Vijay-Shanker, K.; **Weir, D. J.**
The equivalence of four extensions of context-free grammars. (English) ┃Zbl 0813.68129┃
Math. Syst. Theory 27, No. 6, 511-546 (1994).

This paper aims to compare the class of languages generated by *combinatory categorical grammar* [*K. Ajdukiewicz*, Stud. Philos. 1, 1–27 (1935; Zbl 0015.33702)], *head grammars* [*C. Pollard*, Generalized phrase structure grammars. Head grammars, and natural language. Stanford University (Ph.D. Thesis) (1984)], *linear indexed grammars* [https://link.springer.com/chapter/10.1007/978-94-009-1337-0_3], and *tree adjoining grammars* [*A. K. Joshi* et al., J. Comput. Syst. Sci. 10, 136–163 (1975; Zbl 0326.68053)]. showing that all four of the formalisms generate exactly the same class of string languages. Each of these formalisms is known to generate a larger class of languages than context-free grammars, having been developed independently, so that the above result is somewhat astounding.

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References:

[1]   A. V. Aho. Indexed grammars?an extension to context free grammars.J. Assoc. Comput. Mach.,15:647-671, 1968. · Zbl 0175.27801

[2]   K. Ajdukiewicz. Die syntaktische Konnexität.Studia Philosophica,1:1-27, 1935. English translation in: S. McCall, editor,Polish Logic, 1920-1939, pp. 207-231. Oxford University Press, Oxford. · Zbl 0015.33702

[3]   C. Culy. The complexity of the vocabulary of bambara.Ling. Philos.,8:345-351, 1985.· doi:10.1007/BF00630918

[4]   J. Duske and R. Parchmann. Linear indexed languages.Theoret. Comput. Sci.,32:47-60, 1984. · Zbl 0545.68067 · doi:10.1016/0304-3975(84)90023-9

[5]   G. Gazdar. Applicability of indexed grammars to natural languages. In: U. Reyle and C. Rohrer, editors,Natural Language Parsing and Linguistic Theories, pp. 69-94. Reidel, Dordrecht, 1988.

[6]   G. Gazdar, E. Klein, G. K. Pullum, and I. A. Sag.Generalized Phrase Structure Grammars. Blackwell, Oxford, 1985. Also published by Harvard University Press, Cambridge, MA.

[7]   A. K. Joshi. How much context-sensitivity is necessary for characterizing structural descriptions ?Tree Adjoining Grammars? In: D. Dowty, L. Karttunen, and A. Zwicky, editors,Natural Language Processing?Theoretical, Computational and Psychological Perspective, pp. 206-250. Cambridge University Press, New York, 1985. Originally presented in 1983.

[8]   A. K. Joshi, L. S. Levy, and M. Takahashi. Tree adjunct grammars.J. Comput. System Sci.,19(1):136-163, 1975. · Zbl 0326.68053 · doi:10.1016/S0022-0000(75)80019-5

[9]   T. Kasami. An efficient recognition and syntax algorithm for context-free languages. Technical Report AF-CRL-65-758, Air Force Cambridge Research Laboratory, Bedford, MA, 1965.

[10]   A. S. Kroch. Asymmetries in long distance extraction in a tag grammar. In: M. Baltin and A. S. Kroch, editors,New Conceptions of Phrase Structure, pp. 66-98. University of Chicago Press, Chicago, IL, 1986.

[11]   A. S. Kroch. Subjacency in a tree adjoining grammar. In: A. Manaster-Ramer, editor,Mathematics of Language, pp. 143-172. Benjamins, Amsterdam, 1987.

[12]   A. S. Kroch and A. K. Joshi. Linguistic relevance of tree adjoining grammars. Technical Report MS-CIS-85-18, Department of Computer and Information Science, University of Pennsylvania, Philadelphia, PA, 1985.

[13]   A. S. Kroch and A. K. Joshi. Analyzing extraposition in a tree adjoining grammar. In: G. Huck and A. Ojeda, editors,Syntax and Semantics: Discontinuous Constituents, pp. 107-149. Academic Press, New York, 1986.

[14]   A. S. Kroch and B. Santorini. The derived constituent structure of West Germanic verb-raising construction. In: R. Freiden, editor,Proceedings of the Princeton Workshop on Grammar, pp. 269-338, 1991.

[15] C. Pollard. Generalized Phrase Structure Grammars, Head Grammars, and Natural Language. Ph.D. thesis, Stanford University, CA, 1984.

[16] G. Pullum and G. Gazdar. Natural languages and context-free languages. Ling. Philos.,4:471-504, 1982.· doi:10.1007/BF00360802

[17] K. Roach. Formal properties of head grammars. In: A. Manaster-Ramer, editor, Mathematics of Language, pp. 293-348. Benjamins, Amsterdam, 1987.

[18] B. Santorini. The West Germanic verb-raising construction: a tree adjoing grammar analysis. Master's thesis, University of Pennsylvania, Philadelphia, PA, 1986.

[19] S. M. Shieber. Evidence against the context-freeness of natural language. Ling. Philos.,8:333-343, 1985.· doi:10.1007/BF00630917

[20] M. J. Steedman. Dependency and coordination in the grammar of Dutch and English. Language,61:523-568, 1985.· doi:10.2307/414385

[21] M. J. Steedman. Combinators and grammars. In: R. Oehrle, E. Bach, and D. Wheeler, editors, Categorial Grammars and Natural Language Structures, pp. 417-442. Foris, Dordrecht, 1986.

[22] K. Vijay-Shanker. A study of tree adjoining grammars. Ph.D. thesis, University of Pennsylvania, Philadelphia, PA, 1987.

[23] K. Vijay-Shanker and D. J. Weir. Parsing constrained grammar formalisms. Comput. Linguistics, to appear.

[24] K. Vijay-Shanker and D. J. Weir. Polynomial parsing of extensions of context-free grammars. In: M. Tomita, editor, Current Issues in Parsing Technology, pp. 191-206. Kluwer, Boston, 1991.

[25] K. Vijay-Shanker, D. J. Weir, and A. K. Joshi. Tree adjoining and head wrapping. Proceedings of the 11th International Conference on Computational Linguistics, pp. 202-207, 1986.

[26] D. J. Weir. Characterizing mildly context-sensitive grammar formalisms. Ph.D. thesis, University of Pennsylvania, Philadelphia, PA, 1988.

[27] D. J. Weir. A geometric hierarchy beyond context-free languages. Theoret. Comput. Sci.,104:235-261, 1992. · Zbl 0754.68070 · doi:10.1016/0304-3975(92)90124-X

[28] D. J. Weir and A. K. Joshi. Combinatory categorial grammars: generative power and relationship to linear context-free rewriting systems. Proceedings of the 26th Meeting of the Association on Computational Linguistics, pp. 278-285, 1988.

[29] D. H. Younger. Recognition and parsing of context-free languages in time n 3. Inform. and Control,10(2):189-208, 1967. · Zbl 0149.24803 · doi:10.1016/S0019-9958(67)80007-X