11.1 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*:

![Lexical sign](image)

And here’s a store of signs after the word *Most* in the sentence *Most large pumps work*:

![Store of signs](image)
11.2 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↓):
11.3 Lexical inference rules

Lexical inference rules add lexical signs.
(Quantified noun ‘everything’ highlights how constraints are applied in modifiers and arguments.)

a) Every BeingAThing

b) Working

c) BeingHere

11.4 Grammatical inference rules

First we need rules to attach arguments:

Aa:

Ab:

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

\( t=0 \quad t=0.5 \quad t=1 \quad t=1.5 \quad t=2 \)
Then we need rules to attach modifiers:

Ma:

\[\gamma_{1..m}\]

\[\tau-a\psi_{1..\ell}\]

\[\text{sig}\]

\[x\]

\[\text{sig}\]

\[1'\]

\[\text{rin}\]

\[\text{sig}\]

\[\text{rin}\]

\[y\]

These rules attach constraints to the ‘restrictors’ of quantified noun phrases:

\[\text{BeingAThing}\]

\[\text{Every}\]

\[\text{Working}\]

\[\text{BeingHere}\]

\[t=0\]

\[L_{\downarrow}\]

\[A-aN\]

\[S\]

\[V-aN\]

\[G_{\downarrow}\]

\[L_{\uparrow}\]

\[G_{\downarrow}\]

\[L_{\uparrow}\]

\[G_{\downarrow}\]

\[t=0.5\]

\[t=1\]

\[t=1.5\]

\[t=2\]

\[t=2.5\]

\[t=3\]

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

References