

Modification in RRG

Formalization and implementation

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Outline

- 1 Introduction
- 2 Background
- 3 Adverbial modifiers
- 4 RP-internal modifiers
- 5 Extraposed relative clauses
- 6 Implementation
- 7 Conclusion

Introduction

- Our formalization of RRG as a tree rewriting grammar has led to the definition of Tree Wrapping Grammar (Kallmeyer et al., 2013; Osswald & Kallmeyer, 2018).
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Introduction

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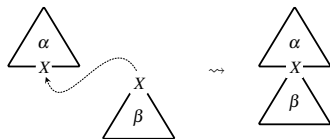
This talk:

- Model the periphery in a similar way, using edge features for controlling the order of modifiers.
- Model long-distance cases of modification, more specifically extraposed relative clauses.

Reminder: Syntactic composition

Modes of composition (\rightsquigarrow **Tree Wrapping Grammar; TWG**)

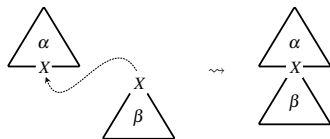
I. Simple substitution



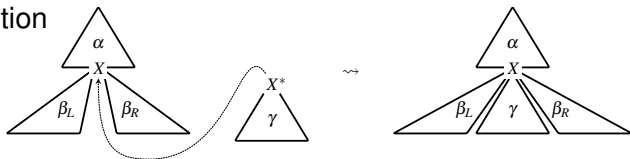
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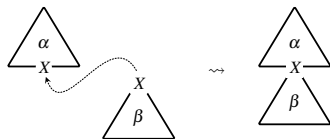
II. Adjunction



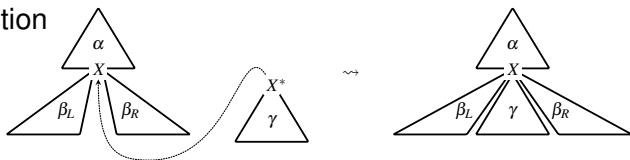
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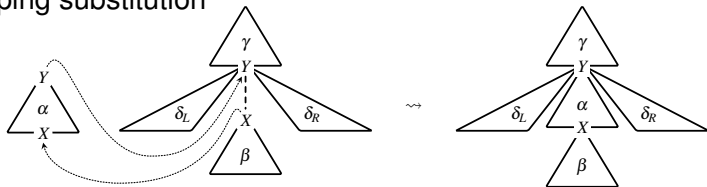
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III. Wrapping substitution

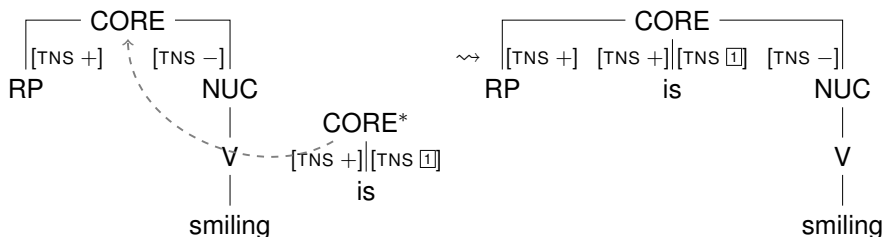


Reminder: Edge features

- Nodes have a single feature structure. Edges have two feature structures, a left one and a right one.
- In a substitution, the feature structure at the root of the tree that gets added and the one at the substitution site unify.
- Edge features remain unchanged during syntactic composition.

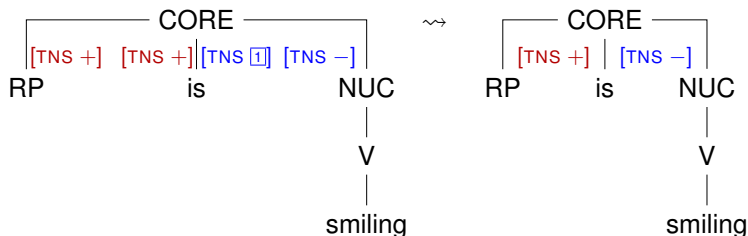
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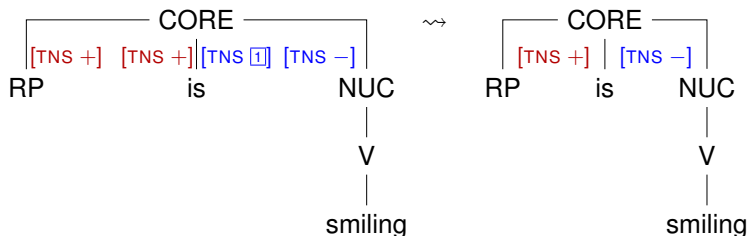
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- Furthermore, features on the leftmost and rightmost edges percolate upwards and downwards.

Adverbs in the periphery

Adjuncts in RRG are (mostly) part of the periphery, which is a structure similar to the operator projection:

- each adjunct targets a specific layer and,
- starting from the nucleus and moving outside, the nuclear adjuncts have to precede the core adjuncts, which in turn have to precede the clausal adjuncts.

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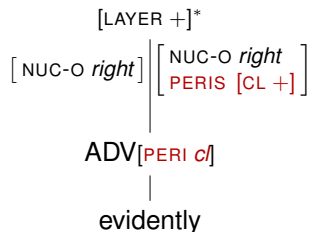
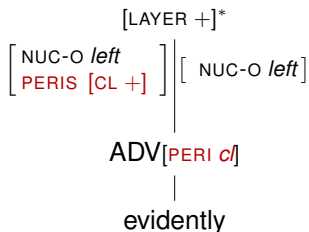
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Adverbs may modify all three layers of the clause (Van Valin, 2005, p.41):

- aspectual adverbs like *completely* and *continuously* modify the nucleus,
- pace adverbs like *quickly* and manner adverbs like *carefully* modify the core,
- and epistemic adverbs like *probably* and evidential adverbs like *evidently* modify the clause.

Adverbs in the periphery

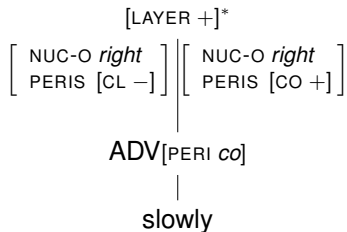
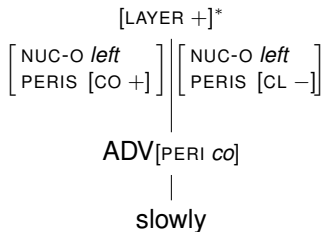
Trees for clause-level periphery adverbs:



- edge feature PERIS (= periphery structure) keeps track of the level of periphery reached so far
- node feature PERI indicates the target layer
- the adjunction site is not necessarily the target periphery layer

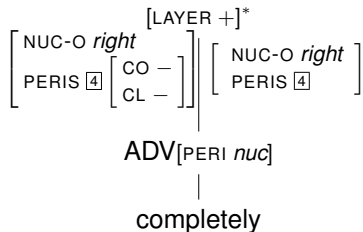
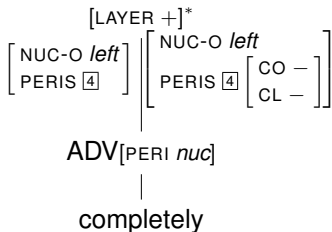
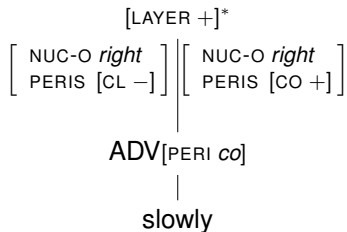
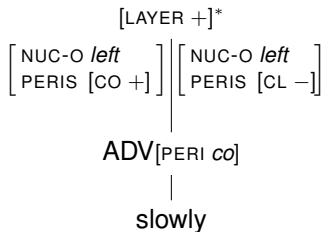
Adverbs in the periphery

Trees for core- and nuc-level periphery adverbs:

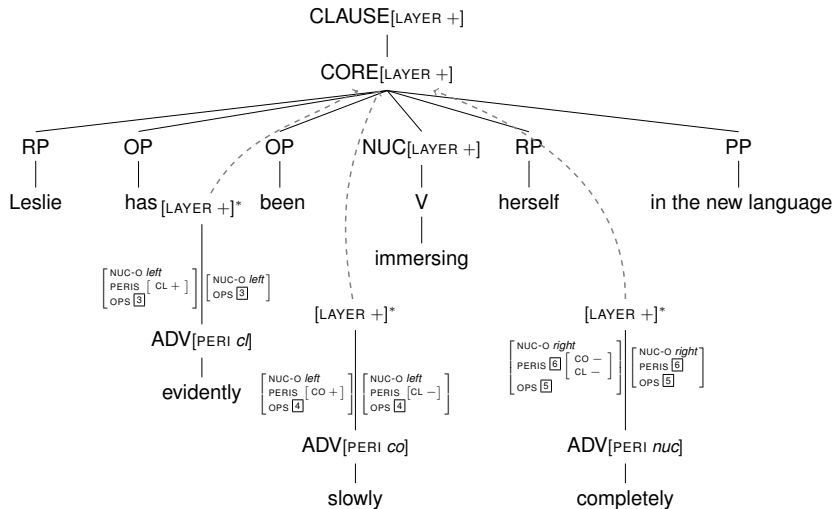


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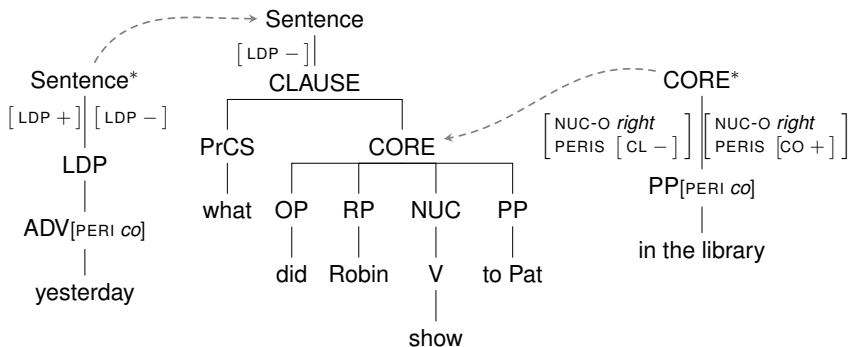


Adverbs in the periphery



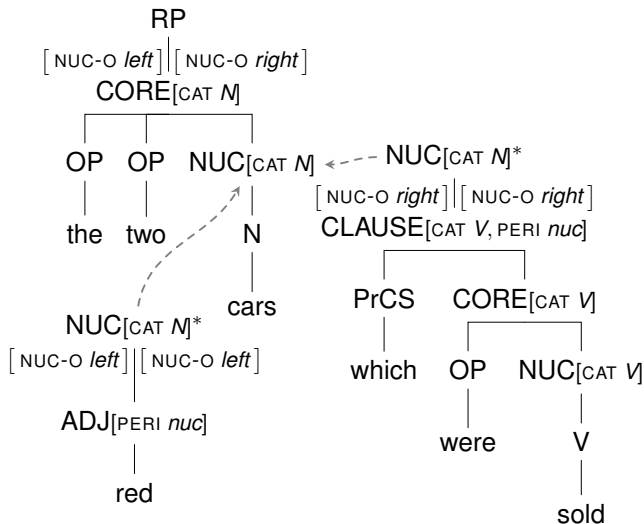
Further adverbial modifiers

- Modifiers can be “moved” to the left of the CLAUSE, in LDP
- Besides adverbs, we can also have other categories as modifiers



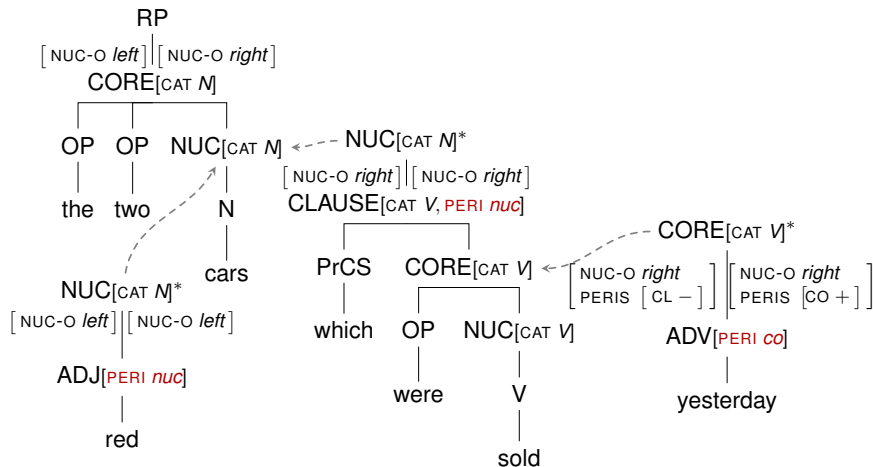
Modifiers inside the RP

The periphery structure for nouns is similar to the verbal one: modifiers can target the NUC, CORE or RP level.



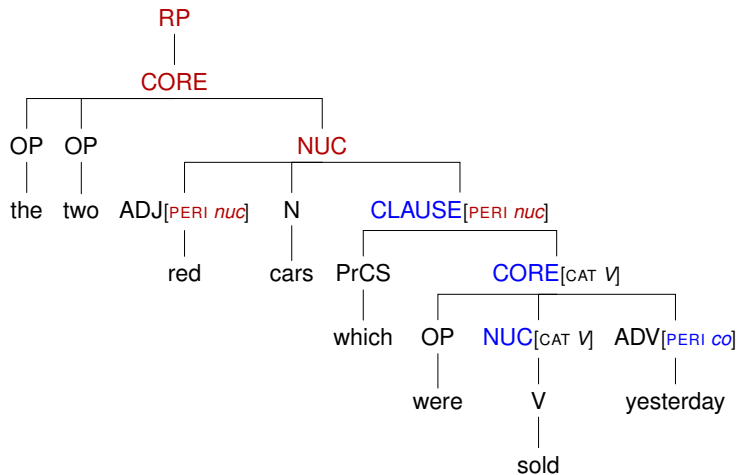
Modifiers inside the RP

We can have modifiers targeting elements of different layered structures in the same tree.

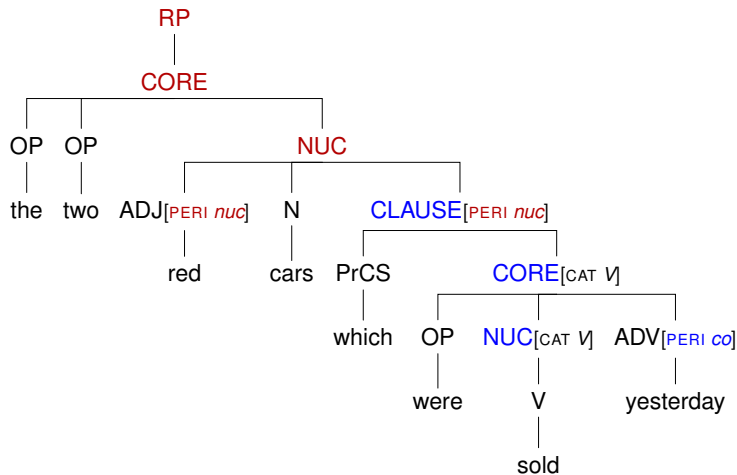


The corresponding PERIS domains should be kept apart.

Modifiers inside the RP



Modifiers inside the RP



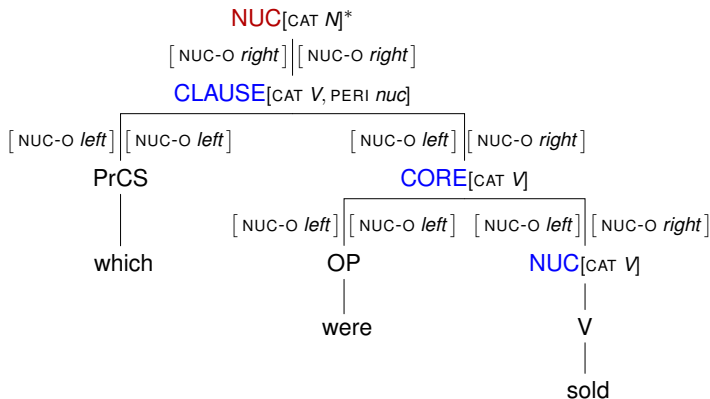
Therefore, we assume that some nodes are blocking concerning operator and periphery structure information.

Modifiers inside the RP

- More technically: some nodes are marked as blocking edge feature percolation.
- Probably all substitution nodes but also some other nodes (maximal projections/maximal layers?)
- Here: The CLAUSE node of the relative clause.

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Extraposited relative clauses

Restrictive relative clauses can be extraposed (see Walker, 2017, for more data)

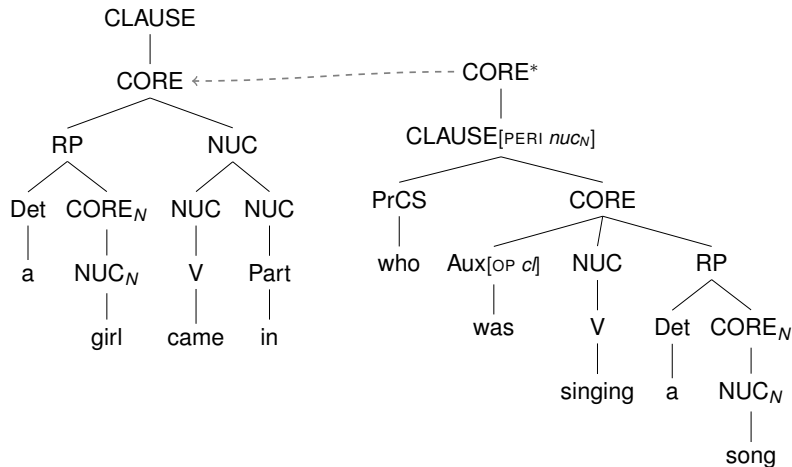
- (1) a. [A girl who was singing a song]_{RP} came in.
b. A girl came in who was singing a song.
- (2) a. Mary saw [the car which was sold yesterday]_{RP} in the street.
b. Mary saw the car in the street which was sold yesterday.

We can also have extraposition in cases where the antecedent RP can be embedded within a PP, both with periphery PPs as well as with argument PPs:

- (3) a. I saw it [in a magazine]_{PP_{peri}} yesterday which was lying on the table.
b. I spoke [to everyone]_{PP_{arg}} yesterday who I liked.

Extrapolated relative clauses

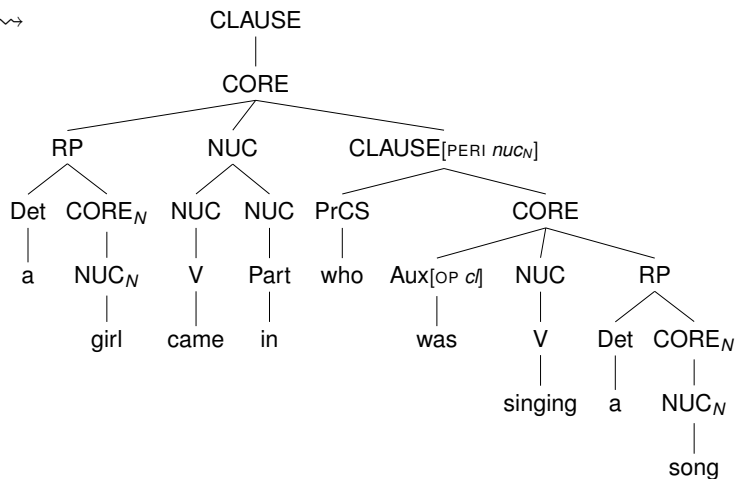
Option 1: “anaphoric approach”:



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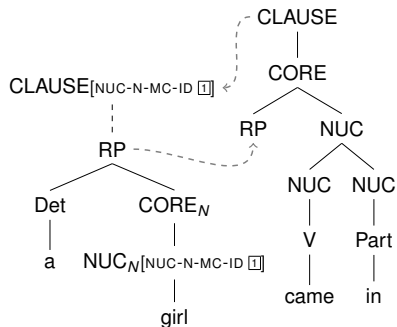
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An appropriate antecedent NUC_N has to be searched for somewhere below the CORE node that was the target of the adjunction

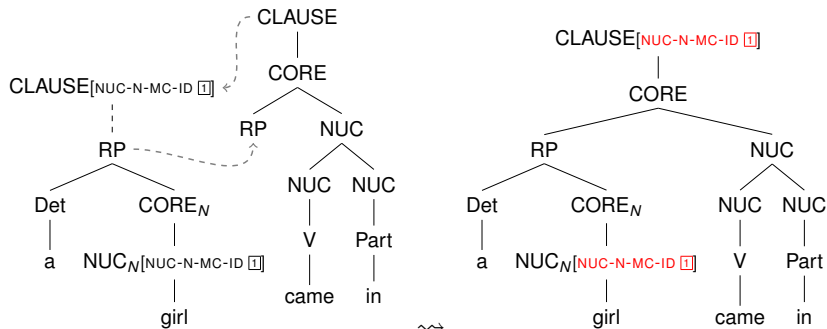
Extrapolated relative clauses

Option 2: the antecedent provides a “landing site” for extraposed relative clauses



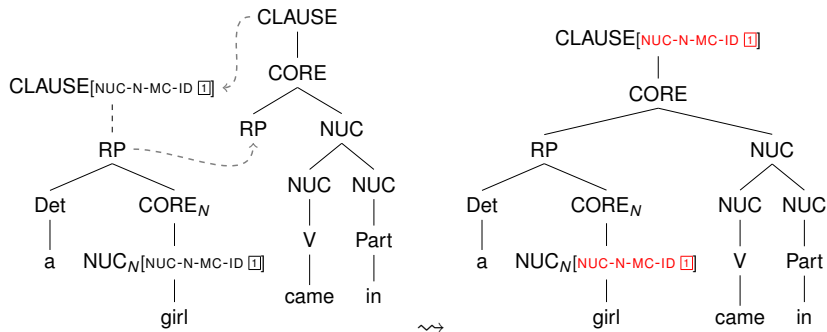
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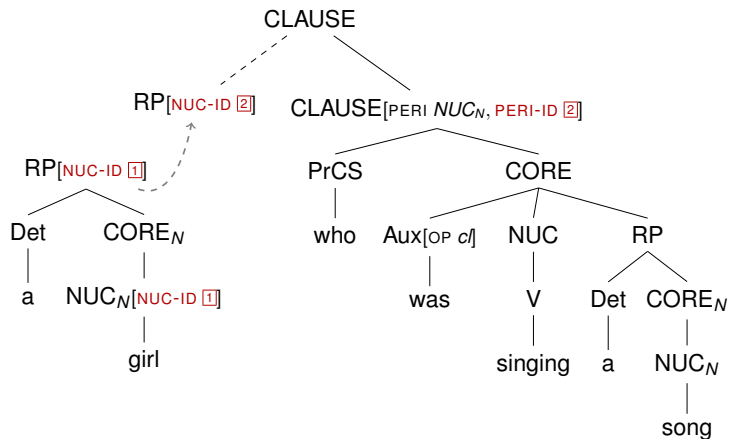


Problems: a) special RP-trees just in case they are modified by an extrapolated relative clause, increases even the number of derivations for sentences without relative clauses

b) antecedent of a relative clause not necessarily unique (one might use several of these special trees)

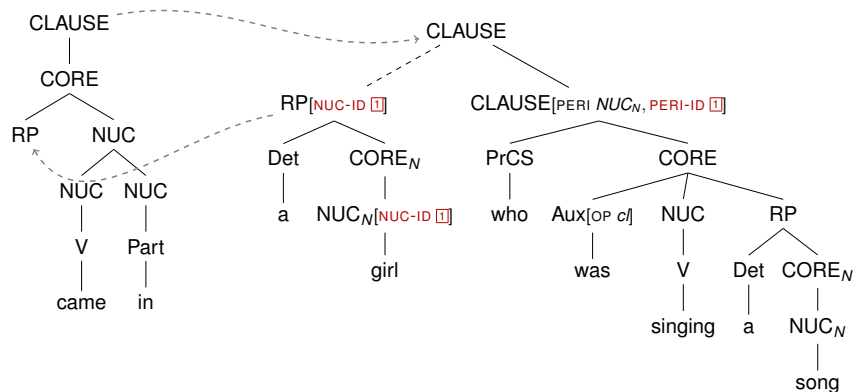
Extrapolated relative clauses

Option 3: Complex RP including the relative clause, which is then added by wrapping substitution



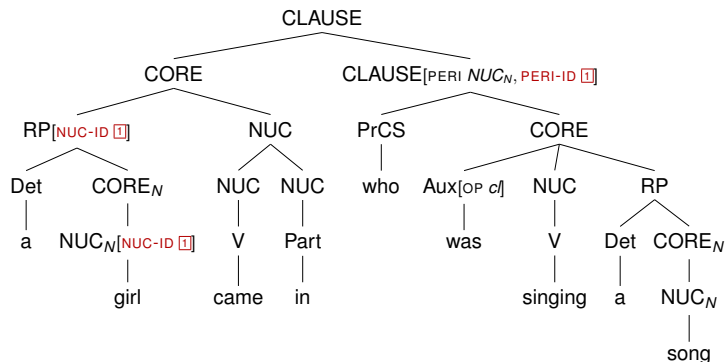
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Extrapolated relative clauses

Option 3 seems nice but

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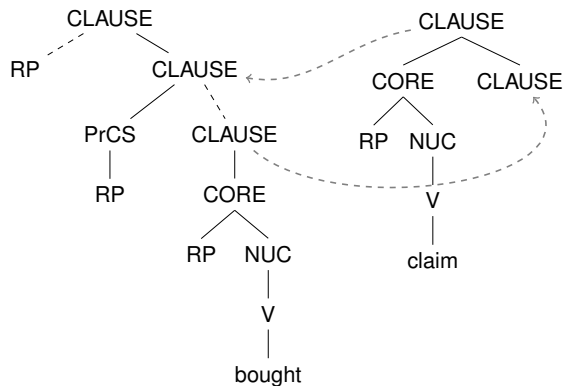
- involves a substitution that is not an argument filling, and
- comes with the requirement to have multiple d-edges in some of the elementary trees.

Multiple d-edges: Long-distance wh-dependencies in extrapolated relative clauses

- (4) a. **the car** is standing in the street **that** my friends claim **Bill bought last week**
- b. **the paper** finally appeared this week **which** the journal has been trying **to accept for years**

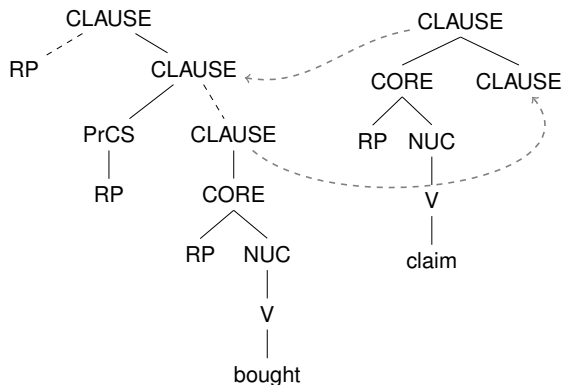
Extrapolated relative clauses

- (5) **the car** is standing in the street **that** my friends claim **Bill bought last week**



Extrapolated relative clauses

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From a formal/parsing point of view, multiple d-edges should be unproblematic.

Implementation

- XMG supports RRG:
 - markings for d-daughters and roots of adjunct trees
 - marking for nodes that block edge feature percolation (operator-periphery-boundaries)
- TuLiPA supports RRG including
 - substitution, wrapping substitution, sister adjunction
 - feature unifications on nodes (in cases of substitution)
 - final edge feature unification and percolation
 - under development: multiple d-edges
- The implementation of an English grammar fragment is under development.

Conclusion

- Elements in the periphery are added via sister adjunction
- Edge features take care of ordering constraints among them.
- For each layered structure there is a highest node that blocks edge feature percolation and therefore encapsulates the embedded operator and periphery structures.
- For extraposed relative clauses, different analysis options exist. The preferred one a) builds a complex RP which includes the relative clause and b) then adds this by wrapping substitution.
- This requires multiple d-edges, which will be included into TuLiPA.

References

- Kallmeyer, Laura, Timm Lichte, Rainer Osswald & Simon Petitjean. 2016. Argument linking in LTAG: A constraint-based implementation with XMG. In *Proceedings of the 12th International Workshop on Tree Adjoining Grammars and related formalisms (TAG+12)*, 48–57.
- Kallmeyer, Laura & Rainer Osswald. 2013. Syntax-driven semantic frame composition in Lexicalized Tree Adjoining Grammars. *Journal of Language Modelling* 1(2). 267–330.
- Kallmeyer, Laura & Rainer Osswald. 2017. Combining predicate-argument structure and operator projection: Clause structure in Role and Reference Grammar. In *Proceedings of the 13th International Workshop on Tree Adjoining Grammars and related formalisms (TAG+13)*, 61–70.
- Kallmeyer, Laura, Rainer Osswald & Robert D. Van Valin, Jr. 2013. Tree wrapping for Role and Reference Grammar. In Glyn Morrill & Mark-Jan Nederhof (eds.), *Formal grammar (FG 2012/2013)* (Lecture Notes in Computer Science 8036), 175–190. Springer.
- Lichte, Timm & Simon Petitjean. 2015. Implementing semantic frames as typed feature structures with XMG. *Journal of Language Modelling* 3(1). 185–228.
- Osswald, Rainer & Laura Kallmeyer. 2018. Towards a formalization of Role and Reference Grammar. In Rolf Kailuweit, Eva Staudinger & Lisann Künkel (eds.), *Applying and expanding Role and Reference Grammar*, 355–378. Freiburg University Press.
- Van Valin, Robert D., Jr. 2005. *Exploring the syntax-semantics interface*. Cambridge University Press.
- Walker, Heike. 2017. *The syntax and semantics of relative clause attachment*: Goethe Universität Frankfurt am Main dissertation.