Grammar Implementation with TAG

TuLiPA and the lexion

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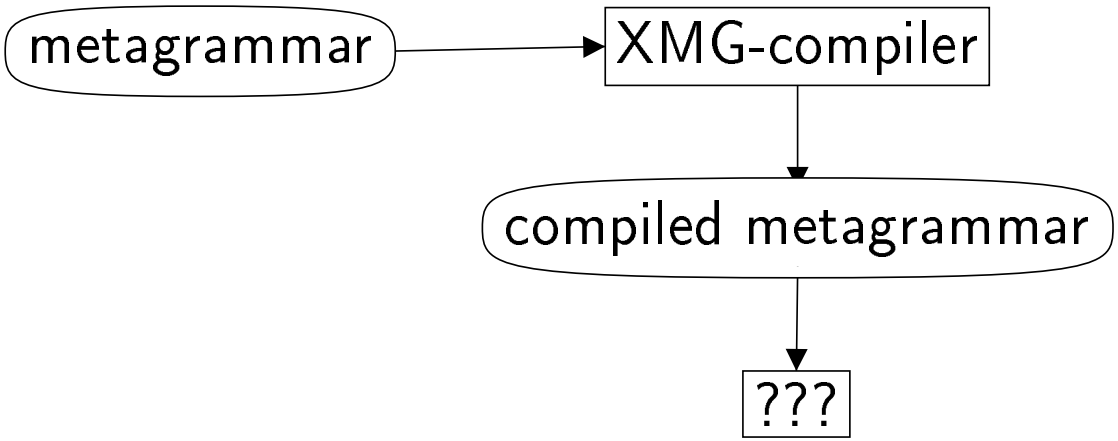
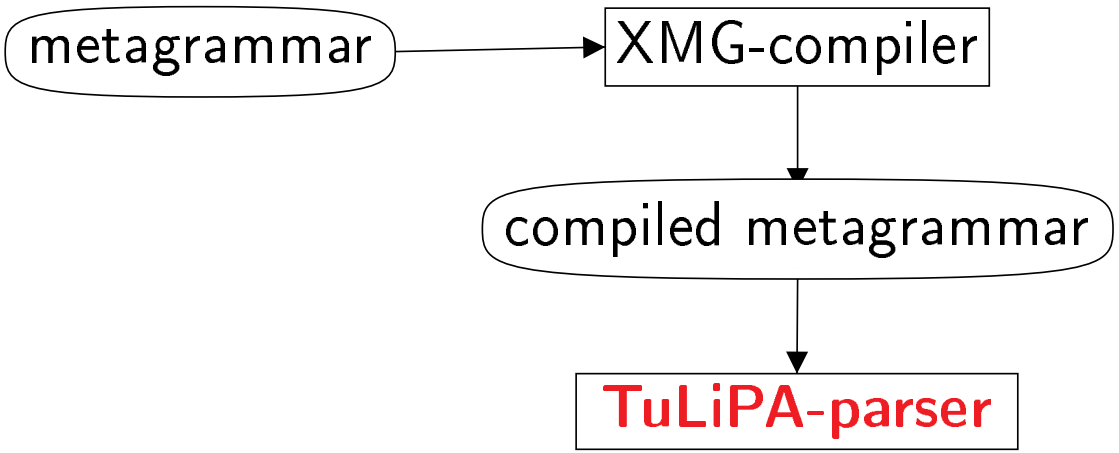
The situation



The missing pieces



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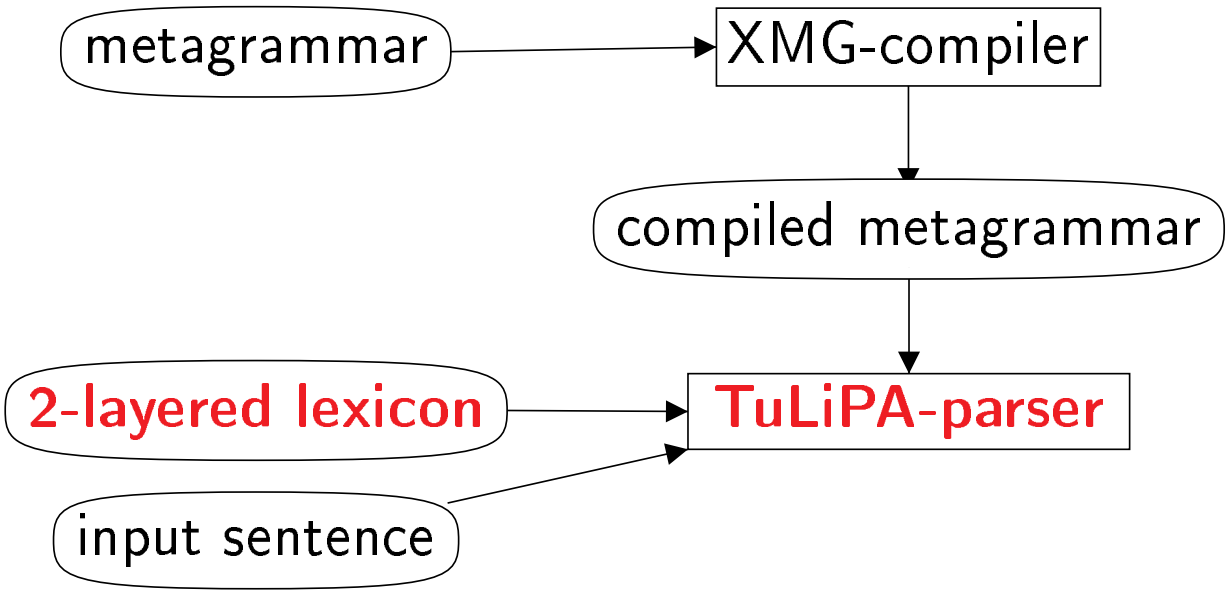

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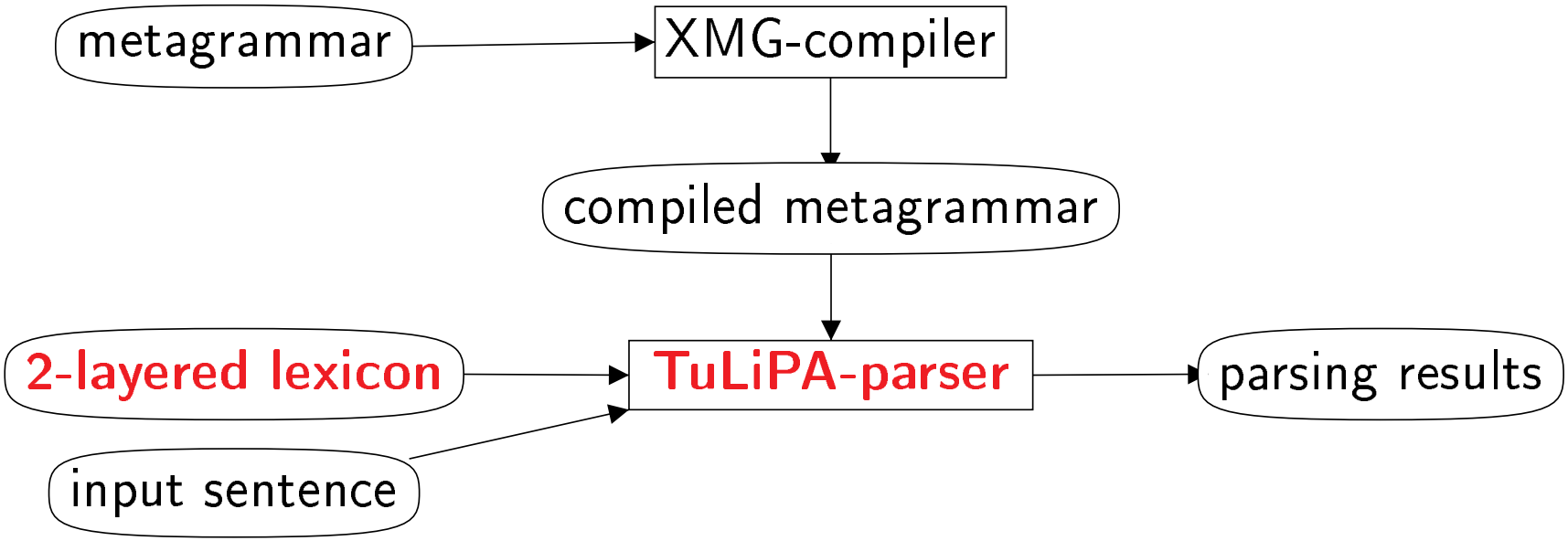

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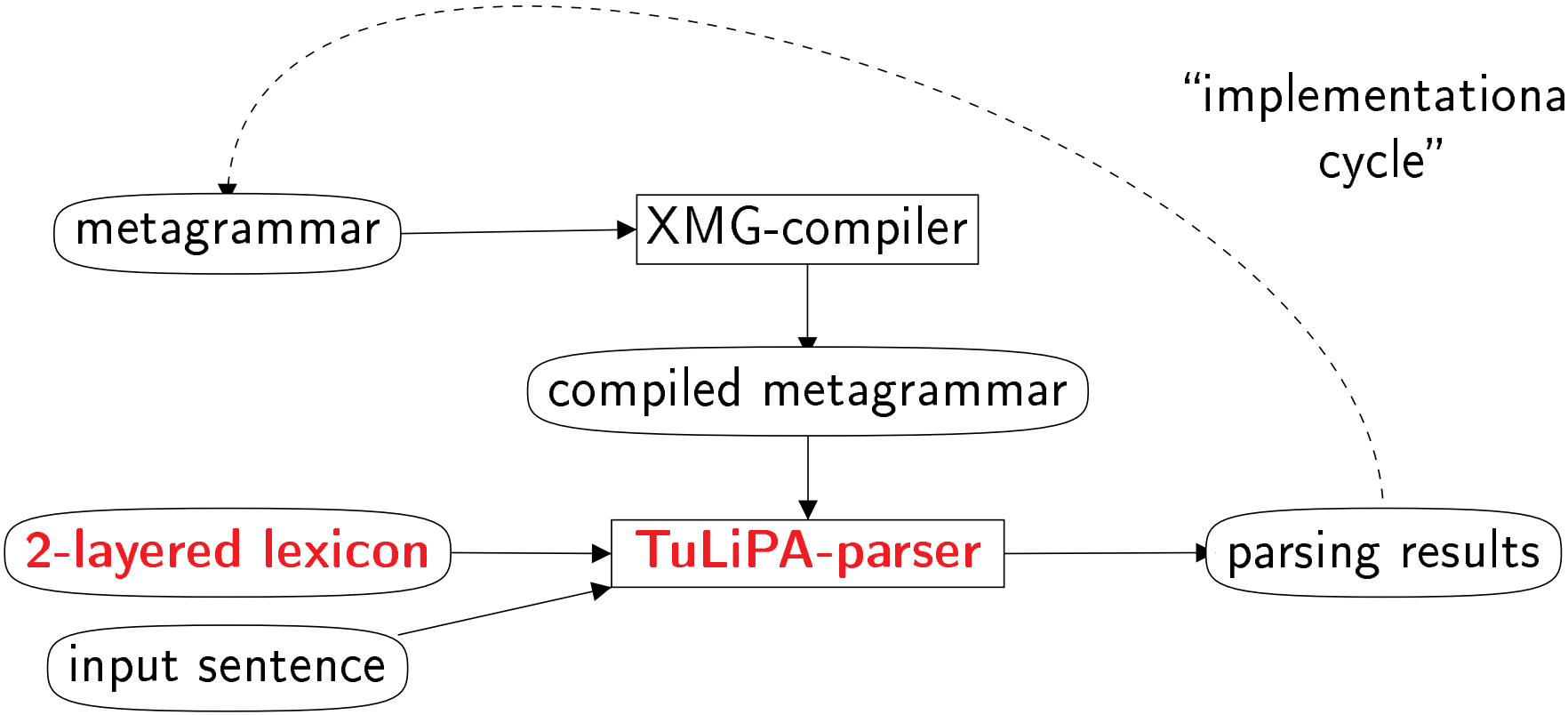


Tübingen Linguistic Parsing Architecture (TuLiPA)

TuLiPA uses Range Concatenation Grammar (RCG) as a pivot formalism.

Components:

1. TAG-to-RCG converter (on-line)
2. RCG parser → RCG derivation forest → TAG derivation forest
3. Parse viewer (derived tree, derivation tree, dependency view, semantic representation)

Availability of TuLiPA:

written in Java and released under the GNU GPL (`http://sourcesup.cru.fr/tulipa/`)

Range Concatenation Grammar (RCG)

$$A(X_1X_2, X_3) \rightarrow B(X_2)\ C(X_1, X_3)$$

A, B, C: predicates
X_1, X_2, X_3: range variables (instantiated with substrings of the string)

Example:

$S(X_1X_2) \rightarrow NP(X_1)\ VP(X_2)$
$VP(X_3X_4) \rightarrow V(X_3)\ NP(X_4)$
$NP(Peter) \rightarrow \epsilon$
$NP(Susan) \rightarrow \epsilon$
$V(loves) \rightarrow \epsilon$

Simple RCG

- **non-combinatorial:** each argument on the RHS of a clause consists of a unique variable!

  NOT: $A(XY, Z) \rightarrow B(Y)\ C(XZ)$

- **linear:** each variable appears at most once in the LHS or RHS of a clause!

  NOT: $A(XYX, Z) \rightarrow B(Y)\ C(X, Z)$

- **non-erasing:** every variable in the LHS of a clause is also in its RHS!

  NOT: $A(XY, Z) \rightarrow B(Y)\ C(X)$

TuLiPA - Why RCG?

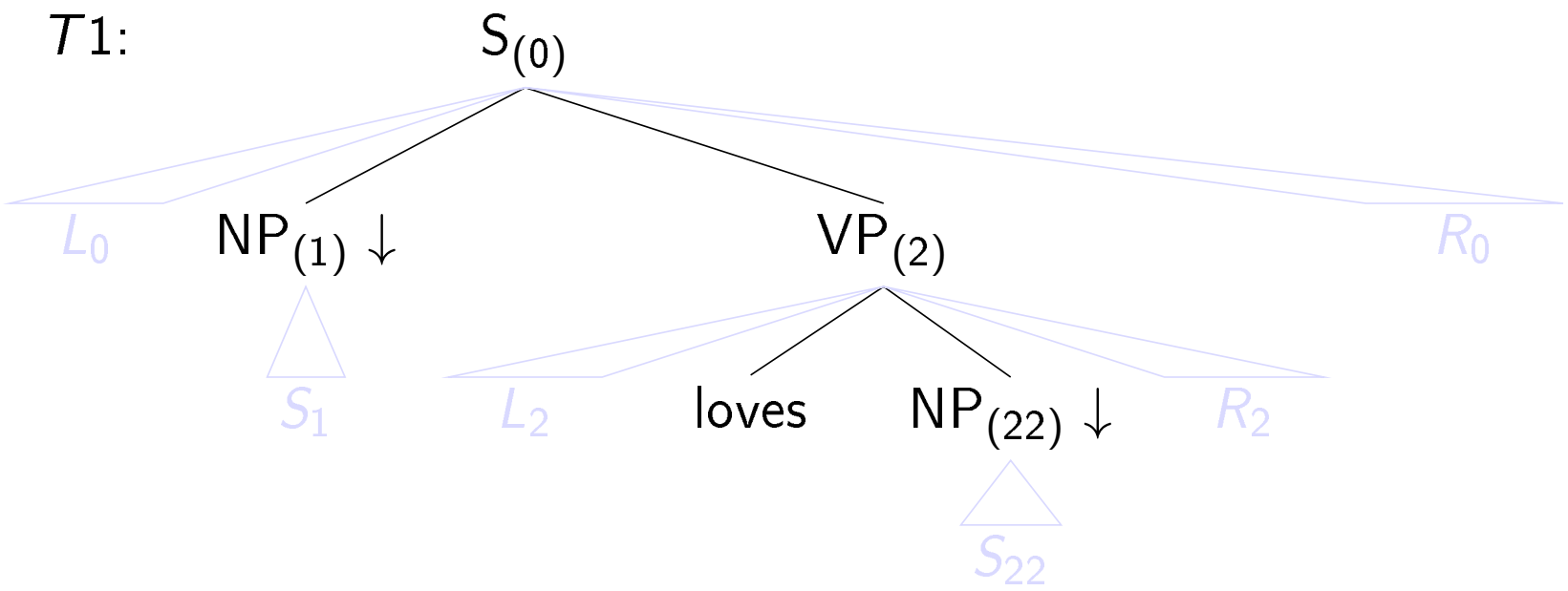
RCG is useful, because:

- it has attractive formal properties (polynomially parsable, full expressive power of MCS-languages);
- there exist parsing algorithms.

$\Rightarrow$ Parser can be reused for other mildly context-sensitive formalisms!

NB: RCG properly includes MCS. We use a restricted RCG, called *simple RCG*, that is included in MCS.

TuLiPA - From TAG to RCG

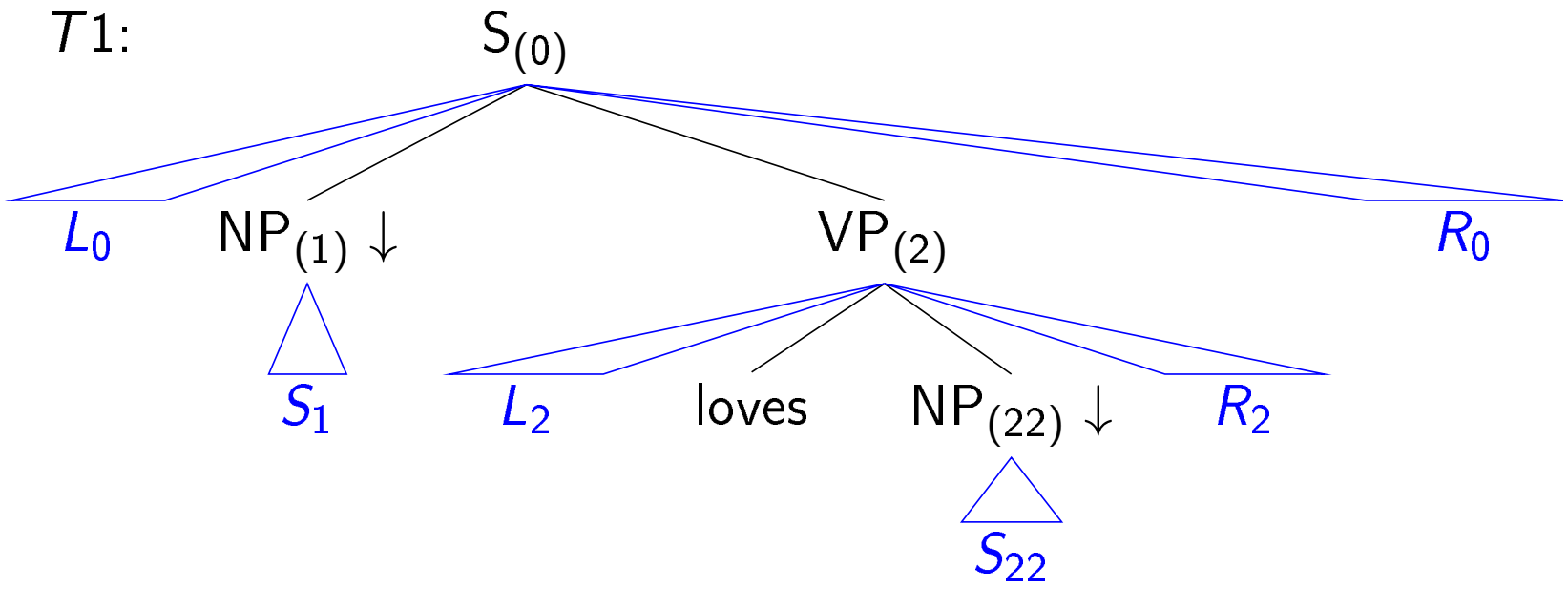


$$T1(L_0\ S_1\ L_2\ loves\ S_{22}\ R_2\ R_0) \rightarrow$$
$$adj_{S_0}(L_0, R_0)\ \ sub_{NP_1}(S_1)\ \ adj_{VP_2}(L_2, R_2)\ \ sub_{NP_{22}}(S_{22})$$

$$adj_{S_0}(X, Y) \rightarrow T2(X, Y)$$

...

TuLiPA - From TAG to RCG



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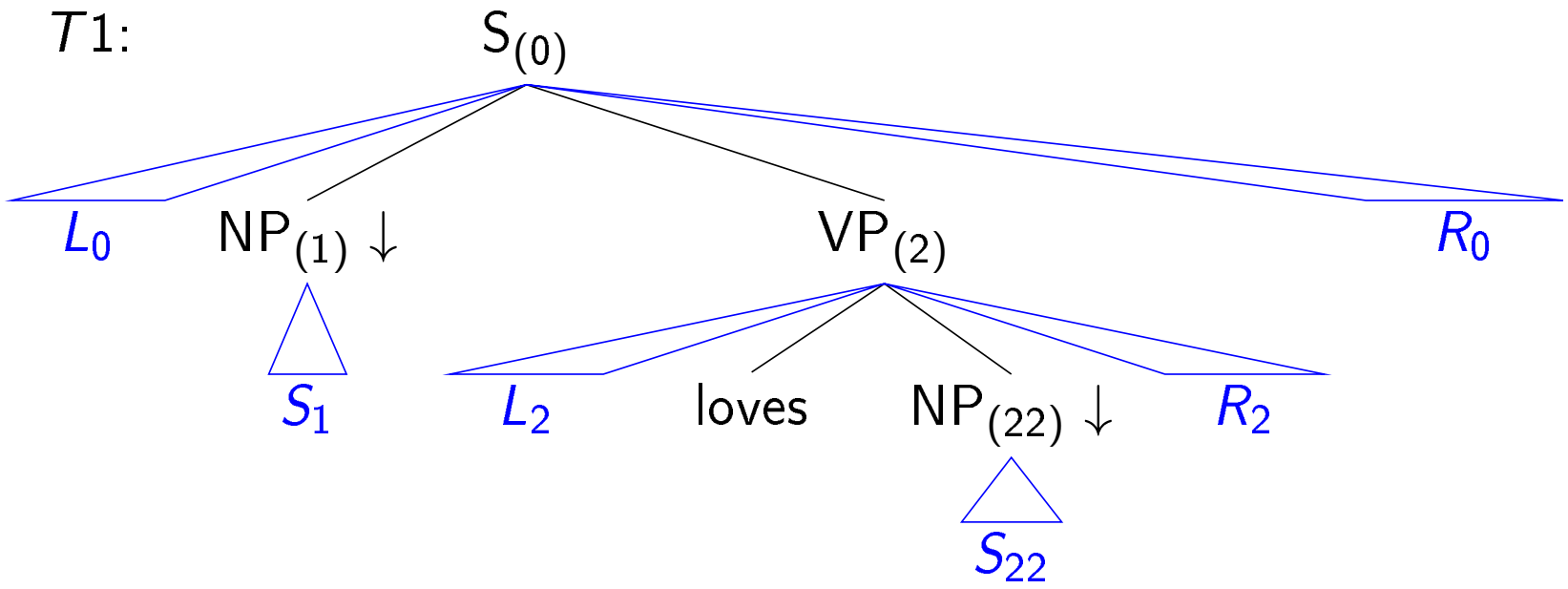

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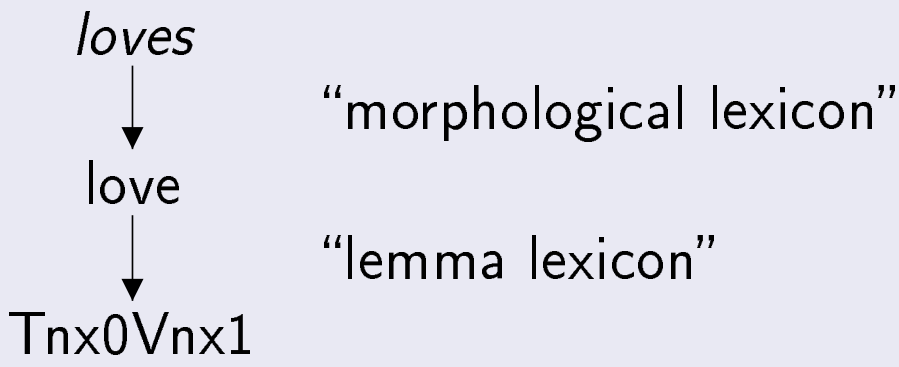
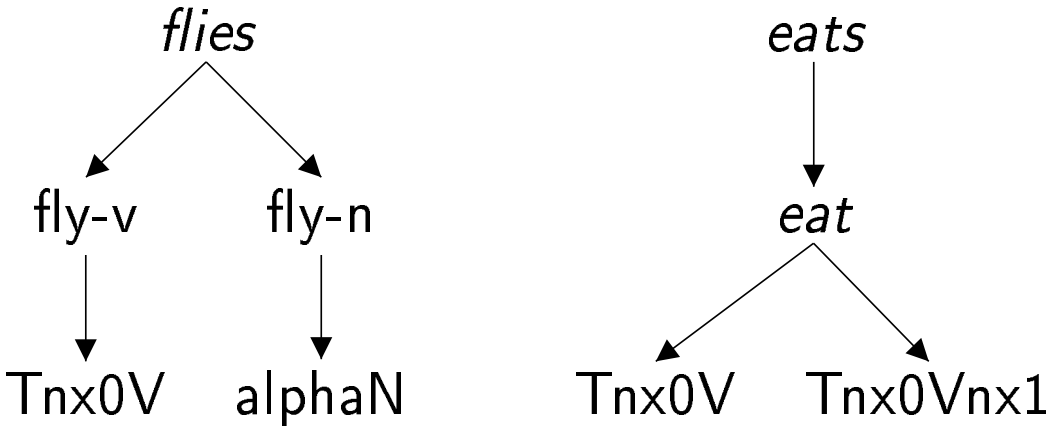
A 2-layered lexicon



The morphological lexicon and the lemma lexicon are compiled using `lexConverter` (as a part of LEX2ALL).

A 2-layered lexicon - 2 sources for ambiguity



A 2-layered lexicon

Morphological lexicon

maps an (inflected) token to some base form (= lemma), while preserving morphological information in a feature structure.

loves	love	[pos=v; num=sing; pers=3;]
Peter	Peter	[pos=n; num=sing; pers=3; case=nom|acc;]

Interface with tree templates:
Feature unification during lexical insertion

A 2-layered lexicon

Lemma lexicon

maps a lemma onto tree tuple families, while also containing selectional restrictions (e.g., case assignment).

```
*ENTRY: love
*CAT: v
*SEM:
*ACC: 1
*FAM: Tnx0Vnx1
*FILTERS: []
*EX:
*EQUATIONS:
NParg1 -> case = nom
NParg2 -> case = acc
*COANCHORS:
```

Interface with tree templates:

EQUATIONS $\rightarrow$ nodes of tree templates (via name property)

FILTERS $\rightarrow$ tree templates (via interface expressions)