A dependency look at the reality of constituency

Xinying Chen,* Carlos Gómez-Rodríguez† and Ramon Ferrer-i-Cancho† ‡

*Foreign Languages Research Center, School of Foreign Studies, Xi’an Jiaotong University, No.28 Xianning West Road, 710049 Xi’an, Shaanxi, P.R. China; †Universidad de Coruña, FASTPARSE Lab, LyS Research Group, Departamento de Computación, Facultad de Informática, Elviña, 15071 A Coruña, Spain; and ‡Complexity & Qualitative Linguistics Lab, LARCA Research Group, Departament de Ciències de la Comunicació, Universitat Politècnica de Catalunya, Campus Nord, Edifici Òmega. Jordi Girona Salgado 1-3. 08034 Barcelona, Catalonia, Spain

Submitted to Proceedings of the National Academy of Sciences of the United States of America

Recently, Nelson et al. have addressed the fundamental problem of the neurophysiological support for complex syntactic operations of theoretical computational models [1]. They interpret their compelling results as supporting the neural reality of phrase structure. Such a conclusion opens various questions.

First, constituency is not the only possible reality for the syntactic structure of sentences. An alternative is dependency, where the structure of a sentence is defined by word pairwise dependencies (Fig. 1). From that perspective, phrase structure is regarded as an epiphenomenon of word-word dependencies and constituency (in a classical sense, as that of X-bar theory) has been argued to not exist [2]. Furthermore, constituency may not be universal and thus its suitability may depend on the language [3]. Dependency is a stronger alternative for its simplicity, its close relationship with merge [4], its compatibility with recent cognitive observations [5] and its success over phrase structure in computational linguistics, where it has become predominant [6].

Second, the authors admit that a parser of the sentence might transiently conclude that “ten sad students”... is a phrase consistently with a transient decrease in activity (1st paragraph of p. 4). Unfortunately, their parser does not account for that as shown in the counts in Fig. 2 A of [1]. In contrast, a standard dependency parser would be likely to be unrealistic and thus it is problematic.

In sum, dependency offers a better approach to the syntactic complexity of languages and merge. n-gram models of higher complexity should be the subject of future research involving realistic sentences.


ACKNOWLEDGMENTS. X.C. is supported by the Social Science Fund of Shaanxi State [2015K001]. C.G.R is funded by the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation programme (grant agreement No 714150 FASTPARSE), and by the TELEPARES-UCD project (FP2014-51978-C2-2-R) from MINECO (Ministerio de Economía y Competitividad). R.F.C is funded by the grants 2014SGR 890 (MACDA) from AGAUR (Generalitat de Catalunya) and the grant TIN2014-57226-P from MINECO.

Author contributions: X. C., C. G. R. and R. F. C. wrote the paper. The authors declare no conflict of interest.

1 To whom correspondence should be addressed. E-mail: rferrericancho@cs.upc.edu.

Reserved for Publication Footnotes

www.pnas.org — — PNAS | Issue Date | Volume | Issue Number | 1-2
Ten sad students of Bill Gates should often sleep.

Fig. 1. Syntactic dependency structure of the sentence in Fig 2 A of [1] according to Universal Dependencies [10].