Ling 5801: Lecture Notes 15
## From Semantics to Comprehension

15.1 Signs

So far, we've seen a formal representation of rules that can be used in planning.

To obtain these from natural language sentences, we'll need to define **signs**, which have:

- **signified** structures (edges labeled sig) – these are our planning rules;

- **syntactic categories** (edges labeled 0) – we've seen these already (**N-aD**, **V-aN**, etc.);

- **syntactic arguments** (labeled $1'$, $2'$, etc., from signified), connecting semantic arguments;

- **apex/base** associations (labeled A, and B), connecting sub-states on the pushdown store.

For example, here's a lexical sign for the word *give*, defined to mean *cause to have*:
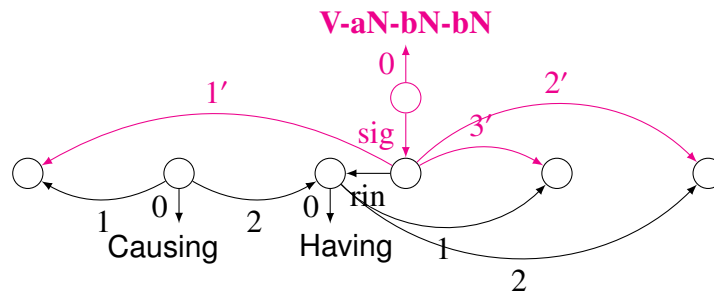
And here's a store of signs after the word *Most* in the sentence *Most large pumps work*:
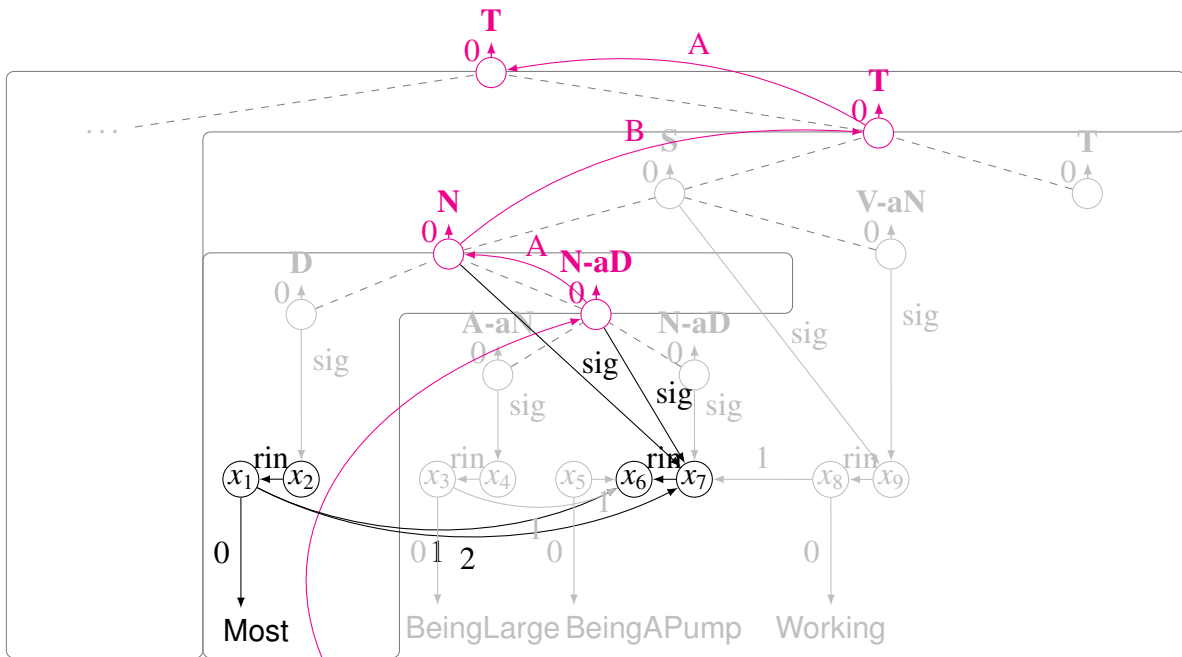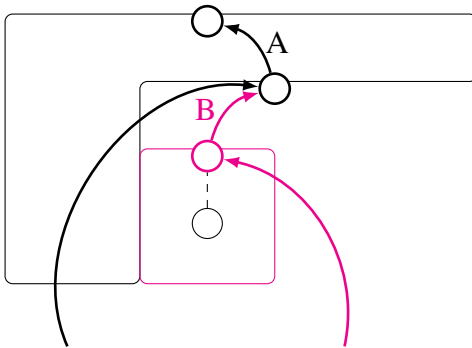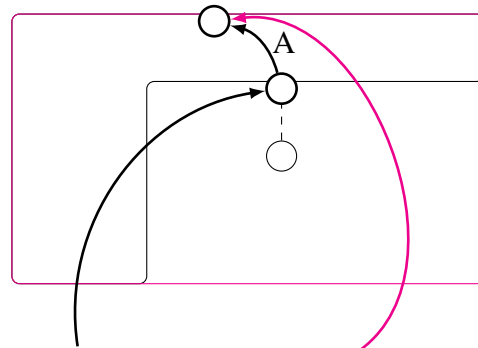
15.2 Processing

Comprehension proceeds as follows, using simplified pushdown automaton operations:

1. a decision is made about whether to **expand** the store at the next word, and

   a **lexical inference rule** is applied (choose a meaning for the next word);

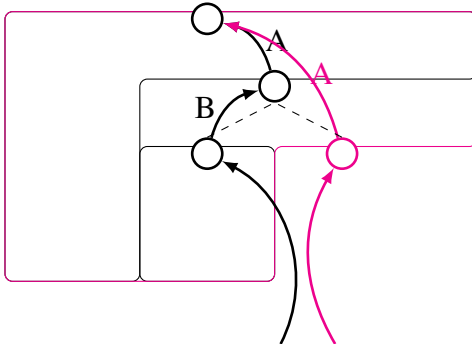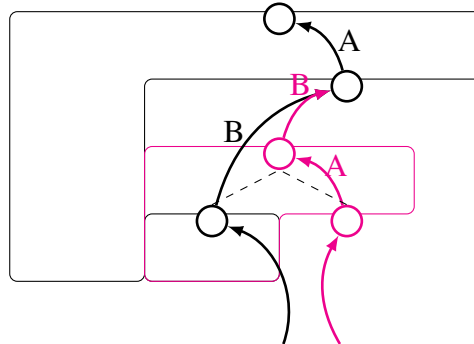   (a) expand (L↓):   (b) no expand (L↑):

2. a decision is made about whether to **reduce** the store at the next grammar rule, and

   a **grammatical inference rule** is applied (choose a rule to compose the next subtree).
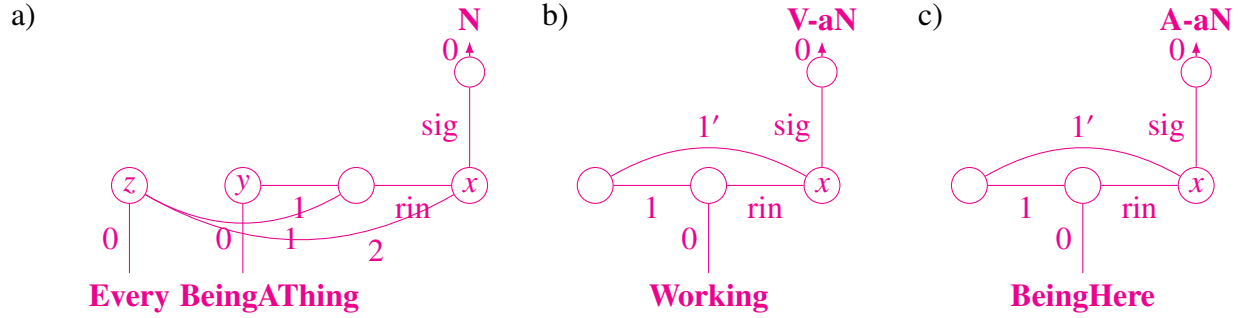
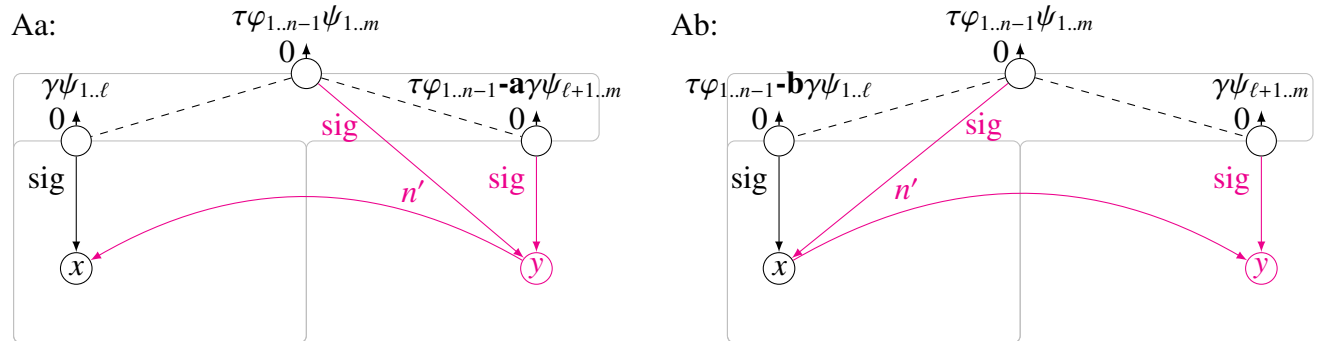   (c) reduce (G↑):   (d) no reduce (G↓):

15.3 Lexical inference rules

Lexical inference rules add lexical signs.

(Quantified noun 'everything' highlights how constraints are applied in modifiers and arguments.)
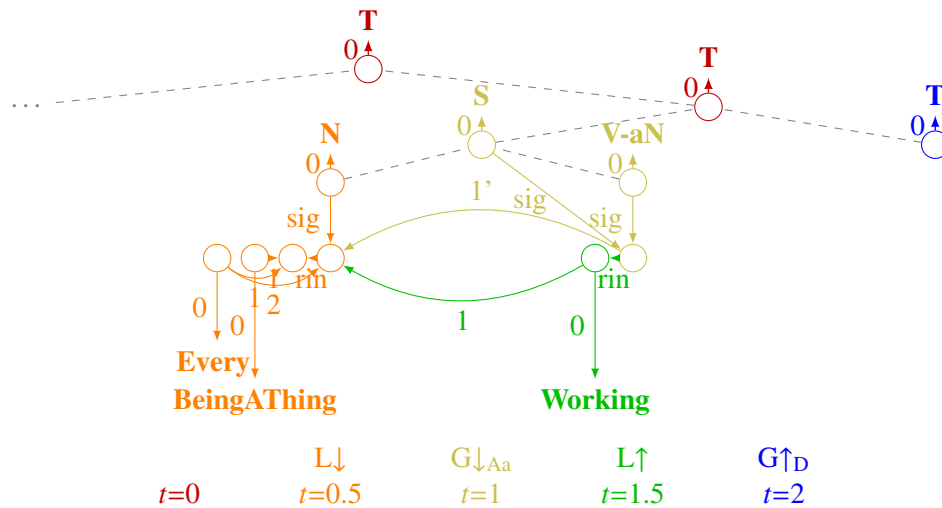
a) **N** … sig, rin, z, y, x, 0, 0, 1, 2, 1 — **Every BeingAThing**

b) **V-aN** … $1'$ sig, rin, 1, 0, x — **Working**

c) **A-aN** … $1'$ sig, rin, 1, 0, x — **BeingHere**

15.4 Grammatical inference rules

First we need rules to attach arguments:

Aa: $\tau\varphi_{1..n-1}\psi_{1..m}$ 0, $\gamma\psi_{1..\ell}$ 0, sig, $\tau\varphi_{1..n-1}\text{-a}\gamma\psi_{\ell+1..m}$ 0, sig, n', sig, x, y

Ab: $\tau\varphi_{1..n-1}\psi_{1..m}$ 0, $\tau\varphi_{1..n-1}\text{-b}\gamma\psi_{1..\ell}$ 0, sig, $\gamma\psi_{\ell+1..m}$ 0, sig, n', sig, x, y

These rules attach constraints to the 'nuclear scopes' of the quantified noun phrase:

T 0, **S** 0, **N** 0, **V-aN** 0, **T** 0, **T** 0, $1'$ sig, sig, rin, rin, 1, 0, 1, 2, 0, 0 — **Every BeingAThing**, **Working**

L↓	G↓_Aa	L↑	G↑_D
$t=0$	$t=0.5$	$t=1$	$t=1.5$	$t=2$

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Then we need rules to attach modifiers:

Ma:

$\gamma\psi_{1..m}$

$\tau\text{-}\mathbf{a}\upsilon\psi_{1..\ell}$ $\gamma\psi_{\ell+1..m}$

sig

$1'$

sig

x y rin

Mb:

$\gamma\psi_{1..m}$

$\gamma\psi_{1..\ell}$ $\tau\text{-}\mathbf{a}\upsilon\psi_{\ell+1..m}$

sig

$1'$

sig

rin x y
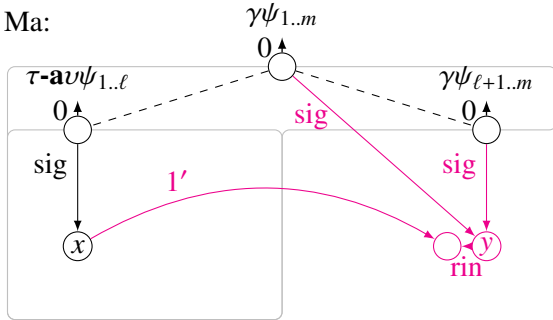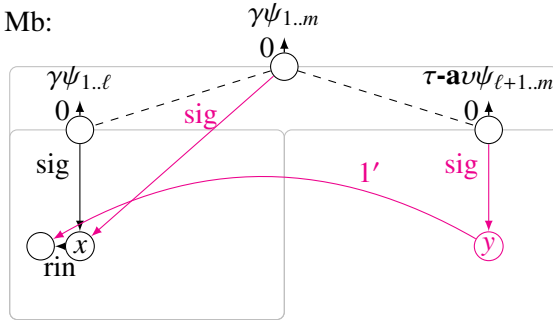
These rules attach constraints to the 'restrictors' of quantified noun phrases:

T **S** **T** **T** **N** **N** **A-aN** **V-aN**

sig   sig   sig   sig   sig

$1'$ $1'$ rin

Every BeingAThing   **BeingHere**   **Working**

	L↓	G↓Mb	L↑	G↓Aa	L↑	G↑D
$t=0$	$t=0.5$	$t=1$	$t=1.5$	$t=2$	$t=2.5$	$t=3$
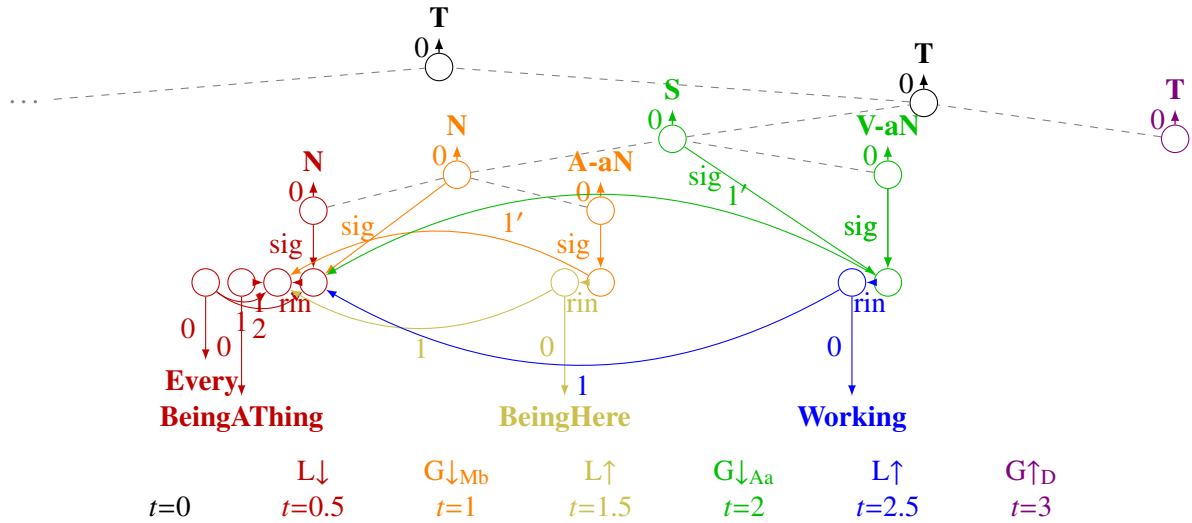
There are several other rules as well, covered in more detail here:

`https://linguistics.osu.edu/sites/linguistics.osu.edu/files/tech-rept-casp_0.pdf`

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