PATR-II

developed by: S. Shieber (et al.) at SRI around 1984

Implementations:

orig.	PATR-II	S. Shieber	Interlisp
	Z-PATR	S. Shieber	Zetalisp
	CL-PATR	S. Shieber	CommonLisp
	D-PATR	L. Karttunen	Interlisp-D
	P-PATR	S. Hirsh	Prolog
	SB-PATR	U. Saarbrücken	Lisp

PATR-Rules

$X_0 \rightarrow X_1 \ X_2$

$$\begin{bmatrix} X_0: & \begin{bmatrix} \text{cat: S} \\ \text{finite:} \langle 1 \rangle \end{bmatrix} \\ X_1: & \begin{bmatrix} \text{cat: NP} \\ \text{agr:} \langle 2 \rangle \end{bmatrix} \\ X_2: & \begin{bmatrix} \text{cat: VP} \\ \text{agr:} \langle 2 \rangle \\ \text{finite:} \langle 1 \rangle \end{bmatrix} \end{bmatrix}$$

$\langle X_0 \ \text{cat} \rangle = \text{S}$

$\langle X_1 \ \text{cat} \rangle = \text{NP}$

$\langle X_2 \ \text{cat} \rangle = \text{VP}$

$\langle X_0 \ \text{finite} \rangle = \langle X_2 \ \text{finite} \rangle$

$\langle X_1 \ \text{agr} \rangle = \langle X_2 \ \text{agr} \rangle$

PATR Grammar I

$S \rightarrow NP \;\; VP$

$X_0 \rightarrow X_1 \;\; X_2$

$$\begin{bmatrix} X_0: & \begin{bmatrix} \text{cat: S} \\ \text{head:}\langle 1 \rangle & [\text{subject:}\langle 2 \rangle] \end{bmatrix} \\ X_1:\langle 2 \rangle & [\text{cat: NP}] \\ X_2: & \begin{bmatrix} \text{cat: VP} \\ \text{head:}\langle 1 \rangle \end{bmatrix} \end{bmatrix}$$

$NP \rightarrow Det \;\; N$

X_0 Ÿ $X_1 \;\; X_2$

$$\begin{bmatrix} X_0: & \begin{bmatrix} \text{cat: NP} \\ \text{head:}\langle 1 \rangle \end{bmatrix} \\ X_1: & \begin{bmatrix} \text{cat: Det} \\ \text{nominal:}\langle 2 \rangle \end{bmatrix} \\ X_2:\langle 2 \rangle & \begin{bmatrix} \text{cat: N} \\ \text{head:}\langle 1 \rangle \end{bmatrix} \end{bmatrix}$$

$VP \rightarrow V$

$X_0 \rightarrow X_1$

$$\begin{bmatrix} X_0: & \begin{bmatrix} \text{cat: VP} \\ \text{head:}\langle 1 \rangle \end{bmatrix} \\ X_1: & \begin{bmatrix} \text{cat: V} \\ \text{head:}\langle 1 \rangle \end{bmatrix} \end{bmatrix}$$

PATR Grammar I (Lexicon)

$$\text{a} := \begin{bmatrix} \text{cat: Det} \\ \text{nominal: } \begin{bmatrix} \text{head: } \begin{bmatrix} \text{agr: } \begin{bmatrix} \text{per: 3} \\ \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

$$\text{boy} := \begin{bmatrix} \text{cat: N} \\ \text{head: } \begin{bmatrix} \text{agr: } \begin{bmatrix} \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

$$\text{sings} := \begin{bmatrix} \text{cat: V} \\ \text{head: } \begin{bmatrix} \text{form: finite} \\ \text{subject: } \begin{bmatrix} \text{head: } \begin{bmatrix} \text{agr: } \begin{bmatrix} \text{per: 3} \\ \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

PATR Grammar II

$S \rightarrow X \ VP$

$X_0 \rightarrow X_1 \ X_2$

$$\begin{bmatrix} X_0: \begin{bmatrix} \text{cat: S} \\ \text{head:} \langle 1 \rangle \ [\text{form: finite}] \end{bmatrix} \\ X_1: \langle 2 \rangle \\ X_2: \begin{bmatrix} \text{cat: VP} \\ \text{head:} \langle 1 \rangle \\ \text{subcat:} \begin{bmatrix} \text{first:} \langle 2 \rangle \\ \text{rest: end} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

$NP \rightarrow Det \ N$

$X_0 \rightarrow X_1 \ X_2$

$$\begin{bmatrix} X_0: \begin{bmatrix} \text{cat: NP} \\ \text{head:} \langle 1 \rangle \end{bmatrix} \\ X_1: \begin{bmatrix} \text{cat: Det} \\ \text{subcat:} [\text{first:} \langle 2 \rangle] \end{bmatrix} \\ X_2: \langle 2 \rangle \begin{bmatrix} \text{cat: N} \\ \text{head:} \langle 1 \rangle \end{bmatrix} \end{bmatrix}$$

PATR Grammar II

$VP \rightarrow VP\ X$

$X_0 \rightarrow X_1\ X_2$

$$\left[\begin{array}{ll} X_0: & \left[\begin{array}{l}\text{cat: VP}\\ \text{head:}\langle 1 \rangle\\ \text{subcat:}\langle 3 \rangle\end{array}\right] \\ X_1: & \left[\begin{array}{ll}\text{cat: VP} & \\ \text{head:}\langle 1 \rangle & \\ \text{subcat:} & \left[\begin{array}{l}\text{first:}\langle 2 \rangle\\ \text{rest:}\langle 3 \rangle\end{array}\right]\end{array}\right] \\ X_2: & \langle 2 \rangle \end{array}\right]$$

PATR Grammar II (Lexicon)

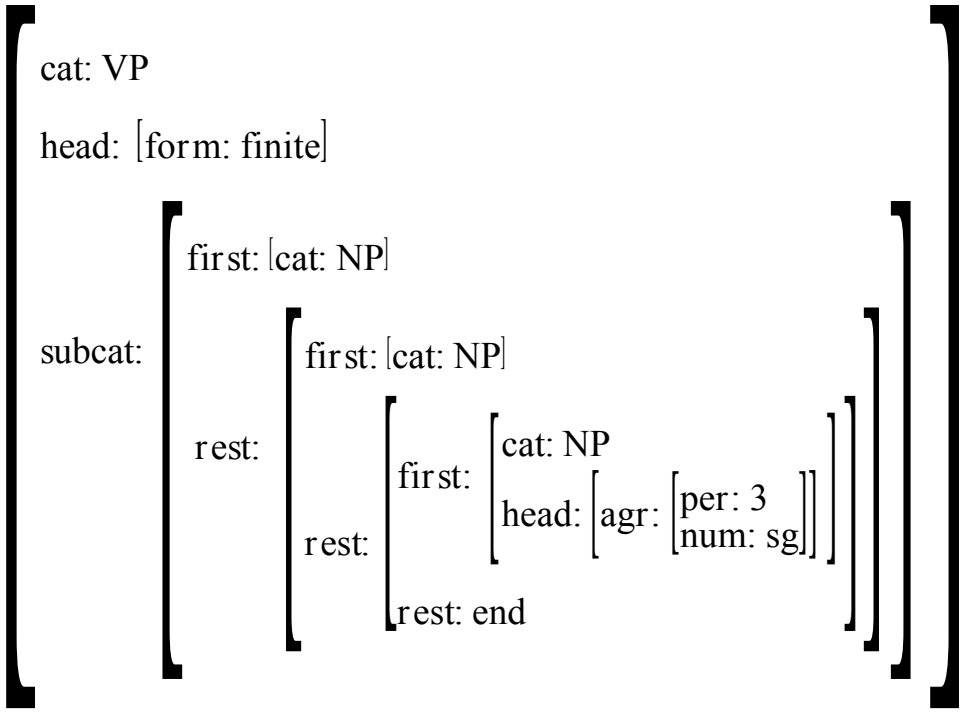
$$\text{a} := \begin{bmatrix} \text{cat: Det} \\ \text{subcat:} \begin{bmatrix} \text{first:} \begin{bmatrix} \text{head:} \begin{bmatrix} \text{agr:} \begin{bmatrix} \text{per: 3} \\ \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{rest: end} \end{bmatrix} \end{bmatrix}$$

$$\text{boy} := \begin{bmatrix} \text{cat: N} \\ \text{head:} \begin{bmatrix} \text{agr:} \begin{bmatrix} \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix}$$

$$\text{sings} := \begin{bmatrix} \text{cat: VP} \\ \text{head:} \begin{bmatrix} \text{form: finite} \end{bmatrix} \\ \text{subcat:} \begin{bmatrix} \text{first:} \begin{bmatrix} \text{cat: NP} \\ \text{head:} \begin{bmatrix} \text{agr:} \begin{bmatrix} \text{per: 3} \\ \text{num: sg} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\ \text{rest: end} \end{bmatrix} \end{bmatrix}$$

PATR Grammar II (Lexicon)

gives :=



PATR Grammar III

$S \rightarrow X \ VP$

$X_0 \rightarrow X_1 \ X_2$

$$\left[\begin{array}{l} X_0: \left[\begin{array}{l} \text{cat: S} \\ \text{head:}\langle 1 \rangle \ [\text{form: finite}] \\ \text{sem:}\langle 3 \rangle \end{array}\right] \\ X_1:\langle 2 \rangle \\ X_2: \left[\begin{array}{l} \text{cat: VP} \\ \text{head:}\langle 1 \rangle \\ \text{subcat: } [\text{first:}\langle 2 \rangle \ \text{rest: end}] \\ \text{sem:}\langle 3 \rangle \end{array}\right] \end{array}\right]$$

$NP \rightarrow Det \ N$

$X_0 \rightarrow X_1 \ X_2$

$$\left[\begin{array}{l} X_0: \left[\begin{array}{l} \text{cat: NP} \\ \text{head:}\langle 1 \rangle \\ \text{sem:}\langle 3 \rangle \end{array}\right] \\ X_1: \left[\begin{array}{l} \text{cat: Det} \\ \text{subcat: } [\text{first:}\langle 2 \rangle] \\ \text{sem:}\langle 3 \rangle \end{array}\right] \\ X_2:\langle 2 \rangle \ \left[\begin{array}{l} \text{cat: N} \\ \text{head:}\langle 1 \rangle \end{array}\right] \end{array}\right]$$

PATR Grammar III

$VP \rightarrow VP\ X$

$X_0 \rightarrow X_1\ X_2$

$$\begin{bmatrix} X_0: \begin{bmatrix} \text{cat: VP} \\ \text{head:} \langle 1 \rangle \\ \text{subcat:} \langle 3 \rangle \\ \text{sem:} \langle 4 \rangle \end{bmatrix} \\ X_1: \begin{bmatrix} \text{cat: VP} \\ \text{head:} \langle 1 \rangle \\ \text{subcat:} \begin{bmatrix} \text{first:} \langle 2 \rangle \\ \text{rest:} \langle 3 \rangle \end{bmatrix} \\ \text{sem:} \langle 4 \rangle \end{bmatrix} \\ X_2: \langle 2 \rangle \end{bmatrix}$$

PATR Grammar III (Lexicon)

$$
\text{a} := \left[\begin{array}{l}
\text{cat: Det} \\
\text{subcat: } \left[\begin{array}{l}
\text{first: } \left[\begin{array}{l}
\text{head: } \left[\text{agr: } \left[\begin{array}{l}\text{per: 3} \\ \text{num: sg}\end{array}\right]\right] \\
\text{sem: } \langle 1 \rangle
\end{array}\right] \\
\text{rest: end}
\end{array}\right] \\
\text{sem: } \left[\begin{array}{l}
\text{quant: exist} \\
\text{var: x} \\
\text{restr: } \langle 1 \rangle
\end{array}\right]
\end{array}\right]
$$

$$
\text{boy} := \left[\begin{array}{l}
\text{cat: N} \\
\text{head: } [\text{agr: } [\text{num: sg}]] \\
\text{sem: boy'}
\end{array}\right]
$$

PATR Grammar III (Lexicon)

$$
\text{sings} := \left[\begin{array}{l}
\text{cat: VP} \\
\text{head: } [\text{form: finite}] \\
\text{subcat: } \left[\begin{array}{l}
\text{first: } \left[\begin{array}{l}
\text{cat: NP} \\
\text{head: } \left[\text{agr: } \left[\begin{array}{l}\text{per: 3}\\ \text{num: sg}\end{array}\right]\right] \\
\text{sem: } \langle 1 \rangle
\end{array}\right] \\
\text{rest: end}
\end{array}\right] \\
\text{sem: } \left[\begin{array}{l}\text{rel: sing'}\\ \text{agent: } \langle 1 \rangle\end{array}\right]
\end{array}\right]
$$

PATR Grammar III (Lexicon)

gives :=