

Displacement Logic for Grammar

Glyn Morrill & Oriol Valentín

Department of Computer Science
Universitat Politècnica de Catalunya
morrill@cs.upc.edu & oriol.valentin@gmail.com

ESLLI 2016, Bolzano

Lecture 3pre

From Displacement Calculus to Displacement Logic:
Polymorphism

Cross-serial dependencies

Swiss-German, and Dutch:

- (1) Jan Cecilia Henk de nijlpaarden zag helpen voeren
J C H the hippos saw help feed
'J saw C help H feed the hippos'

$sSi = 1$

- (2) **Jan:** $N: j$
Cecilia: $N: c$
Henk: $N: h$
de: $N/CN: t$
nijlpaarden: $CN: hippos$
zag: $(N \setminus Si) \downarrow (N \setminus (N \setminus S))$: see
1+helpen: $(N \setminus Si) \downarrow (N \setminus (N \setminus Si))$: help
1+voeren: $N \setminus (N \setminus Si)$: feed

		de+nijlpaarden:		1+voeren:		1+helpen:	
		N:		N\ (N\Si):			
		(ι hippos)		feed			
	H:				E\	(N\Si)↓(N\ (N\Si)):	
	N:	de+nijlpaarden+1+voeren: N\S: (feed (ι hippos))				help	
		h	de+nijlpaarden+1+helpen+voeren: N\ (N\Si): (help (feed (ι hippos)))			E↓	
	C:	H+de+nijlpaarden+1+helpen+voeren: N\Si: ((help (feed (ι hippos)) h))					zag:
	N:	H+de+nijlpaarden+1+helpen+voeren: N\Si: ((help (feed (ι hippos)) h))			E\		(N\Si)↓(N\ (N\S)):
		c	H+de+nijlpaarden+zag+helpen+voeren: N\ (N\S): (see ((help (feed (ι hippos)) h)))				see
J:		C+H+de+nijlpaarden+zag+helpen+voeren: N\ (N\S): ((see ((help (feed (ι hippos)) h))) c)			E↓		
N:		C+H+de+nijlpaarden+zag+helpen+voeren: N\S: (((see ((help (feed (ι hippos)) h))) c) j)			E\		
j		J+C+H+de+nijlpaarden+zag+helpen+voeren: S: (((see ((help (feed (ι hippos)) h))) c) j)					

$$\begin{array}{c}
\frac{CNp(n) \Rightarrow CNp(n) \quad \overline{Nt(s(p(n)))} \Rightarrow \overline{Nt(s(p(n)))}}{Nt(s(p(n)))/CNp(n) \quad CNp(n) \Rightarrow Nt(s(p(n)))} \downarrow L \quad \frac{\overline{Nt(s(m))} \Rightarrow \overline{Nt(s(m))} \quad \overline{Si(1)} \Rightarrow \overline{Si}}{Nt(s(m)), \overline{Nt(s(m)) \setminus Si(1)}} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(m)), \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, \overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si) \setminus 1)}} \Rightarrow \overline{Si} \downarrow L \quad \frac{\overline{Nt(s(m))} \Rightarrow \overline{Nt(s(m))} \quad \overline{Si(1)} \Rightarrow \overline{Si}}{Nt(s(m)), \overline{Nt(s(m)) \setminus Si(1)}} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(m)), \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, 1, \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Si} \triangleright^{-1} L \quad \frac{\overline{Nt(s(m))} \Rightarrow \overline{Nt(s(m))} \quad \overline{Nt(s(m)), \overline{Nt(s(m)) \setminus Si(1)}} \Rightarrow \overline{Si}}{Nt(s(m)), \overline{Nt(s(m)) \setminus Si(1)}} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(p(n)))/CNp(n), \overline{CNp(n)}, 1, \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Nt(s(m)) \setminus Si} \downarrow R \quad \frac{\overline{Nt(s(m)), Nt(s(m))}, \overline{Nt(s(m)) \setminus (Nt(s(m)) \setminus Si) \setminus 1}} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(m)), \overline{Nt(s(m))}, \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, \overline{\{Nt(s(m)) \setminus Si\} \downarrow (Nt(s(m)) \setminus (Nt(s(m)) \setminus Si) \setminus 1)} \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(m)), \overline{Nt(s(m))}, \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, 1, \triangleright^{-1}(\overline{\{Nt(s(m)) \setminus Si\} \downarrow (Nt(s(m)) \setminus (Nt(s(m)) \setminus Si) \setminus 1)} \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Si} \triangleright^{-1} L \quad \frac{\overline{Nt(s(m))} \Rightarrow \overline{Nt(s(m))} \quad \overline{Nt(s(m)), \overline{Nt(s(m)) \setminus Si}} \Rightarrow \overline{Si}}{Nt(s(m)), \overline{Nt(s(m)) \setminus Si}} \Rightarrow \overline{Si} \downarrow L \\
\frac{Nt(s(m)), \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, 1, \triangleright^{-1}(\overline{\{Nt(s(m)) \setminus Si\} \downarrow (Nt(s(m)) \setminus (Nt(s(m)) \setminus Si) \setminus 1)} \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Nt(s(m)) \setminus Si} \downarrow R \quad \frac{\overline{Nt(s(m)), Nt(s(f))}, \overline{Nt(s(f)) \setminus (Nt(s(m)) \setminus Sf)}} \Rightarrow \overline{Sf} \downarrow L \\
\frac{\overline{Nt(s(m)), Nt(s(f)), Nt(s(m)), \overline{Nt(s(p(n)))/CNp(n)}, \overline{CNp(n)}, \overline{\{Nt(s(m)) \setminus Si\} \downarrow (Nt(s(f)) \setminus (Nt(s(m)) \setminus Sf)}} \triangleright^{-1}(\overline{\{Nt(s(m)) \setminus Si\} \downarrow (Nt(s(m)) \setminus (Nt(s(m)) \setminus Si) \setminus 1)} \triangleright^{-1}(\overline{Nt(s(p(n)) \setminus (Nt(s(m)) \setminus Si)})} \Rightarrow \overline{Sf} \downarrow L
\end{array}$$