Constraints: an operational framework for Constructions Grammars

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Usually, linguistic theories make use of a hierarchical representation of syntactic information. Even when no relation with tree-like structures is explicit, as for HPSG ([Sag99]) or Construction Grammars (see for example [Kay99]), a structure is described in terms of a hierarchy. This aspect is reinforced by lexicalization: representing syntactic information at the lexical level comes with feature localization in terms of position into a hierarchy, feature propagation being controlled through the head/mother structure. This conception, close to the generative way of representing information, is very rigid in the sense that building a hierarchical structure is a pre-requisite and one cannot say anything about syntactic properties of non-canonical (not to say non-grammatical) utterances. Construction grammars also suffer from this problem. Moreover, for the same reasons, the only way to represent local constraints is sub-constructions inheriting from higher level frames. Let's take the example of the SAI construction (see [Fillmore98]):

(1) Did you learn your lesson? (4) *Did really you learn your lesson?
(2) Did you really learn your lesson? (5) *Did you not learn your lesson?
(3) Didn't you learn your lesson? (6) *Did you your lesson learn?

SAI construction:

inherit VHP
level [srs +]
head $\begin{bmatrix}\text{auxiliary } + \\ \text{finite } +\end{bmatrix}$ relational [gf subject] relational [gf ¬subject] *

The representation of linear constraints between the fillers (for example the fact that negative adverbs must precede the clitic and be contracted) needs the specification of a new sub-construction. More generally, each new local constraints necessitates a new construction. At the grammar level, this leads to build a complex construction hierarchy which becomes very difficult to maintain in case of broad-coverage grammars. This problem can be avoided with the use of constraints.

Constructions can be conceived in a more flexible way as a set of syntactic properties characterizing a given phenomenon. Syntax is typically a set of relations between categories (such as linearity, exclusion, etc.) that can be represented (and implemented) by means of constraints. Such approach is a typical constraint-based view as described in [Blache00] in which all information is described by means of constraints with no other mechanism but constraint satisfaction. Let's posit the set of following constraints:

Constraint	Definition	Example
Linearity ($\prec$)	Linear precedence constraints.	$Det \prec N$
Dependency ($\rightsquigarrow$)	Dependency relations between categories.	$AP \rightsquigarrow N$
Obligation ($\mapsto$)	Set of compulsory and unique categories. One of these categories (and only one) has to be realized in a phrase.	$N \mapsto NP$
Exclusion ($\not\Leftrightarrow$)	Restriction of cooccurrence between sets of categories.	*N[pro]* $\not\Leftrightarrow$ *Det*
Requirement ($\Rightarrow$)	Cooccurrence between sets of categories.	*N[com]* $\Rightarrow$ *Det*
Uniqueness (*Uniq*)	Set of categories which cannot be repeated.	*Uniq(NP)* = {*Det, N, AP, PP, Pro*}

On the basis of such properties, it is possible to specify for an utterance, whatever its form, its syntactic specificities. The process is simple: given a set of categories corresponding to the lexical entries, properties of the grammar can be evaluated. Some of them are satisfied, some other can be violated (this is the case of non canonical inputs). The result is a syntactic *characterization* of the input, formed by these two sets of properties. A construction can be detailed as a set of such constraints:

(1) V[aux] $\prec$ NP[subj] (2) NP[subj] $\prec$ V[¬fin]
(3) V[aux] $\Rightarrow$ NP[subj] (4) V[¬fin] $\prec$ XP[¬sub]
(5) Adv[neg] $\prec$ NP[subj] (6) NP[subj] $\prec$ Adv[¬neg]
(7) NP $\rightsquigarrow$ V (8) Adv $\rightsquigarrow$ V

This subset of constraints {1,2,4,7,8} represents the information of the SAI construction represented above and we can say that these two notations are equivalent. However, adding new information such the one concerning the adverbs simply consists in adding new constraints to the set describing the construction, at the same level, without needing any inheritance mechanism.

The interest of such a constraint-based approach is that constraints are used as properties making it possible to identificate a construction. In our example, when the subset of constraints {1,2,4,7,8} is satisfied, we know that we have a SAI construction. Then other properties (for example semantic ones) specific to this construction can be applied. Moreover, it is possible to identify constructions even for ill-formed inputs by means of constraint relaxation techniques. Using constraints allows in conclusion to represent all information contained in constructions in a more flexible way.

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