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THE (PUTATIVE) LIMITS OF INHERITANCE IN CONSTRUCTIONIST GRAMMAR THEORIES

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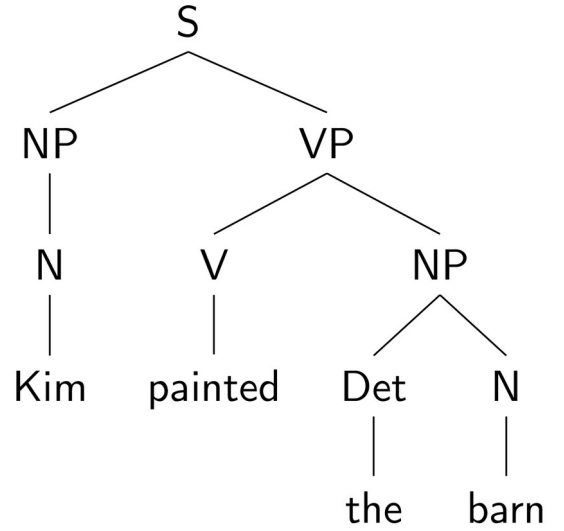
AIM OF THIS TALK

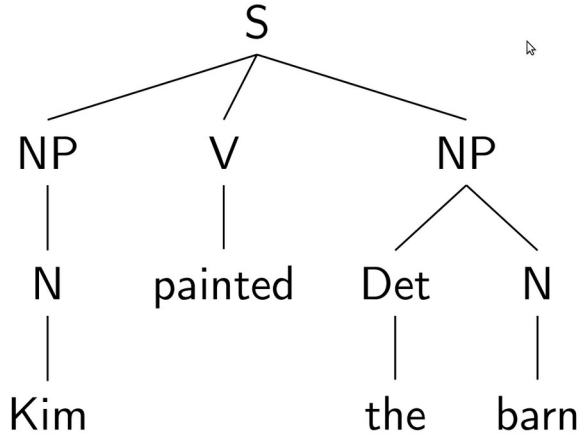
- **Motivation:** Constructionist theories of grammar have been criticized for their exclusive use of **inheritance** when attempting to capture the relationships between constructions.
- In this talk, we argue that inheritance generally suffices within an **EDL** framework, if it provides **sufficient flexibility** to describe and constrain syntactic representations.
- Using **TAG and metagrammars**, we will demonstrate this for
  - active passive alternation in combination with resultative constructions
- Using a new and more flexible EDL formalism, **TUCO**, we will look at
  - coordination of unlikes (involving benefactives and ditransitives)

EDL VERSUS BDL

- Let's say we have a syntactic tree – be it flat or binary.

- There are two very general, but fundamentally different ways a theory can deal with its structure and meaning.
  1) Bounded Domain of Locality (BDL)
  2) Extended Domain of Locality (EDL)

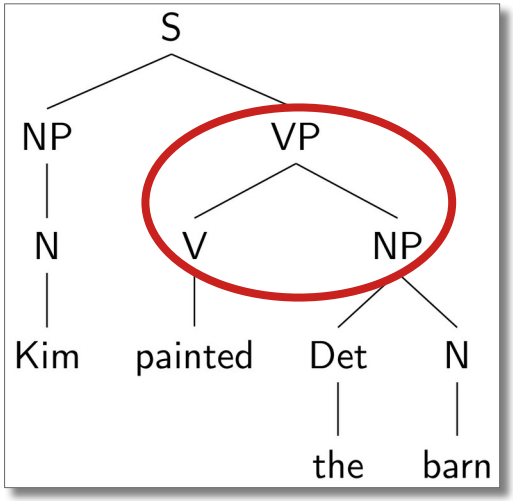




EDL VERSUS BDL

1) Bounded Domain of Locality (BDL)

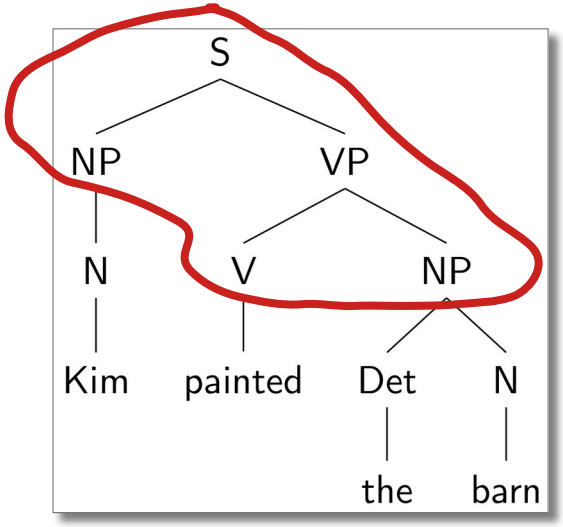
- Grammar rules over **smallest** subtrees
- Challenge: Where am I?
  - Need for a “memory” in the nodes for orientation purposes → valency list / slash list → “potential structure” (Müller 2019b)
  - Need for something that contributes valency → head
  - Need for the distinction between complements and adjuncts (because the VL must be finite)
  - Tendency towards binary structures (also driven by the idea that structures reflect Curried functor-argument combinations)
- This is sometimes called the **lexicalist way** of doing grammar.
- Basic formalisms: CFG, Categorical Grammar



EDL VERSUS BDL

2) Extended Domain of Locality (EDL)

- Grammar rules over **arbitrary** subtrees
- Challenge: What am I?
  - No need for a memory in the nodes for orientation purposes → no valency list → “actual structure” (Müller 2019), aka. "usage-based"
  - Tendency towards flat or non-binary trees
  - Need to capture the nature of and relationship between subtrees
    - by inheritance or rewriting
    - by lexicalization (e.g. as in LTAG)
- We will call this the **constructionist way** of doing grammar.
- Basic formalisms: tree rewriting grammars such as TAG

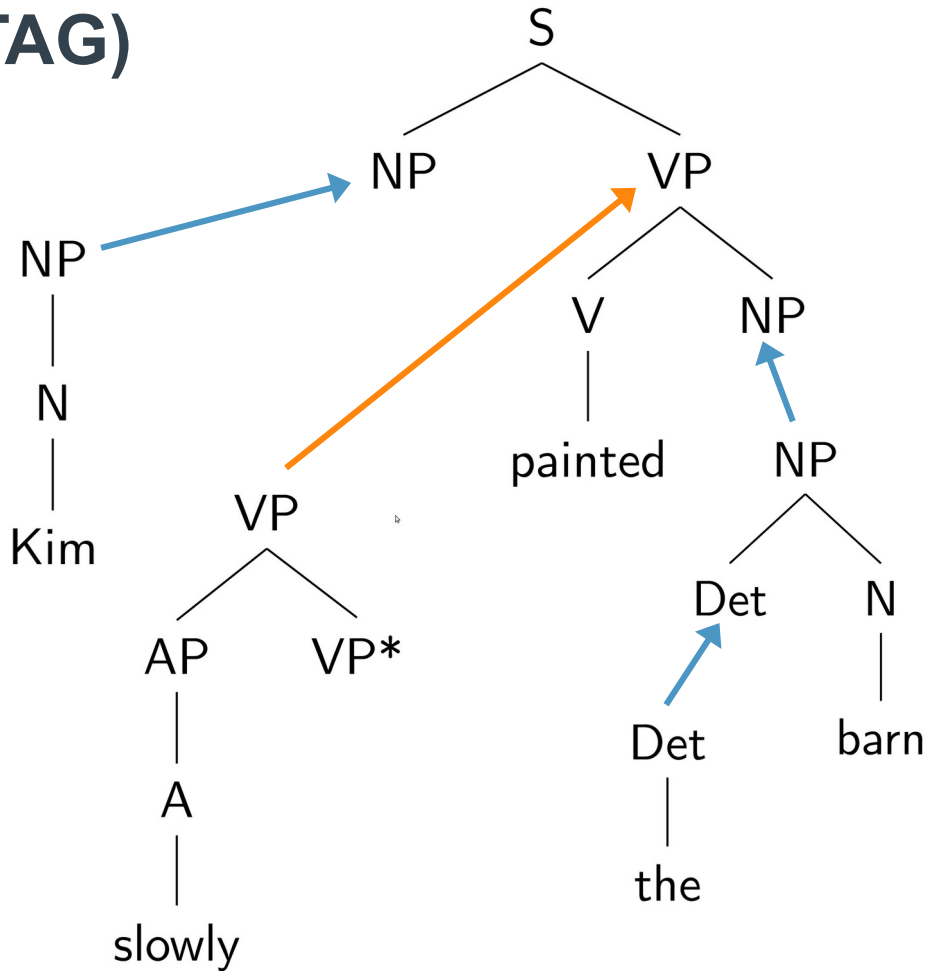


EDL VERSUS BDL

- Which one is better?
- Wrong question! We're at the level of formalisms, not theories!
- Rephrase: Which one enables more correct, comprehensive, "intuitive"/"elegant", and manageable theories?
  - First difficulty: infinitely many possible theories that can be compared
  - Second difficulty: lack of work that outlines the potentials of the EDL approach
- Examples of **limited** EDL such as TAG have lead to misunderstandings → see, e.g., Müller (2019a, 2019b)
- We think EDL is better than its reputation, in particular **unlimited** EDL.
- But first take a look at TAG.

TREE-ADJOINING GRAMMAR (TAG)

- A TAG consists of a finite set of **elementary trees (ETs)** that are combined into larger trees with two operations:
  - **Substitution**: rewriting of leaves
  - **Adjunction**: rewriting of nonterminals
- More powerful than CFG
  ⟶ mildly context sensitive



SHAPE OF ELEMENTARY TREES

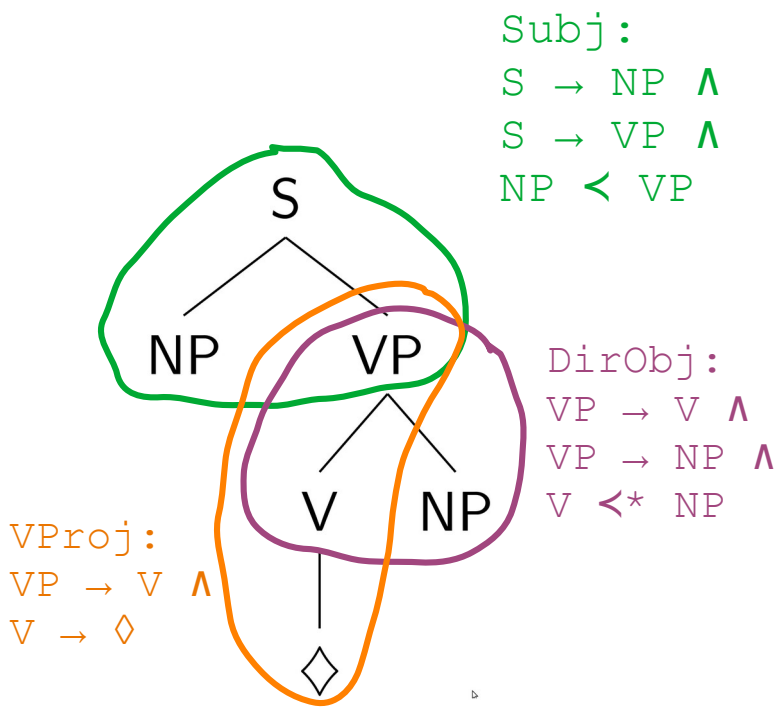
- What am I? What is the shape and function of an ET?
- **XTAG standard:** Lexicalized TAG + well-formedness conditions
  - Every ET has at least one "lexical anchor".
  - The lexical anchor determines the structure of the ET.
  - Verbal ETs correspond to a linearization ("real structure") of the associated valency list.
  - ETs are grouped into tree families that correspond to valency lists.
- But that's just one choice.
- At any rate, the **metagrammar** must be seen as an **integral part** of any serious theory based on TAG.

TAG AND METAGRAMMARS

- ETs can be arbitrarily large → indeed good for modelling long-distance dependencies and idioms/MWEs.
- But how to express lexical generalizations?
- **Metagrammars** help factorizing elementary trees and representing relations between elementary trees, for example valency alternation (active-passive alternation) or linearization options (base order, extraction).
- The building blocks of metagrammars are **labeled descriptions** of tree fragments, that can be combined and reused within a metagrammar to generate **unlexicalized elementary trees** (tree templates).

TAG AND METAGRAMMARS

- Descriptions refer to (among others)
  - immediate/non-immediate dominance (→)
  - immediate/non-immediate precedence (≺)
  - identity (=)
  - connected with conjunction (∧) or disjunction (∨)
- Tree templates are **minimal models** of tree descriptions (Do not add nodes!).

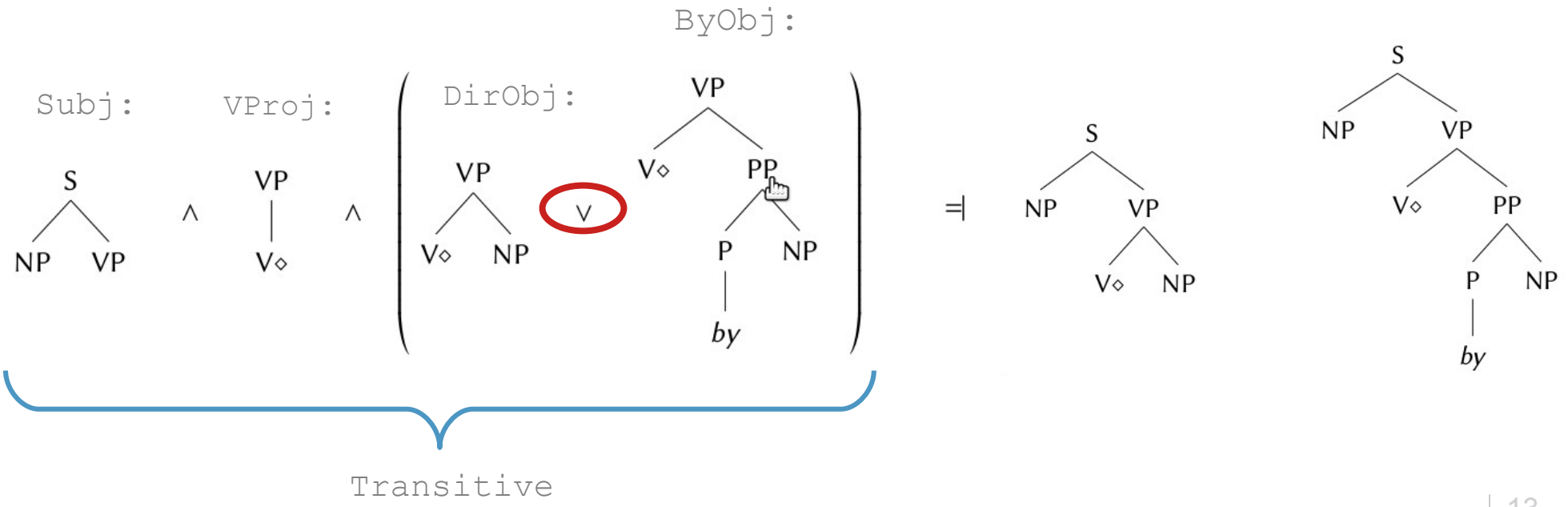


- The combination of tree descriptions to form bigger tree descriptions can be seen as **inheritance**, because descriptions can only be added, not removed. (monotonicity)

```
Transitive:
    Subj ∧ VProj ∧  DirObj
```

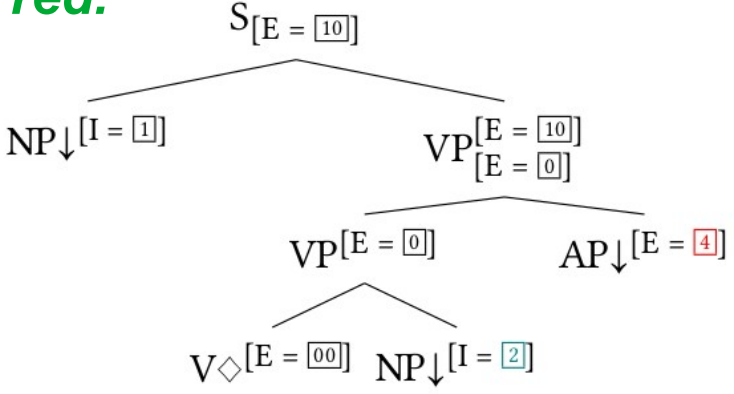
LEXICAL GENERALIZATIONS: ACTIVE-PASSIVE ALTERNATION

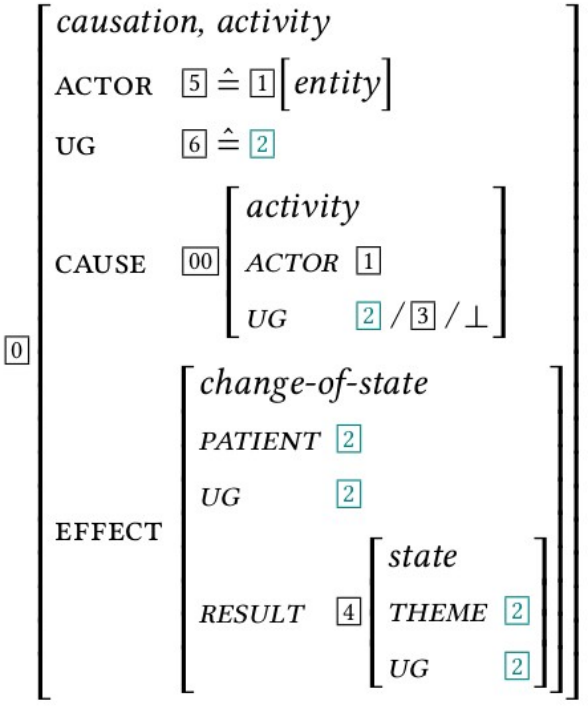
- Active and passive are derived independently
  - Commonalities can be factored out using **disjunction** in the descriptions the trees satisfy.



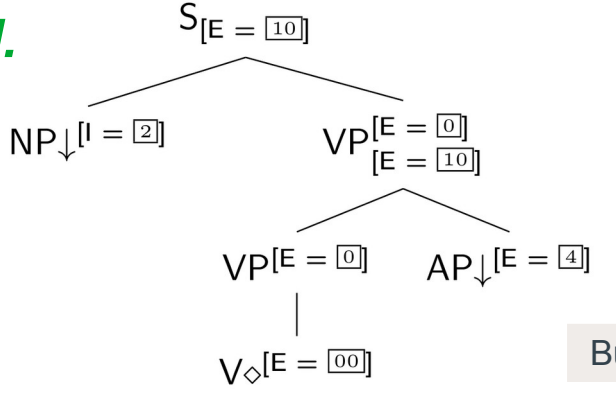
EXAMPLE: RESULTATIVE CONSTRUCTIONS

- ***Kim painted the barn red.***





- ***The barn was painted red.***



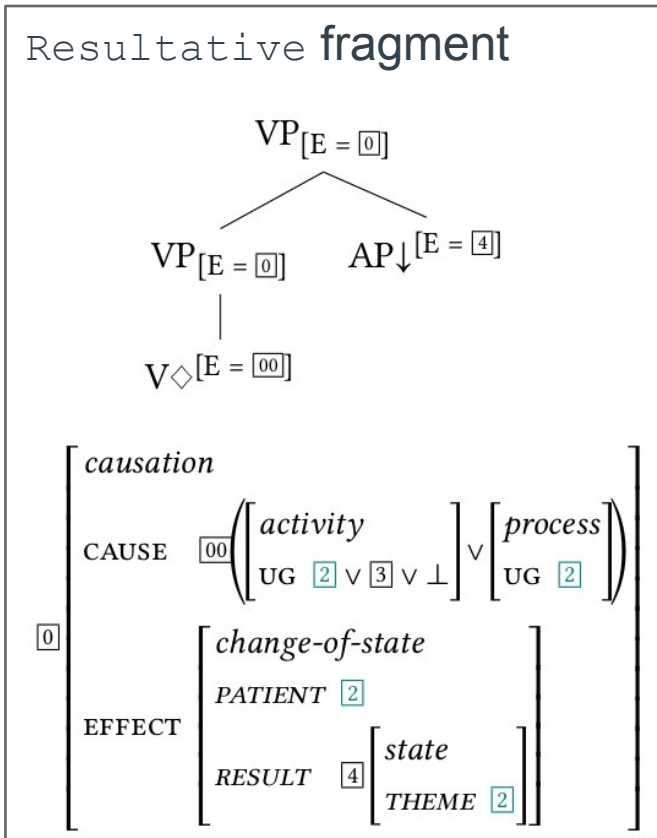
Burkhardt, Kallmeyer & Lichte (subm.)

EXAMPLE: RESULTATIVE CONSTRUCTIONS

```
Subj:
  ActorSubj ∨ UndergoerSubj

Transitive:
  Subj ∧
  ((ActiveVerb ∧ DirObj) ∨
   (PassiveVerb ∧ (ByObj ∨ None))) ∧
   (Resultative ∨ None)
```

Resultative fragment



TAG AND METAGRAMMARS

- Drawbacks of TAG & metagrammars
  - Due to the precompilation step, TAG's EDL is usually limited in order to limit the number of ETs. For example, every verbal ET corresponds to **one** argument structure construction.
  - For this reason, it is difficult to analyze cases of coordination in which more than one argument structure construction is found:
  - ***She offered and made me a wonderful espresso.*** (Müller 2019a)
    - The verbs ***offered*** and ***made*** differ with respect to the role they assign to the "dative" pronoun ***me***:
      - For ***offered***, ***me*** is an obligatory argument with a specific role such as GOAL.
      - For ***made***, ***me*** is an optional argument with a benefactive role.
- However, we will show that coordination of unlikes can be treated using a more flexible EDL, namely the one of **TUCO**, without resorting to lexical rules or ad-hoc constructions.

RADICAL EDL WITH TREE UNIFICATION & CONSTRAINTS (TUCO)

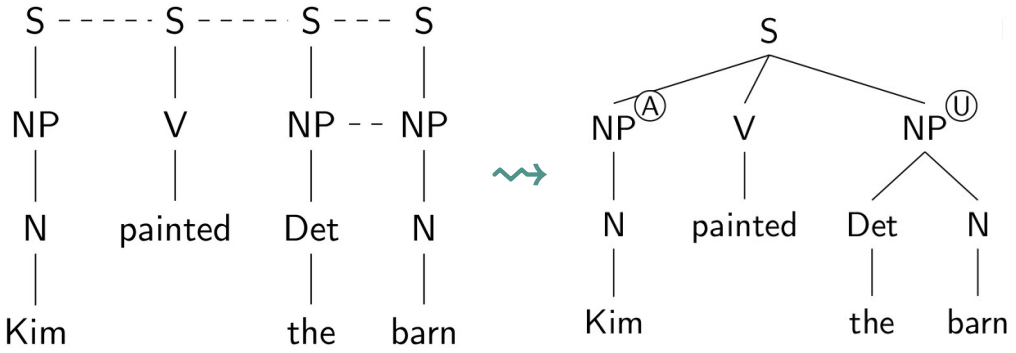
Idea

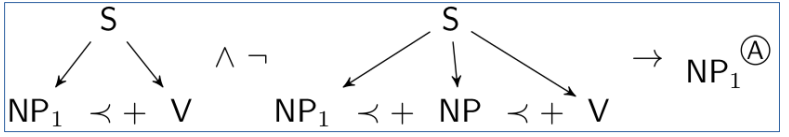
- Tree descriptions do not describe ETs, but derived trees.
  - ➔ No precompilation → Tree descriptions are effective **immediately**.
- Furthermore, tree descriptions have the shape of constraints:
  - X → Y: If X is true/exists, then Y is also true/exists.
  - This can be characterized as **conditional addition of descriptions** → corresponds to inheritance.
- Tree unification is used instead of substitution and adjunction.

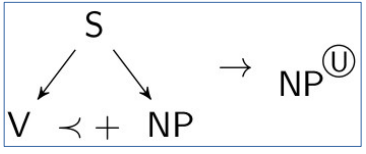
RADICAL EDL WITH TUCO

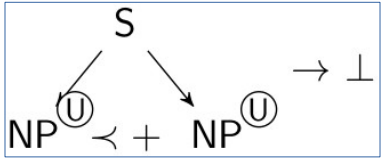
Example

- Tree unification of spinal ETs (but they could be any shape)
- Tree constraints
  - enforce correct linearization
  - add information about semantic macroroles (following Van Valin):
    - NP^A is the actor, NP^U is the undergoer.
  - make sure that at most one NP has the undergoer role.



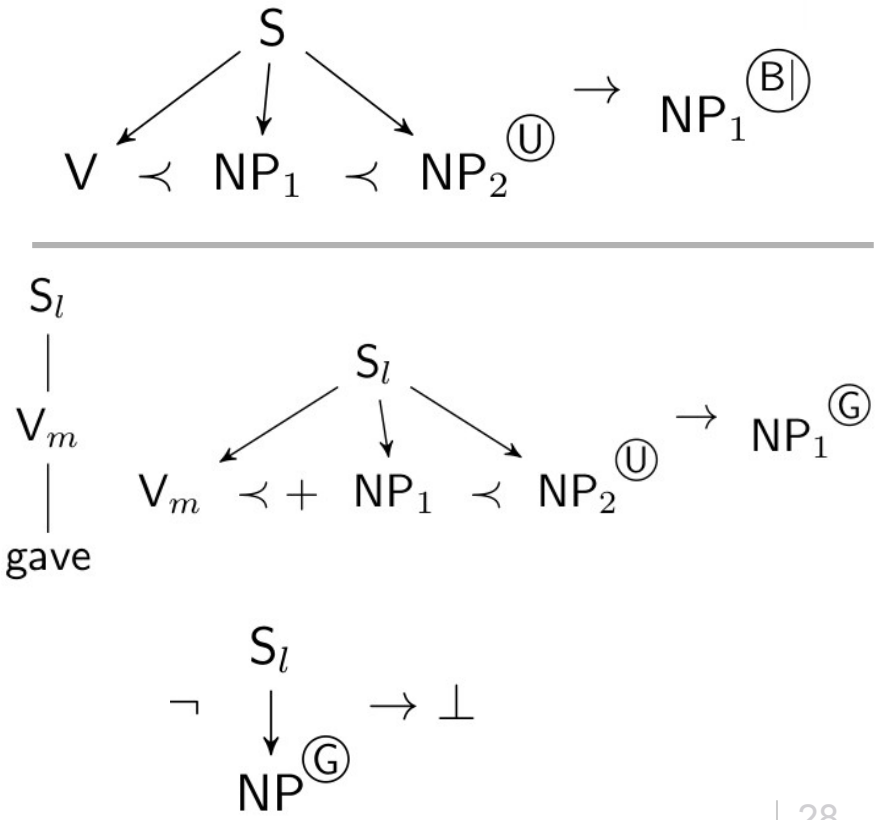




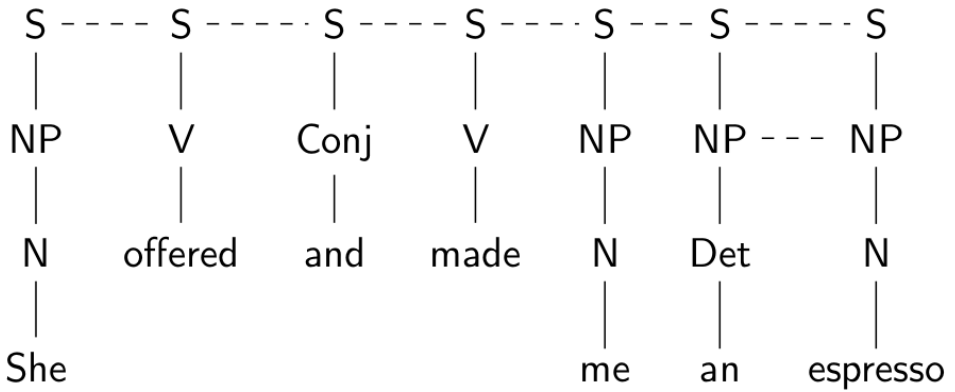


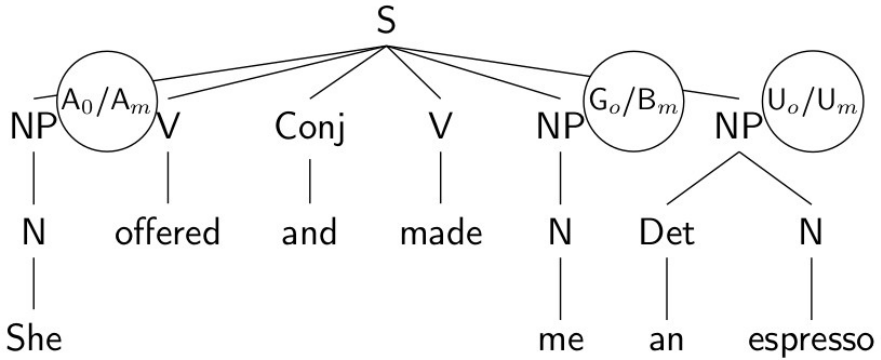
BENEFACTIVE & DITRANSITIVE CONSTRUCTION

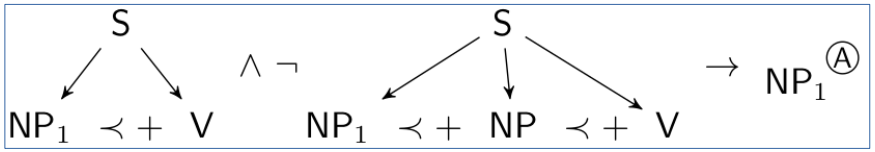
- Benefactives are semantic roles often expressed as dative NPs or ***for***-PPs.
  - The “dative” in English is indicated by the position between the full verb and the accusative/undergoer.
  - ***Kim painted Sue the barn.***
- However, the dative NP is ambiguous, and could be also the goal argument of a ditransitive verb such as ***give***:
  - ***Kim gave Sue the barn.***

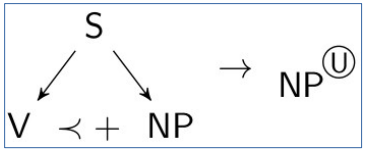


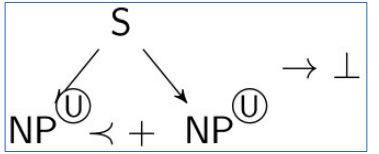
COORDINATION OF UNLIKES

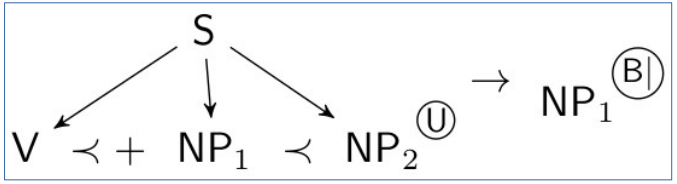


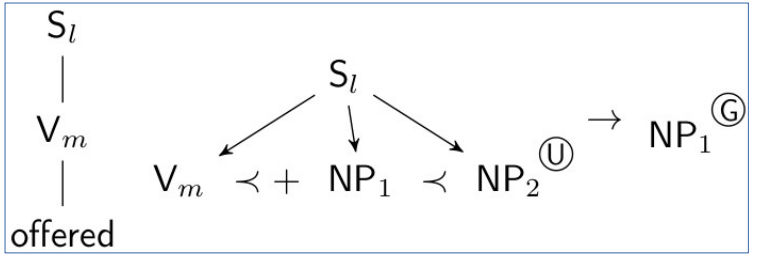












CONCLUSION

- The (putative) limits of inheritance in constructionist grammar theories
  - There are limits, but are they relevant?
  - In this talk, we argued that inheritance generally suffices within an EDL framework that is sufficiently flexible.
  - Using TAG and the new TUCO formalism, we demonstrated this on a selection of phenomena:
    - active passive alternation in combination with the resultative construction
    - coordination of unlikes (involving benefactives and ditransitives)
- Inheritance may be insufficient for specific kinds of analyses (e.g. deriving passive from active), but a rewriting mechanism could be added to achieve this (with all the computational downsides).
- However, in our opinion, this is orthogonal to the distinction between BDL and EDL, or between lexical and phrasal approaches.

LIST OF REFERENCES

- Müller, Stefan. 2019a. Grammatical theory: From transformational grammar to constraint-based approaches. Third revised and extended edition. Berlin: Language Science Press.
- Müller, Stefan. 2019b. Complex predicates: Structure, potential structure and underspecification. Linguistic Issues in Language Technology (LiLT) 16. https://aclanthology.org/2019.lilt-17.3.

LEXICAL GENERALIZATIONS: ACTIVE-PASSIVE ALTERNATION

- Passive is derived from active → using **destructive rewriting** of trees (known as "metarules" or "lexical rules", basically transformations)
  - Metarules must be powerful.
    - deletion, copying, recursive application, metavariables over trees
    - thereby: order sensitive, non-declarative
    - in the unrestricted case: undecidable
  - Metarules can be restricted: finite closure, bi-closure, explicit ordering, …
  - However, it is unclear why metarules are necessary, i.e., why they are preferable to disjunction.
  - Furthermore, this does not distinguish EDL an BDL approaches.