From Lexical Functional Grammar to Enhanced Universal Dependencies

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Universal Dependencies (UD; Nivre et al. 2016) has recently become a *de facto* standard as a dependency representation used in Natural Language Processing (NLP). As perhaps most of syntactic processing in NLP involves dependency structures, it is safe to say that it is becoming a standard for syntactic processing at large. There are 122 treebanks for 71 languages in the July 2018 release 2.2 of UD, publicly available at http://universaldependencies.org/. New UD treebanks are often the result of converting corpora adhering to other annotation schemes – not only dependency-based, but also constituency-based.

Lexical Functional Grammar (LFG; Bresnan 1982, Dalrymple 2001, Bresnan et al. 2015) is a linguistic theory which assumes two syntactic levels of representation (in addition to other, non-syntactic levels): constituency structure (c-structure) and functional structure (f-structure). In the case of the Polish sentence (1), in which two asyndetically coordinated verbs within a clausal subject share a number of dependents, the c-structure is given in (2) and the f-structure – in (3):[1]

(1) Wydawało się, że wojna jednak go przerosła, przeraziła.
seemed.3.SG.N RM that war.NOM.SG.F after all him.ACC overwhelmed.3.SG.F scared.3.SG.F
'It seemed that, after all, the war overwhelmed and scared him.'

The first aim of this paper is to describe a procedure of converting such LFG structures to dependency representations following the UD standard, specifically, its enhanced version 2. Conversion of LFG structures to dependency structures is not a new task, but – with the exception of Meurer 2017 – previous attempts are only mentioned or very roughly outlined in the literature. Moreover, previous work has been limited to *dependency trees* as the output format. As is well known, simple dependency trees cannot straightforwardly represent many kinds of linguistic information, so the conversion from representations such as those assumed in LFG invariably resulted in considerable loss of information.

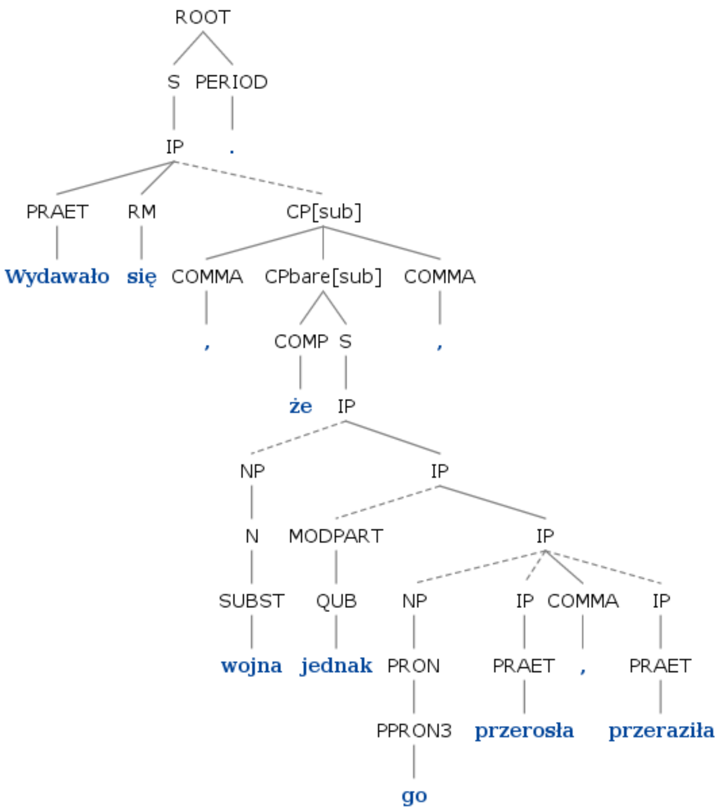
The current version 2 of Universal Dependencies assumes, apart from basic dependency trees, also *enhanced dependency structures*, which make it possible to represent phenomena beyond the scope of simple trees. For example, the result of converting the LFG structures (2)–(3) to UD is shown in (4) (with the basic tree displayed above the text and the enhanced structure – below the text, with the differences shown in red). The second aim of this paper is to examine to what extent rich information available in LFG structures is or may in principle be preserved in such enhanced UD representations.

The empirical basis for the conversion is a manually disambiguated LFG parsebank of Polish (Patejuk and Przepiórkowski 2014) consisting of over 17,000 sentences (almost 131,000 tokens). Since this is a parsebank, it only contains analyses successfully provided by the LFG parser of Polish (Patejuk and Przepiórkowski 2012b, 2015) and selected by human annotators as correct. While this constrains the number and kinds of constructions present in the corpus, the underlying LFG grammar of Polish is currently one of the largest implemented LFG grammars, and it includes a comprehensive analysis of various kinds of coordination and its interaction with other phenomena (Patejuk and Przepiórkowski 2012a), so there is no shortage of sentences which pose potential difficulties for the conversion.

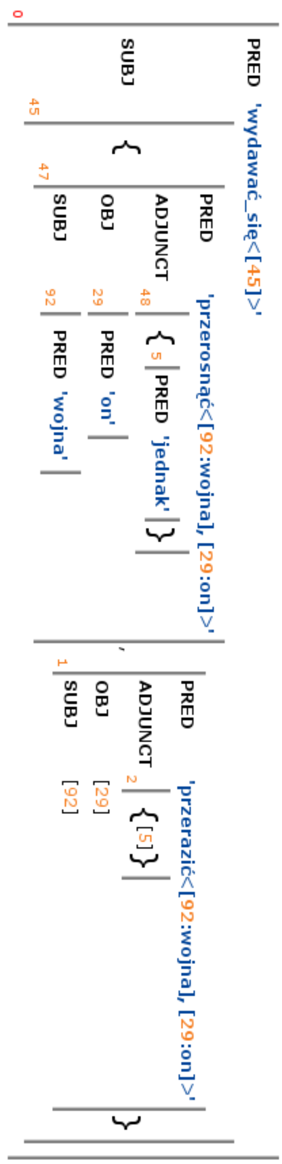
[1] RM in (1) stands for 'reflexive marker', which in this case is an inherent part of the verb *wydawało się* 'seemed'; other abbreviations are standard. LFG structures shown in (2)–(3) are visualisations produced by the INESS system (http://clarino.uib.no/iness/; Rosén et al. 2012), which hosts the Polish LFG structure bank, among other treebanks.

Proceedings of the Joint Workshop on
Linguistic Annotation, Multiword Expressions and Constructions (LAW-MWE-CxG-2018), pages 2–4
Santa Fe, New Mexico, USA, August 25-26, 2018.

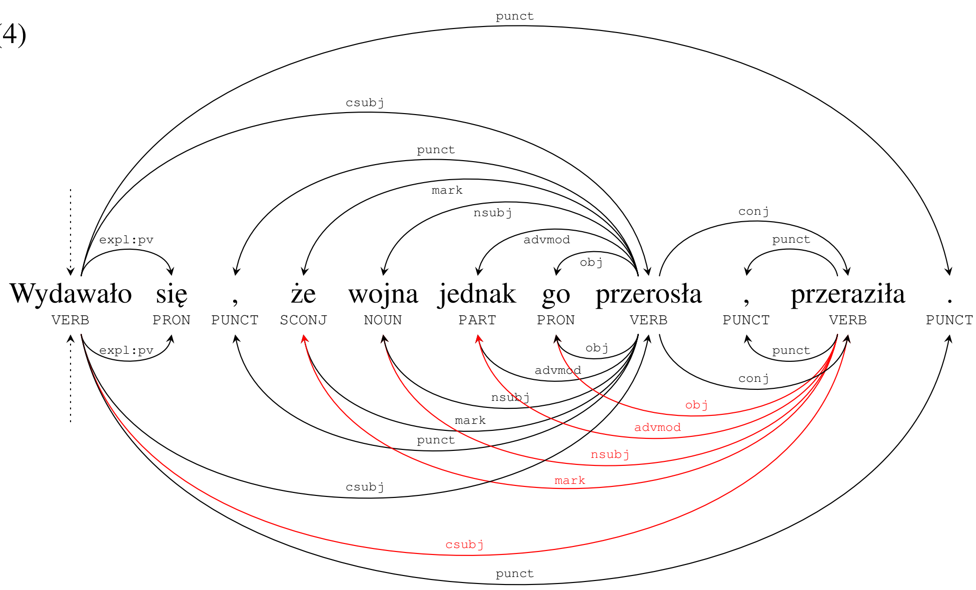
(2)


ROOT
S PERIOD
IP .
PRAET RM CP[sub]
Wydawało się COMMA CPbare[sub] COMMA
, ,
COMP S
że IP
NP IP
N MODPART IP
SUBST QUB NP IP COMMA IP
wojna jednak PRON PRAET , PRAET
PPRON3 przerosła przeraziła
go

(3)


PRED 'wydawać_się<[45]>'
SUBJ
PRED 'przerosnąć<[92:wojna], [29:on]>'
ADJUNCT PRED 'jednak'
OBJ PRED 'on'
SUBJ PRED 'wojna'
PRED 'przerazić<[92:wojna], [29:on]>'
ADJUNCT [5]
OBJ [29]
SUBJ [92]

(4)


Wydawało się , że wojna jednak go przerosła , przeraziła .
VERB PRON PUNCT SCONJ NOUN PART PRON VERB PUNCT VERB PUNCT
punct
csubj
expl:pv
mark
nsubj
advmod
obj
conj

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