13. DBS.2: Hearer Mode

13.1 Lexicon of LA-hear.2

13.1.1 Proper names as in LA-hear.1 (cf. Section 11.2)

13.1.2 personal pronouns

sur: I	sur: you	sur: he	sur: she	sur: it	sur: we
noun: *I*	noun: *you*	noun: *he*	noun: *he*	noun: *he*	noun: *I*
cat: ns1	cat: pro2	cat: ns3	cat: ns3	cat: snp	cat: np-2
sem: sg	sem:	sem: sg m	sem: sg f	sem: sg	sem: pl
mdr:	mdr:	mdr:	mdr:	mdr:	mdr:
fnc:	fnc:	fnc:	fnc:	fnc:	fnc:
idy:	idy:	idy:	idy:	idy:	idy:
prn:	prn:	prn:	prn:	prn:	prn:

sur: they	sur: me	sur: him	sur: her	sur: us	sur: them
noun: *he*	noun: *I*	noun: *he*	noun: *he*	noun: *I*	noun: *he*
cat: np-2	cat: obq	cat: obq	cat: obq	cat: obq	cat: obq
sem: pl	sem: sg	sem: sg m	sem: sg f	sem: pl	sem: pl
mdr:	mdr:	mdr:	mdr:	mdr:	mdr:
fnc:	fnc:	fnc:	fnc:	fnc:	fnc:
idy:	idy:	idy:	idy:	idy:	idy:
prn:	prn:	prn:	prn:	prn:	prn:

13.1.3 Determiners

$$
\begin{bmatrix} \text{sur: } \textsf{a} \\ \text{noun: n\_1} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: } \textsf{every} \\ \text{noun: n\_1} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: pl exh} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: } \textsf{some} \\ \text{noun: n\_1} \\ \text{cat: pn}' \text{ pnp} \\ \text{sem: pl sel} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: } \textsf{all} \\ \text{noun: n\_1} \\ \text{cat: pn}' \text{ pnp} \\ \text{sem: pl exh} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: } \textsf{the} \\ \text{noun: n\_1} \\ \text{cat: nn}' \text{ np} \\ \text{sem: def} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}
$$

13.1.4 Nouns

$$\begin{bmatrix}\text{sur: car}\\ \text{noun: }\textit{car}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: cars}\\ \text{noun: }\textit{car}\\ \text{cat: pn}\\ \text{sem: pl}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: driver}\\ \text{noun: }\textit{driver}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: drivers}\\ \text{noun: }\textit{driver}\\ \text{cat: pn}\\ \text{sem: pl}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: farmer}\\ \text{noun: }\textit{farmer}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: farmers}\\ \text{noun: }\textit{farmer}\\ \text{cat: pn}\\ \text{sem: pl}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}$$

$$\begin{bmatrix}\text{sur: lift}\\ \text{noun: }\textit{lift}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: lifts}\\ \text{noun: }\textit{lift}\\ \text{cat: pn}\\ \text{sem: pl}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: tree}\\ \text{noun: }\textit{tree}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}\begin{bmatrix}\text{sur: trees}\\ \text{noun: }\textit{tree}\\ \text{cat: pn}\\ \text{sem: pl}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}$$

13.1.5 Main verbs, one place

1 *Third person singular present tense*: as in LA-hear.1 (cf. Section 11.2).

2 *Non-third-person singular present tense*

$$\begin{bmatrix}\text{sur: sleep}\\ \text{verb: }\textit{sleep}\\ \text{cat: n-s3}'\text{ v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: sing}\\ \text{verb: }\textit{sing}\\ \text{cat: n-s3}'\text{ v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: dream}\\ \text{verb: }\textit{dream}\\ \text{cat: n-s3}'\text{ v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: speed}\\ \text{verb: }\textit{speed}\\ \text{cat: n-s3}'\text{ v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

3 *Past tense – past participle*

$$\begin{bmatrix}\text{sur: slept}\\ \text{verb: }\textit{sleep}\\ \text{cat: n}'\text{ v}\\ \text{sem: past/perf}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: sang}\\ \text{verb: }\textit{sing}\\ \text{cat: n}'\text{ v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: dreamt}\\ \text{verb: }\textit{dream}\\ \text{cat: n}'\text{ v}\\ \text{sem: past/perf}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: speeded}\\ \text{verb: }\textit{speed}\\ \text{cat: n}'\text{ v}\\ \text{sem: past/perf}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

4 *Separate past participle*

$$\begin{bmatrix} \text{sur: sung} \\ \text{verb: } \textit{sing} \\ \text{cat: hv} \\ \text{sem: perf} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}$$

5 *Present participle*

$$\begin{bmatrix} \text{sur: sleeping} \\ \text{verb: } \textit{sleep} \\ \text{cat: be} \\ \text{sem: prog} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix} \begin{bmatrix} \text{sur: singing} \\ \text{verb: } \textit{sing} \\ \text{cat: be} \\ \text{sem: prog} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix} \begin{bmatrix} \text{sur: dreaming} \\ \text{verb: } \textit{dream} \\ \text{cat: be} \\ \text{sem: prog} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix} \begin{bmatrix} \text{sur: speeding} \\ \text{verb: } \textit{speed} \\ \text{cat: be} \\ \text{sem: prog} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}$$

13.1.6 Main verbs, two place

1 *Third person singular present tense*

$$\begin{bmatrix}\text{sur: hits}\\ \text{verb: } \textit{hit}\\ \text{cat: ns3}'\ \text{a}'\ \text{v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: knows}\\ \text{verb: } \textit{know}\\ \text{cat: ns3}'\ \text{a}'\ \text{v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

2 *Non-third person singular present tense*

$$\begin{bmatrix}\text{sur: hit}\\ \text{verb: } \textit{hit}\\ \text{cat: n-s3}'\ \text{a}'\ \text{v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: know}\\ \text{verb: } \textit{know}\\ \text{cat: n-s3}'\ \text{a}'\ \text{v}\\ \text{sem: pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

3 *Past tense/past participle*

sur: hit	sur: knew
verb: *hit*	verb: *know*
cat: n′ a′ v	cat: n′ a′ v
sem: past/perf	sem: past
mdr:	mdr:
arg:	arg:
nc:	nc:
pc:	pc:
prn:	prn:

4 *Separate past participle*

sur: known
verb: *know*
cat: a′ hv
sem: perf
mdr:
arg:
nc:
pc:
prn:

5 *Present participle*

sur: hitting	sur: knowing
verb: *hit*	verb: *know*
cat: a′ be	cat: a′ be
sem: prog	sem: prog
mdr:	mdr:
arg:	arg:
nc:	nc:
pc:	pc:
prn:	prn:

13.1.7 Forms of a three place main verb

sur: give	sur: gives	sur: gave	sur: given	sur: giving
verb: *give*	verb: *give*	verb: *give*	verb: *give*	verb: *give*
cat: n-s3′ d′ a′ v	cat: ns3′ d′ a′ v	cat: n′ d′ a′ v	cat: d′ a′ hv	cat: d′ a′ be
sem: pres	sem: pres	sem: past	sem: perf	sem: prog
mdr:	mdr:	mdr:	mdr:	mdr:
arg:	arg:	arg:	arg:	arg:
nc:	nc:	nc:	nc:	nc:
pc:	pc:	pc:	pc:	pc:
prn:	prn:	prn:	prn:	prn:

13.1.8 Forms of the auxiliary be

sur: am	sur: ain’t	sur: is	sur: isn’t
verb: v_1	verb: v_1	verb: v_1	verb: v_1
cat: ns1′ be′ v	cat: ns13′ be′ v	cat: ns3′ be′ v	cat: ns3′ be′ v
sem: be_pres	sem: be_pres neg	sem: be_pres	sem: be_pres neg
mdr:	mdr:	mdr:	mdr:
arg:	arg:	arg:	arg:
nc:	nc:	nc:	nc:
pc:	pc:	pc:	pc:
prn:	prn:	prn:	prn:

$$
\begin{bmatrix}
\text{sur: are} \\
\text{verb: v\_1} \\
\text{cat: n-s13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_pres} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: aren't} \\
\text{verb: v\_1} \\
\text{cat: n-s13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_pres neg} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: was} \\
\text{verb: v\_1} \\
\text{cat: ns13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_past} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: wasn't} \\
\text{verb: v\_1} \\
\text{cat: ns13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_past neg} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
$$

$$
\begin{bmatrix}
\text{sur: were} \\
\text{verb: v\_1} \\
\text{cat: n-s13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_past} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: weren't} \\
\text{verb: v\_1} \\
\text{cat: n-s13}'\ \text{be}'\ \text{v} \\
\text{sem: be\_past neg} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: been} \\
\text{verb: v\_1} \\
\text{cat: be}'\ \text{hv} \\
\text{sem: be\_perf} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
\begin{bmatrix}
\text{sur: being} \\
\text{verb: v\_1} \\
\text{cat: be}'\ \text{be} \\
\text{sem: be\_prog} \\
\text{mdr:} \\
\text{arg:} \\
\text{nc:} \\
\text{pc:} \\
\text{prn:}
\end{bmatrix}
$$

13.1.9 Forms of the auxiliary have

$$\begin{bmatrix}\text{sur: have}\\ \text{verb: v\_1}\\ \text{cat: n-s3}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: haven't}\\ \text{verb: v\_1}\\ \text{cat: n-s3}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_pres neg}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: has}\\ \text{verb: v\_1}\\ \text{cat: s3}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_pres}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: hasn't}\\ \text{verb: v\_1}\\ \text{cat: s3}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_pres neg}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

$$\begin{bmatrix}\text{sur: had}\\ \text{verb: v\_1}\\ \text{cat: n}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_past}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: hadn't}\\ \text{verb: v\_1}\\ \text{cat: n}'\ \text{hv}'\ \text{v}\\ \text{sem: hv\_past neg}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix} \begin{bmatrix}\text{sur: having}\\ \text{verb: v\_1}\\ \text{cat: be}'\ \text{hv}\\ \text{sem: hv\_prog}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}$$

13.1.10 Forms of the auxiliary do

$$
\begin{bmatrix} \text{sur: do} \\ \text{verb: v\_1} \\ \text{cat: n-s3}' \text{ do}' \text{ v} \\ \text{sem: do\_pres} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: don't} \\ \text{verb: v\_1} \\ \text{cat: n-s3}' \text{ do}' \text{ v} \\ \text{sem: do\_pres neg} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: does} \\ \text{verb: v\_1} \\ \text{cat: ns3}' \text{ do}' \text{ v} \\ \text{sem: do\_pres} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: doesn't} \\ \text{verb: v\_1} \\ \text{cat: ns3}' \text{ do}' \text{ v} \\ \text{sem: do\_pres neg} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
$$

$$
\begin{bmatrix} \text{sur: did} \\ \text{verb: v\_1} \\ \text{cat: n}' \text{ do}' \text{ v} \\ \text{sem: do\_past} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: didn't} \\ \text{verb: v\_1} \\ \text{cat: n}' \text{ do}' \text{ v} \\ \text{sem: do\_past neg} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: doing} \\ \text{verb: v\_1} \\ \text{cat: a}' \text{ be} \\ \text{sem: do\_prog} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
\begin{bmatrix} \text{sur: done} \\ \text{verb: v\_1} \\ \text{cat: a}' \text{ hv} \\ \text{sem: do\_perf} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}
$$

13.1.11 Forms of adnominals

sur: beautiful	sur: heavy	sur: heavier	sur: heaviest	sur: old	sur: older	sur: oldest
adj: *beautiful*	adj: *heavy*	adj: *heavy*	adj: *heavy*	adj: *old*	adj: *old*	adj: *old*
cat: adn	cat: adn	cat: adn	cat: adn	cat: adn	cat: adn	cat: adn
sem:	sem:	sem: comp	sem: SUP	sem:	sem: comp	sem: sup
mdr: B	mdr: B	mdr: B	mdr: B	mdr: B	mdr: B	mdr: B
mdd:	mdd:	mdd:	mdd:	mdd:	mdd:	mdd:
idy: B	idy: B	idy: B	idy: B	idy: B	idy: B	idy: B
prn:	prn:	prn:	prn:	prn:	prn:	prn:

13.1.12 Forms of adverbials

sur: heavily	sur: beautifully
adj: *heavy*	adj: *beautiful*
cat: adv	cat: adv
sem:	sem:
mdr: B	mdr: B
mdd:	mdd:
idy: B	idy: B
prn:	prn:

13.1.13 Lexical values of the cat attribute

decl = declarative sentence
v = verb, unmarked for sentence mood
ns1 = nominative singular first person filler
pro2= nominative and oblique second person singular and plural filler
ns3 = nominative singular third person filler
np-2= nominative plural minus second person filler (i.e. first and third plural)
obq = noun phrase filler in the oblique (non-nominative) case
snp = third person singular noun phrase filler unmarked for case
pnp = third person plural noun phrase filler unmarked for case
np = third person noun phrase filler unmarked for case and number
nm = proper name
sn = singular noun valency filler
pn = plural noun valency filler
nn = noun filler unmarked for number
be = valency filler indicating a present participle
hv = valency filler indicating a past participle
adn = adnominal

v′	= valency position for verb unmarked for sentence mood
n′	= valency position for nominative of any person or number
n-s3′	= valency position for nominative minus singular third person
ns1′	= valency position for nominative singular first person
ns3′	= valency position for nominative singular third person
ns13′	= valency position for nominative singular first and third person
n-s13′	= valency position for nominative minus singular first and third person
a′	= accusative valency position for oblique noun phrase
d′	= dative valency position for oblique noun phrase
sn′	= valency position for third person singular noun
pn′	= valency position for third person plural noun
be′	= valency position for a present participle
hv′	= valency position for a past participle
do′	= valency position for an infinitive

13.1.14 Lexical values of the sem attribute

f	= femininum
m	= masculinum
sg	= singular
pl	= plural
def	= definite
indef	= indefinite
sel	= selective
exh	= exhaustive
pres	= present tense
past	= past tense
perf	= past participle
prog	= progressive
be_pres	= present tense of auxiliary be
hv_pres	= present tense of auxiliary have
do_pres	= present tense of auxiliary do, including modals
be_past	= past tense of auxiliary be
hv_past	= past tense of auxiliary have
do_past	= past tense of auxiliary do, including modals
be_perf	= past participle of auxiliary be
hv_perf	= past participle of auxiliary have
do_perf	= past participle of auxiliary do
neg	= negated
comp	= comparative
sup	= superlative

13.2 Preamble and Definition of LA-hear.2

13.2.1 List of variables

α, β, γ= for a core value
SM = sentence mood
VT = verb type filler
VT$'$ = verb type valency position
NP = noun phrase filler
NP$'$ = noun phrase valency position
OBQ = oblique noun phrase filler
OBQ$'$ = oblique noun phrase valency position
N = noun filler
N$'$ = noun valency position
AUX = auxiliary filler
AUX$'$ = auxiliary valency position

X, Y, Z = .?.?.?.? (arbitrary sequence up to length 4)
N_n = simultaneous substitution variable for a noun
V_n = simultaneous substitution variable for a verb

13.2.2 Restrictions of variables

SM	ϵ {decl}
VT	ϵ {v}
VT′	ϵ {v′}
NP	ϵ {pro2, nm, ns1, ns3, np-2, snp, pnp, pn, np, obq}
NP′	ϵ {n′, n-s3′, ns1′, ns3′, ns13′, n-s13′, d′, a′}
OBQ	ϵ {snp, pnp, pn, obq}
OBQ′	ϵ {d′, a′}
N	ϵ {sn, pn}
N′	ϵ {nn′, sn′, pn′}
AUX	ϵ {do, hv, be}
AUX′	ϵ {do′, hv′, be′}
N_*n*	ϵ {n_1, n_2, n_3, . . . }
V_*n*	ϵ {v_1, v_2, v_3, . . . }

13.2.3 Agreement conditions

if NP = ns1, then NP$'$ ϵ {n$'$, n-s3$'$, ns1$'$, ns13$'$}
if NP = pro2, then NP$'$ ϵ {n$'$, n-s3$'$, n-s13$'$, d$'$, a$'$}
if NP = ns3, then NP$'$ ϵ {n$'$, ns3$'$, ns13$'$}
if NP = np-2, then NP$'$ ϵ {n$'$, n-s3$'$, n-s13$'$}
if NP ϵ {nm, snp}, then NP$'$ ϵ {n$'$, ns3$'$, ns13$'$, d$'$, a$'$}
if NP = pnp, then NP$'$ ϵ {n$'$, n-s3$'$, n-s13$'$, d$'$, a$'$}
if NP = np, then NP$'$ ϵ {n$'$, ns3$'$, ns13$'$, n-s3$'$, n-s13$'$, d$'$, a$'$}
if NP = obq, then NP$'$ ϵ {d$'$, a$'$}
if AUX$'$ = do$'$, then AUX = n-s3$'$
if AUX$'$ = hv$'$, then AUX ϵ {hv, n$'$}
if AUX$'$ = be$'$, then AUX = be
if N$'$ = nn$'$, then N ϵ {nn, sn, pn}
if N$'$= sn$'$, then N ϵ {nn, sn}
if N$'$= pn$'$, then N ϵ {nn, pn}

13.2.4 Formal definition of LA-hear.2

$$\textbf{ST}_S =_{def} \{ \; (\begin{bmatrix}\text{cat: X}\end{bmatrix} \; \{\text{1 DET+ADN, 2 DET+NN, 3 NOM+FV}\}) \; \}$$

DET+ADN {4 DET+ADN, 5 DET+NN}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\text{ X}\\ \text{mdr:}\\ \text{idy:}\end{bmatrix} \begin{bmatrix}\text{adj: }\alpha\\ \text{cat: adn}\\ \text{mdd:}\end{bmatrix} \quad \begin{array}{l}\text{acopy } \alpha \text{ ss.mdr}\\ \text{ecopy ss.noun nw.mdd}\\ \text{acopy ss.idy nw.mdd}\\ \text{copy}_{ss} \text{ copy}_{nw}\end{array}$$

DET+NN {6 NOM+FV, 7 FV+NP, 8 S+IP}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\text{ X}\\ \text{sem: Y}\end{bmatrix} \begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{sem: Z}\end{bmatrix} \quad \begin{array}{l}\text{delete N}' \text{ ss.cat}\\ \text{acopy nw.sem ss.sem}\\ \text{replace } \alpha \text{ N\_}n\\ \text{copy}_{ss}\end{array}$$

NOM+FV {9 FV+NP, 10 AUX+NFV, 11 S+IP}

$$\begin{bmatrix}\text{noun: }\alpha\\ \text{cat: NP}\\ \text{fnc:}\\ \text{prn: k}\end{bmatrix} \begin{bmatrix}\text{verb: }\beta\\ \text{cat: NP}'\text{ X VT}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\end{bmatrix} \quad \begin{array}{l}\text{delete NP}' \text{ nw.cat}\\ \text{acopy } \alpha \text{ nw.arg}\\ \text{ecopy } \beta \text{ ss.fnc}\\ \text{ecopy PC nw.pc}\\ \text{acopy PCV nw.pc}\\ \text{set } \beta \text{ NCV}\\ \text{copy}_{ss} \text{ copy}_{nw}\end{array}$$

FV+NP {12 DET+ADN, 13 DET+NN, 14 FV+NP, 15 S+IP}

$$\begin{bmatrix}\text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:}\end{bmatrix} \begin{bmatrix}\text{noun: } \alpha \\ \text{cat: Y NP} \\ \text{fnc:}\end{bmatrix} \quad \begin{array}{l}\text{delete NP}' \text{ ss.cat} \\ \text{acopy } \alpha \text{ ss.arg} \\ \text{ecopy } \beta \text{ nw.fnc} \\ \text{copy}_{ss}\text{copy}_{nw}\end{array}$$

AUX+NFV {16 AUX+NFV, 17 FV+NP 18 S+IP}

$$\begin{bmatrix}\text{verb: V\_}n \\ \text{cat: AUX}' \text{ V} \\ \text{sem: X}\end{bmatrix} \begin{bmatrix}\text{verb: } \alpha \\ \text{cat: Y AUX} \\ \text{sem: Z}\end{bmatrix} \quad \begin{array}{l}\text{replace Y AUX}' \\ \text{acopy nw.sem ss.sem} \\ \text{replace } \alpha \text{ V\_}n \\ \text{copy}_{ss}\end{array}$$

S+IP { 19 IP+START}

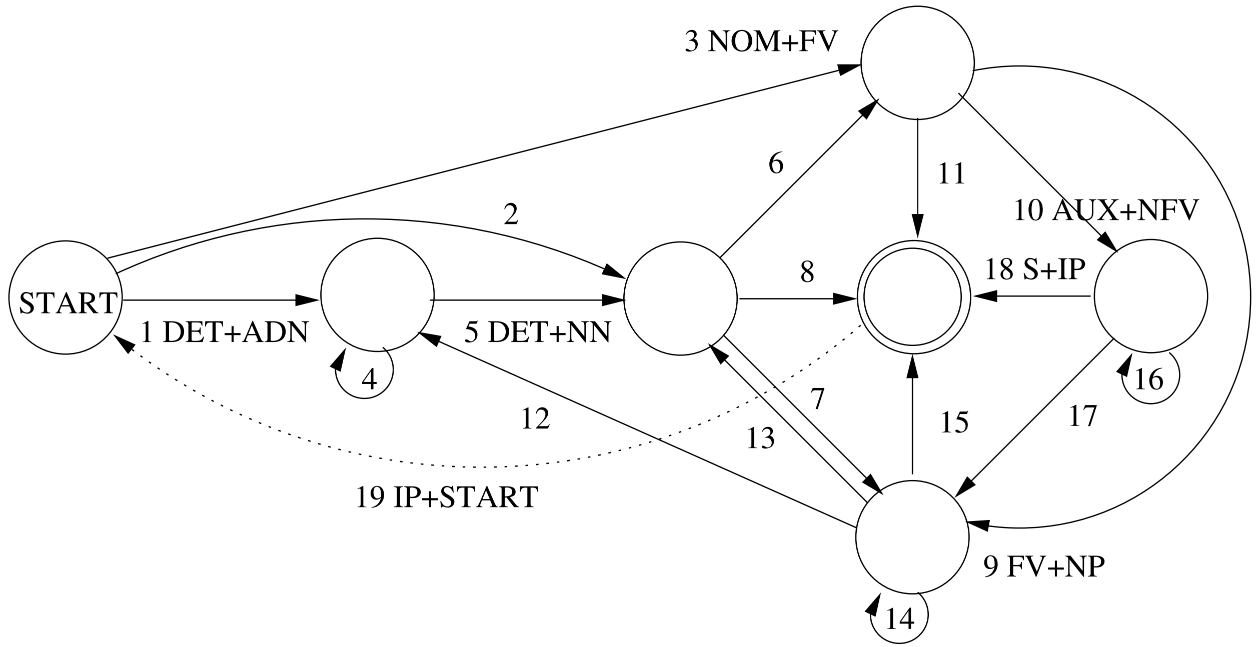
$$\begin{bmatrix}\text{verb: } \alpha \\ \text{cat: VT} \\ \text{prn: k}\end{bmatrix} \begin{bmatrix}\text{cat: VT}' \text{ SM}\end{bmatrix} \quad \begin{array}{l}\text{replace SM VT} \\ \text{set k ss.PC} \\ \text{set } \alpha \text{ PCV} \\ \text{copy}_{ss}\end{array}$$

IP+START {1 DET+ADN, 2 DET+NN, 3 NOM+FV}

$$\begin{bmatrix}\text{verb: } \alpha \\ \text{cat: SM} \\ \text{nc:}\end{bmatrix} \begin{bmatrix}\text{noun: } \beta \\ \text{cat: X NP} \\ \text{prn: k}\end{bmatrix} \quad \begin{array}{l}\text{increment nw.prn} \\ \text{ecopy k ss.nc} \\ \text{acopy `NCV' ss.nc} \\ \text{copy}_{ss} \text{ copy}_{nw}\end{array}$$

$$\textbf{ST}_F =_{def} \{ (\begin{bmatrix}\text{cat: decl}\end{bmatrix} \text{ rp}_{\text{ S+IP}}) \}$$

13.2.5 Finite state transition network of LA-hear.2


3 NOM+FV
6
11
10 AUX+NFV
2
8
18 S+IP
START
1 DET+ADN
5 DET+NN
4
16
7
12
13
15
17
19 IP+START
9 FV+NP
14

13.2.6 Sequence of rule applications in derivations 5.4, 5.5, and 5.6

	1.1 The
1 DET+ADN	1.2 heavy
4 DET+ADN	1.3 old
5 DET+NN	1.4 car
6 NOM+FV	1.5 hit
9 FV+NP	1.6 a
12 DET+ADN	1.7 beautiful
5 DET+NN	1.8 tree
8 S+IP	1.9 .
19 IP+START	2.1 The
2 DET+NN	2.2 car
6 NOM+FV	2.3 had
10 AUX+NFV	2.4 been
16 AUX+NFV	2.5 speeding
18 S+IP	2.6 .
19 IP+START	3.1 The
2 DET+NN	3.2 farmer
6 NOM+FV	3.3 gave
9 FV+NP	3.5 the
13 DET+NN	3.6 driver
7 FV+NP	3.7 a
13 DET+NN	3.8 lift
8 S+IP	3.4 .

13.3 Interpreting a Sentence with Complex Noun Phrases

13.3.1 Combining The and heavy

1 DET+ADN {4 DET+ADN, 5 DET+NN}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\text{ X}\\ \text{mdr:}\\ \text{idy:}\end{bmatrix} \quad \begin{bmatrix}\text{adj: }\alpha\\ \text{cat: adn}\\ \text{mdd:}\end{bmatrix} \qquad \begin{array}{l}\text{acopy }\alpha\text{ ss.mdr}\\ \text{ecopy ss.noun nw.mdd}\\ \text{acopy ss.idy nw.mdd}\\ \text{copy}_{ss}\text{ copy}_{nw}\end{array}$$

$$\begin{bmatrix}\text{sur: 1.1 the}\\ \text{noun: n\_1}\\ \text{cat: nn}'\text{ np}\\ \text{sem: def}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_1 \begin{bmatrix}\text{sur: 1.2 heavy}\\ \text{adj: }\textit{heavy}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd:}\\ \text{idy: B}\\ \text{prn:}\end{bmatrix}_2 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{noun: n\_1}\\ \text{cat: nn}'\text{ np}\\ \text{sem: def}\\ \text{mdr: heavy}\\ \text{fnc:}\\ \text{idy: 1}\\ \text{prn: 1}\end{bmatrix}_1 \begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{heavy}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n\_1 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_2$$

13.3.2 Combining The heavy and old

4 DET+ADN {4 DET+ADN, 5 DET+NN}

$$
\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\ \text{X}\\ \text{mdr:}\\ \text{idy:}\end{bmatrix}
\quad
\begin{bmatrix}\text{adj: }\alpha\\ \text{cat: adn}\\ \text{mdd:}\end{bmatrix}
\quad
\begin{array}{l}\text{acopy }\alpha\text{ ss.mdr}\\ \text{ecopy ss.noun nw.mdd}\\ \text{acopy ss.idy nw.mdd}\\ \text{copy}_{ss}\ \text{copy}_{nw}\end{array}
$$

$$
\begin{bmatrix}\text{sur:}\\ \text{noun: n\_1}\\ \text{cat: nn}'\ \text{np}\\ \text{sem: def}\\ \text{mdr: heavy}\\ \text{fnc:}\\ \text{idy: 1}\\ \text{prn: 1}\end{bmatrix}_1
\begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{heavy}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n\_1 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_2
\begin{bmatrix}\text{sur: 1.3 old}\\ \text{adj: }\textit{old}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd:}\\ \text{idy: B}\\ \text{prn:}\end{bmatrix}_3
\Longrightarrow
\begin{bmatrix}\text{sur:}\\ \text{noun: n\_1}\\ \text{cat: nn}'\ \text{np}\\ \text{sem: def}\\ \text{mdr: heavy}\\ \quad\text{old}\\ \text{fnc:}\\ \text{idy: 1}\\ \text{prn: 1}\end{bmatrix}_1
\begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{heavy}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n\_1 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_2
\begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{old}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n\_1 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_3
$$

13.3.3 Combining The heavy old and car

5 DET+NN { 6 NOM+FV, 7 FV+NP, 8 S+IP}

Rule patterns:

ss	nw
noun: N_*n*	noun: α
cat: N′ X	cat: N
sem: Y	sem: Z

Operations:

delete N′ ss.cat
acopy nw.sem ss.sem
replace α N_*n*
copy$_{ss}$

Input:

1	2	3	4
sur:	sur:	sur:	sur: 1.4 car
noun: n_1	adj: *heavy*	adj: *old*	noun: *car*
cat: nn′ np	cat: adn	cat: adn	cat: sn
sem: def	sem:	sem:	sem: sg
mdr: heavy old	mdr: B	mdr: B	mdr:
fnc:	mdd: n_1 1	mdd: n_1 1	fnc:
idy: 1	idy: B	idy: B	idy:
prn: 1	prn: 1	prn: 1	prn:

$\Longrightarrow$

Output:

1	2	3
sur:	sur:	sur:
noun: *car*	adj: *heavy*	adj: *old*
cat: np	cat: adn	cat: adn
sem: def sg	sem:	sem:
mdr: heavy old	mdr: B	mdr: B
fnc:	mdd: car 1	mdd: car 1
idy: 1	idy: B	idy: B
prn: 1	prn: 1	prn: 1

13.3.4 **Combining** The heavy old car **and** hit

6 NOM+FV {9 FV+NP, 10 AUX+NFV, 11 S+IP}

$$\begin{bmatrix}\text{noun: } \alpha \\ \text{cat: NP} \\ \text{fnc:} \\ \text{prn: k}\end{bmatrix} \quad \begin{bmatrix}\text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:}\end{bmatrix}$$

delete NP$'$ nw.cat
acopy α nw.arg
ecopy β ss.fnc
ecopy PC nw.pc
acopy PCV nw.pc
set β NCV
copy$_{ss}$ copy$_{nw}$

$$\begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{car} \\ \text{cat: np} \\ \text{sem: def sg} \\ \text{mdr: heavy old} \\ \text{fnc:} \\ \text{idy: 1} \\ \text{prn: 1}\end{bmatrix}_1 \begin{bmatrix}\text{sur: 1.5 hit} \\ \text{verb: } \textit{hit} \\ \text{cat: n}' \text{ a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_5 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{car} \\ \text{cat: np} \\ \text{sem: def sg} \\ \text{mdr: heavy old} \\ \text{fnc: hit} \\ \text{idy: 1} \\ \text{prn: 1}\end{bmatrix}_1 \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car} \\ \text{nc:} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_5$$

13.3.5 Combining The heavy old car hit **and** a

9 FV+NP {12 DET+ADN, 13 DET+NN, 14 FV+NP, 15 S+IP}

$$\begin{bmatrix}\text{verb: } \beta\\ \text{cat: NP}' \text{ X VT}\\ \text{arg: }\end{bmatrix} \begin{bmatrix}\text{noun: } \alpha\\ \text{cat: Y NP}\\ \text{fnc: }\end{bmatrix}$$

delete NP$'$ ss.cat
acopy α ss.arg
ecopy β nw.fnc
copy$_{ss}$copy$_{nw}$

$$\begin{bmatrix}\text{sur: }\\ \text{verb: } \textit{hit}\\ \text{cat: a}' \text{ v}\\ \text{sem: past}\\ \text{mdr: }\\ \text{arg: car}\\ \text{nc: }\\ \text{pc: }\\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur: 1.6 a}\\ \text{noun: n\_2}\\ \text{cat: sn}' \text{ snp}\\ \text{sem: indef sg}\\ \text{mdr: }\\ \text{fnc: }\\ \text{idy: }\\ \text{prn: }\end{bmatrix}_6 \Longrightarrow \begin{bmatrix}\text{sur: }\\ \text{verb: } \textit{hit}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr: }\\ \text{arg: car n\_2}\\ \text{nc: }\\ \text{pc: }\\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur: }\\ \text{noun: n\_2}\\ \text{cat: sn}' \text{ snp}\\ \text{sem: indef sg}\\ \text{mdr: }\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6$$

13.3.6 **Combining** The heavy old car hit a **and** beautiful

12 DET+ADN {4 DET+ADN, 5 DET+NN}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\text{ X}\\ \text{mdr:}\\ \text{idy:}\end{bmatrix} \quad \begin{bmatrix}\text{adj: }\alpha\\ \text{cat: adn}\\ \text{mdd:}\end{bmatrix}$$

acopy α ss.mdr
ecopy ss.noun nw.mdd
acopy ss.idy nw.mdd
copy$_{ss}$ copy$_{nw}$

$$\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{hit}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: car n\_2}\\ \text{nc:}\\ \text{pc:}\\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur:}\\ \text{noun: n\_2}\\ \text{cat: sn}'\text{ snp}\\ \text{sem: indef sg}\\ \text{mdr:}\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6 \begin{bmatrix}\text{sur: 1.7 beautiful}\\ \text{adj: }\textit{beautiful}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd:}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_7 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{hit}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: car n\_2}\\ \text{nc:}\\ \text{pc:}\\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur:}\\ \text{noun: n\_2}\\ \text{cat: sn}'\text{ snp}\\ \text{sem: indef sg}\\ \text{mdr: beautiful}\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6 \begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{beautiful}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n\_2 2}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_7$$

13.3.7 Combining The heavy old car hit a beautiful and tree

5 DET+NN {6 NOM+FV, 7 FV+NP, 8 S+IP}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\ \text{X}\\ \text{sem: Y}\end{bmatrix} \qquad \begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{sem: Z}\end{bmatrix}$$

delete N′ ss.cat
acopy nw.sem ss.sem
replace α N_n
copy$_{ss}$

$$\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{hit}\\ \text{cat: sn}'\ \text{v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: car n_2}\\ \text{nc:}\\ \text{pc:}\\ \text{prn: 1}\end{bmatrix}_5
\begin{bmatrix}\text{sur:}\\ \text{noun: n_2}\\ \text{cat: sn}'\ \text{snp}\\ \text{sem: indef sg}\\ \text{mdr: beautiful}\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6
\begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{beautiful}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: n_2 2}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_7
\begin{bmatrix}\text{sur: 1.8 tree}\\ \text{noun: }\textit{tree}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_8
\Longrightarrow
\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{hit}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: car tree}\\ \text{nc:}\\ \text{pc:}\\ \text{prn: 1}\end{bmatrix}_5$$

$$\begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{tree}\\ \text{cat: snp}\\ \text{sem: indef sg}\\ \text{mdr: beautiful}\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6
\begin{bmatrix}\text{sur:}\\ \text{adj: }\textit{beautiful}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: tree 2}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_7$$

13.3.8 Combining The heavy old car hit a beautiful tree **and .**

8 S+IP {19 IP+START}

$$\begin{bmatrix}\text{verb: } \alpha \\ \text{cat: VT} \\ \text{prn: k}\end{bmatrix} \qquad \begin{bmatrix}\text{cat: VT}' \text{ SM}\end{bmatrix} \qquad \begin{array}{l}\text{replace SM VT} \\ \text{set k PC} \\ \text{set } \alpha \text{ PCV} \\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc:} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{tree} \\ \text{cat: np} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: hit} \\ \text{idy: 2} \\ \text{prn: 1}\end{bmatrix}_6 \begin{bmatrix}\text{sur: 1.9 .} \\ \text{cat: v}' \text{ decl}\end{bmatrix}_8 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc:} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_5 \begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{tree} \\ \text{cat: np} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: hit} \\ \text{idy: 2} \\ \text{prn: 1}\end{bmatrix}_6$$

13.3.9 Result of parsing The heavy old car hit a beautiful tree.

$$
\begin{bmatrix}\text{sur:}\\ \text{noun: } \textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr: heavy}\\ \qquad\quad \text{old}\\ \text{fnc: hit}\\ \text{idy: 1}\\ \text{prn: 1}\end{bmatrix}_1
\begin{bmatrix}\text{sur:}\\ \text{adj: } \textit{heavy}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: car 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_2
\begin{bmatrix}\text{sur:}\\ \text{adj: } \textit{old}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: car 1}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_3
\begin{bmatrix}\text{sur:}\\ \text{verb: } \textit{hit}\\ \text{cat: decl}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: car tree}\\ \text{nc:}\\ \text{pc:}\\ \text{prn: 1}\end{bmatrix}_5
\begin{bmatrix}\text{sur:}\\ \text{noun: } \textit{tree}\\ \text{cat: snp}\\ \text{sem: indef sg}\\ \text{mdr: beautiful}\\ \text{fnc: hit}\\ \text{idy: 2}\\ \text{prn: 1}\end{bmatrix}_6
\begin{bmatrix}\text{sur:}\\ \text{adj: } \textit{beautiful}\\ \text{cat: adn}\\ \text{sem:}\\ \text{mdr: B}\\ \text{mdd: tree 2}\\ \text{idy: B}\\ \text{prn: 1}\end{bmatrix}_7
$$

13.4 Interpreting a Sentence with a Complex Verb Phrase

13.4.1 Combining The heavy old car hit a beautiful tree. and The

19 IP+START {1 DET+ADN, 2 DET+NN, 3 NOM+FV}

$$\begin{bmatrix} \text{verb: } \alpha \\ \text{cat: SM} \\ \text{nc:} \end{bmatrix} \quad \begin{bmatrix} \text{noun: } \beta \\ \text{cat: X NP} \\ \text{prn: k} \end{bmatrix}$$

increment nw.prn
ecopy k ss.nc
acopy 'NCV' ss.nc
copy$_{ss}$ copy$_{nw}$

$$\begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc:} \\ \text{pc:} \\ \text{prn: 1} \end{bmatrix}_8 \begin{bmatrix} \text{sur: 2.1 the} \\ \text{noun: n\_1} \\ \text{cat: nn}' \text{ np} \\ \text{sem: def} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:} \end{bmatrix}_1 \Longrightarrow \begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc: 2 NCV} \\ \text{pc:} \\ \text{prn: 1} \end{bmatrix}_8 \begin{bmatrix} \text{sur:} \\ \text{noun: n\_1} \\ \text{cat: nn}' \text{ np} \\ \text{sem: def} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy: 3} \\ \text{prn: 2} \end{bmatrix}_1$$

13.4.2 Combining The and car

2 DET+NN $\{$6 NOM+FV, 7 FV+NP, 8 S+IP$\}$

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\ \text{X}\\ \text{sem: Y}\end{bmatrix}\quad\begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{sem: Z}\end{bmatrix}\qquad\begin{array}{l}\text{delete N}'\text{ ss.cat}\\ \text{acopy nw.sem ss.sem}\\ \text{replace }\alpha\text{ N\_}n\\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:}\\ \text{noun: n\_1}\\ \text{cat: nn}'\text{ np}\\ \text{sem: def}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1\begin{bmatrix}\text{sur: 2.2 car}\\ \text{noun: }\textit{car}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_2\quad\Longrightarrow\quad\begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1$$

13.4.3 Combining The car and had

6 NOM+FV {9 FV+NP, 10 AUX+NFV, 11 S+IP}

$$\begin{bmatrix}\text{noun: } \alpha \\ \text{cat: NP} \\ \text{fnc:} \\ \text{prn: k}\end{bmatrix} \begin{bmatrix}\text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:}\end{bmatrix}$$

delete NP′ nw.cat
acopy α nw.arg
ecopy β ss.fnc
ecopy PC nw.pc
acopy PCV nw.pc
set β NCV
copy$_{ss}$ copy$_{nw}$

$$\begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc: 2 NCV} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_8 \begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{car} \\ \text{cat: np} \\ \text{sem: def sg} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy: 3} \\ \text{prn: 2}\end{bmatrix}_1 \begin{bmatrix}\text{sur: 2.3 had} \\ \text{verb: v\_1} \\ \text{cat: n}' \text{ hv}' \text{ v} \\ \text{sem: hv\_past} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:}\end{bmatrix}_3 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{hit} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: car tree} \\ \text{nc: 2 v\_1} \\ \text{pc:} \\ \text{prn: 1}\end{bmatrix}_8 \begin{bmatrix}\text{sur:} \\ \text{noun: } \textit{car} \\ \text{cat: np} \\ \text{sem: def sg} \\ \text{mdr:} \\ \text{fnc: v\_1} \\ \text{idy: 3} \\ \text{prn: 1}\end{bmatrix}_1 \begin{bmatrix}\text{sur:} \\ \text{verb: v\_1} \\ \text{cat: hv}' \text{ v} \\ \text{sem: hv\_past} \\ \text{mdr:} \\ \text{arg: car} \\ \text{nc:} \\ \text{pc: 1 hit} \\ \text{prn: 2}\end{bmatrix}_3$$

13.4.4 Combining The car had **and** been

10 AUX+NFV $\{$16 AUX+NFV, 17 FV+NP 18 S+IP$\}$

$$\begin{bmatrix}\text{verb: V\_}n\\ \text{cat: AUX}'\text{ v}\\ \text{sem: X}\end{bmatrix}\quad \begin{bmatrix}\text{verb: }\alpha\\ \text{cat: Y AUX}\\ \text{sem: Z}\end{bmatrix}\qquad \begin{array}{l}\text{replace Y AUX}'\\ \text{acopy nw.sem ss.sem}\\ \text{replace }\alpha\text{ V\_}n\\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc: v\_1}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1 \begin{bmatrix}\text{sur:}\\ \text{verb: v\_1}\\ \text{cat: hv}'\text{ v}\\ \text{sem: hv\_past}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 2.4 been}\\ \text{verb: v\_2}\\ \text{cat: be}'\text{ hv}\\ \text{sem: be\_perf}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}_4 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc: v\_2}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1 \begin{bmatrix}\text{sur:}\\ \text{verb: v\_2}\\ \text{cat: be}'\text{ v}\\ \text{sem: hv\_past be\_perf}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3$$

13.4.5 Combining The car had been and speeding

16 AUX+NFV {16 AUX+NFV, 17 FV+NP 18 S+IP}

$$\begin{bmatrix}\text{verb: V\_}n\\ \text{cat: AUX}'\ \text{v}\\ \text{sem: X}\end{bmatrix}\quad\begin{bmatrix}\text{verb: }\alpha\\ \text{cat: Y AUX}\\ \text{sem: Z}\end{bmatrix}$$

replace Y AUX′
acopy nw.sem ss.sem
replace α V_n
copy$_{ss}$

$$\begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc: v\_2}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1 \begin{bmatrix}\text{sur:}\\ \text{verb: v\_2}\\ \text{cat: be}'\ \text{v}\\ \text{sem: hv\_past}\\ \text{be\_perf}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 2.5 speeding}\\ \text{verb: }\textit{speed}\\ \text{cat: be}\\ \text{sem: prog}\\ \text{mdr:}\\ \text{arg:}\\ \text{nc:}\\ \text{pc:}\\ \text{prn:}\end{bmatrix}_5 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{car}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc: speed}\\ \text{idy: 3}\\ \text{prn: 2}\end{bmatrix}_1 \begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{speed}\\ \text{cat: v}\\ \text{sem: hv\_past}\\ \text{be\_perf prog}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3$$

13.4.6 Combining The car had been speeding **and** .

18 S+IP {19 IP+START}

$$\begin{bmatrix}\text{verb: }\alpha\\ \text{cat: VT}\\ \text{prn: k}\end{bmatrix} \qquad [\text{cat: VT}'\ \text{SM}] \qquad \begin{array}{l}\text{replace SM VT}\\ \text{set k PC}\\ \text{set }\alpha\text{ PCV}\\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{speed}\\ \text{cat: v}\\ \text{sem: hv\_past be\_perf prog}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3 \quad \begin{bmatrix}\text{sur: 2.6 .}\\ \text{cat: v}'\ \text{decl}\end{bmatrix}_6 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{speed}\\ \text{cat: decl}\\ \text{sem: hv\_past be\_perf prog}\\ \text{mdr:}\\ \text{arg: car}\\ \text{nc:}\\ \text{pc: 1 hit}\\ \text{prn: 2}\end{bmatrix}_3$$

13.4.7 Result of parsing The car had been speeding.

$$
\begin{bmatrix}
\text{sur:} \\
\text{noun: } \textit{car} \\
\text{cat: np} \\
\text{sem: def sg} \\
\text{mdr:} \\
\text{fnc: speed} \\
\text{idy: 3} \\
\text{prn: 2}
\end{bmatrix}_1
\begin{bmatrix}
\text{sur:} \\
\text{verb: } \textit{speed} \\
\text{cat: decl} \\
\text{sem: hv\_past be\_perf prog} \\
\text{mdr:} \\
\text{arg: car} \\
\text{nc:} \\
\text{pc: 1 hit} \\
\text{prn: 2}
\end{bmatrix}_3
$$

13.5 Interpreting a Sentence with a Three-Place Verb

13.5.1 Combining The car had been speeding. and A

19 IP+START { 1 DET+ADN, 2 DET+NN, 3 NOM+FV}

$$\begin{bmatrix}\text{verb: } \alpha \\ \text{cat: SM} \\ \text{nc: }\end{bmatrix} \quad \begin{bmatrix}\text{noun: } \beta \\ \text{cat: X NP} \\ \text{prn: k}\end{bmatrix}$$

increment nw.prn
ecopy k ss.nc
acopy 'NCV' ss.nc
copy_{ss} copy_{nw}

$$\begin{bmatrix}\text{sur: } \\ \text{verb: } \textit{speed} \\ \text{cat: decl} \\ \text{sem: hv\_past} \\ \quad \text{be\_perf prog} \\ \text{mdr: } \\ \text{arg: car} \\ \text{nc: } \\ \text{pc: 1 hit} \\ \text{prn: 2}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 3.1 A} \\ \text{noun: n\_1} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: indef sg} \\ \text{mdr: } \\ \text{fnc: } \\ \text{idy: } \\ \text{prn: }\end{bmatrix}_1 \Longrightarrow \begin{bmatrix}\text{sur: } \\ \text{verb: } \textit{speed} \\ \text{cat: decl} \\ \text{sem: past perf prog} \\ \text{mdr: } \\ \text{arg: car} \\ \text{nc: 3 NCV} \\ \text{pc: 1 hit} \\ \text{prn: 2}\end{bmatrix}_3 \begin{bmatrix}\text{sur: } \\ \text{noun: n\_1} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: indef sg} \\ \text{mdr: } \\ \text{fnc: } \\ \text{idy: 4} \\ \text{prn: 3}\end{bmatrix}_1$$

13.5.2 Combining A and farmer

2 DET+NN $\{$6 NOM+FV, 7 FV+NP, 8 S+IP$\}$

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\ \text{X}\\ \text{sem: Y}\end{bmatrix} \quad \begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{v sem: Z}\end{bmatrix}$$

delete N$'$ ss.cat
acopy nw.sem ss.sem
replace α N_n
copy$_{ss}$

$$\begin{bmatrix}\text{sur:}\\ \text{noun: n\_1}\\ \text{cat: sn}'\ \text{snp}\\ \text{sem: indef sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy: 4}\\ \text{prn: 3}\end{bmatrix}_1 \begin{bmatrix}\text{sur: 3.2 farmer}\\ \text{noun: }\textit{farmer}\\ \text{cat: sn}\\ \text{sem:}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_2 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{farmer}\\ \text{cat: snp}\\ \text{sem: indef sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy: 4}\\ \text{prn: 3}\end{bmatrix}_1$$

13.5.3 Combining A farmer and gave

6 NOM+FV {9 FV+NP, 10 AUX+NFV, 11 S+IP}

$$
\begin{bmatrix} \text{noun: } \alpha \\ \text{cat: NP} \\ \text{fnc:} \\ \text{prn: k} \end{bmatrix}
\quad
\begin{bmatrix} \text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \end{bmatrix}
\quad
\begin{array}{l} \text{delete NP}' \text{ nw.cat} \\ \text{acopy } \alpha \text{ nw.arg} \\ \text{ecopy } \beta \text{ ss.fnc} \\ \text{ecopy PC nw.pc} \\ \text{acopy PCV nw.pc} \\ \text{set } \beta \text{ NCV} \\ \text{copy}_{ss} \text{ copy}_{nw} \end{array}
$$

$$
\begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{speed} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{ perf prog} \\ \text{mdr:} \\ \text{arg: car} \\ \text{nc: 3 NCV} \\ \text{pc: 1 hit} \\ \text{prn: 2} \end{bmatrix}_3
\begin{bmatrix} \text{sur:} \\ \text{noun: } \textit{farmer} \\ \text{cat: snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy: 4} \\ \text{prn: 3} \end{bmatrix}_1
\begin{bmatrix} \text{sur: 3.3 gave} \\ \text{verb: } \textit{give} \\ \text{cat: n}' \text{ d}' \text{ a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg:} \\ \text{nc:} \\ \text{pc:} \\ \text{prn:} \end{bmatrix}_3
\Longrightarrow
\begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{speed} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{ perf prog} \\ \text{mdr:} \\ \text{arg: car} \\ \text{nc: 3 give} \\ \text{pc: 1 hit} \\ \text{prn: 2} \end{bmatrix}_3
\begin{bmatrix} \text{sur:} \\ \text{noun: } \textit{farmer} \\ \text{cat: snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 4} \\ \text{prn: 3} \end{bmatrix}_1
\begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: d}' \text{ a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3} \end{bmatrix}_3
$$

13.5.4 Combining A farmer gave and the

9 FV+NP $\{$12 DET+ADN, 13 DET+NN, 14 FV+NP, 15 S+IP$\}$

$$\begin{bmatrix}\text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:}\end{bmatrix} \begin{bmatrix}\text{noun: } \alpha \\ \text{cat: Y NP} \\ \text{fnc:}\end{bmatrix} \quad \begin{array}{l}\text{delete NP}' \text{ ss.cat} \\ \text{acopy } \alpha \text{ ss.arg} \\ \text{ecopy } \beta \text{ nw.fnc} \\ \text{copy}_{ss}\text{copy}_{nw}\end{array}$$

$$\begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: d}' \text{ a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 3.4 the} \\ \text{noun: n\_2} \\ \text{cat: nn}' \text{ np} \\ \text{sem: def} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:}\end{bmatrix}_4 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer n\_1} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur:} \\ \text{noun: n\_2} \\ \text{cat: nn}' \text{ np} \\ \text{sem: def} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 5} \\ \text{prn: 3}\end{bmatrix}_4$$

13.5.5 Combining A farmer gave the and driver

13 DET+NN $\{$6 NOM+FV, 7 FV+NP, 8 S+IP$\}$

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\text{ X}\\ \text{sem: Y}\end{bmatrix}\quad\begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{sem: Z}\end{bmatrix}$$

delete N$'$ ss.cat
acopy nw.sem ss.sem
replace α N_n
copy$_{ss}$

$$\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{give}\\ \text{cat: a}'\text{ v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: farmer n\_2}\\ \text{nc:}\\ \text{pc: 2 speed}\\ \text{prn: 3}\end{bmatrix}_3\begin{bmatrix}\text{sur:}\\ \text{noun: n\_2}\\ \text{cat: nn}'\text{ np}\\ \text{sem: def}\\ \text{mdr:}\\ \text{fnc: give}\\ \text{idy: 5}\\ \text{prn: 3}\end{bmatrix}_4\begin{bmatrix}\text{sur: 3.5 driver}\\ \text{noun: }\textit{driver}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_5\Longrightarrow\begin{bmatrix}\text{sur:}\\ \text{verb: }\textit{give}\\ \text{cat: a}'\text{ v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: farmer driver}\\ \text{nc:}\\ \text{pc: 2 speed}\\ \text{prn: 3}\end{bmatrix}_3\begin{bmatrix}\text{sur:}\\ \text{noun: }\textit{driver}\\ \text{cat: np}\\ \text{sem: def sg}\\ \text{mdr:}\\ \text{fnc: give}\\ \text{idy: 5}\\ \text{prn: 3}\end{bmatrix}_4$$

13.5.6 Combining A farmer gave the driver and a

7 FV+NP {12 DET+ADN, 13 DET+NN, 14 FV+NP, 15 S+IP}

$$\begin{bmatrix}\text{verb: } \beta \\ \text{cat: NP}' \text{ X VT} \\ \text{arg:}\end{bmatrix} \quad \begin{bmatrix}\text{noun: } \alpha \\ \text{cat: Y NP} \\ \text{fnc:}\end{bmatrix}$$

delete NP′ ss.cat
acopy α ss.arg
ecopy β nw.fnc
copy$_{ss}$copy$_{nw}$

$$\begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: a}' \text{ v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer driver} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 3.6 a} \\ \text{noun: n\_3} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc:} \\ \text{idy:} \\ \text{prn:}\end{bmatrix}_6 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer driver n\_3} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur:} \\ \text{noun: n\_3} \\ \text{cat: sn}' \text{ snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 6} \\ \text{prn: 3}\end{bmatrix}_6$$

13.5.7 Combining A farmer gave the driver a **and** lift

13 DET+NN {6 NOM+FV, 7 FV+NP, 8 S+IP}

$$\begin{bmatrix}\text{noun: N\_}n\\ \text{cat: N}'\ \text{X}\\ \text{sem: Y}\end{bmatrix} \quad \begin{bmatrix}\text{noun: }\alpha\\ \text{cat: N}\\ \text{sem: Z}\end{bmatrix} \quad \begin{array}{l}\text{delete N}'\ \text{ss.cat}\\ \text{acopy nw.sem ss.sem}\\ \text{replace }\alpha\ \text{N\_}n\\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:}\\ \text{verb: } \textit{give}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: farmer driver n\_3}\\ \text{nc:}\\ \text{pc: 2 speed}\\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur:}\\ \text{noun: n\_3}\\ \text{cat: sn}'\ \text{snp}\\ \text{sem: indef sg}\\ \text{mdr:}\\ \text{fnc: give}\\ \text{idy: 6}\\ \text{prn: 3}\end{bmatrix}_6 \begin{bmatrix}\text{sur: 3.7 lift}\\ \text{noun: } \textit{lift}\\ \text{cat: sn}\\ \text{sem: sg}\\ \text{mdr:}\\ \text{fnc:}\\ \text{idy:}\\ \text{prn:}\end{bmatrix}_7 \Longrightarrow \begin{bmatrix}\text{sur:}\\ \text{verb: } \textit{give}\\ \text{cat: v}\\ \text{sem: past}\\ \text{mdr:}\\ \text{arg: farmer driver lift}\\ \text{nc:}\\ \text{pc: 2 speed}\\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur:}\\ \text{noun: } \textit{lift}\\ \text{cat: snp}\\ \text{sem: indef sg}\\ \text{mdr:}\\ \text{fnc: give}\\ \text{idy: 6}\\ \text{prn: 3}\end{bmatrix}_6$$

13.5.8 Combining A farmer gave the driver a lift **and** .

8 S+IP { 19 IP+START}

$$\begin{bmatrix}\text{verb: } \alpha \\ \text{cat: VT} \\ \text{prn: k}\end{bmatrix} \quad \begin{bmatrix}\text{cat: VT}' \text{ SM}\end{bmatrix} \quad \begin{array}{l}\text{replace SM VT} \\ \text{set k PC} \\ \text{set } \alpha \text{ PCV} \\ \text{copy}_{ss}\end{array}$$

$$\begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: v} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer driver lift} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3 \begin{bmatrix}\text{sur: 3.8 .} \\ \text{cat: v}' \text{ decl}\end{bmatrix}_8 \Longrightarrow \begin{bmatrix}\text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer driver lift} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3}\end{bmatrix}_3$$

13.5.9 Result of parsing A farmer gave the driver a lift.

$$
\begin{bmatrix} \text{sur:} \\ \text{noun: } \textit{farmer} \\ \text{cat: snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 4} \\ \text{prn: 3} \end{bmatrix}_2
\begin{bmatrix} \text{sur:} \\ \text{verb: } \textit{give} \\ \text{cat: decl} \\ \text{sem: past} \\ \text{mdr:} \\ \text{arg: farmer driver lift} \\ \text{nc:} \\ \text{pc: 2 speed} \\ \text{prn: 3} \end{bmatrix}_3
\begin{bmatrix} \text{sur:} \\ \text{noun: } \textit{driver} \\ \text{cat: np} \\ \text{sem: def sg} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 5} \\ \text{prn: 3} \end{bmatrix}_4
\begin{bmatrix} \text{sur:} \\ \text{noun: } \textit{lift} \\ \text{cat: snp} \\ \text{sem: indef sg} \\ \text{mdr:} \\ \text{fnc: give} \\ \text{idy: 6} \\ \text{prn: 3} \end{bmatrix}_6
$$

13.6 Storing the Output of LA-hear.2 in a Word Bank

13.6.1 Sorting proplets of LA-hear.2 sample into Word Bank

owner records (isolated proplets)	*member records* (connected proplets)		
sur: adj: *beautiful* cat: adn sem: mdr: B mdd: idy: B prn:	sur: beautiful adj: *beautiful* cat: adn sem: mdr: B mdd: tree 2 idy: B prn: 1		
sur: noun: *car* cat: sn sem: sg mdr: fnc: idy: prn:	sur: car noun: *car* cat: np sem: def sg mdr: heavy old fnc: hit idy: 1 prn: 1	sur: car noun: *car* cat: np sem: def sg mdr: fnc: speed idy: 3 prn: 2	
sur: noun: *driver* cat: sn sem: sg mdr: fnc: idy: prn:			sur: driver noun: *driver* cat: np sem: def sg mdr: fnc: give idy: 5 prn: 3

owner records (isolated proplets)	*member records* (connected proplets)
sur:	sur: farmer
noun: *farmer*	noun: *farmer*
cat: sn	cat: snp
sem:	sem: indef sg
mdr:	mdr:
fnc:	fnc: give
idy:	idy: 4
prn:	prn: 3

owner records (isolated proplets)	*member records* (connected proplets)
sur:	sur: gave
verb: *give*	verb: *give*
cat: n-s3′ d′ a′ v	cat: decl
sem: pres	sem: past
mdr:	mdr:
arg:	arg: farmer driver lift
nc:	nc:
pc:	pc: 2 speed
prn:	prn: 3

owner records (isolated proplets)	*member records* (connected proplets)
sur: adj: *heavy* cat: adn sem: mdr: B mdd: idy: B prn:	sur: heavy adj: *heavy* cat: adn sem: mdr: B mdd: car 1 idy: B prn: 1
sur: verb: *hit* cat: $n\text{-}s3'\ a'\ v$ sem: PRES mdr: arg: nc: pc: prn:	sur: hit verb: *hit* cat: decl sem: past mdr: arg: car tree nc: 2 speed pc: prn: 1
sur: adj: *old* cat: adn sem: mdr: B mdd: idy: B prn:	sur: old adj: *old* cat: adn sem: mdr: B mdd: car 1 idy: B prn: 1

owner records (isolated proplets)	*member records* (connected proplets)
sur: verb: *speed* cat: n-s3′ v sem: pres mdr: arg: nc: pc: prn:	sur: speeding verb: *speed* cat: decl sem: hv_past be_perf prog mdr: arg: car nc: 3 give pc: 1 hit prn: 2
sur: noun: *lift* cat: sn sem: sg mdr: fnc: idy: prn:	sur: lift noun: *lift* cat: snp sem: indef sg mdr: fnc: give idy: 6 prn: 3
sur: noun: *tree* cat: sn sem: sg mdr: fnc: idy: prn:	sur: tree noun: *tree* cat: np sem: indef sg mdr: beautiful fnc: hit idy: 2 prn: 1

isolated proplet	*connected proplets*	
sur: car	sur:	sur:
noun: *car*	noun: *car*	noun: *car*
cat: sn	cat: np	cat: np
sem: sg	sem: def sg	sem: def sg
mdr:	mdr: heavy old	mdr:
fnc:	fnc: hit	fnc: speed
idy:	idy: 1	idy: 3
prn:	prn: 1	prn: 2