Reed-Kellogg, Tesnière, Мельчук,
and
Universal Dependencies

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The basic structure of Universal Dependencies[1] mainly inherits Мельчук Dependency Syntax[2] while the structure is influenced by Reed-Kellogg Diagram.[3]

Reed-Kellogg Diagram visualizes a sentence in English upon the subject-verb-object structure, where the main sentence is shown on a thick line, other clauses are on thin lines, and modifiers are on slanted lines. For example in the sentence "Those who labour with their minds rule others" (Figure 1), the main sentence "Those rule others" is on a thick line, in which "Those" is modified by "who labour" on a thin line, in which "labour" is modified by "with minds", in which "minds" is modified by "their". Reed-Kellogg Diagram was designed to visualize English only.

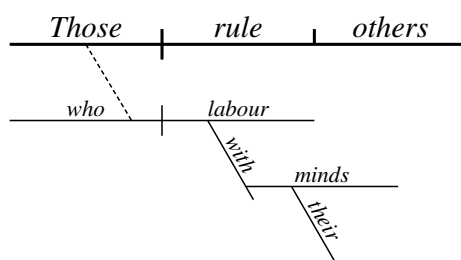
Figure 1: Reed-Kellogg Diagram

Tesnière originated Syntaxe Structurale,[4] which was the origin of dependency syntax, through his analysis of Slavic and other languages. In his dependency syntax, every word in a sentence depends on one another. For example in the sentence "Those who labour with their minds rule others" (Figure 2 left), "Those" and "others" depend on "rule". "labour" is under A-transfer (transfer into adjectives) with "who" and depends on "Those". "minds" is under E-transfer (transfer into adverbs) with "with" and depends on "labour". "their" depends on "minds".

His dependency syntax can be applied to Classical Chinese. For example in the sentence "勞心者治人" (Figure 2 right), "人" depends on "治", "勞" is under O-transfer (transfer into nouns) with "者" and depends on "治", and "心" depends on "勞". Here we can compare the structures of "Those who labour with their minds rule others" and "勞心者治人" as shown in Figure 2.

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[1]Marie-Catherine de Marneffe, Christopher D. Manning, Joakim Nivre, Daniel Zeman: Universal Dependencies, Computational Linguistics, Vol.47, No.2 (June 2021), pp.255-308.

[2]Igor A. Mel'čuk: Dependency Syntax: Theory and Practice, New York: State University of New York Press (1988).

[3]Alonzo Reed and Brainerd Kellogg: Higher Lessons in English: A Work on English Grammar and Composition, New York: Clark & Maynard (1877).

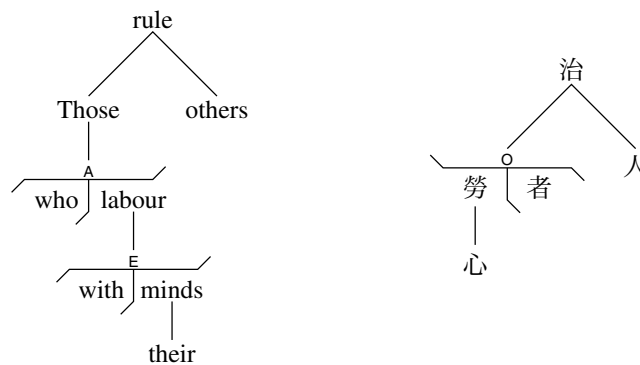[4]Lucien Tesnière: Éléments de Syntaxe Structurale, Paris: C. Klincksieck (1959).

Figure 2: Syntaxe Structurale de Tesnière

Tesnière dependency syntax was challenged by Robinson[5] and Hudson[6] to merge with Chomsky phrase structure.[7] On the other hand, Мельчук completed his own dependency syntax,[2] in which the directed acyclic graph was used to describe the syntax structure, to say good-bye to Chomsky.

Мельчук Dependency Syntax describes a sentence, whose words X and Y is visualized with the dependency edge X→Y (Y depends on X). Every edge has its own tag to represent the relation between words, neither clauses nor phrases. Every word has at most one incoming edge, and the edges are acyclic with no loop. Figure 3 shows the dependency graph for three sentences: "Those who labour with their minds rule others", "心を労する者は人を治める", and "労心者治人". Мельчук presented several tags for his Dependency Syntax[8] but did not present what tags were suitable to describe languages over the world.

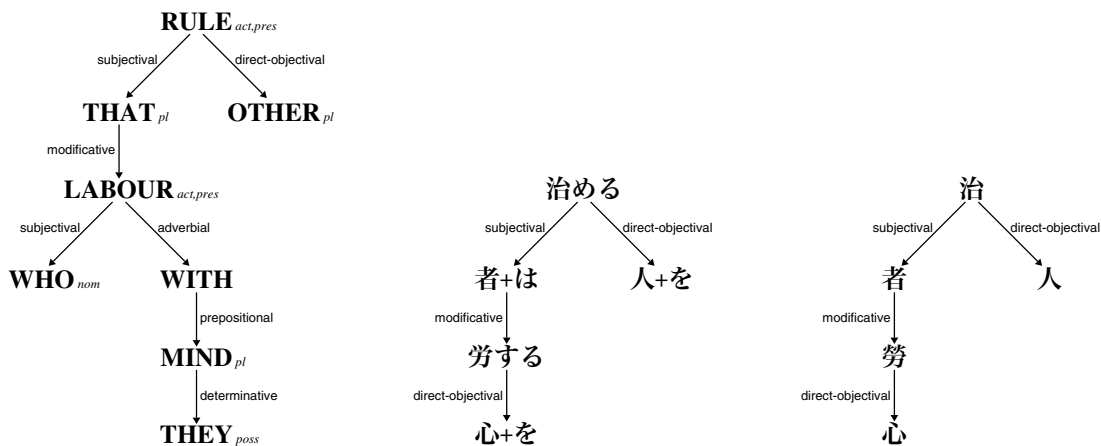Figure 3: Мельчук Dependency Syntax

[5]Jane J. Robinson: Dependency Structures and Transformational Rules, Language, Vol.46, No.2 (June 1970), pp.259-285.

[6]Richard Hudson: Word Grammar, New York: Basil Blackwell (1984).

[7]Noam Chomsky: Aspects of the Theory of Syntax, Cambridge: MIT Press (1965).

[8]Alain Polguère, Igor A. Mel'čuk: Dependency in Linguistic Description, Amsterdam: John Benjamins (2009).

Table 1: Dependency Relations of Universal Dependencies

	Nominals	Clauses	Modifier Words	Function Words
Core arguments	nsubj obj iobj	csubj ccomp xcomp		
Non-core dependents	obl vocative expl dislocated	advcl	advmod discourse	aux cop mark
Nominal dependents	nmod appos nummod	acl	amod	det clf case
Coordination	**MWE**	**Loose**	**Special**	**Other**
conj cc	fixed flat compound	list parataxis	orphan goeswith reparandum	punct root dep

Universal Dependencies are considered as a brute challenge to limit Мельчук tags upto the 37 tags in Table 1. You can consider that subjectival direct-objectival modicative and determinative in Figure 3, for example, are changed into nsubj obj acl and det respectively in Figure 4. But several modifications were made in the structure. The adpositions are treated as the modifiers of nouns in Universal Dependencies (as "with"←"minds" in Figure 4)[9] contrary to Мельчук (as "WITH"→"MIND" in Figure 3). Furthermore, the clauses receive special treatment in the tags of Universal Dependencies (Table 1), since their origins include Stanford Dependencies[10] and Bresnan Lexical-Functional Syntax.[11]

Although Мельчук excluded clauses from his Dependency Syntax, Universal Dependencies conjured them again. In English, as shown in Reed-Kellogg, we have some consensus about the clauses. But in other languages we often don't. Universal Dependencies aim to be universal, but still incline to English.

[9]Joakim Nivre: Towards a Universal Grammar for Natural Language Processing, CICLing 2015: 16th International Conference on Intelligent Text Processing and Computational Linguistics (April 2015), pp.3-16.

[10]Marie-Catherine de Marneffe and Christopher D. Manning: The Stanford Typed Dependencies Representation, Coling 2008: Proceedings of the Workshop on Cross-Framework and Cross-Domain Parser Evaluation (August 2008), pp.1-8.

[11]Joan Bresnan: Lexical-Functional Syntax, Malden: Blackwell (2001).

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# text = Those who labour with their minds rule others
1    Those    that      PRON    DT                               _    7    nsubj    _    _
2    who      who       PRON    WP                               _    3    nsubj    _    _
3    labour   labour    VERB    VBP                              _    1    acl      _    _
4    with     with      ADP     IN                               _    6    case     _    _
5    their    they      PRON    PRP$                             _    6    det      _    _
6    minds    mind      NOUN    NNS$                             _    3    obl      _    _
7    rule     rule      VERB    VBP                              _    0    root     _    _
8    others   other     NOUN    NNS                              _    7    obj      _    SpaceAfter=No

# text = 心を労する者は人を治める
1    心       心        NOUN    名詞-普通名詞-サ変可能           _    3    obj      _    SpaceAfter=No
2    を       を        ADP     助詞-格助詞                      _    1    case     _    SpaceAfter=No
3    労する   労する    VERB    動詞-一般                        _    4    acl      _    SpaceAfter=No
4    者       者        NOUN    名詞-普通名詞-一般               _    8    nsubj    _    SpaceAfter=No
5    は       は        ADP     助詞-係助詞                      _    4    case     _    SpaceAfter=No
6    人       人        NOUN    名詞-普通名詞-一般               _    8    obj      _    SpaceAfter=No
7    を       を        ADP     助詞-格助詞                      _    6    case     _    SpaceAfter=No
8    治める   治める    VERB    動詞-一般                        _    0    root     _    SpaceAfter=No

# text = 勞心者治人
1    勞       勞        VERB    v,動詞,描写,境遇                 _    3    acl      _    SpaceAfter=No
2    心       心        NOUN    n,名詞,不可讓,身体               _    1    obj      _    SpaceAfter=No
3    者       者        PART    p,助詞,提示,*                    _    4    nsubj    _    SpaceAfter=No
4    治       治        VERB    v,動詞,行為,動作                 _    0    root     _    SpaceAfter=No
5    人       人        NOUN    n,名詞,人,人                     _    4    obj      _    SpaceAfter=No
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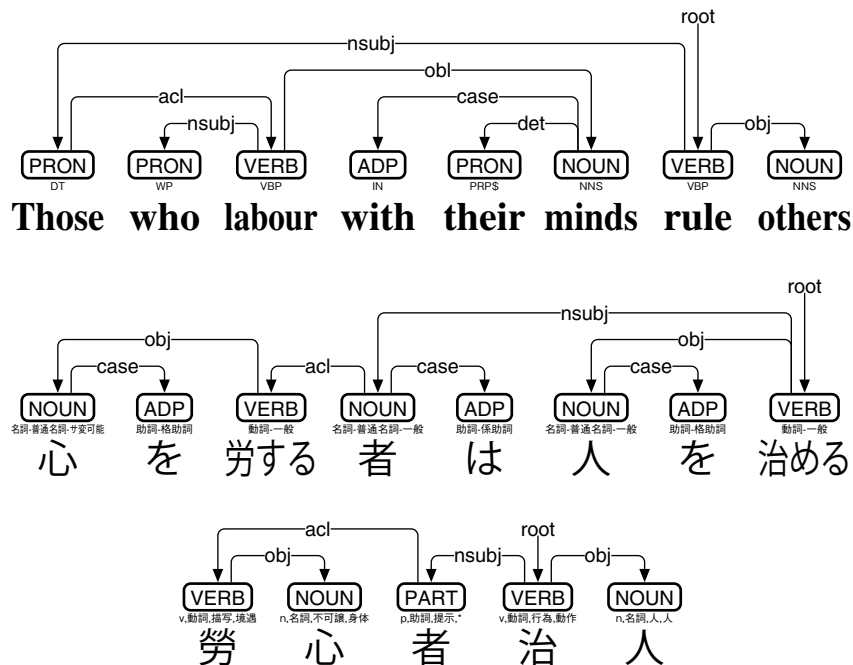

Figure 4: Universal Dependencies