

Frank Richter:
Grammatikformalismen für die Computerlinguistik

Homework Assignment 2**Due: May 5th**

Exercise 1. [5 points] We presuppose the signature presented on page 26 (Section 2.1.2) of *Grammar Formalisms and Parsing*. Which ones of the following expressions are syntactically well-formed, and which ones are not? For those which are ill-formed, indicate what is wrong with them (keywords suffice). Make sure to mention all mistakes in each description. Note that in MoMo notation, each description ends with a period.

1. `nelist,head:(cat;three).`
2. `elist;(nelist,tail):elist.`
3. `~yellow;brown.`
4. `(~color):black.`
5. `woodpecker;legs.`
6. `(list,head:bird:legs:number,color:number);elist.`
7. `nelist,head:(pet:cat);dog.`
8. `head:(parrot,legs:two,color:(yellow;green,~brown)).`
9. `head:bird;pet *> color:color,legs:number.`
10. `color:red;legs:three <*> ~(bird),green,two.`
11. `head,tail *> nelist.`
12. `(head:green,color:one);(head:cat,color:cat).`
13. `animal:pet:(cat;dog).`
14. `~elist <*> nelist:(first,rest).`
15. `nelist,head:legs:(two;four),color:(green;red;yellow;brown),
tail:nelist,head:canary,legs:two,color:yellow,tail:elist.`

It might be best to solve this exercise first with paper and pencil, and to check only later with MoMo whether your answers are correct. For this purpose, you may use the prepared mmp file which you get by opening `syntax-exercise.mmp` in the folder `Section212` in MoMo (menu `File` → `Open`).¹

¹Alternatively, the file is available from the URL milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section212/syntax-exercise.mmp, and from the *Get Web Resource* menu item in MoMo.

The file already contains the signature and description cards with all descriptions of the exercise. Be warned that the syntax checker of MoMo will not always find all syntax errors in a description. When you analyze ill-formed descriptions, please consider *all* mistakes that you can detect in them.

Exercise 2. [4 points] The signature of Pollard and Sag’s grammar of English is fairly big. In this exercise, we want to translate a small part of it into the MoMo notation for signatures of Section 2.1.2.

Recall that there is a sort *object* in Pollard and Sag’s sort hierarchy which subsumes all other sorts of their signature. Take Pollard and Sag’s sort *head* as immediate subsort of *object* and complete the sort hierarchy under *head* as it is given by Pollard and Sag. Add all appropriate attributes to the sorts under *head* as well as the sorts that are in turn appropriate for them.

Note that attributes might introduce attribute values that may not be in the sort hierarchy of your signature yet, since they may not be subsorts of *head*. In order to use them as appropriate values you will have to introduce them in your sort hierarchy as additional immediate subsorts of *object*. However, for completing the present exercise you do *not* have to complete the sort hierarchy under those additional sorts.

For an illustration of your task, you might want to take a look at `nominalobjects.mmp` in Section 212,² which shows how the very same task can be completed for the sort *nom-obj* in Pollard and Sag’s sort hierarchy.

Remember that you may use MoMo to verify that you have created a well-formed signature. You can check it by typing your signature into the signature window and then pressing the *Check Syntax* button above that window. Don’t forget to precede the type hierarchy by the line *type-hierarchy* and to finish it with a period in the last line.

Exercise 3. [3 points] We said that we did not want to introduce a potentially complicated definition of a syntax of AVM descriptions as Pollard and Sag use in their HPSG book. Nevertheless, we will often appeal to a correspondence between the syntax of descriptions in MoMo and the AVM notation that is standard in linguistics. With a bit of practice, you will in fact find that this correspondence is fairly obvious. This exercise is meant to help you get some of the necessary practice.

In the file `momo-avms.mmp`, Section 221,³ you find MoMo descriptions that correspond to the first three AVM descriptions below. Complete this file with corresponding MoMo descriptions for the last three AVMs .

a.
$$\left[\begin{array}{l} \textit{cat} \\ \text{COLOR } \textit{yellow} \vee \textit{brown} \end{array} \right]$$

b.
$$\left[\begin{array}{l} \textit{dog} \\ \text{LEGS } \neg \textit{three} \end{array} \right]$$

²Also available at milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section212/nominalobjects.mmp

³Also at milca.sfs.uni-tuebingen.de/A4/Course/Momo/mmps/Section221/momo-avms.mmp

$$\begin{array}{l}
\text{c. } \left[\begin{array}{l} \textit{list} \\ \text{HEAD} \left[\begin{array}{l} \textit{canary} \\ \text{COLOR } \textit{yellow} \end{array} \right] \\ \text{TAIL} \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \textit{woodpecker} \\ \text{COLOR } \textit{brown} \end{array} \right] \\ \text{TAIL } \textit{elist} \end{array} \right] \end{array} \right] \\
\text{d. } \left[\begin{array}{l} \textit{parrot} \\ \text{COLOR } \textit{green} \vee \textit{red} \vee \textit{yellow} \vee \textit{brown} \end{array} \right] \\
\text{e. } \left[\textit{canary} \right] \rightarrow \left[\text{COLOR } \textit{yellow} \right] \\
\text{f. } \left[\begin{array}{l} \textit{nelist} \\ \text{TAIL TAIL } \textit{elist} \end{array} \right] \leftrightarrow \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \textit{canary} \\ \text{COLOR } \textit{yellow} \end{array} \right] \\ \text{TAIL} \left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \textit{parrot} \\ \text{COLOR } \textit{green} \end{array} \right] \\ \text{TAIL } \textit{elist} \end{array} \right] \end{array} \right]
\end{array}$$

Exercise 4. [Extra Credit: 2 points] In Section 2.2.1, we showed how a MoMo signature can be rewritten in a standard set notation of mathematics: We saw the MoMo signature with lists and animals of Section 2.1.2, *Signatures: Partitions and Feature Declarations*, in a notation that follows Definition 2 of initial signatures.

In Exercise 2 you reconstructed a small part of Pollard and Sag’s signature of English in MoMo notation, the sort hierarchy under *head* plus that part of the overall appropriateness function that concerns *head* and its subsorts. Take the signature that you constructed in MoMo (where you had to use MoMo’s notation for signatures) and rewrite it now in the set-theoretical notation of Section 2.2.1.