LaTex Typesetting Features Used in Linguistics

Jake Warde
Warde Publishers, Inc.

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Abstract

The following sections are excerpts from linguistics papers and texts. The excerpts were selected to show a variety of typesetting requirements in the field of linguistics as they can be implemented using Latex. Each section lists the key typesetting features demonstrated and the Latex packages used to create them. The footnotes provide biblographic references or internet linking to the source for the linguistic example.

1 Numbered Linguistic Examples

(1) John is a polyglot.

(2) By way of contrast, however, consider the following examples:

a. * He is a polyglot, aren't they?

b. * Come here, isn't Bill?

c. * Himself saw John.[1]

2 Glosses

2.1 Glosses with word-by-word alignment

(3) *Wenn jemand in die Wüste zieht...*
If someone in the desert draws...
'if one retreats to the desert and ... '[2]

(4) *ni- c- chihui -lia in no- piltzin ce calli*
I it make for to-the my son a house
'I made my son a house.' [3]

[1] Akmajian, A. and Heny F.; An Introduction to the Principles of Transformational Syntax: MIT Press 1980" p.1
[2] `ftp://ftp.dante.de/tex-archive/macros/latex/contrib/gb4e/gb4e-doc.pdf`
[3] `http://en.wikipedia.org/wiki/Interlinear_gloss`

2.2 Glosses with morepheme-by-morpheme correspondence and grammatical categories

(5) *Gila abur-u-n ferma hamialu gna amuq-da-.*
now the-OBL-GEN farm forever behind stay-FUT-NEG
'Now their farm will not stay behind forever.'

(6) *Musa a-li-ni-andik-ia barua*
Musa SBJ.CL.1-PST-OBJ.1.SG-send-APPL letter
Musa sent me a letter[4]

Latex Package: The examples in Sections 1 and 2 were created using *gb4e*.

3 Phrase Structure Rules and Trees

3.1 Phrase Structure Rules

The English sentence in example (7) is ambiguous:

(7) Mary saw the dragon in the cave.[5]

In one reading, the speaker is in the cave (call it reading A), while under the second reading the dragon is in the cave but the speaker is not (reading B). Phrase structure grammars can capture ambiguity by assigning more than one structure to a given string. The phrase structure rules in (8) would license the sentence in (7).

(8)

$S \rightarrow NP\ VP$	
$NP \rightarrow Det\ N$	$Det \rightarrow the$
$NP \rightarrow NP\ PP$	$N \rightarrow cave$
$NP \rightarrow Pro$	$N \rightarrow dragon$
$VP \rightarrow V\ NP\ PP$	$P \rightarrow in$
$VP \rightarrow V\ NP$	$NP \rightarrow Mary$
$PP \rightarrow P\ NP$	$V \rightarrow Mary$

Note that the grammar in [8] contains two rules with the category VP on the left. This means that there are two structures that this grammar can categorize as being VP-type things. This is where the ambiguity will be captured in the case of (7). The two phrase structure possibilities are presented in section 3.2.

Latex Package: The Phrase Structure Rules in Section 3.1 were created using *covington*.

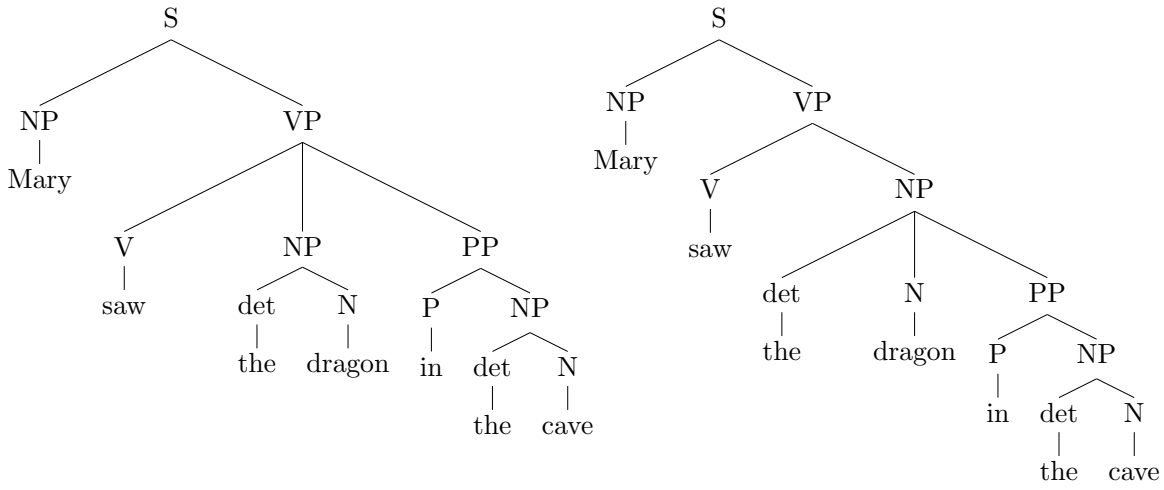
[4] Examples 5 and 6: The Leipzig Glossing Rules `http://www.eva.mpg.de/lingua/resources/glossing-rules.php`

[5] `http://www.ling.ohio-state.edu/~scott/teaching/2008/autumn/201/handouts/psg.pdf`

3.2 Phrase Structure Trees

Two possible phrase structure trees for the sentence in (7): The phrase structure tree on the left defines reading A. The phrase structure tree on the right defines reading B.

(9)



Latex Package: The example in Section 3.2 was created using *qtree.*

4 Attribute Value Matrices

4.1 Overview

Attribute-Value Matrix (AVM) This description of AVMs is from Zhang and Fokkens.[6]

Attribute-value matrix (AVM) notation is a description language to describe sets of feature structures, with the following three building blocks.

- Type descriptions selects all objects of a particular type
- Attribute-value pairs describe objects that have a particular property. The attribute must be appropriate for the particular type, and the value can be any kind of description
- Tags to specify token identity

$$_{t1}\left[\text{F1} \quad t2 \;\; F2 \quad \boxed{1} \;\; _{t3}\left[\text{F4} \quad t\right] F3 \quad \boxed{1}\right]$$

- Attribute-Value Matrix (AVM) is used to describe feature structures
- The order of the rows is not important

[6] `http://www.coli.uni-saarland.de/courses/syntactic-theory-09/slides/tfs.pdf`

- Each attribute can only take one value, hence the following AVM is improper and does NOT describe any feature structure

$$_{person}\left[\textsc{Name} \quad \textit{Sandy} \quad \textit{Age} \quad \textit{29} \quad \textit{Age} \quad \textit{30}\right]$$

- It is common practice to refer to AVMs as feature structures, although strictly speaking they are feature structure descriptions

4.2 Examples of AVMs

In the simplified AVM for the word "walks" below, the verb's categorical information is divided into features that describe it (HEAD) and features that describe its arguments (VALENCE).[7]

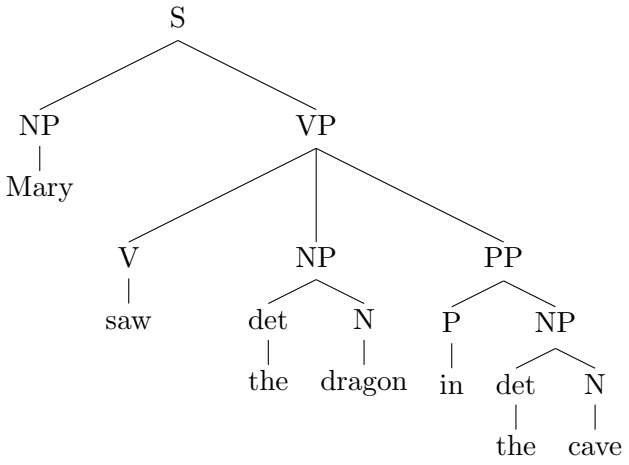
(10) $\left[\textit{word} \quad \text{PHON} \quad \left\langle \text{'walks'} \right\rangle \text{SYNSEM} \quad \left[\textit{synsem} \quad \text{CAT} \quad \left[\textit{category} \quad \text{HEAD} \quad \textit{verb} \quad \text{VALENCE} \quad \left[\text{SUBJ} \quad \left\langle \left[\textit{synsem} \quad \text{CAT—HEAD} \right.\right.\right.\right.\right.$

Latex Pacakge: The Attribute Value Matrix was created using the *AVM* package.

4.3 Drawing Connecting Lines on Trees and AVMS

For simplicity and to help readers compare the Latex used to produce the lines, connecting lines are shown on the two examples shown in (9-left) and (10).

(11)



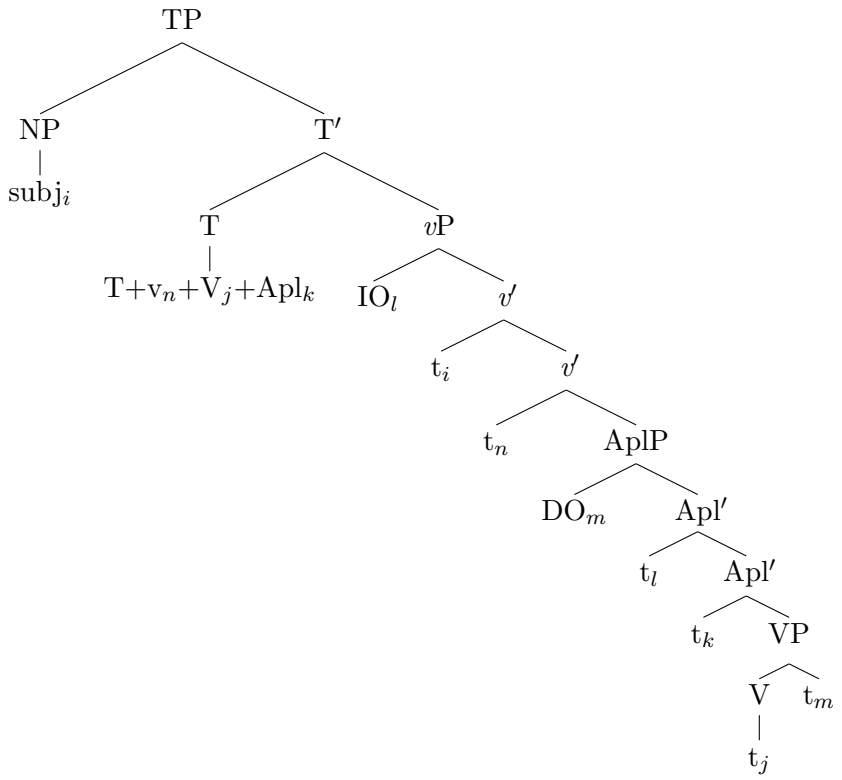
The tree graph in (11) corresponds to Reading A in (9) in which Mary is "'in the cave."

[7] http://en.wikipedia.org/wiki/Head-driven_phrase_structure_grammar

(12) [*word* PHON ⟨'walks'⟩ SYNSEM [*synsem* CAT [*category* HEAD *verb* VALENCE [SUBJ ⟨[*synsem* CAT—HEAD

A more complex example of example of lines connecting nodes of phrase structure tree follows in (13).

(13)



Latex Package: The connecting lines on the tree in (11) (*qtree*) were set using the package *tree-dvips.* The connecting line in the AVM shown in (12) was created from within the *AVM* package using its own node location and line drawing capabilities. The example in (13) was created using *tree-dvips.*

5 Categorical Grammar Derivations

5.1 Overview

Categorical Grammar (CG) The following introductory description of Categorical Grammar in Section 5.1 is from Mark Stedman, Categorical Grammar.[8] Categorial Grammar (CG), together with its close cousin Dependency Grammar (which also originated in the 1950s, in work by Tesni‘ere) stems from an alternative approach to context-free grammar pioneered by Bar-Hillel 1953 and Lambek 1958, with earlier antecedents in Ajdukiewicz 1935 and still earlier work by Husserl and Russell in category theory and the theory of types. Categorical Grammars capture the same information by associating a functional type or category with all grammatical entities. For example, all transitive verbs are associated via the lexicon with a category that can be written as follows: likes := (SnNP)=NP

(14)
$$\begin{array}{l} S \rightarrow NP\ VP \\ VP \rightarrow TV\ NP \\ TV \rightarrow \textit{[likes, sees,...]} \end{array}$$

The notation here is the “result leftmost” notation according to which =and nrepresent functions from into , where the slash determines that the argument is respectively to the right (=) or to the left (n) of the functor. Thus the transitive verb (3) is a functor over NPs to its right yielding predicates, or functors over NPs to the left, which in turn yield S.

In pure context-free CG, categories can combine via two general function application rules, which in the present notation are written as in (14), to yield derivations, written as in (15), in which underlines indexed with right and left arrows indicate the application of the two rules.

(15) *Functional application*

a. $X/Y\ \ Y \Rightarrow X$

b. $Y\ \ X\backslash Y \Rightarrow X$

(16)
$$\dfrac{\dfrac{\dfrac{Dexter}{NP}\quad\dfrac{likes}{(S\backslash N)/NP}\quad\dfrac{Warren}{NP}}{S\backslash NP}\,>}{S}\,<$$

Latex Package: The Categorical Grammar example in 15 was created using the *Semantic* package with the *inference* command.

[8] `http://conf.ling.cornell.edu/~timh/ling419-spring09/readings/Steedman99-EncCogSci.pdf`

6 Examples Using the International Phonetic Alphabet

6.1 Simple English Phonetic Transcriptions

Sample Phonetics Transcriptions [9]	
phonetics	/fəˈnɛtɪks/
linguistics	/lɢɬɛɴʜ/ɡwɢɬstɢɬks/
computation	/ʜ\kɢ/mpjʃʝʜ/teɢɬʃʝ\ɢ̃n/

6.2 International Phonetic Alphabet-Consonants (Pulmonic)

	Bilabial	Labiodental	Dental	Alveolor	Postalovelar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ːn	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Trap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral Fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral Approximant				l		ːl	ʎ	ʟ			

Note: The symbols for the sounds of English are color-coded blue in the tables in Sections 5.2 and 5.3.

6.3 The Consonants of English by Place and Manner of Articulation

PLACE OF ARTICULATION									
		Labial		Dental			Palatovelar		Glottal
		Bilabial	Labiodental	Interdental	Alveolar	Alvelo-palatal	Palatal	Velar	
Stop	voiceless	p			t			k	
Stop	voiced	b			d			g	
Fricatives	voiceless		f	θ	s	ʃ			h
Fricatives	voiced		v	ð	z	ʒ			
Affricants	voicelss					ç			
Affricants	voiced					j			
Nasals		m			n			ŋ	
Liquids	lateral				l				
Liquids	retroflex				r		y	w	
Semivowels									

Latex Package: The Tables dislaying IPA Characters were created using the *TIPA* package.

7 Selected Language Excerpts

7.1 German

Und ebenso muß man die Gnadenhilfen selbst unterscheiden. Etwas anderes ist eine Hilfe, ohne die etwas nicht geschieht, und etwas anderes eine Hilfe, durch die etwas geschieht.

Dem ersten Menschen, der in dem Gute, worin er gerecht erschaffen war, die Fähigkeit empfangen hatte, nicht zu sündigen, nicht zu sterben und vom Guten selbst nicht abzufallen, ist demnach die Gnade der Beharrlichkeit verliehen worden, nicht jene, wodurch seine Beharrlichkeit bewirkt worden wäre, sondern jene, ohne die er nicht imstande gewesen wäre, mit seinem freien Willen auszuharren. Jetzt aber wird den Heiligen, die durch die Gnade Gottes für das Reich Gottes vorherbestimmt sind, nicht eine solche Gnade der Beharrlichkeit gegeben, sondern eine derartige, daß ihnen die Beharrlichkeit selbst geschenkt wird; daher sind sie ohne dieses Gnadengeschenk nicht nur unfähig zur Beharrlichkeit, sondern sind auch durch dieses Geschenk Nurbeharrende. [10]

7.2 French

Les fleurs ont souvent des récompenses de nectar, de pétrole ou de pollen pour des visiteurs, et il est à l'avantage de la fleur si l'animal que prend la récompense est susceptible de transférer son pollen entre les fleurs de mêmes espèces. [11]

7.3 Spanish

Las flores tienen a menudo recompensas del néctar, del aceite o del polen por visitantes, y es a la ventaja de la flor si el animal que toma la recompensa es probable transferir su polen entre las flores de la misma especie. [12]

[10] St. Augustine; De corr. et gratia XII, 34, ALG VII, 214f.
[11] http://www.reed.edu/cis/help/latex/language.html
[12] http://www.reed.edu/cis/help/latex/language.html