexives boil down to multiple arcs of the same predicate terminating at the same node. While it is not immediately clear how other cases (e.g., reciprocals, split antecedents) would work, this problem can probably be overcome with a more nuanced definition of what the nodes in a graph correspond to; the possibility of altering “the level of granularity at which nodes are defined (basic expressions, features or feature bundles, roots, etc.)” is mentioned by the author on p. 83.

Moving on to a critical assessment of the model, it should be emphasized that we have before us a partial model of the syntactic structure of a sentence, reflecting only those of its properties that follow from the definition of Relational Grammar: “A clause consists of a network of grammatical relations” [Perlmutter, Postal 1983: 9]. Accordingly, we should not expect to learn anything new about the structure of nominal constituents, prepositional phrases, or adjectival phrases. Incomplete representation of sentence structure leads to the fact that restrictions on representation in such an impoverished structure can be formulated only for a certain range of phenomena and, in general, are unable to distinguish grammatical sentences from ungrammatical ones. For example, the representation of (2a) looks like (2b). At the same time, this formalism is apparently unable to express the difference between grammatical (2a) and ungrammatical (2c).

- (2) a. What did Sue say?
 b. $\rho = \langle (\text{what, say}), (\text{say, Sue}), (\text{say, what}) \rangle$
 c. *What said Sue?

The issues discussed in the monograph relate to two important areas: the establishment of hierarchical grammatical relations within a clause (that is, an elementary tree) and ways of combining elementary trees into a derived structure corresponding to a complex sentence.

In both cases the model is vulnerable to criticism. In the structure of an elementary tree, we observe the consistent use of the direction of the semantic relationship between predicate and argument to determine the direction of syntactic dependence. However, since the time of Otto Jespersen [1924] a distinction has been made between syntactic dependencies that coincide in direction with semantic ones (nexus) and those opposite in direction to semantic ones (junction). Models based on semantic relationships between concepts use special rules that “reverse” the direction of dependency in syntagmas with junction at the syntactic level. The lack of distinction between nexus and junction leads to expressions with different meanings receiving the same representation (and, apparently, the same interpretation):

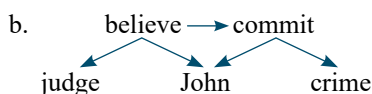
- (3) a. I like my tea strong.
 b. I like my strong tea.
 (4) $\rho = \langle (\text{like, I}), (\text{like, tea}), (\text{strong, tea}) \rangle$ (for (3a) (p. 195) and (3b))

The author explicitly rejects labeling the arrows (p. 162), suggesting that their interpretation is uniquely determined by the order of the relations listed in the ρ -set. However, it should be emphasized that the presence of an edge (v_i, v_j) between the vertices of the graph is used to encode relations of different levels: semantic relations (that is, hierarchies at the level of the thematic structure), grammatical relations (that is, hierarchies at the level of syntactic functions), logical relations (that is, the relationship between the antecedent and the anaphoric element, for example, in the identification of a *wh*-pronoun and a resumptive pronoun, or between an operator and the head of its nuclear scope, such as a *wh*-pronoun and a predicate). The need to distinguish between these hierarchies and the possibility of discrepancies in the ranks of arguments at different levels has been widely discussed in the syntactic literature. Some models, such as Lexical functional grammar (LFG), map multiple representations to linguistic expressions and formulate rules connecting argument structure, functional structure, and constituent structure. In other models, such as generative grammar, hierarchical relationships can be established within extended verb projections of different levels (vP, TP, CP). In the monograph under review, there is no articulated distinction between the levels to which specific relations belong, which, in our opinion, will cause serious problems when modeling phenomena oriented towards different hierarchies (cf. [Manning 1996] on the need to distinguish between the subject of argument structure and the subject of grammatical relations).

Furthermore, even if all edges in an elementary graph represent grammatical relations, their ordered sets do not solve the problem of identifying a particular relation. In the fundamental absence of null and syncategorematic units in the representation, the first relation in the tuple is inevitably interpreted as the subject, and the second as the direct object. This makes it difficult to analyze impersonal constructions (such as lenient passives), intransitive verbs with two arguments, and many other cases where a gap occurs in the hierarchy of grammatical relations (SU > DO > IO > Oblique). All of the above leads to the idea that one of the basic dichotomies of the monograph — that between transformations that change and those that do not change the grammatical relations — turns out to be an epiphenomenon of the adopted formalism.

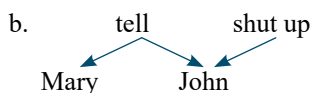
Let us now turn to derived structures. Biclausal constructions are formed by combining elementary graphs; possible methods of unification are through a root node (nesting one tree into another) and through a non-root node (in which case a multirooted graph is formed). According to the author, the ways of connecting graphs distinguish between English infinitive constructions and control and raising (p. 203). Thus, the ECM-construction in (5a) receives the representation (5b) which includes a relation between the matrix and nested predicate (see also the ordered ρ -set in (5c)), while the control configuration (6a) is represented as (6b)–(6c), where the dependent and main clauses are connected only through a common argument.

- (5) a. The judge believed John to have committed the crime.



- c. $\rho_{\text{derived}} = \langle (\text{believe, judge}), (\text{believe, John}), (\text{believe, commit}), (\text{commit, John}), (\text{commit, crime}) \rangle$

- (6) a. Mary told John to shut up.



- c. $\rho_{\text{derived}} = \langle (\text{tell, Mary}), (\text{tell, John}), (\text{shut up, John}) \rangle$

Without disputing the validity of such a solution (it seems to us that the dependent clause is an argument of the matrix predicate both in the case of control and in the ECM-configuration), we note that the proposed model does not in any way limit the configurations in which predicates can have a common argument, and does not place any limitations on which arguments can be shared. It appears that this model can represent any combination of control/raising and shared argument, non-local control, hyper-hyperraising, and other ungrammatical configurations that are consistently constrained, for example, in generative models of control and raising. Note also that when connecting graphs by means of a non-root node (as in (6b)), it is impossible to read the status of the main vs. dependent clause off the representation, so (5b) could also be the graph of the completely ungrammatical *John_i shut up Mary to tell e_i*. From a broader perspective, the model seems capable of representing both natural language expressions and those that are not characteristic of natural languages. Constraints on graphs are intended to distinguish between them, but there are surprisingly few such constraints in the monograph, and for the complementation constructions under consideration they are absent.

The scope of the review does not allow us to dwell in detail on all the grammatical phenomena considered in the monograph, which are quite diverse and include, for example, clitic climbing, *wh*-movement, restrictive and appositive relative constructions, and anaphora. However, despite a rather sophisticated analysis and the involvement of a huge amount of relevant literature from a variety of theoretical frameworks, one cannot avoid the impression that the model being developed does not allow us to learn anything fundamentally new about language. The monograph outlines a number of interesting ideas but stops just short of developing them, highlighting a (legitimately hard) challenge inevitably faced by any newly introduced linguistic formalism: the need for a balance between compatibility with different competing analyses vs. making specific decisions to enable the theory to make specific predictions. Traditional questions of the research program of formal linguistics about the human language ability, the acquisition and origin of language, the universal and specific in language, the parameters and limits of linguistic variation can hardly be adequately posed within the framework of the proposed model. The author explicitly rejects this view of the theory of language (pp. 437–438) and proposes to model the relational structure of linguistic expressions *an und für sich*. One can only hope that this research program will find its followers.

REFERENCES

- Chomsky 2000 — Chomsky N. Minimalist inquiries: The framework. *Step by step: Essays on minimalist syntax in honor of Howard Lasnik*. Martin R., Michaels D., Uriagereka J. (eds.). Cambridge (MA): MIT Press, 2000, 89–156.
- Chomsky 2001 — Chomsky N. Derivation by phase. *Ken Hale: A life in language*. Kenstowicz M. (ed.). Cambridge (MA): MIT Press, 2001, 1–52.
- Chomsky 2008 — Chomsky N. On phases. *Foundational issues in linguistic theory*. Freidin R., Otero C. P., Zubizarreta M.-L. (eds.). Cambridge (MA): MIT Press, 2008, 133–166.
- Hudson 1984 — Hudson R. *Word grammar*. Oxford: Basil Blackwell, 1984.
- Hudson 2021 — Hudson R. Word grammar. *The Routledge handbook of cognitive linguistics*. Xu W., Taylor J. R. (eds.). New York; London: Routledge, 2021, 111–126.
- Jespersen 1924 — Jespersen O. *The philosophy of grammar*. New York: Allen & Unwin, 1924.
- Johnson, Postal 1980 — Johnson D., Postal P. *Arc pair grammar*. Princeton: Princeton Univ. Press, 1980.
- Joshi 1985 — Joshi A. Tree adjoining grammars: How much context-sensitivity is required to provide reasonable structural descriptions? *Natural language parsing*. Dowty D., Karttunen L., Zwicky A. (eds.). Cambridge: Cambridge Univ. Press, 1985, 206–250.
- Kudlek et al. 2001 — Kudlek M., Martin-Vide C., Păun G. Toward a formal macroset theory. *Multiset processing: Mathematical, computer science, and molecular computing point of view*. Calude C. S., Păun Gh., Rozenberg G., Salomaa A. (eds.). Berlin; Heidelberg: Springer, 2001, 123–133.
- Manning 1996 — Manning Ch. *Ergativity: Argument structure and grammatical relations*. Stanford: CSLI Publications, 1996.

- Mel'čuk 1974 — Mel'čuk I. A. *Opyt teorii lingvisticheskikh modelei «Smysl ⇔ Tekst»* [Toward a theory of “Meaning ⇔ Text” linguistic models]. Moscow: Nauka, 1974.
- Mel'čuk 1988 — Mel'čuk I. *Dependency syntax: Theory and practice*. Albany: State Univ. of New York Press, 1988.
- Mohri, Sproat 2006 — Mohri M., Sproat R. On a common fallacy in computational linguistics. *SKY Journal of Linguistics*, 2006, 19: 432–439.
- Perlmutter (ed.) 1983 — Perlmutter D. (ed.). *Studies in relational grammar I*. Chicago: Univ. of Chicago Press, 1983.
- Perlmutter, Postal 1983 — Perlmutter D., Postal P. M. Some proposed laws of basic clause structure. *Studies in Relational Grammar I*. Perlmutter D. (ed.) Chicago: Univ. of Chicago Press, 1983, 81–128.
- Postal 2010 — Postal P. *Edge-based clausal syntax*. Cambridge (MA): MIT Press, 2010.
- Shieber 1985 — Shieber S. Evidence against the context-freeness of natural language. *Linguistics and Philosophy*, 1985, 8(3): 333–343.
- Svenonius 2004 — Svenonius P. On the edge. *Peripheries*. Adger D., de Cat C., Tsoulas G. (eds.). Dordrecht: Kluwer, 2004, 259–287.

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