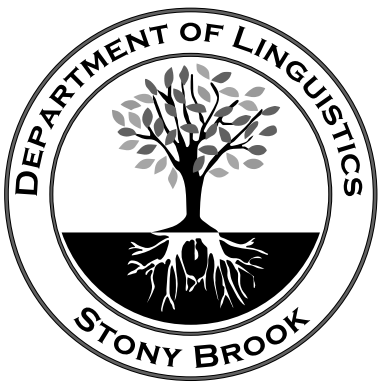
Subregular Linguistics for. . . well, Linguists

(Part 1: String Land)

Thomas Graf



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MIT Mini Course
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The Big Linguistic Questions

- What are the laws that govern each structural level?
- **Why** are those the laws?
- How **complex** are these laws? How hard are they to compute?
- How are they **learned**?
- Do we find **typological gaps**, i.e.
  patterns that should exist but don't appear in any language?
- What can we infer about human cognition?

The Opportunistic Program for Lazy Researchers Like Myself

- Stand on the shoulders of giants.
- Computer scientists have figured out a lot about complexity, so let's apply their ideas to language.

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A Mathematical Distinctness Theorem

- From a computational perspective, there is a split between "P-side" and "S-side".

$$\text{regular} < \text{context-free} < \text{mildly context-sensitive} < \cdots$$

Phonology

Morphology

Syntax

- Matches linguistic practice (despite attempts at unification, e.g. Government Phonology, DM, OT syntax)
- A unified Theory of Everything is not on the linguistic horizon.

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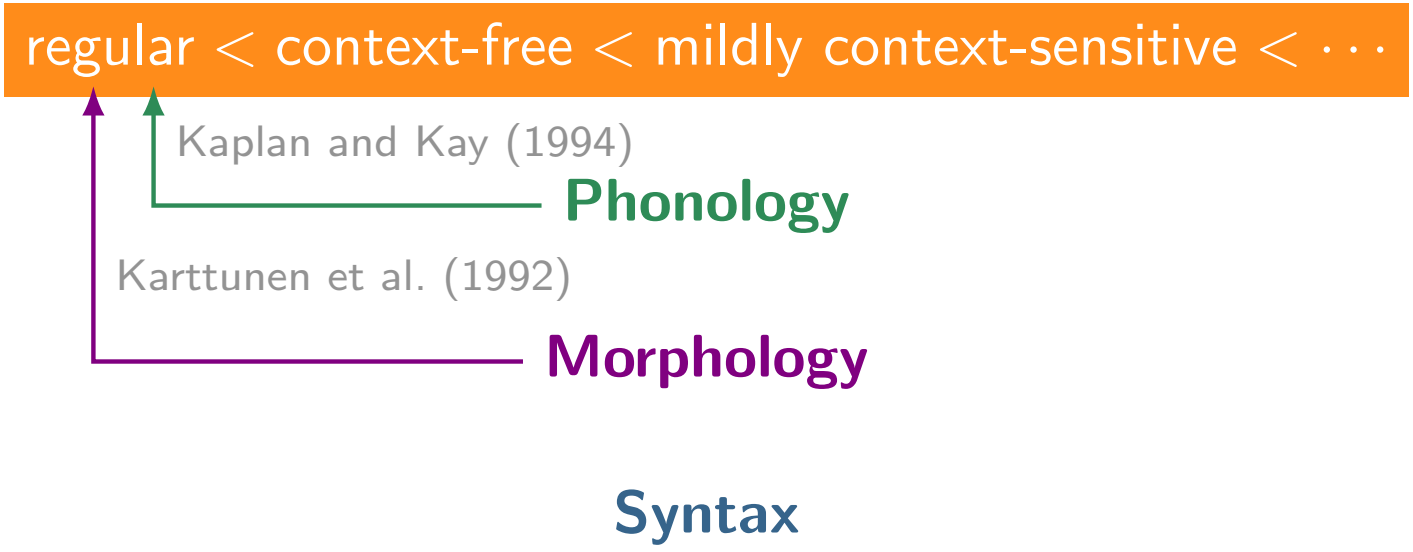

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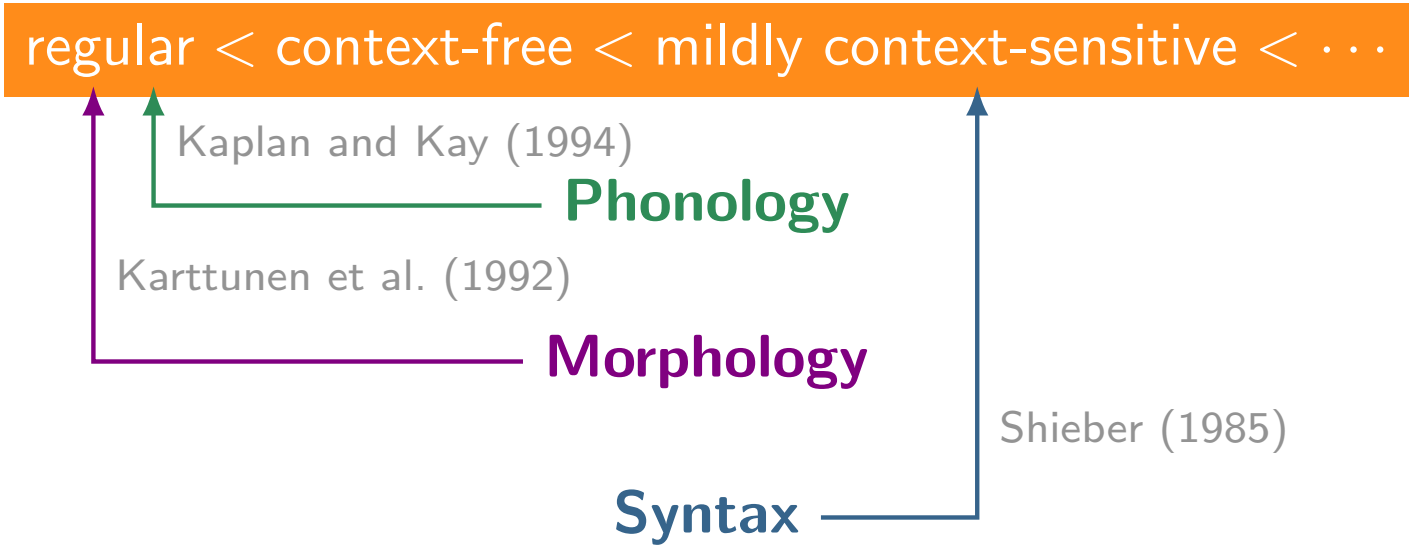

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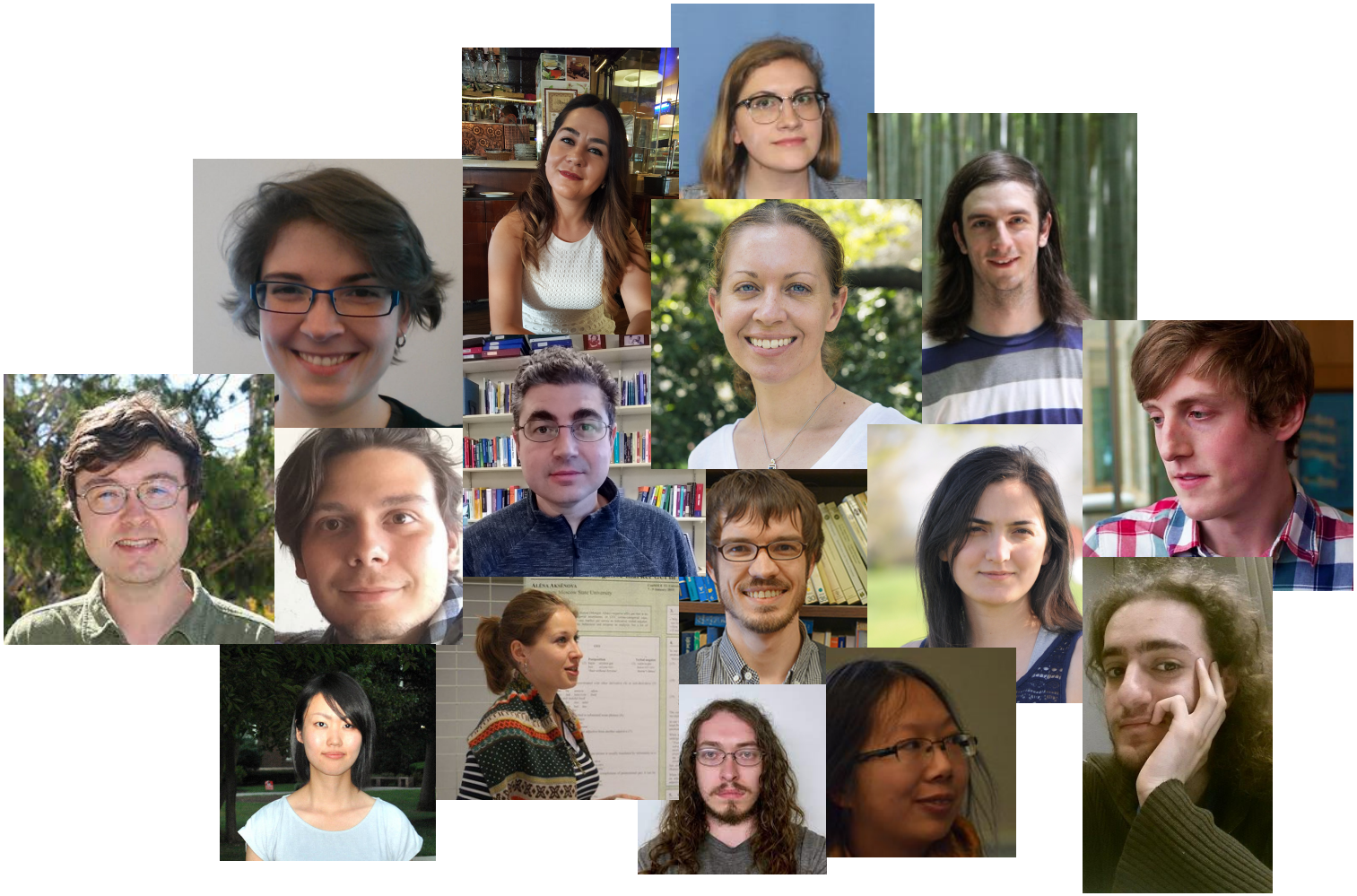
Cognitive Parallelism Hypothesis

- The postulated split is misleading.
- If we probe deeper, we find that
  - different modules are remarkably similar,
  - their dependencies are weaker than regular
    $\Rightarrow$ **subregular**
- Cognitive parallelism is **empirically fertile**.

Take-Home Messages

1. Phonology and syntax show surprising subregular parallels.
   (Morphology and morphosemantics, too. . .)
2. Like every good theory, subregularity yields
   new generalizations and data.
3. You can easily add subregular ideas to your own research!

A Growing Community



A Growing Community

Outline

SL & TSL: (T)ier-Based Strictly Local

- There are a variety of subregular classes to choose from.
- SL and TSL are among the weaker ones.
- They work well empirically.

(Tier-Based) Strictly Local Dependencies

- All patterns described by markedness constraints that are
  - inviolable,
  - locally bounded,
  - formalized as n-grams.
- Non-local dependencies are **local over tiers**.
  (Goldsmith 1976; but there is another. . .)
- **Linguistic core idea:**
  Dependencies are local over the right structure.

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Example: Word-Final Devoicing is SL-2

- Captured by forbidding voiced segments at the end of a word
- **German**: Don't have **z$** or **v$** or **d$** (where **$** = word edge).

Example: German

*$ r a d $

*z$

*v$

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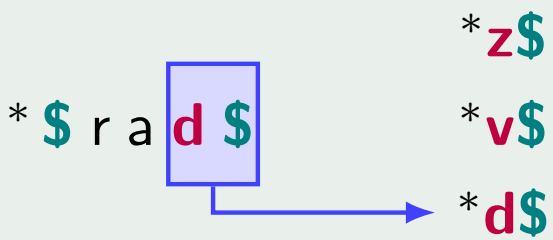

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Test Your Might

Exercise

Suppose that a language with CV as the only syllable template exhibits vowel harmony without any neutral vowels or any blockers.

1. What is the complexity of vowel harmony in this language?
2. What if CVC syllables are also possible?

Exercise

Can you give an example of an SL string dependency in (morpho)syntax?

More SL: Quantifier Languages (van Benthem 1986)

(1) a. Every student cheated.
b. No student cheated.
c. Some student cheated.
d. Three students cheated.

students	John	Mary	Sue
cheated	yes	no	yes
string	Y	N	Y

- (1a): **False**, because the string contains a N
- (1b): **False**, because the string contains a Y
- (1c): **True**, because the string contains a Y
- (1d): **False**, because the string does not contain three Ys

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Every and *No* are SL-1

- Every quantifier defines a set of licit **strings over Y and N**.

every	string must not contain N (*N ⇒ SL-1)
no	string must not contain Y (*Y ⇒ SL-1)

- But what about other quantifiers?

some	string contains at least one Y
not all	string contains at least one N
three	string contains at least three Y
most	string contains more Y than N
even number	string contains $2n$ Y, $n \geq 0$

- These languages are **not SL**!

The Limits of SL

Example: *some* is not SL

1. The quantifier language for *some* must
   - include every string of the form NN$\cdots$Y$\cdots$NN,
   - exclude every string of the form NN$\cdots$N$\cdots$NN.
2. But every **n**-gram of some illicit string is also an **n**-gram of some well-formed string.
3. Forbidding any **n**-gram of an illicit string means incorrectly ruling out some well-formed strings.
4. Hence the quantifier language of *some* cannot be SL.

Exercise

Show that the quantifier languages of *most* and *an even number* are not SL either.

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Some in Phonology

- The problem with *some* goes beyond semantics.

Culminativity

Every phonological word has **exactly one** syllable that carries primary stress.

Culminativity (Rephrased)

Every phonological word has

- **at most one** syllable that carries primary stress, and
- **some** syllable that carries primary stress.

- Culminativity cannot be SL.

Another Problem: Samala Sibilant Harmony

- If multiple sibilants occur in the same word, they must all be [+anterior] (**s**,**z**) or [−anterior] (**ʃ**,**ʒ**).
- In other words: Don't mix **purple** and **teal**.

*sʃ *sʒ *zʃ *zʒ
*ʃs *ʒs *ʃz *ʒz

- **But:** Sibilants can be arbitrarily far away from each other!

Example: Samala (Applegate 1972)

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- If multiple sibilants occur in the same word, they must all be [+anterior] (**s**,**z**) or [−anterior] (**ʃ**,**ʒ**).
- In other words: Don't mix **purple** and **teal**.

*sʃ *sʒ *zʃ *zʒ
*ʃs *ʒs *ʃz *ʒz

- **But:** Sibilants can be arbitrarily far away from each other!

Example: Samala (Applegate 1972)

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Making Long-Distance Dependencies Local

- Let's take a clue from phonology: create locality with **tiers**. (Heinz et al. 2011)

Jeff Heinz

Example: Samala Revisited

1. Project sibilant tier
2. *sʃ, *s3, *zʃ, *z3, *ʃs, *3s, *ʃz, *3z

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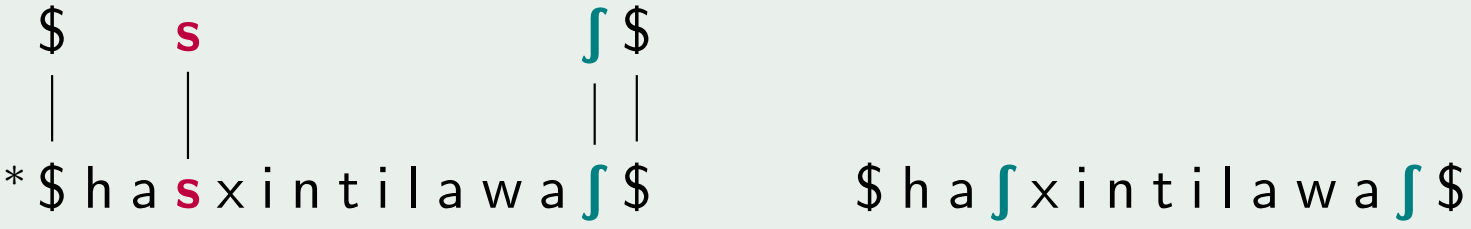

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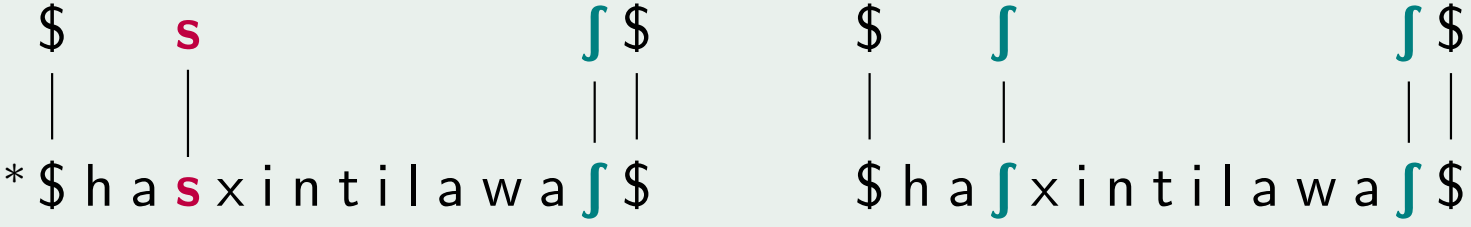

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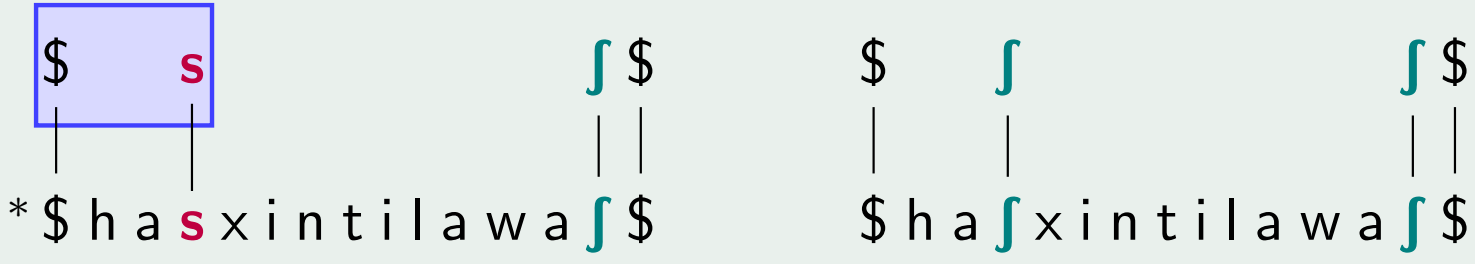

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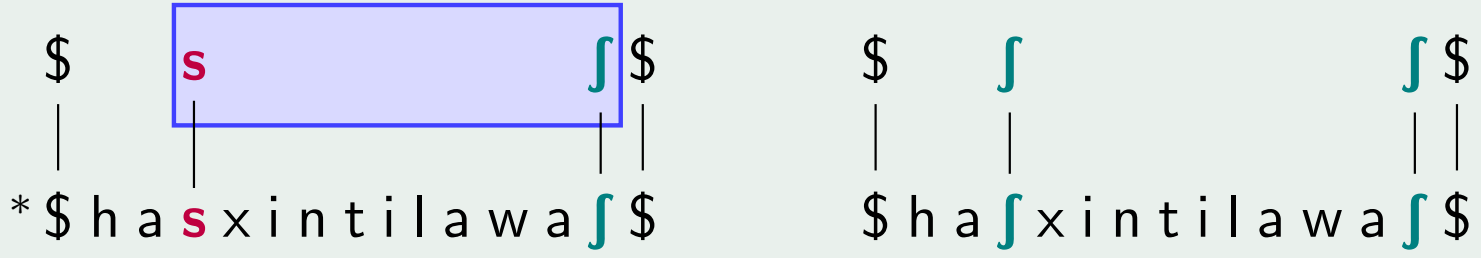

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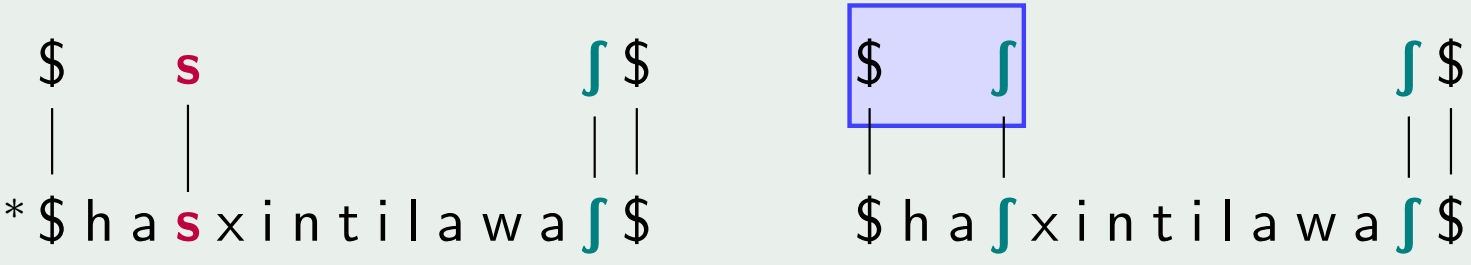

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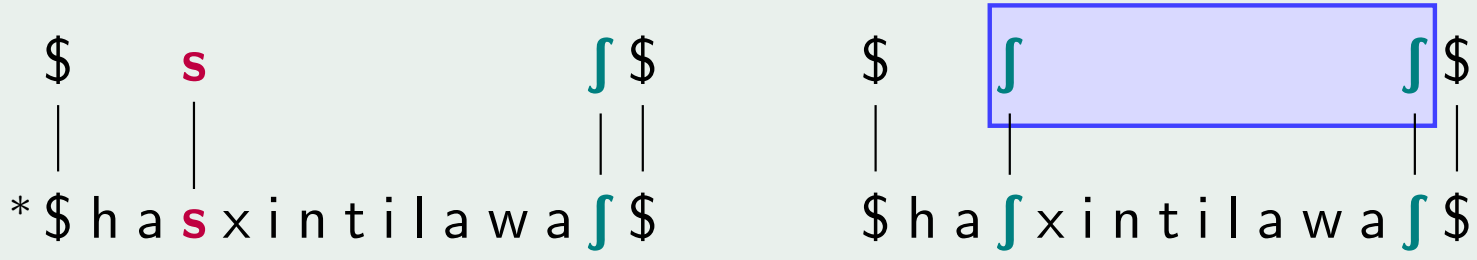

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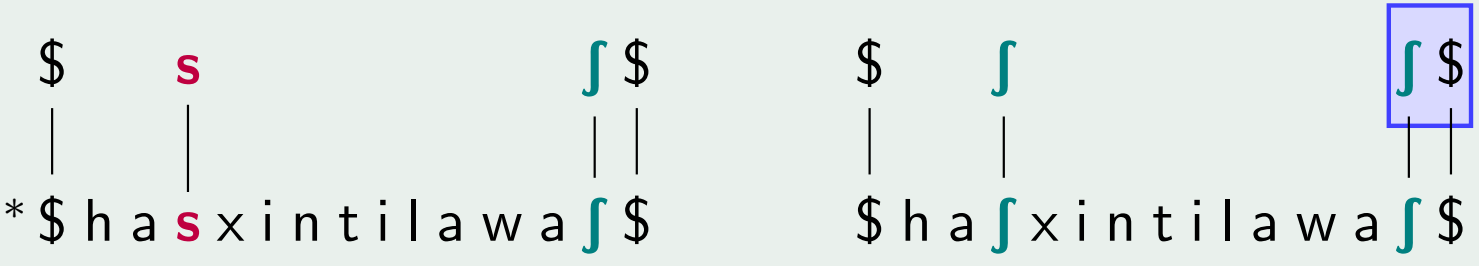

Another TSL Boon: Blocking

- TSL can also handle blocking effects.
- **Slovenian sibilant harmony with blocking**
  1. **[−ant]** . . . **[+ant]** is illicit,
  2. unless **t** or **d** intervenes.
- **TSL-2 account**
  1. project all **[−ant]**, **[+ant]**, **t**, and **d**
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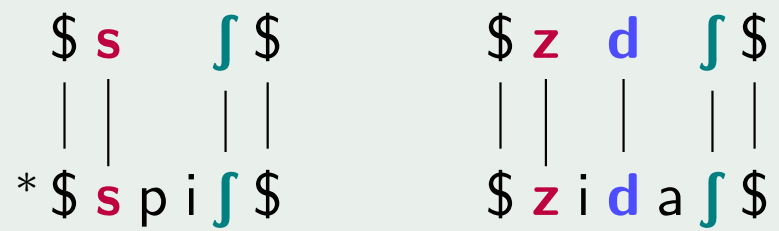

Some revisited

- TSL is a much better fit for quantifier languages.

Example: *Some* with Tier Projection

1. Project **Y**-tier
2. *$$ (tier must not be empty)

*$ N N N N N N N N N N $ $ N N Y N N N N N N Y $

Exercise

Suppose we also forbid YY on the Y-tier.

1. What quantifier does the resulting string set describe?
2. Do we perhaps need that somewhere else?

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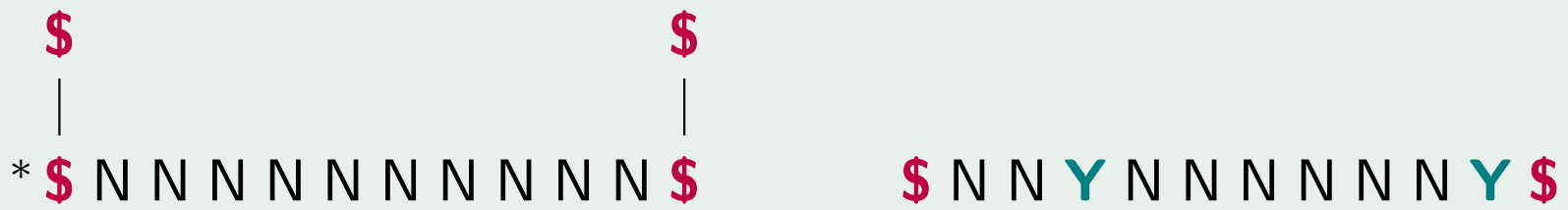

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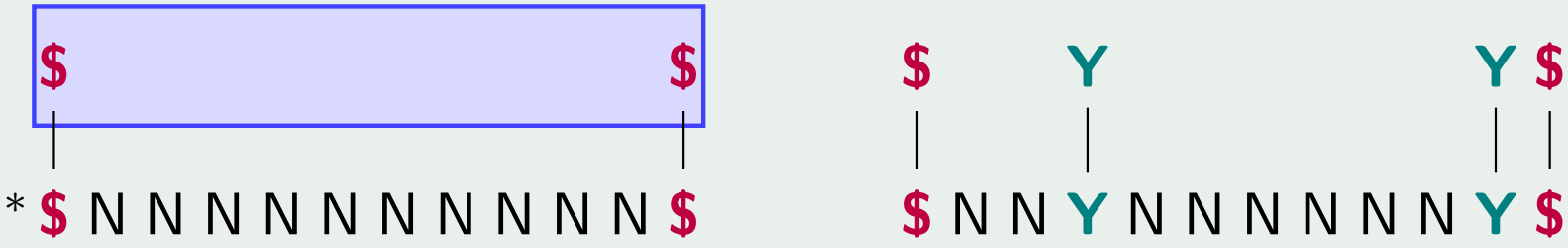

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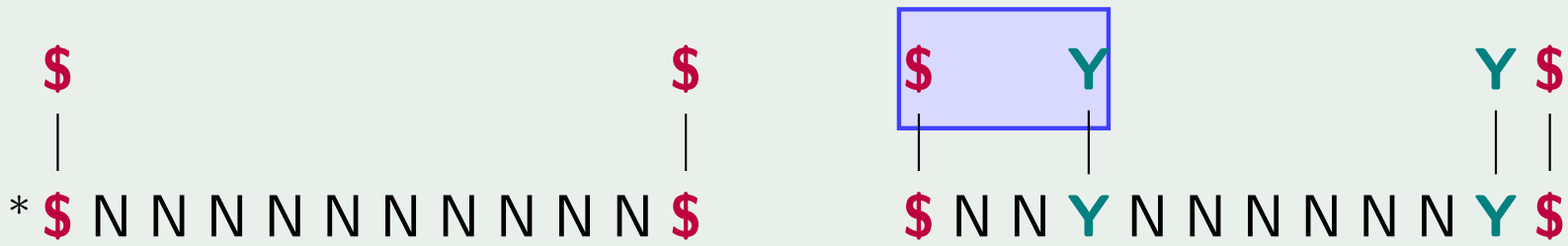

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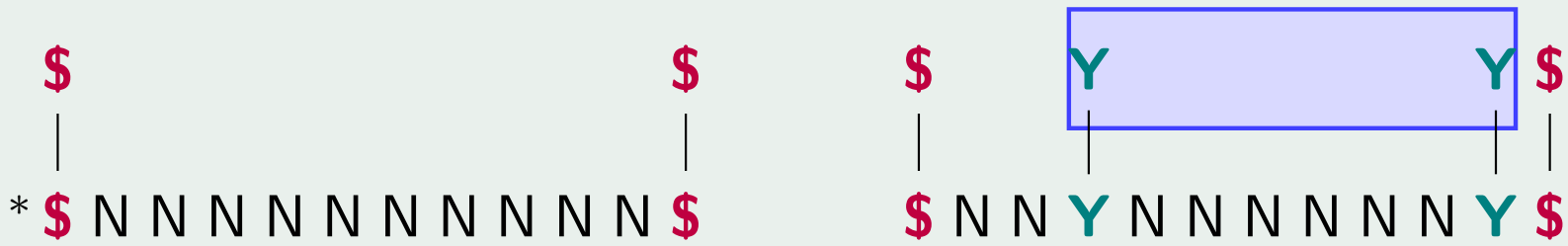

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Overview of Quantifier Languages

If a quantifier language is **not TSL**,
then its quantifier **cannot be lexically simplex** in any language.

Quantifier	**TSL?**	**Tier**	**Lex.** (Paperno 2011)
every	yes	none	yes
no	yes	none	yes
some	yes	Y	yes
(at least) two	yes	Y	yes
(at most) two	yes	Y	yes
not all	yes	N	no
all but one	yes	N	no
even number	no		no
prime number	no		no
infinitely many	no		no
most	no		???

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(at most) two	yes	Y	yes	
not all	yes	N	no	TSL
all but one	yes	N	no	
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The Case of *most*

There is good semantic evidence that "most" is internally complex and hence **not lexically simplex**. (Hackl 2009)

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(Paperno 2011)

Lexical

TSL

SL and TSL for Phonology and Semantics

- Linguistically natural
- Correct and efficient learning algorithm (Jardine and McMullin 2017)
- Low resource demands ⇒ cognitively plausible
- Captures wide range of phonotactic dependencies
- Excludes many unattested patterns

Example: First-Last Harmony

- Harmony only holds between initial and final segments
- Linguistically plausible, yet unattested

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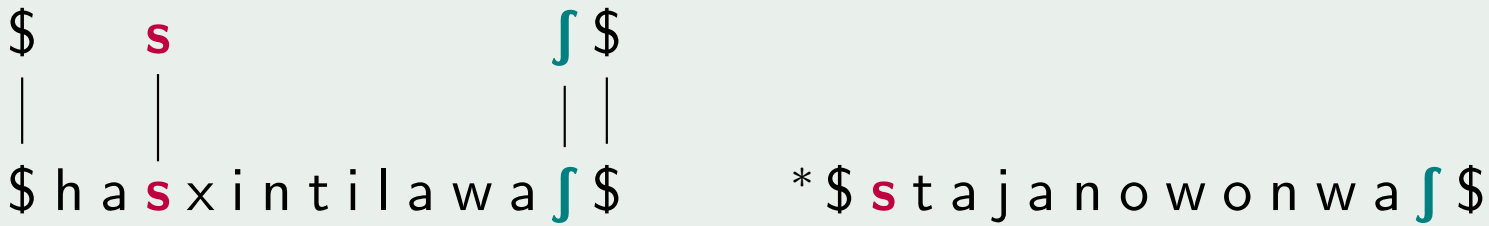

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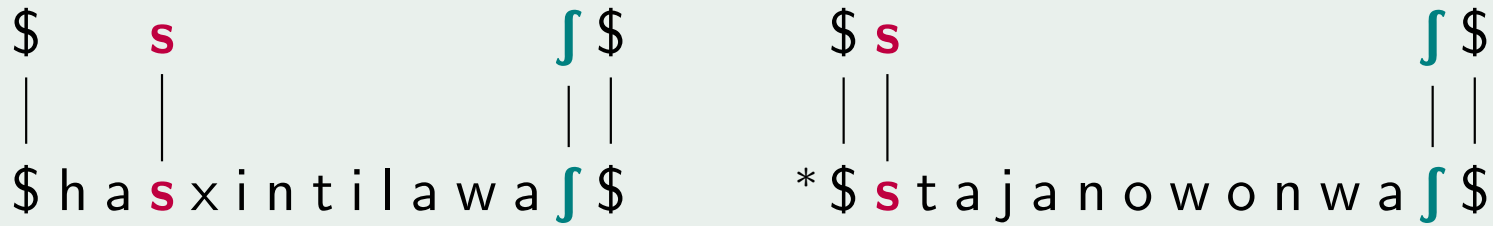

Supercharging the Tier Projection

- The TSL tier projection only considers individual symbols.
- But sometimes we need the context, too.

I[nput TSL]	consider surrounding symbols in input string
O[utput TSL]	consider previous symbols in output tier
IOTSL	consider both

What may Project?

Tier projection controlled by

1. label of segment
2. local context
3. symbols already on tier

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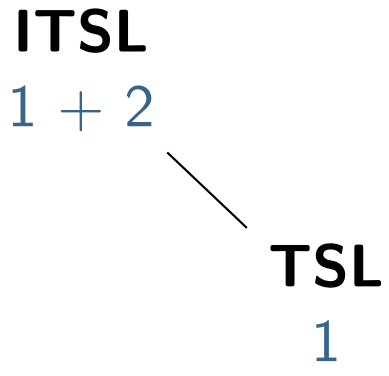

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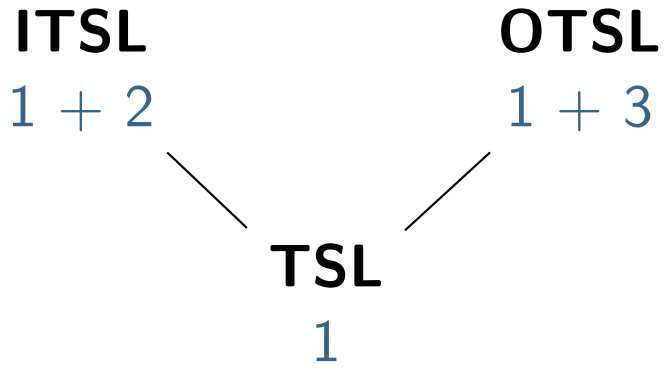

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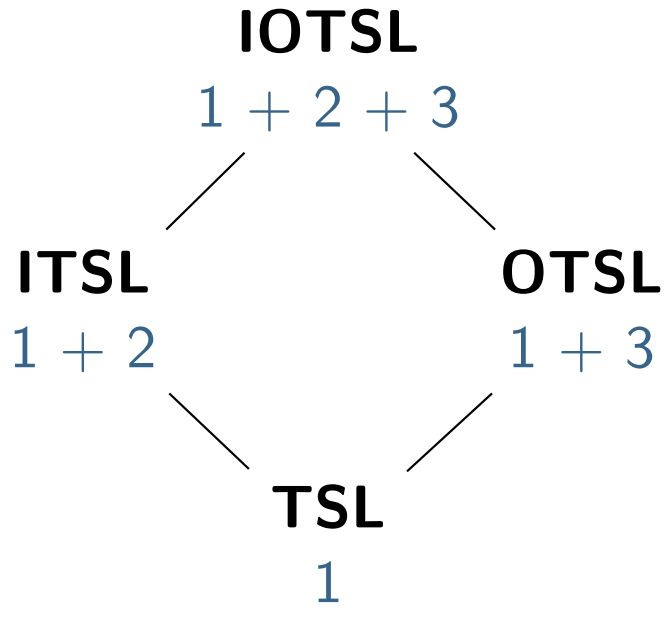

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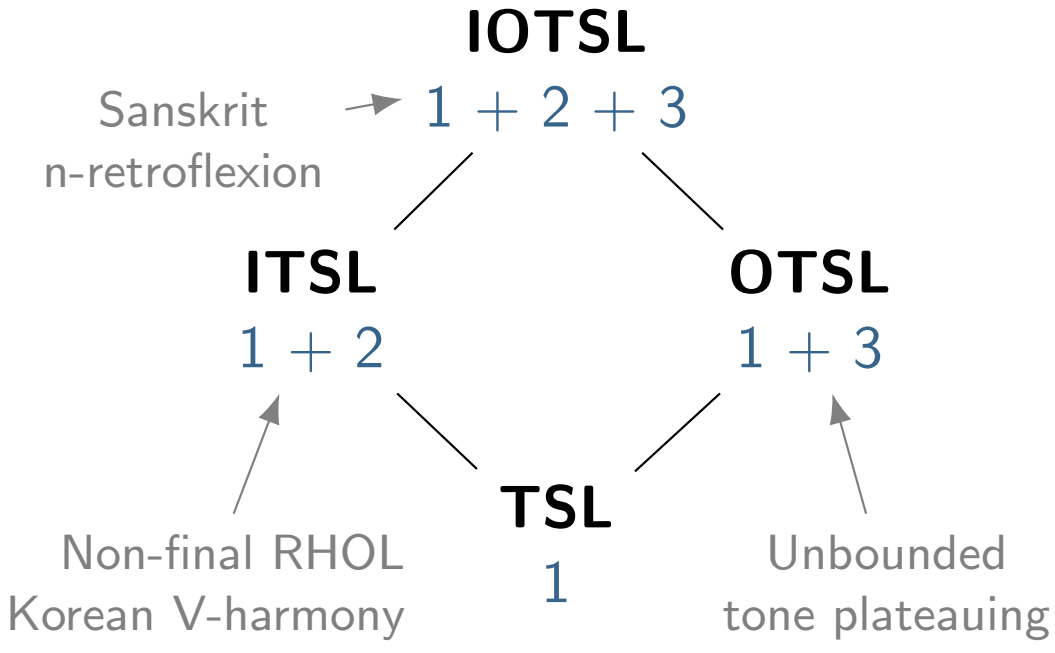

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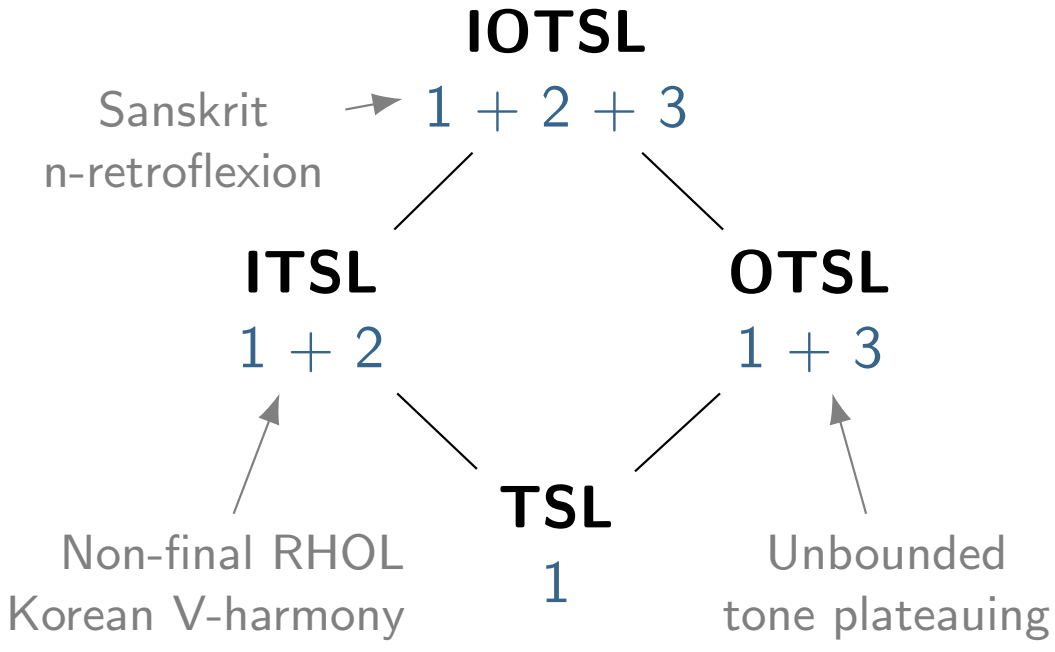

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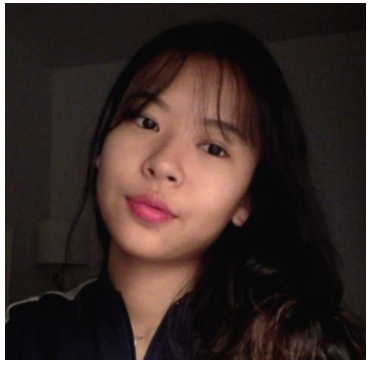

Suji Yang

ITSL: Korean Vowel Harmony

High dark vowels are neutral unless they are initial, in which case they behave like mid dark vowels.

Example: Korean Vowel Harmony with CV-Syllables

1. Project bright vowels (**B**), mid dark (**M**), and initial high dark (**H**)
2. ***BM**, ***MB**, ***HB**

*$ C **H** C **H** C **B** $ $ C **B** C **H** C **B** $

Exercise

Why is Korean vowel harmony not TSL?

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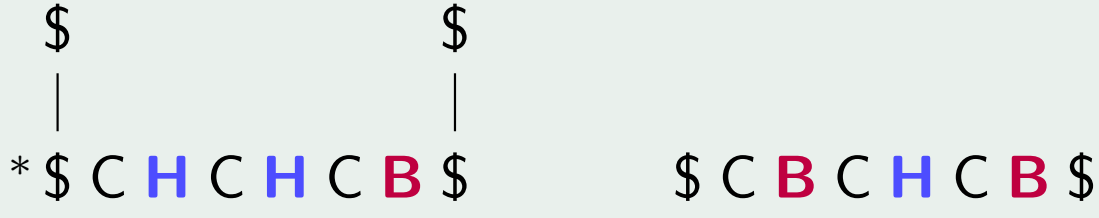

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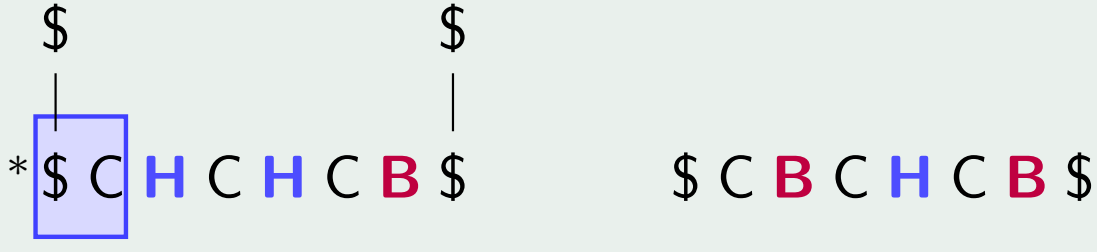

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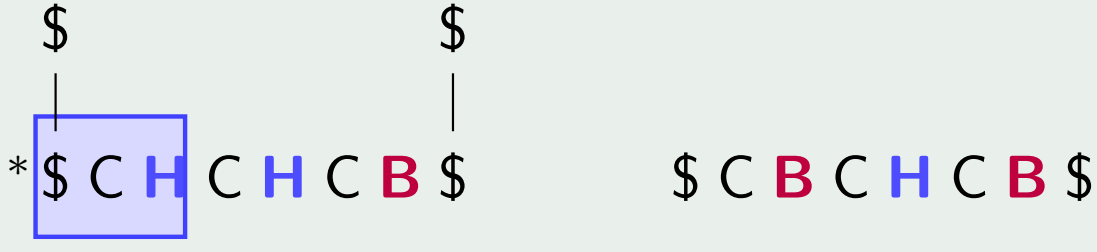

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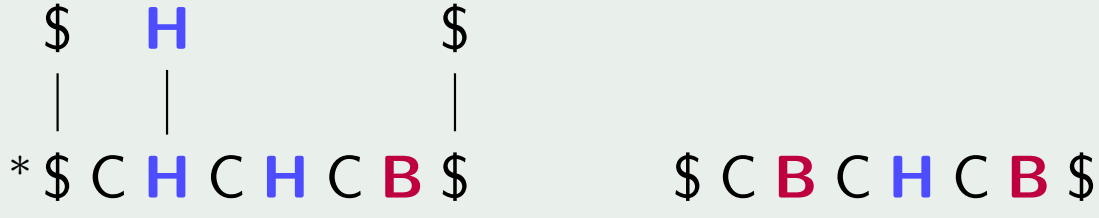

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ITSL: Korean Vowel Harmony

High dark vowels are neutral unless they are initial, in which case they behave like mid dark vowels.

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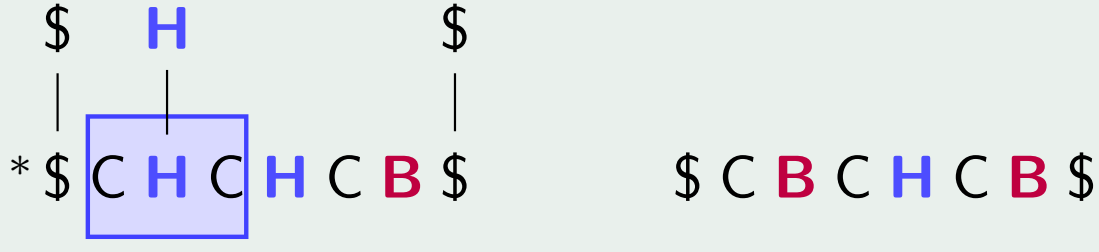

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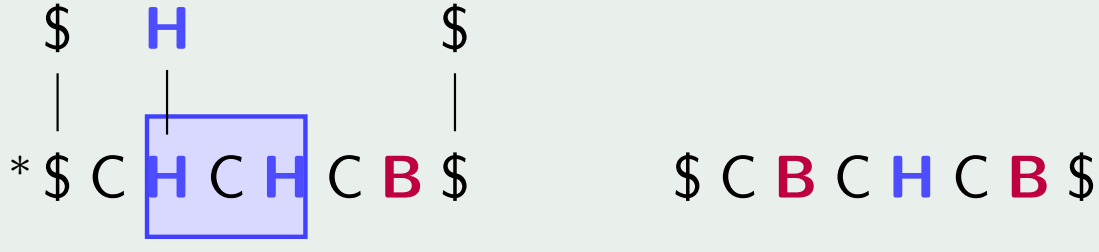

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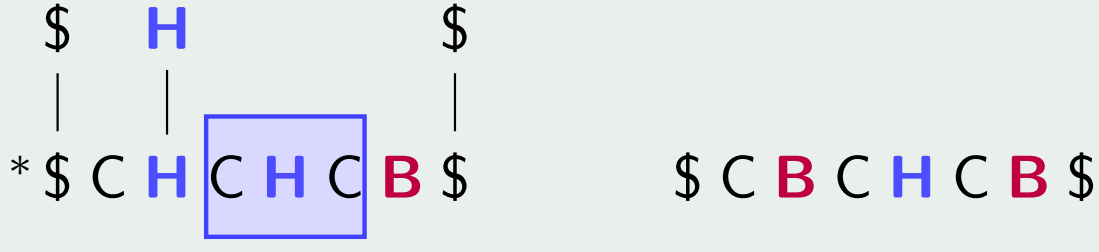

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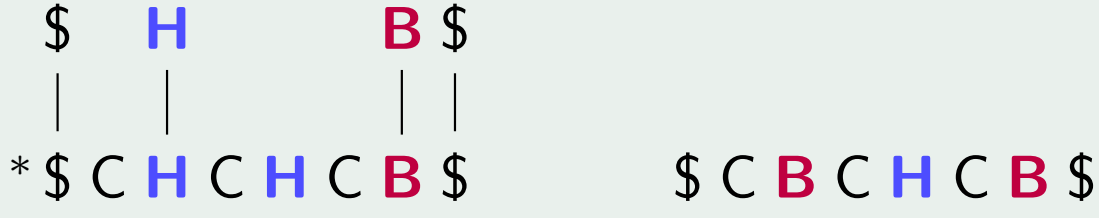

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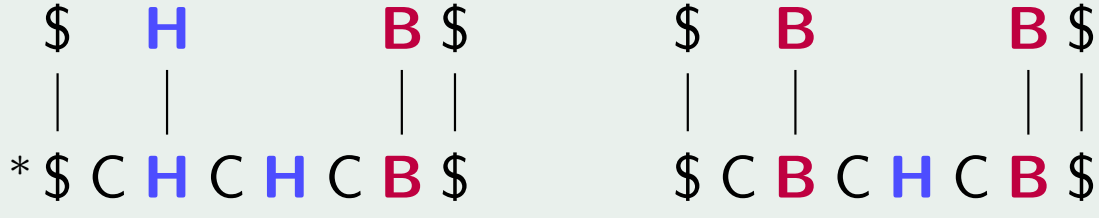

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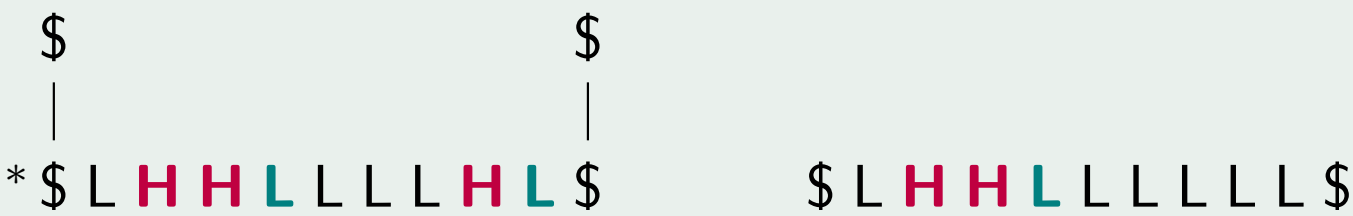

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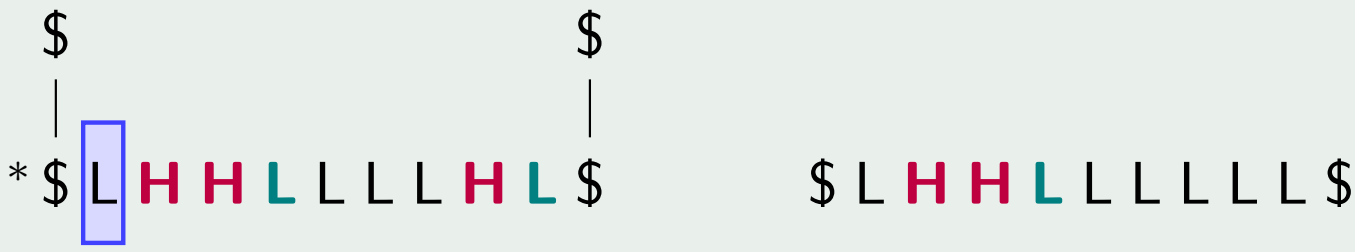

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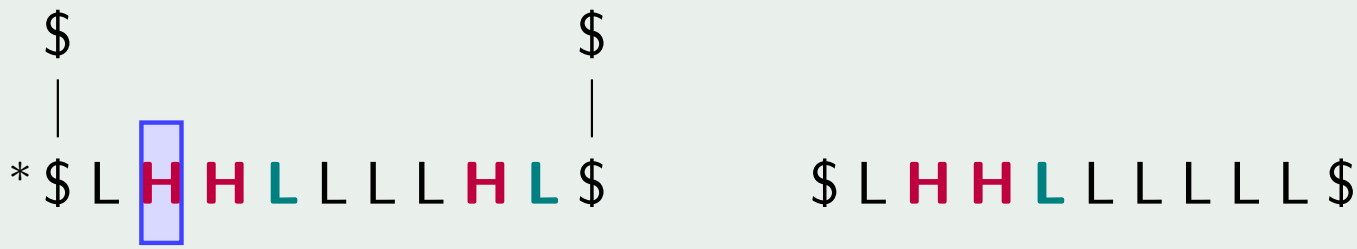

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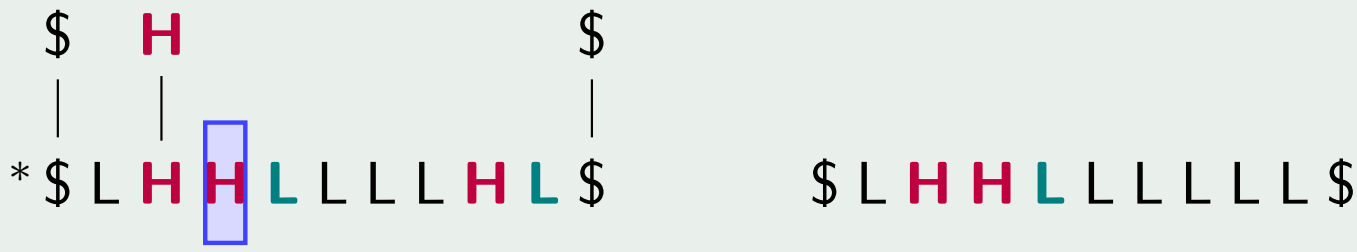

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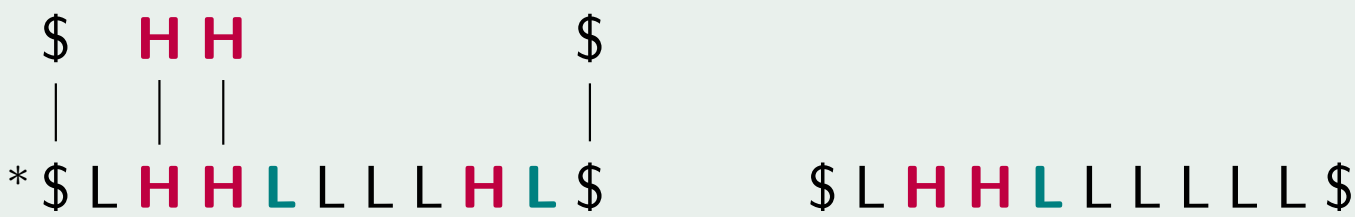

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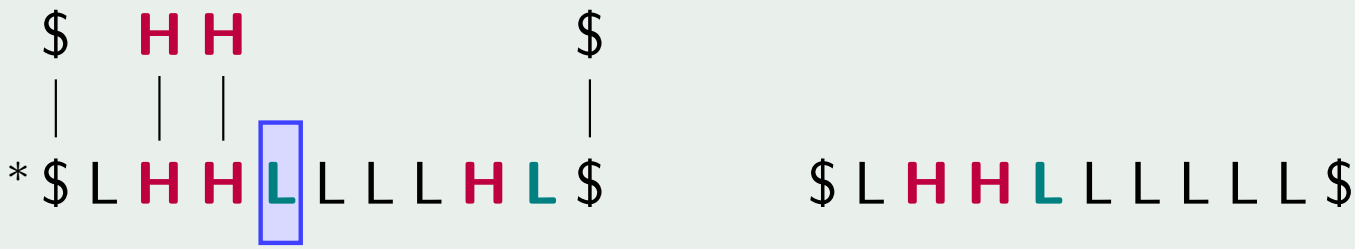

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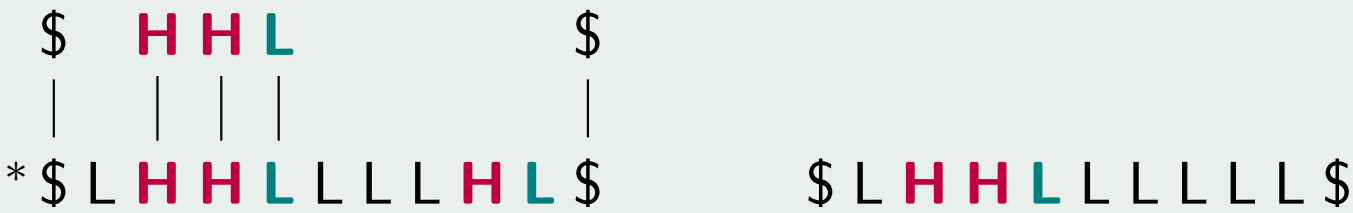

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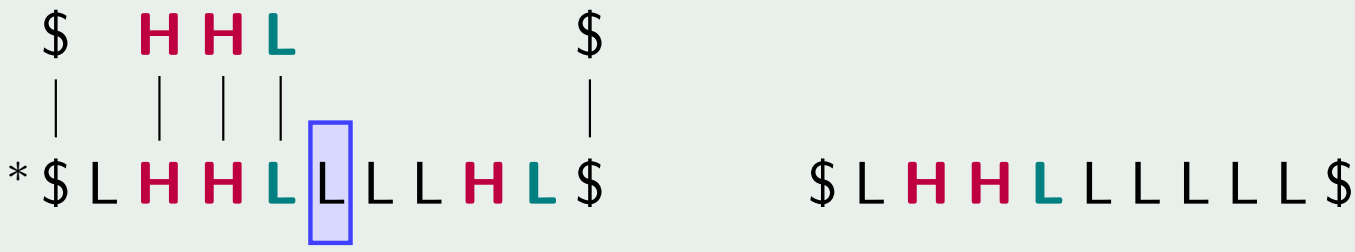

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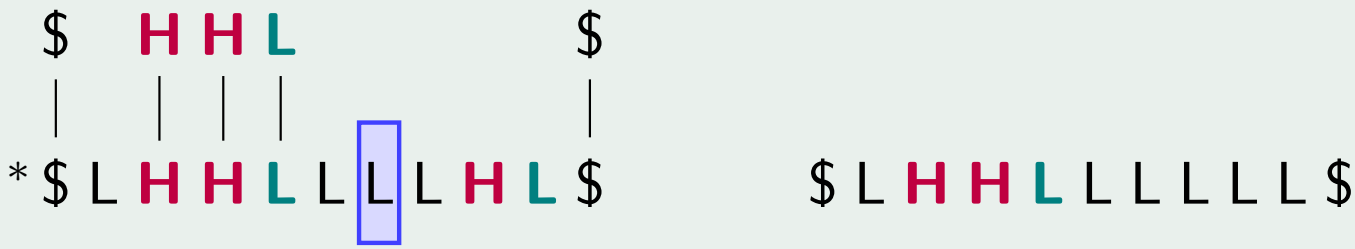

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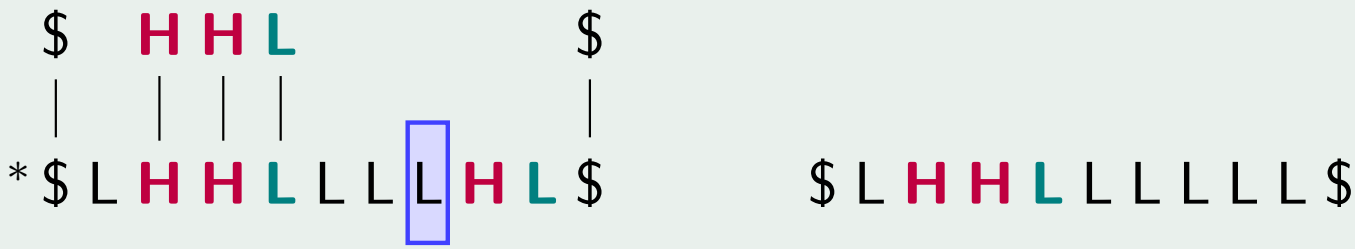

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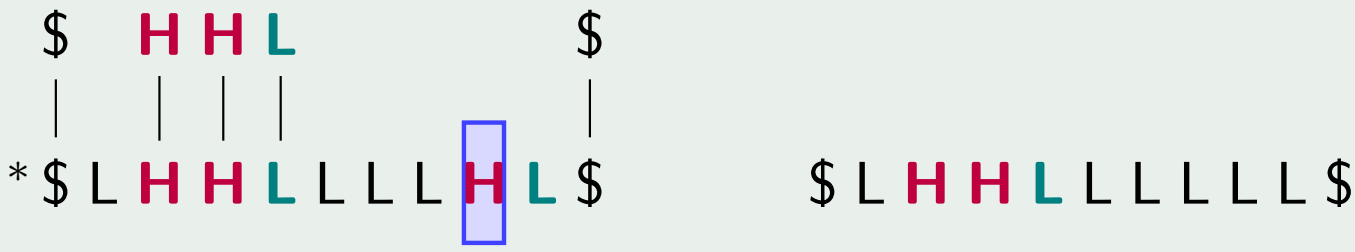

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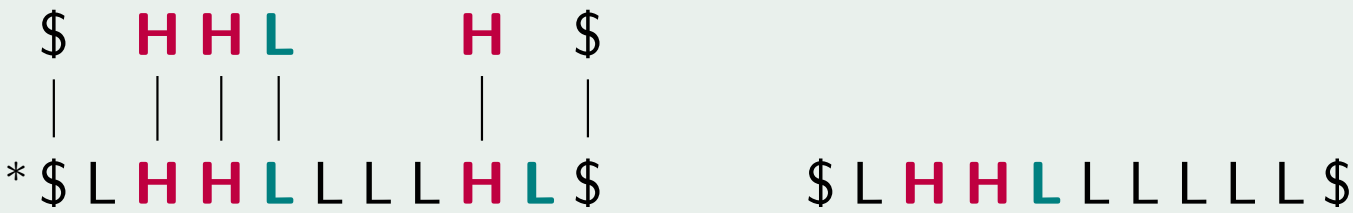

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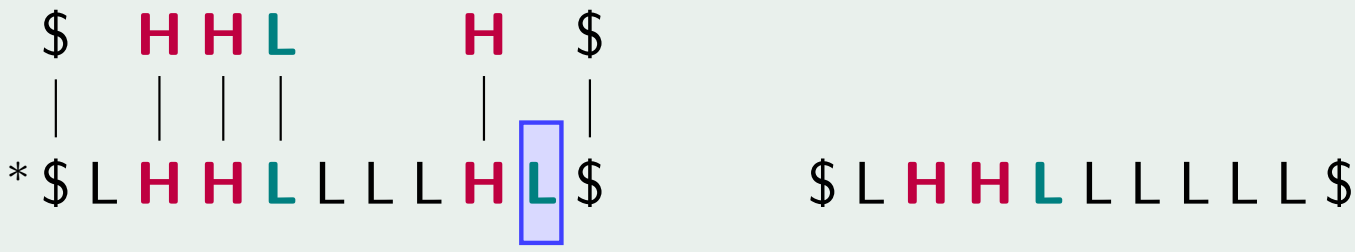

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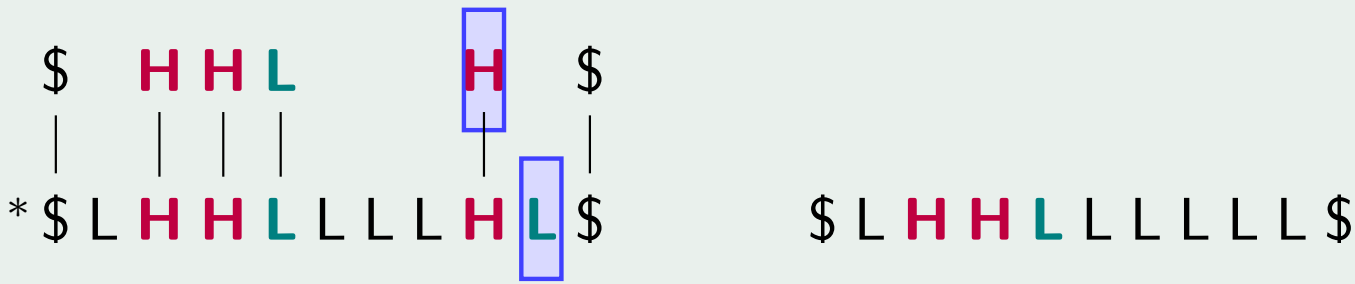

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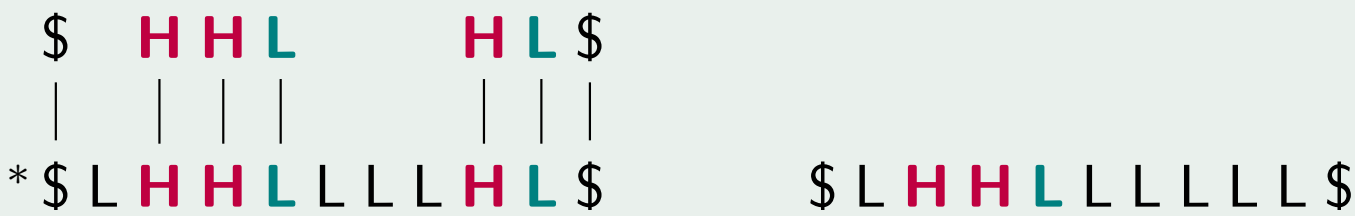

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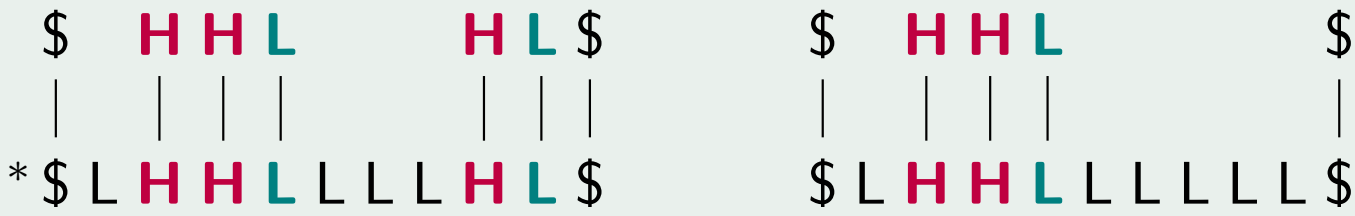

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The Full Monty: IOTSL

- IOTSL uses a tier projection that considers both the structural context and the previous **n** tier symbols.
- Only a few phenomena in phonology seem to require IOTSL:
  - Sanskrit n-retroflexion (aka *nati*) (Graf and Mayer 2018)
  - Uyghur backness harmony (Mayer and Major 2018)
- **Spoiler:** IOTSL shows up quite a bit in syntax.

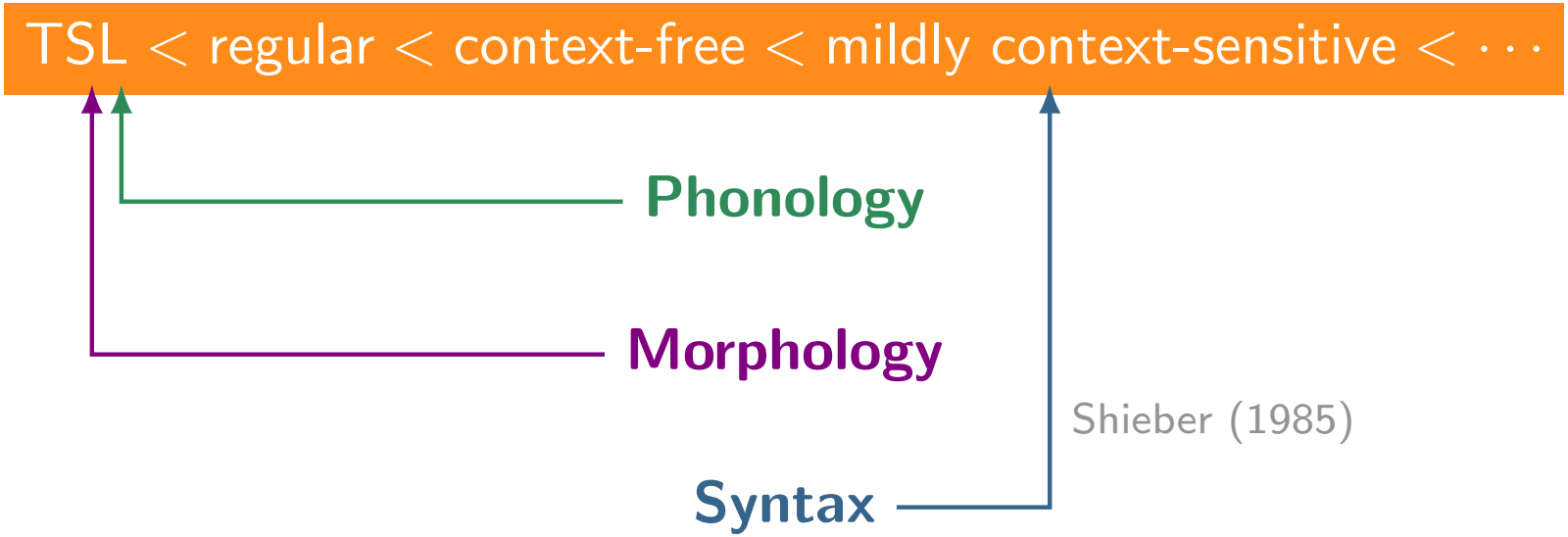
Interim Summary

SL local dependencies

TSL local dependencies over tiers (ITSL, OTSL, IOTSL use more powerful tier projections); can also handle blocking

- We can model various phenomena over strings and classify them by their complexity.
- This is not a pointless mathematical exercise, it is **useful and insightful**:
  - separate attested from unattested phenomena,
  - explain expressivity boundary of lexicalized quantifiers,
  - learning algorithms,
  - guide data gathering.
- But imho, things get really interesting once we apply these ideas to syntax...

Could Syntax Also be Subregular?



- Syntax seems even more like an outlier. . .
- Don't look at surface strings!
  What about **syntactic dependencies**?

Nazila Shafiei

c-Strings

Command-Strings

The **c[ommand]-string** of a node **n** contains

- **n** itself and
- every node that c-commands **n**.

- easily computed from dependency trees
- C-command constraints seem to be largely **IOTSL over c-strings**.

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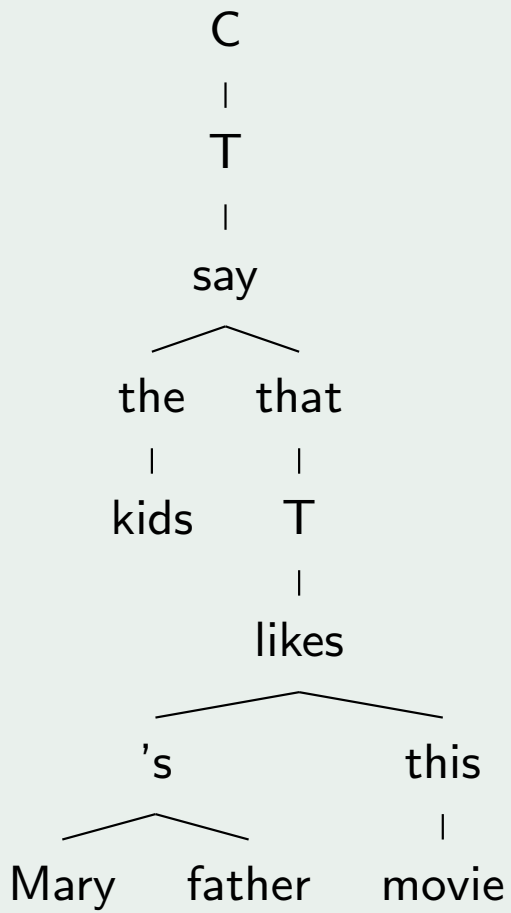

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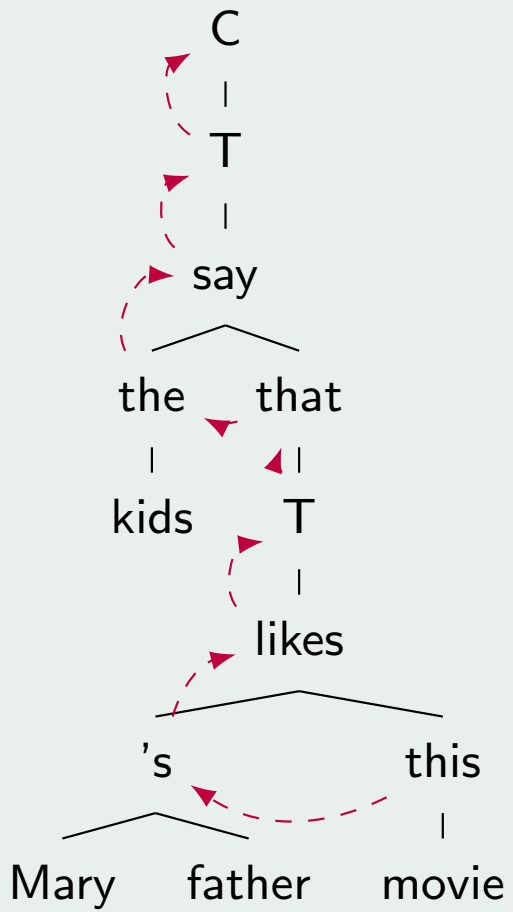

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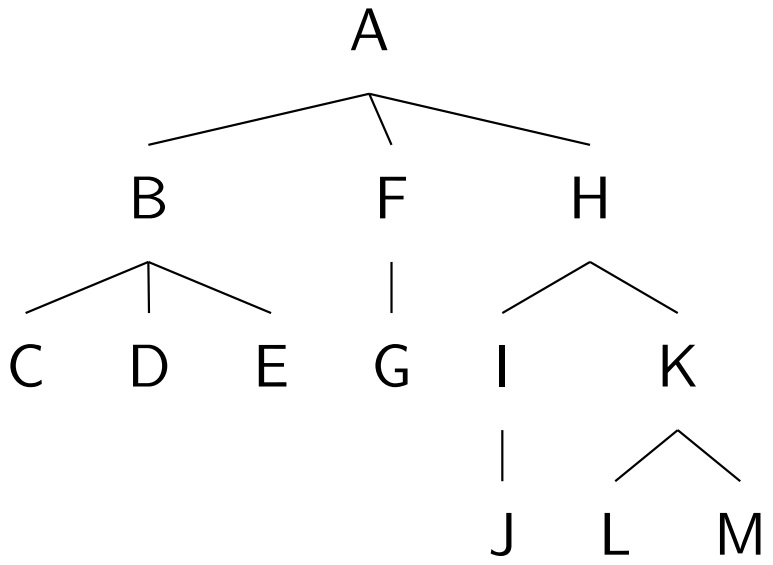
Exercise: Computing c-strings



Exercise

Compute the command string of

1. E
2. G
3. M
4. A

Principle A

Principle A (as a distributional constraint)

Every reflexive must be c-commanded by a DP in the same TP.

Equivalent c-String Constraint

Verify for each node: If its c-string starts with a reflexive, then at least one D must occur before the first T.

TSL Strategy for Principle A

1. Always project first symbol (ITSL)
2. Project D/T if previous symbol is Refl (OTSL)
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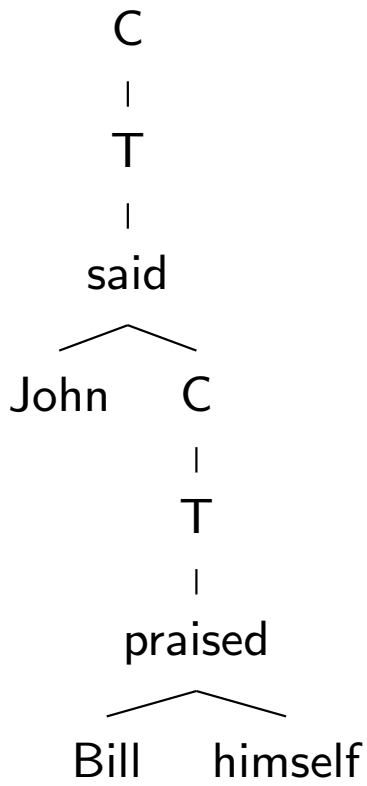

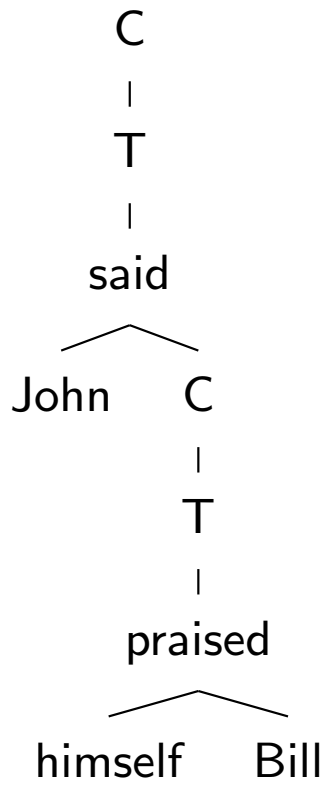

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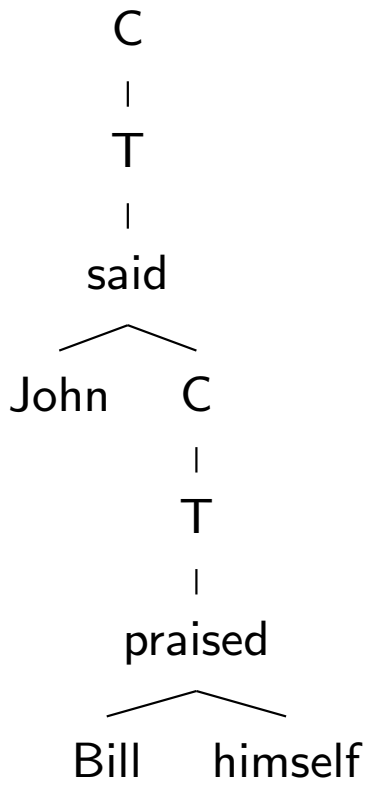

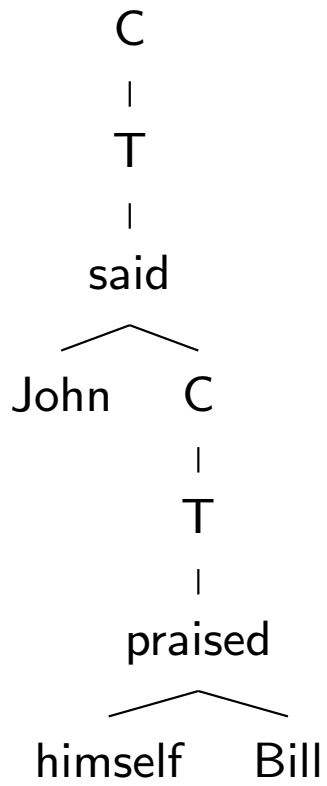

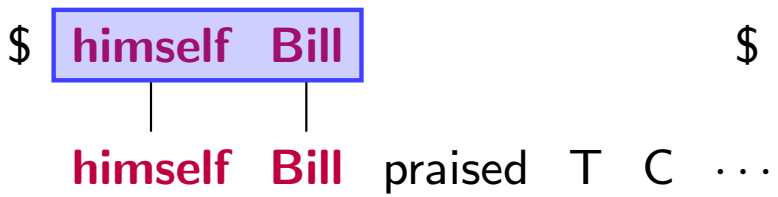

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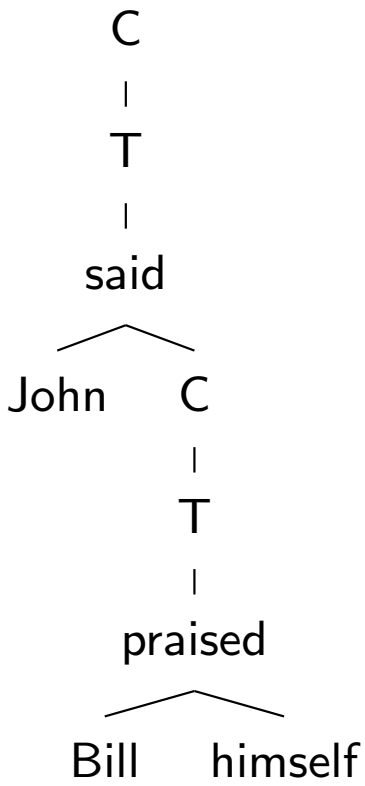
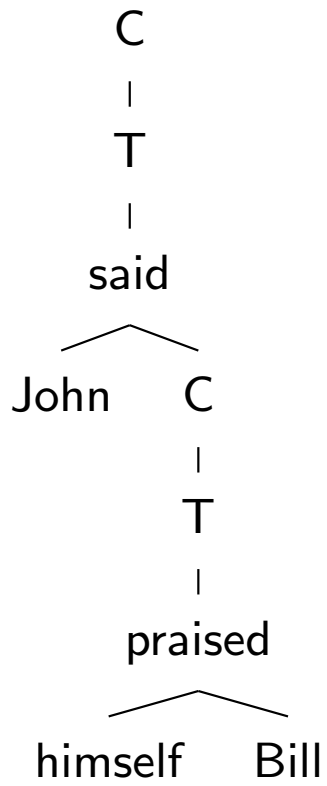
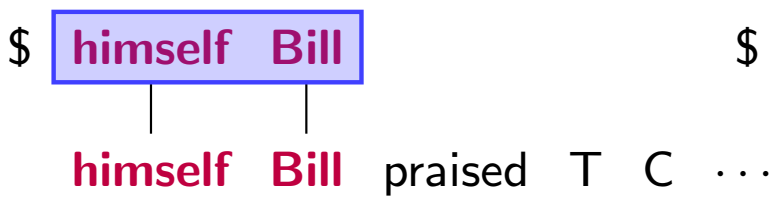
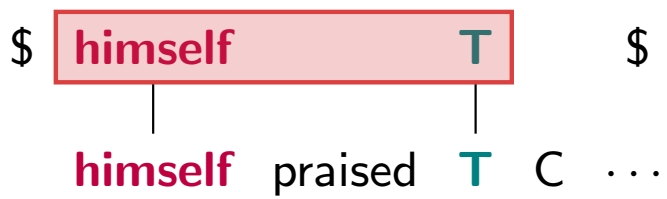








Another Example: Swedish *SE*

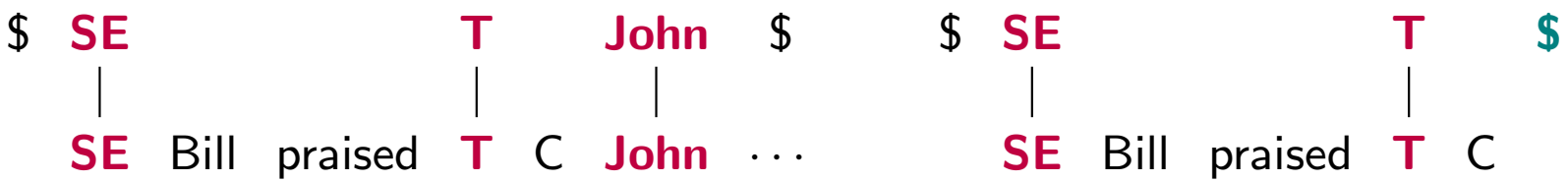
- Swedish *SE*-reflexive must be non-locally bound.

(2) a. John said Bill praised SE.

b. * Bill praised SE.

TSL Strategy for *SE*

1. Always project first symbol (ITSL)
2. Project T if previous symbol is SE (OTSL)
3. Project D if previous symbol is T (OTSL)
4. Constraint: ***SE T $** (trigram)



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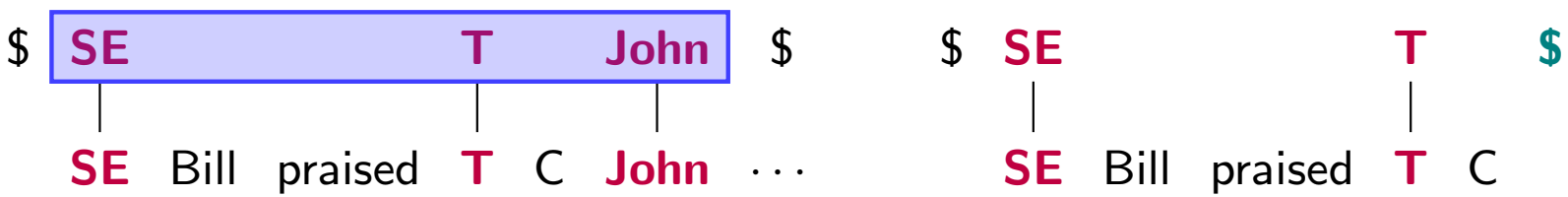

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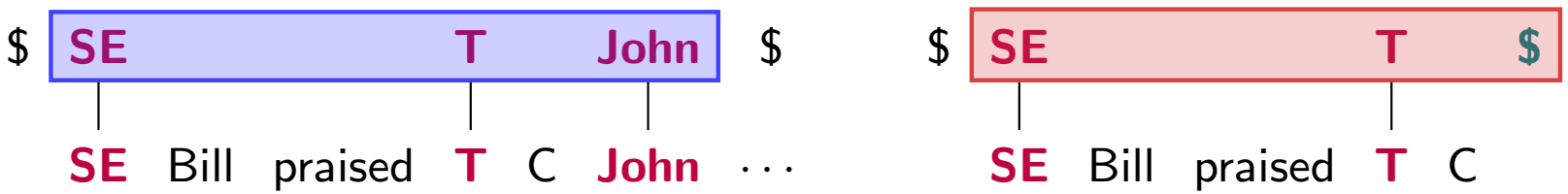
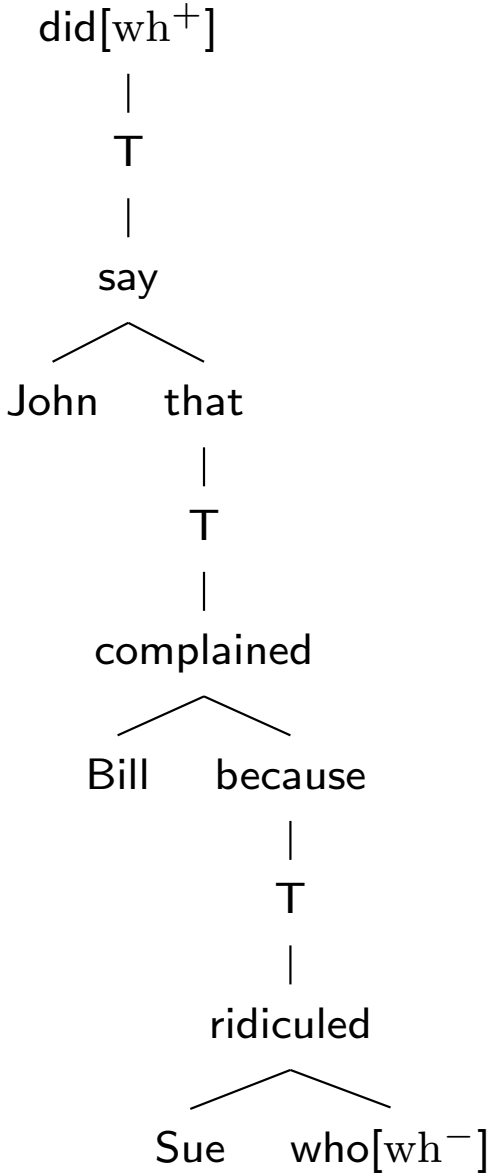


Hey, You Got Your Phonology in My Syntax

- Binding actually looks a lot like long-distance consonant dissimilation. (Ikawa and Jardine 2020)
- And two phenomena look remarkably like unbounded tone plateauing:
  - island effects
  - wh-agreement in complementizers.

Path Constraints on Movement



- **C-string of who**
  who$[\mathrm{wh}^-]$ $\cdots$ because $\cdots$ that $\cdots$ did$[\mathrm{wh}^+]$
- **Adjunct island constraint**
  No adjunct head may occur within an interval spanned by f^- and f^+.
- **Complementizer agreement**
  No complementizer that lacks wh-agreement may occur within an interval spanned by wh^- and wh^+.

Wrapping up String Land

- **Cognitive Parallelism**
  - Phonology and syntax are surprisingly similar.
  - Some aspects of syntax can be studied via strings.
  - SL and TSL play a central role in both.
- **Specific Phenomena**
  - unbounded tone plateauing $\approx$ islands, wh-agreement
  - lexically simplex quantifiers are TSL

Join the Program

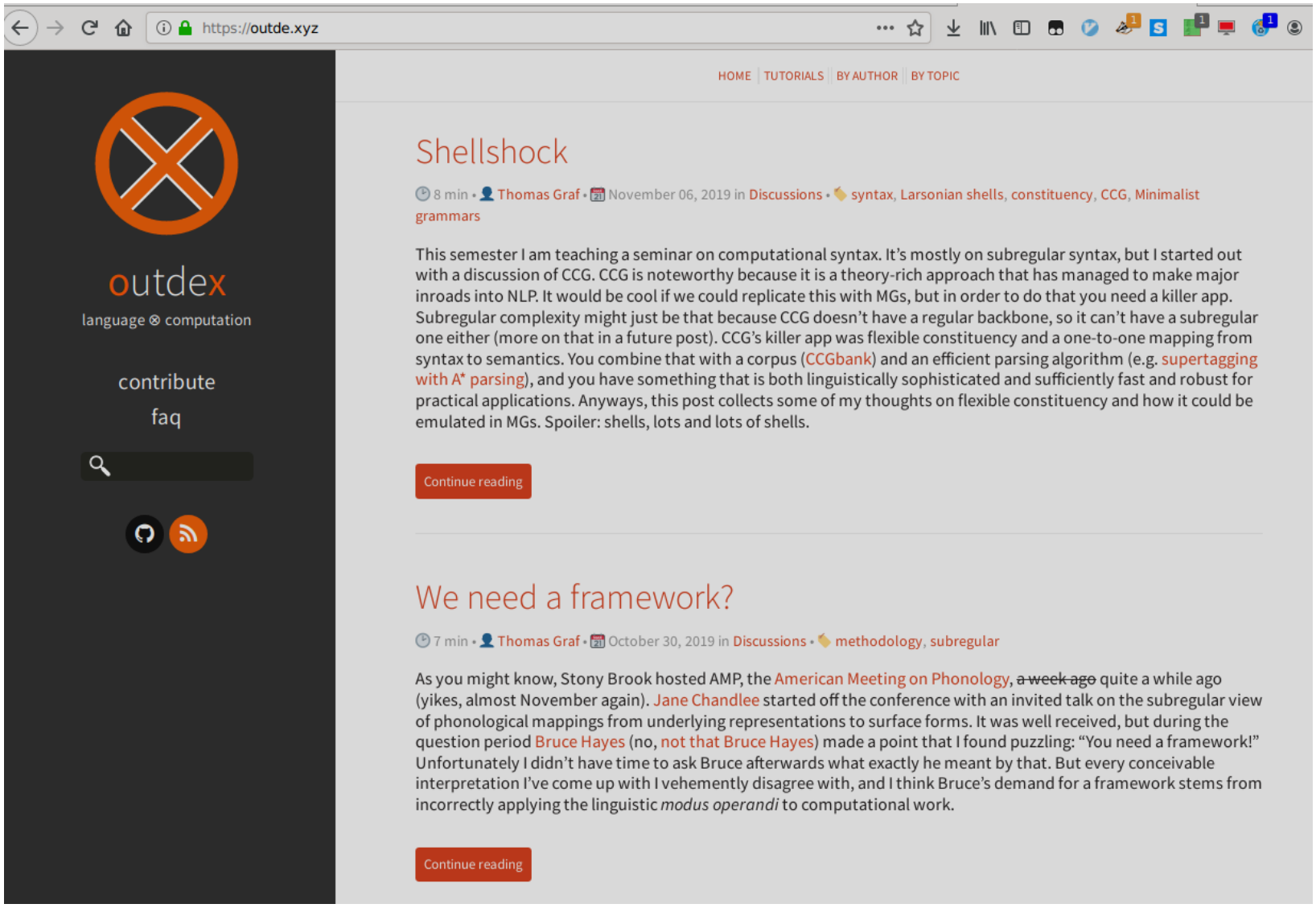
Everybody has something to contribute!

- Do you have data that contradicts current predictions?
- In-depth analysis of specific phenomena
- Grammar fragments

Follow-Up Projects

1. Temporal semantics (Fernando 2015)
2. Weighted and probabilistic versions (Mayer 2021)
3. SL-analysis of *that*-trace filter
4. C-string syntax (in particular movement-feeding/bleeding)

Follow Along (`https://outde.xyz`)



Learning More About String Land

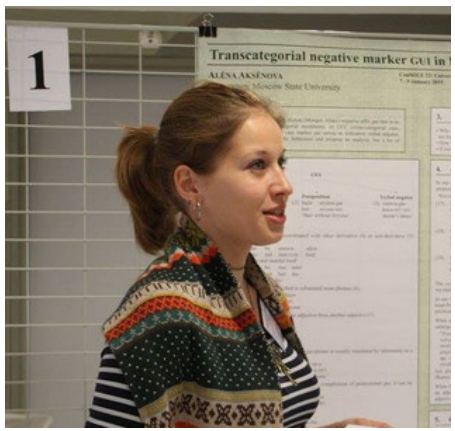
1. **Survey papers:** Pullum and Rogers (2006); Heinz (2011a,b, 2018); Rogers and Pullum (2011); Chandlee and Heinz (2016)
2. **TSL and its extensions:** Heinz et al. (2011); McMullin (2016); Baek (2018); De Santo (2017); De Santo and Graf (2019); Graf (2017); Graf and Mayer (2018); Mayer and Major (2018); Mayer (2021)
3. **TSL morphology:** Aksënova et al. (2016)
4. **TSL morpho-semantics:** Graf (2019)
5. **TSL string-syntax:** Graf and Shafiei (2019); Shafiei and Graf (2020)
6. **String parallels between phonology and syntax:** Graf (2018); Ikawa and Jardine (2020)
7. **Mappings:** Courcelle and Engelfriet (2012); Chandlee (2014, 2017); Jardine (2016)
8. **Learnability:** Heinz (2010); Kasprzik and Kötzing (2010); Heinz et al. (2012); Jardine et al. (2014); Lai (2015); Jardine and Heinz (2016); Jardine and McMullin (2017)

Acknowledgments

This work was supported by the National Science Foundation under Grant No. BCS-1845344.

Appendix

TSL Morphology



Alëna Aksënova

Sophie Moradi

- Joint work with Alëna Aksënova and Sophie Moradi.
- It seems that **morphotactics is also TSL**.
  (Aksënova et al. 2016)

Example: Unbounded *the day after*-Prefixation in German

- German has a prefix **über**.
- This prefix can be freely combined with *morgen* ‘tomorrow’.

Example

morgen	tomorrow
über+*morgen*	the day after tomorrow
(**über**+)$^{\mathbf{n}}$*morgen*	(the day after)^{n} tomorrow

TSL Description

Tier: **über**, stem boundary +

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über must be prefix	*+ **über**

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$ **über** **über** + + **über** $
| | | | | | | |
$ **über** **über** + *morgen* + **über** $

Example: Bounded *the day after*-Circumfixation in Ilocano

- Ilocano has a circumfix **ka- -an**.
- This prefix can be combined once with *bigát* 'tomorrow'.

Example

bigát	tomorrow
ka+*bigát*+**an**	the day after tomorrow
*(**ka**)$^{\mathbf{n}}$+*bigát*+(**an**)$^{\mathbf{n}}$	(the day after)^n tomorrow

TSL Description

Tier: *ka*, *an*, stem boundary +

Constraint	**Bigrams**
ka must be prefix	*+ **ka**
an must be suffix	***an** +
ka before **an**	***an ka**
no iteration	***ka ka**, ***an an**
no lonely affix	***ka** ++ $, *$++ **an**

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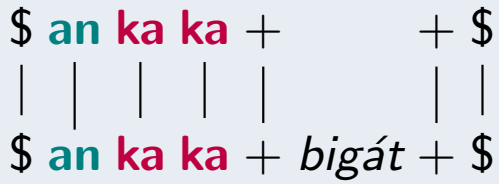

Typological Gap: No Unbounded Circumfixation

- There seems to be no language with an affix that is
  - freely iterable like German **über**, and
  - a circumfix like **ka- -an** in Ilocano.
- Why this gap? Because the **result would not be TSL**!

Explanation

- The pattern would be $\mathbf{ka}^{\mathbf{n}}$+*bigát*+$\mathbf{an}^{\mathbf{n}}$.
- TSL cannot memorize exact numbers.
- All affixes would have to be visible in the same search window.
- But the window's size is bounded, while the pattern is not.

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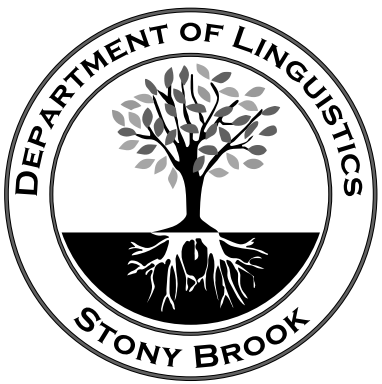
Subregular Linguistics for. . . well, Linguists

(Part 2: Tree Land)

Thomas Graf



Stony Brook University
mail@thomasgraf.net
https://thomasgraf.net

MIT Mini Course
May 5 & 6, 2021

Outline

SL Over Strings and Trees

SL-**n** over strings

sliding window of **width n**

checks string for illicit substrings

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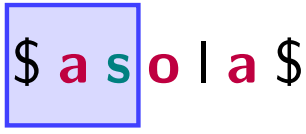

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SL-**n** over trees

sliding window of **depth n**

checks tree for illicit subtrees

SL Over Strings and Trees

SL-**n** over strings

sliding window of **width n**

checks string for illicit substrings

* $ **a** **s** **o** l **a** $ $ **a** z **o** l **a** $ $ **a** + **s** **o** c **i** **a** l **e** $

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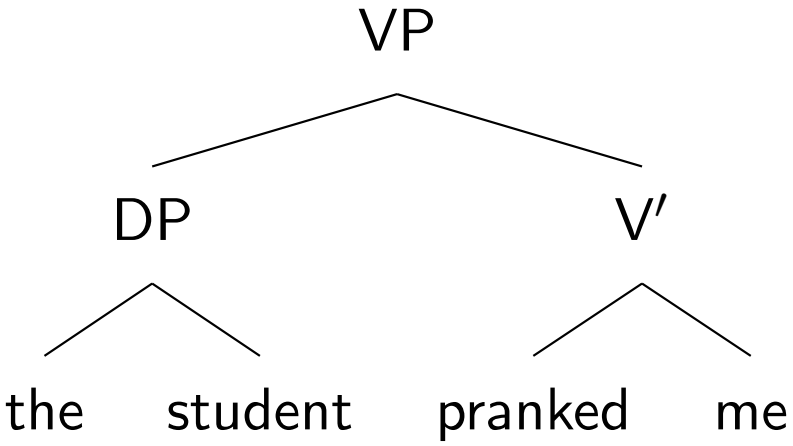

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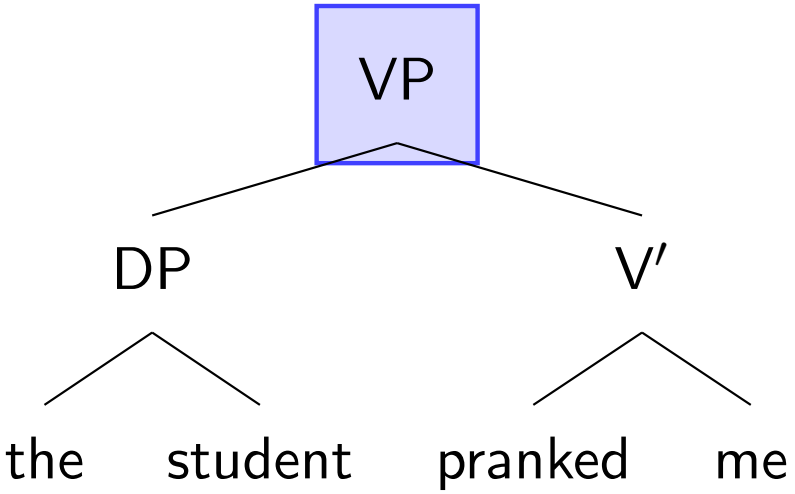

SL-1

SL Over Strings and Trees

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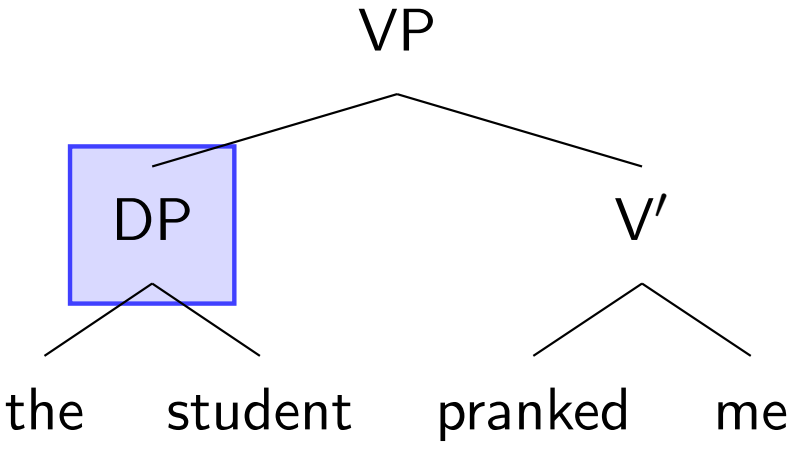

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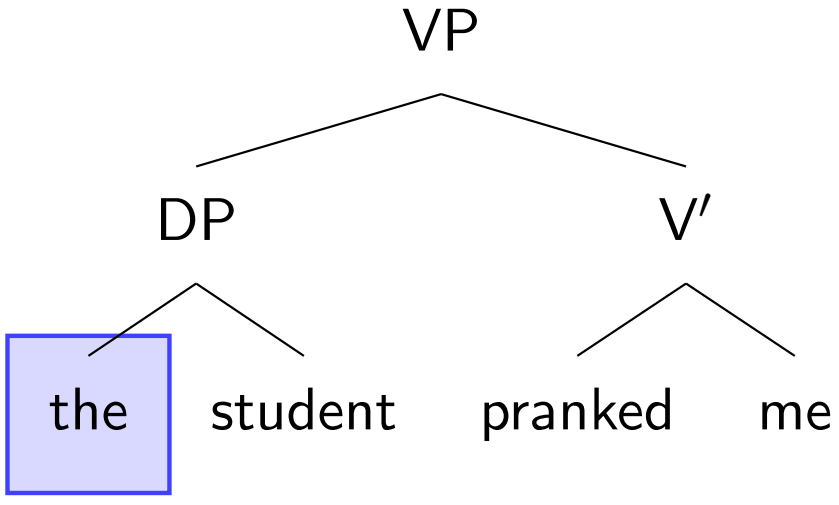

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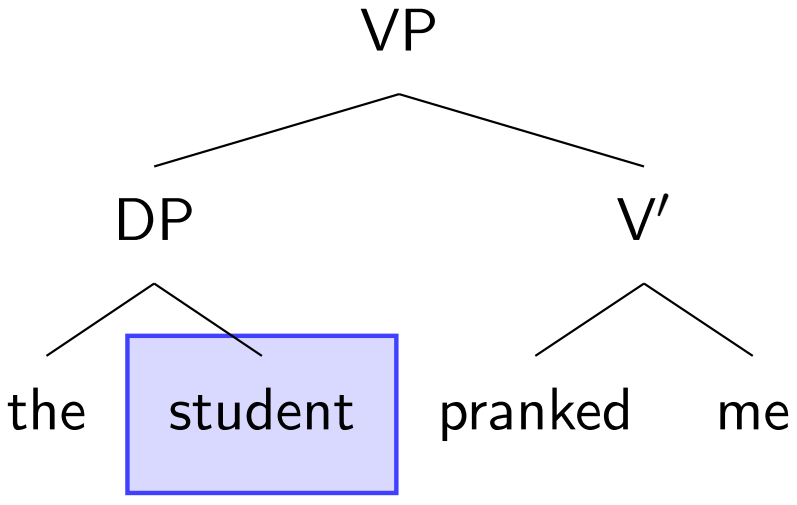

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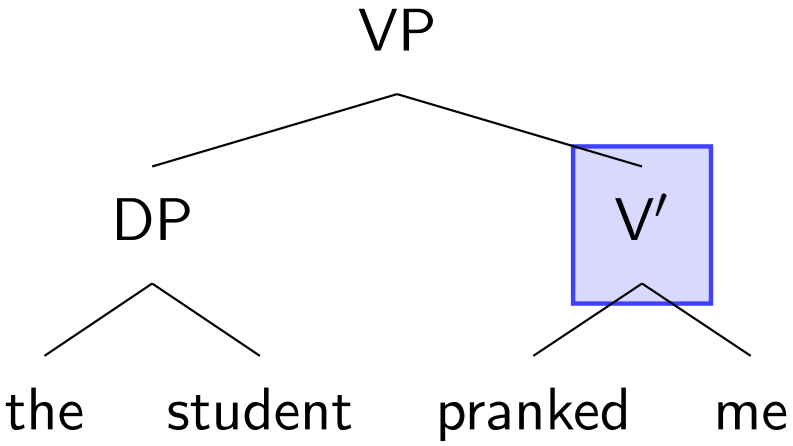

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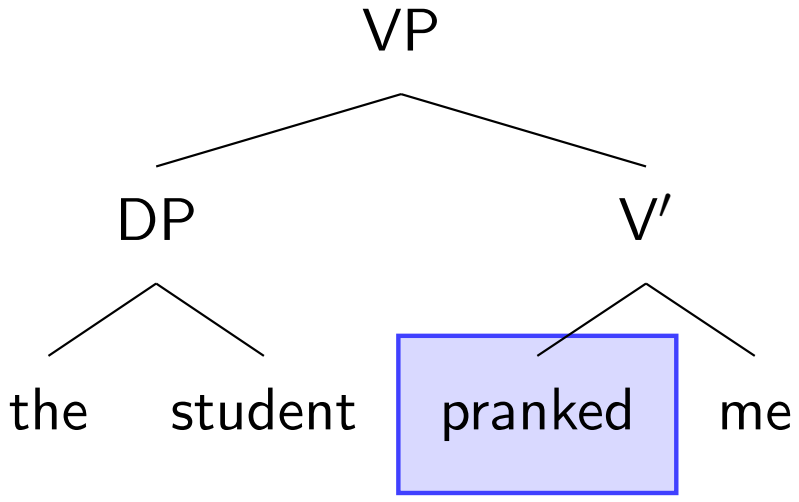

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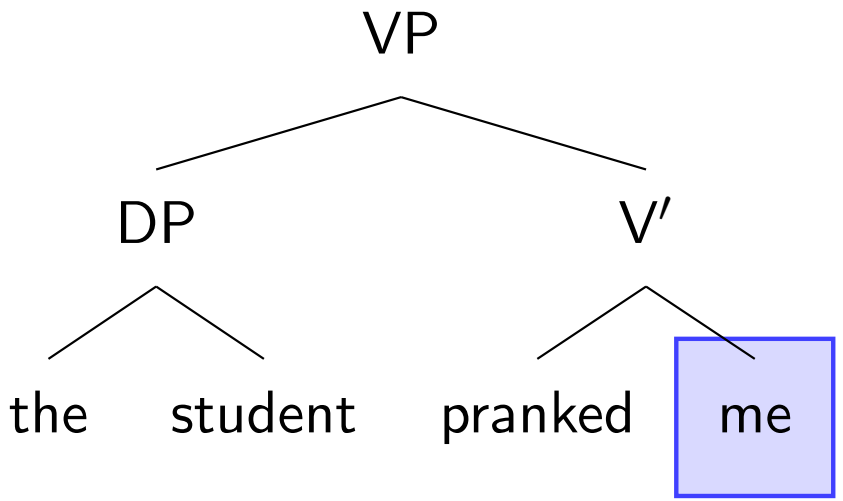

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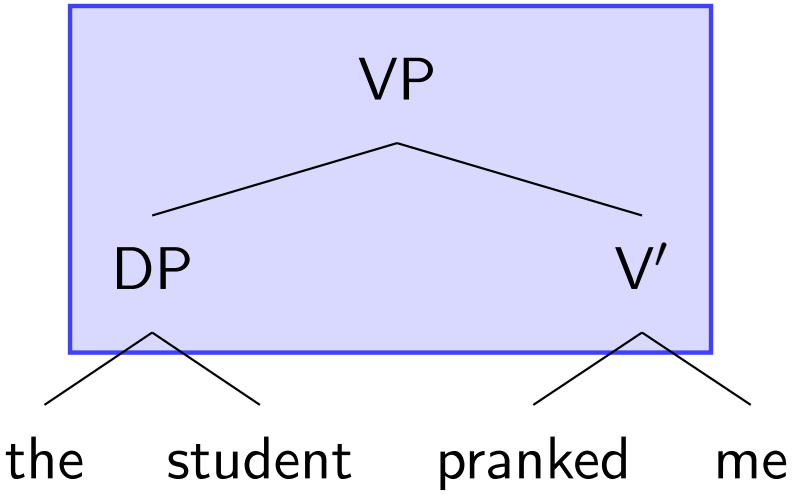

SL-2

SL Over Strings and Trees

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SL-**n** over trees

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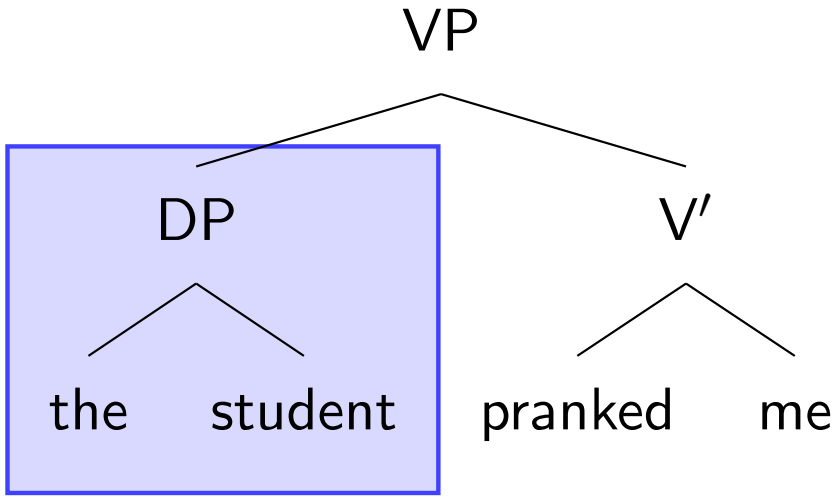

SL-2

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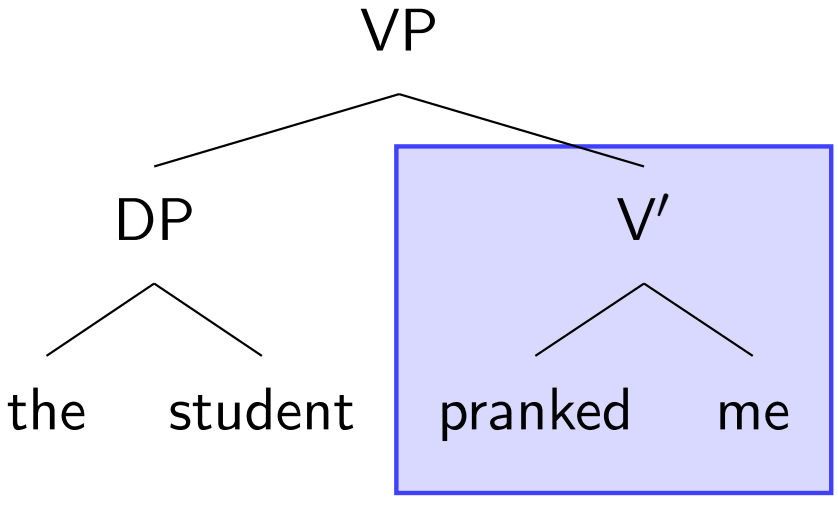

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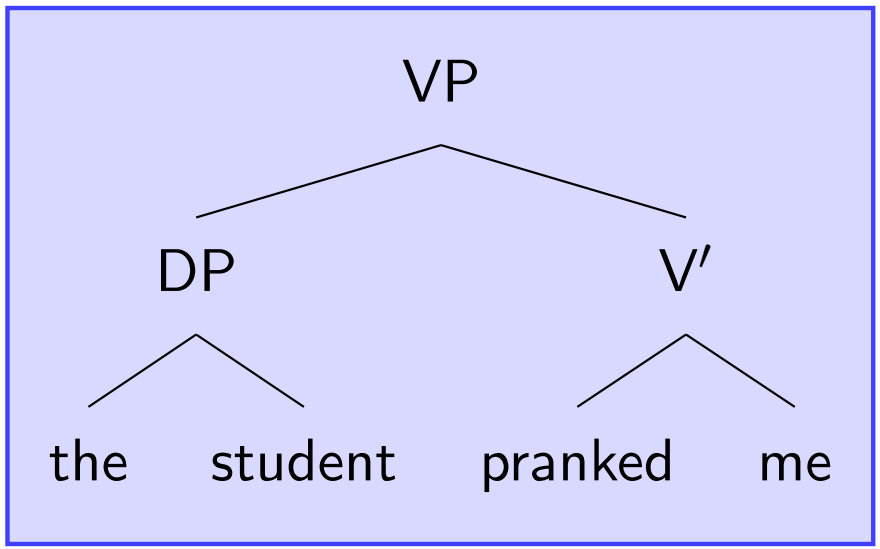
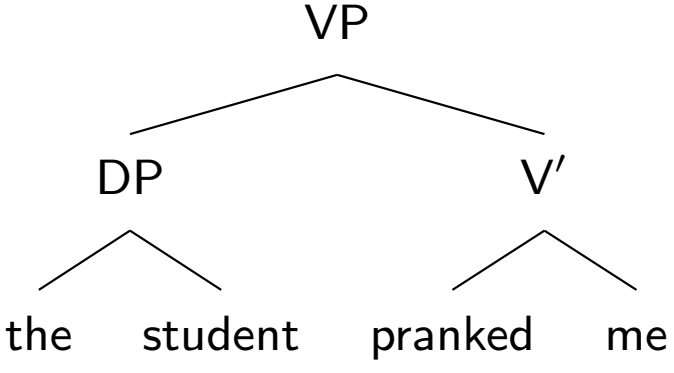


SL-3

Feature-Driven Merge

- What is the computational complexity of Merge?
- We have to look at the computations carried out by syntax, i.e. the **derivation!**

Bare Phrase Structure Tree



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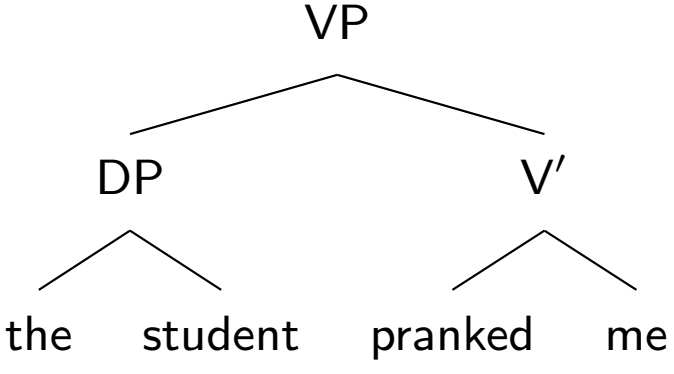
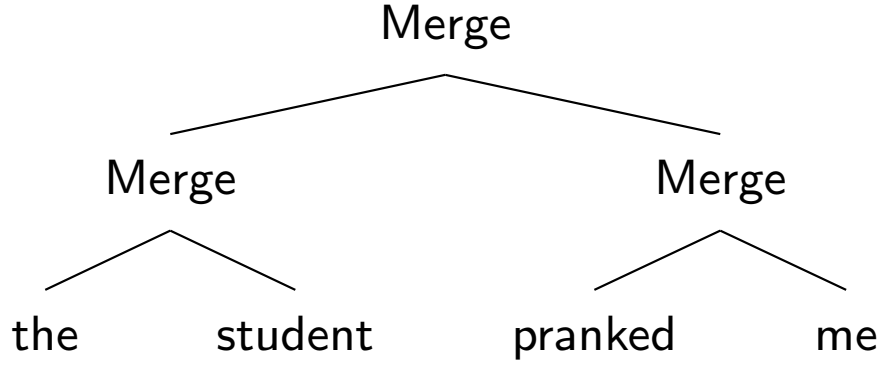


Derivation Tree



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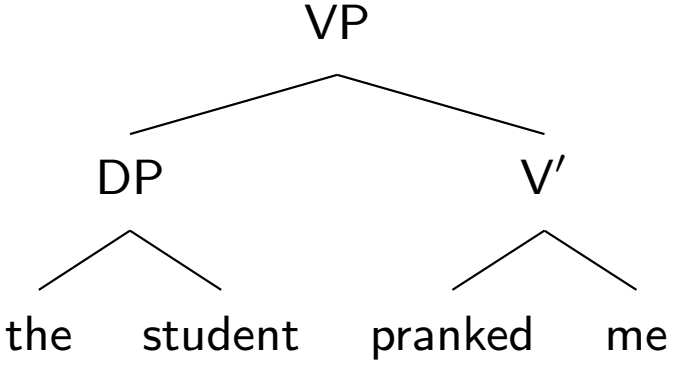

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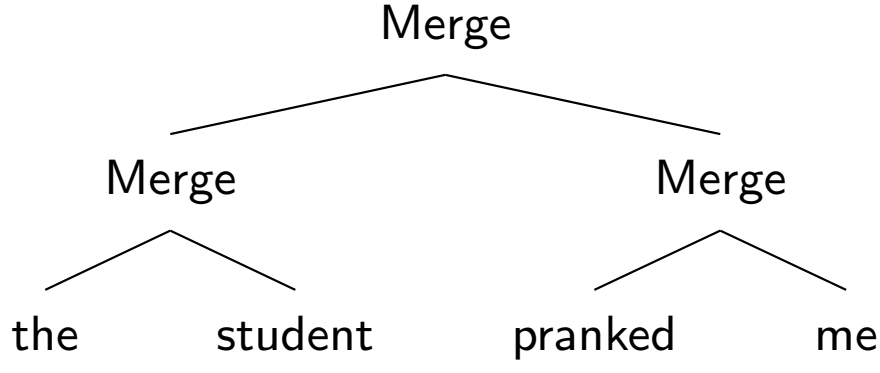

- **Assumption:** Merge is feature-triggered
  (or: interfaces use feature-like information to limit Merge)

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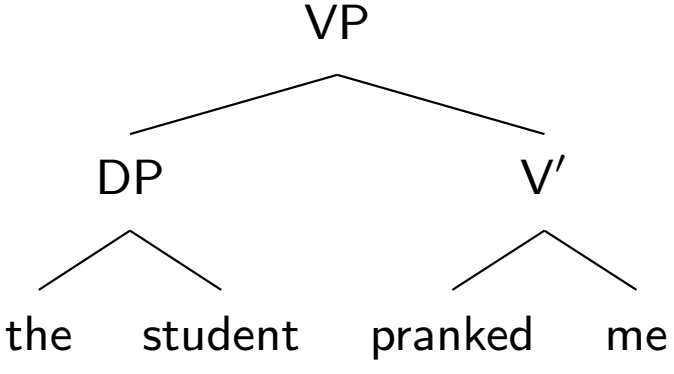

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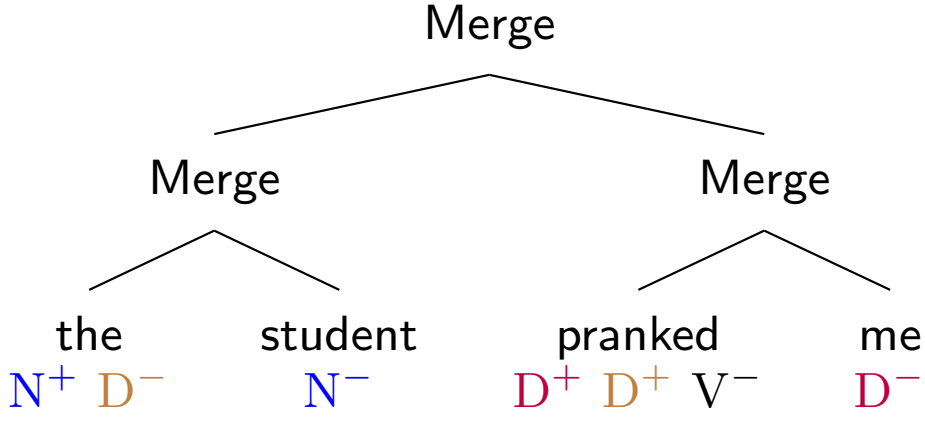

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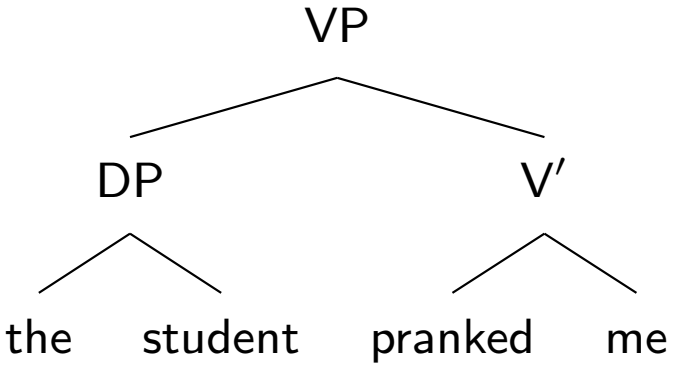

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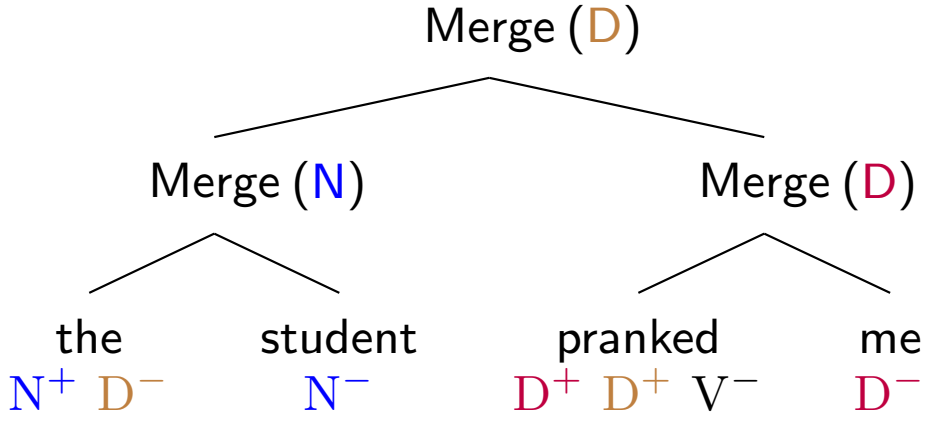

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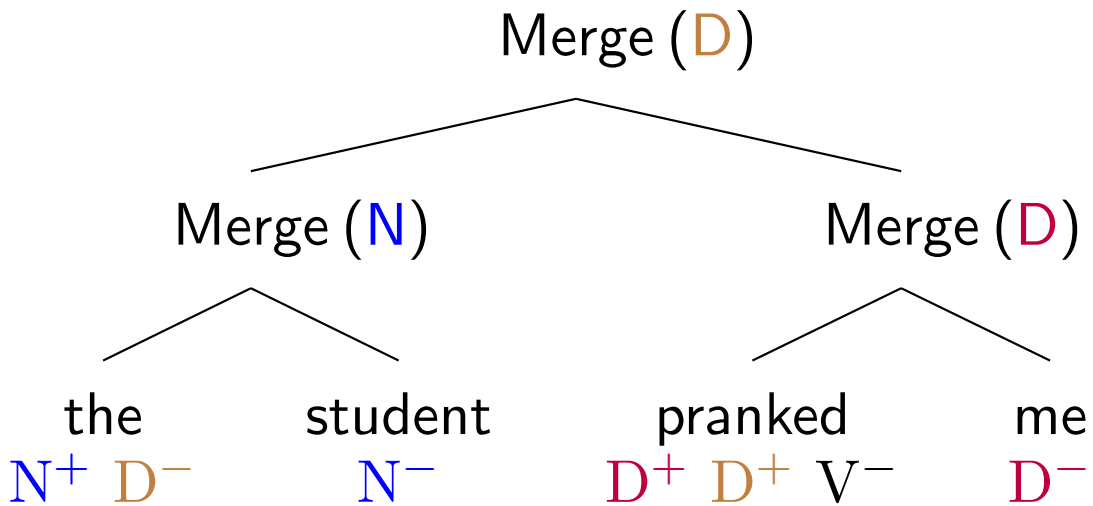
Remark: The Central Role of Derivation Trees

- Derivation trees are rarely considered in generative syntax.
  (but see Epstein et al. 1998)
- Satisfy Chomsky's structural desiderata:
  - no linear order
  - label-free
  - extension condition
  - inclusiveness condition
- Contain all information to produce phrase structure trees
  $\Rightarrow$ **central data structure** of syntax

Merge as an SL-Dependency over Derivation Trees

Feature Calculus for Merge

- The selector features (X^{+}) of the head have to match the category features (X^{-}) of the arguments.
- 1-to-1 match between selector features and category features.



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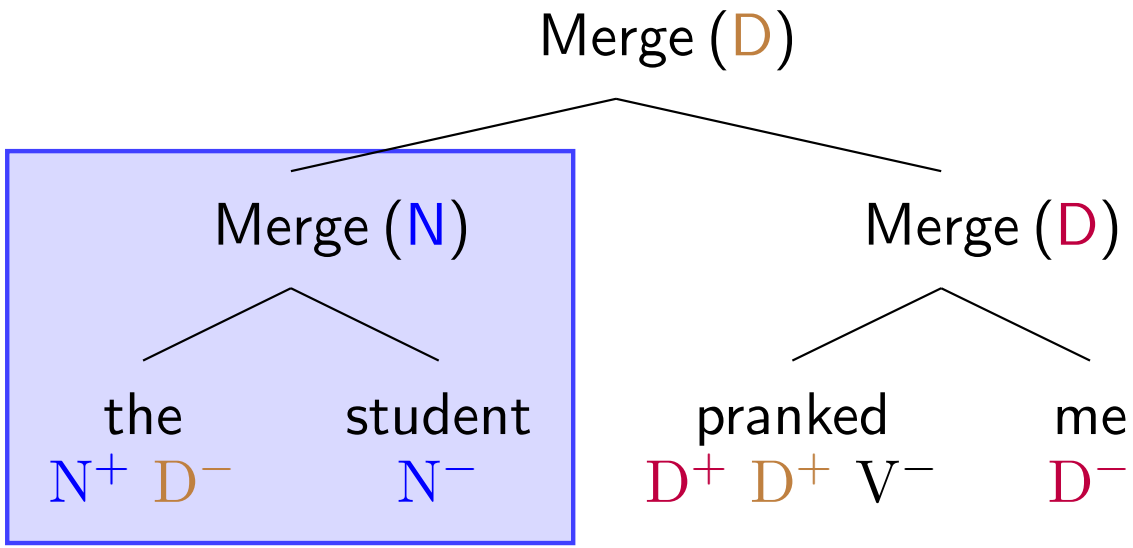

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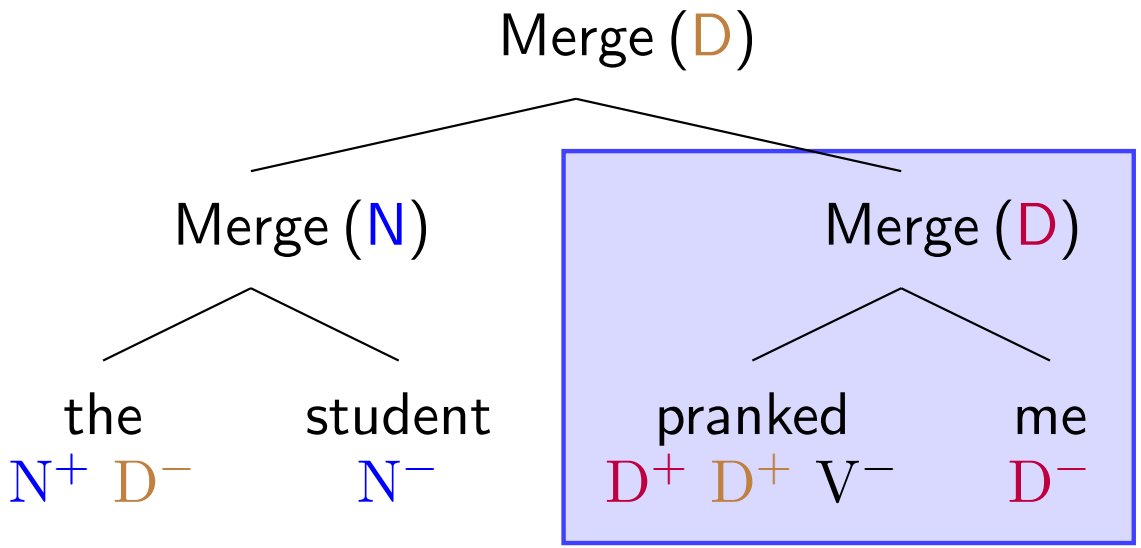

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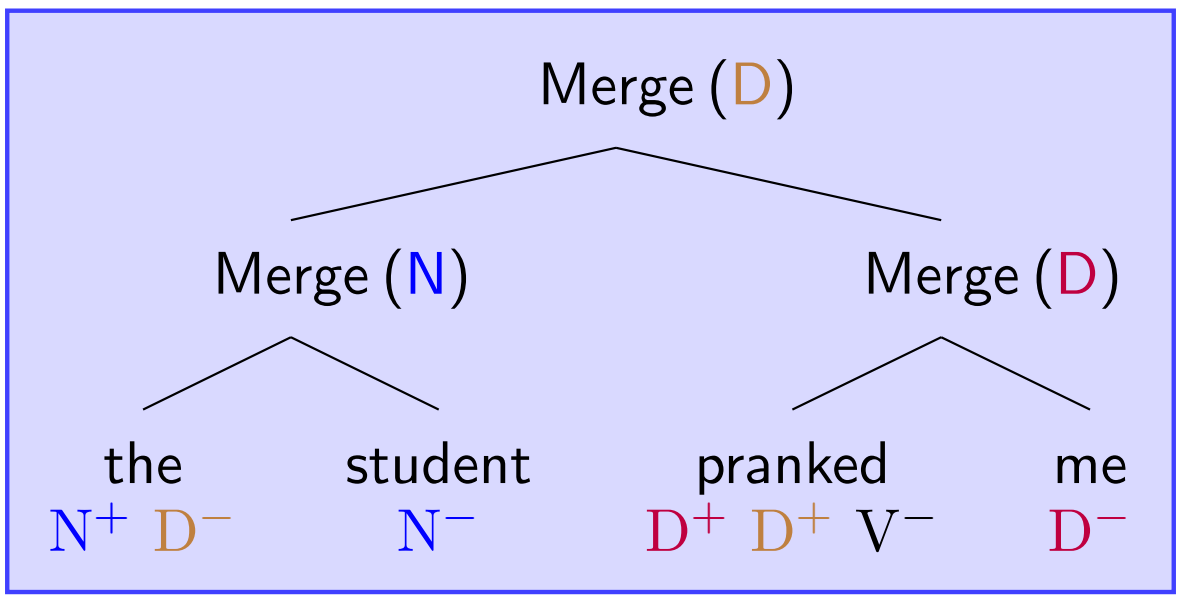
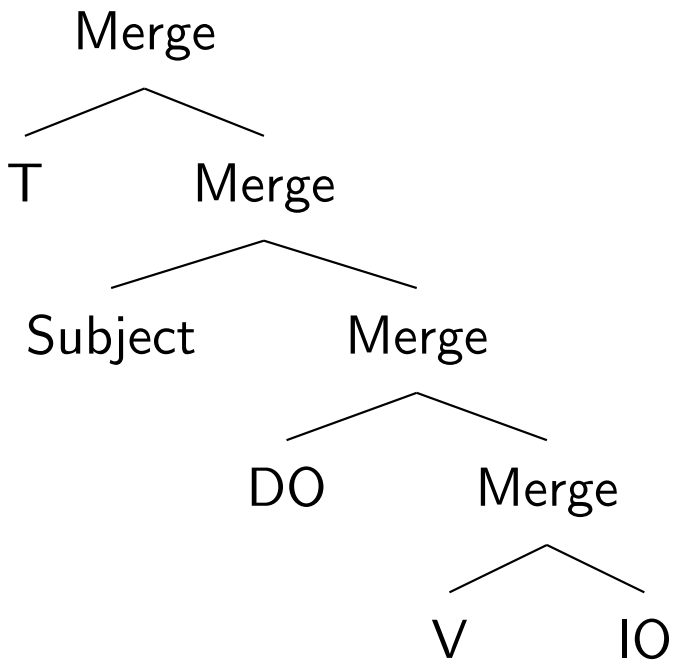


SL-Merge Lacks Succinctness

- A large sliding window contains lots of irrelevant material
  $\Rightarrow$ needlessly bloated list of forbidden subtrees
- Small grammars should be cognitively preferable to large ones.
- Factorization helps, but not enough.

Single VP



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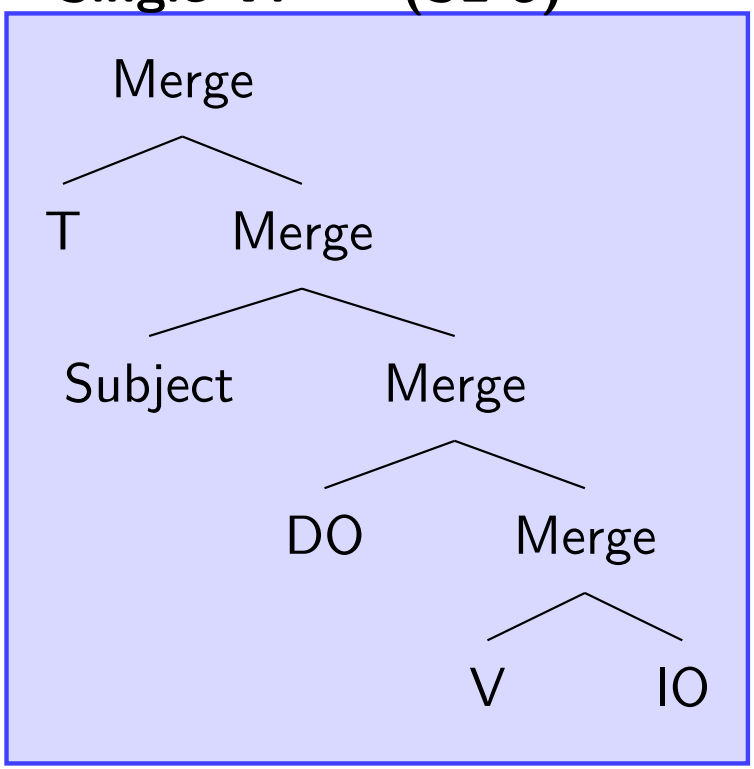

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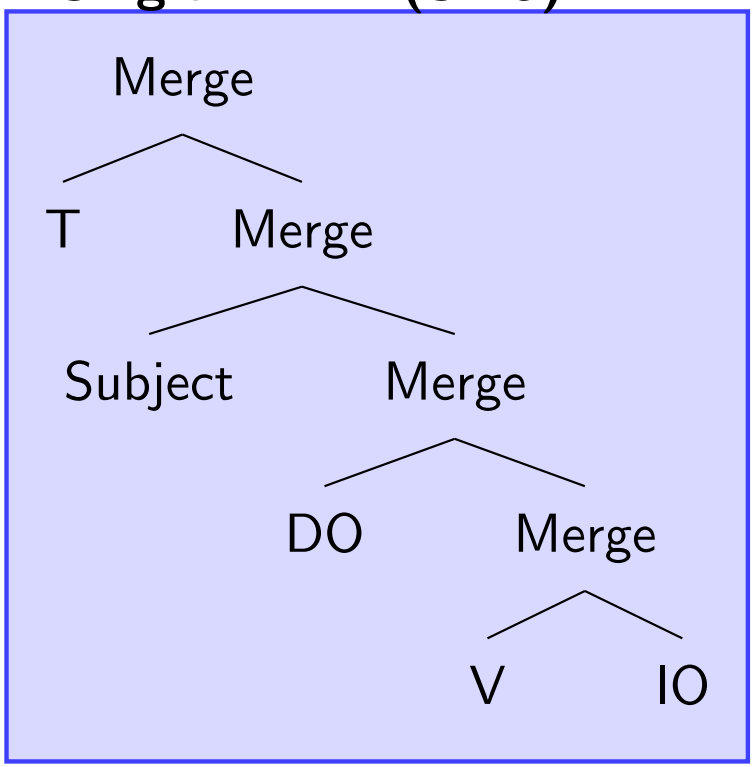
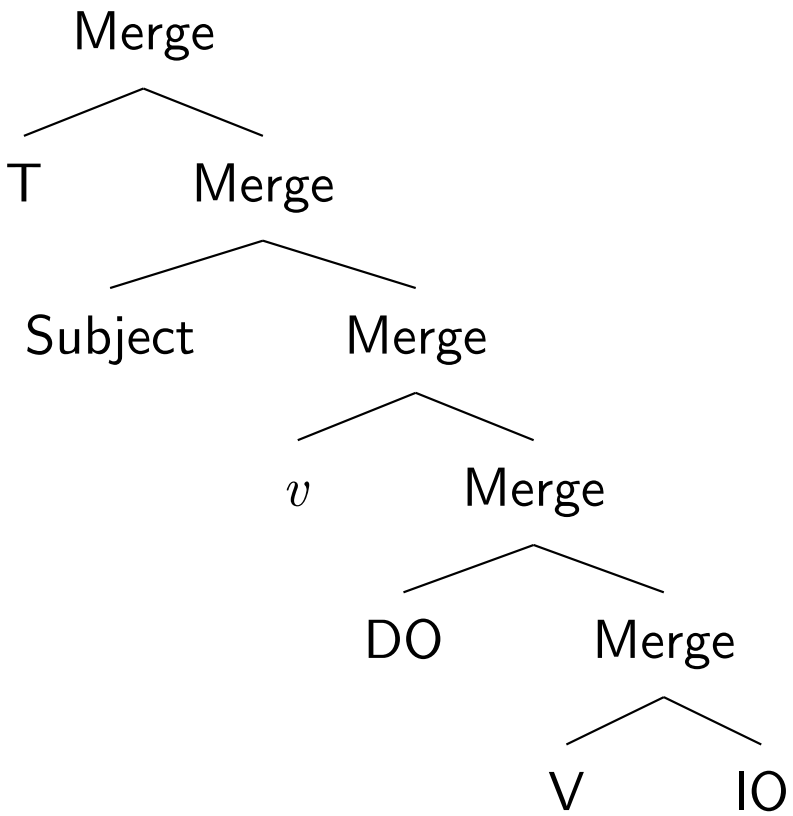


VP-Shells



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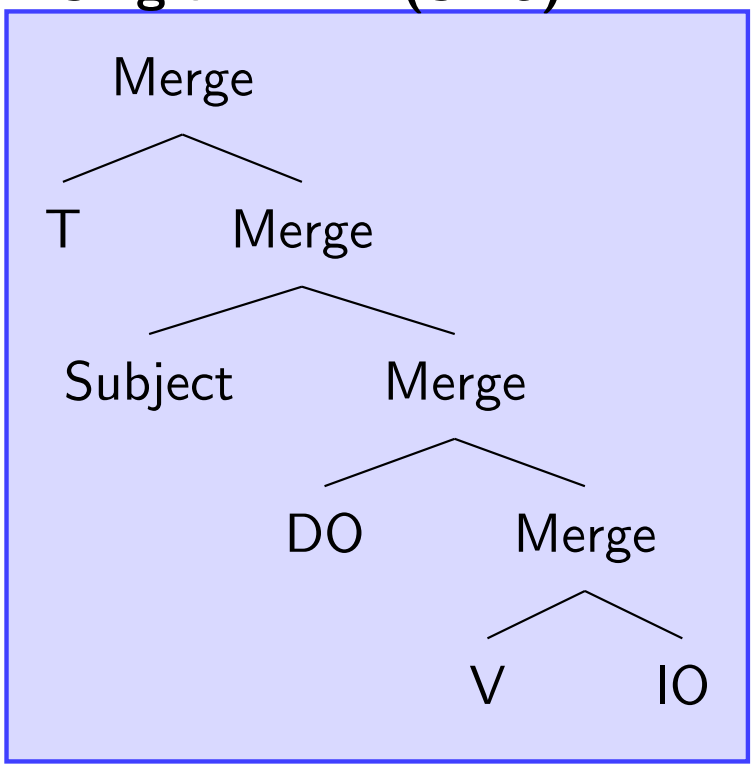

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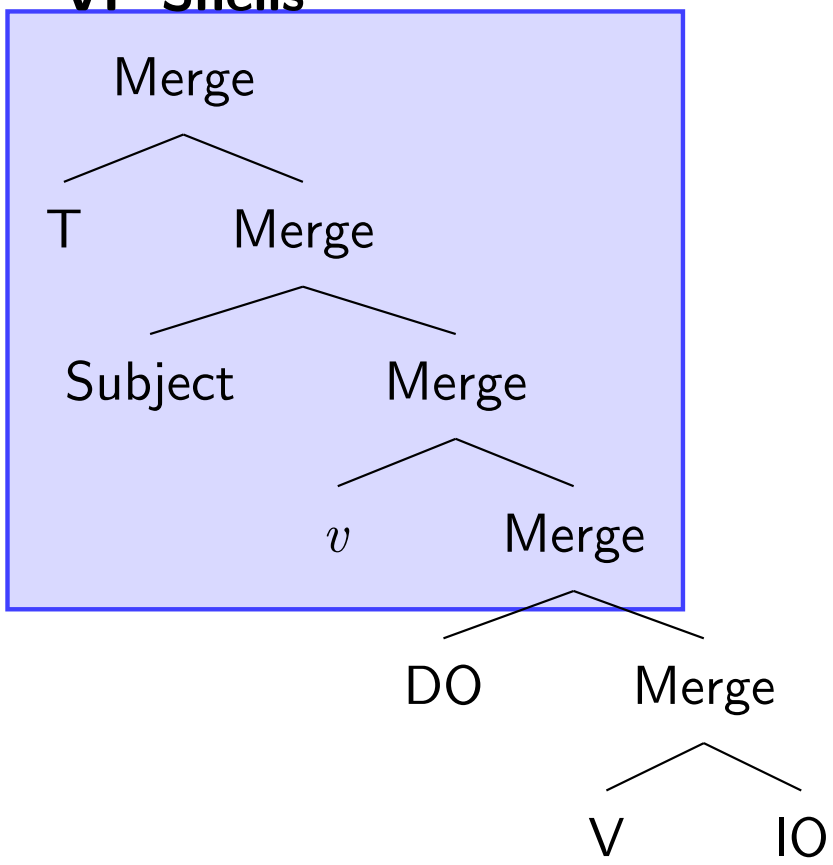

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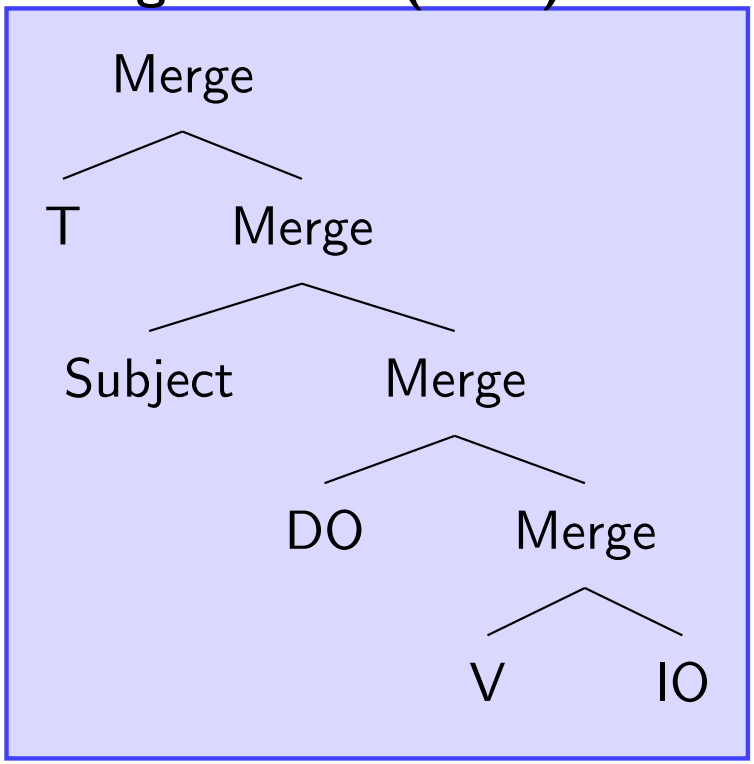
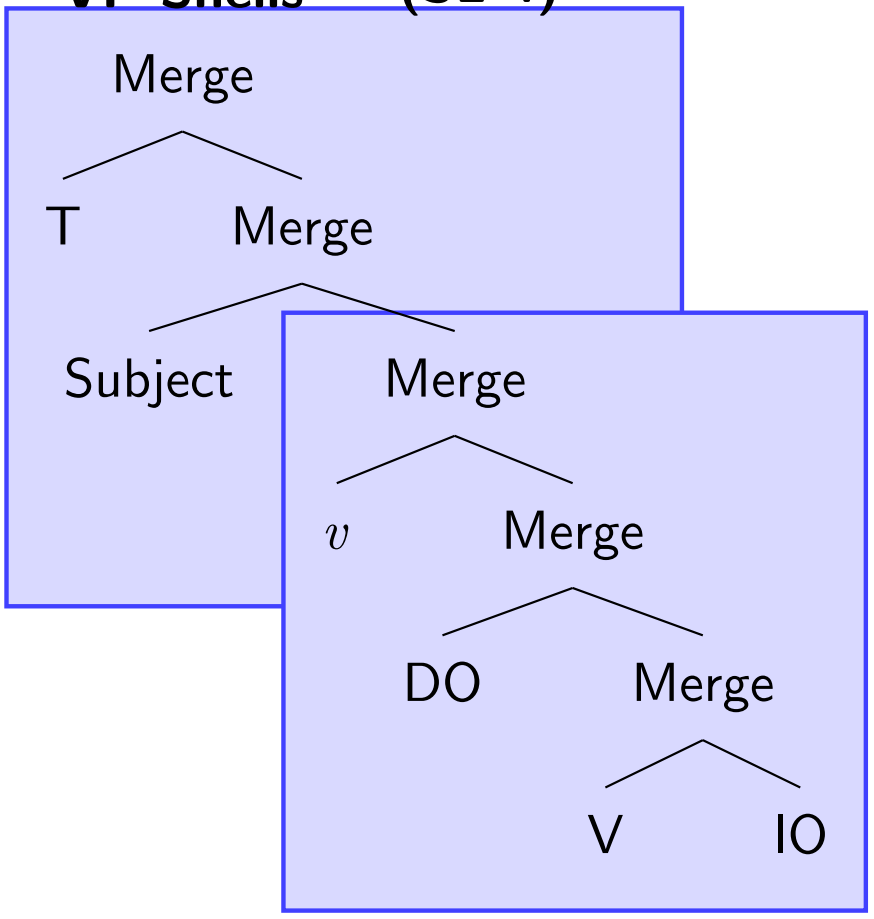


VP-Shells (SL-4)



Reminder: Samala Sibilant Harmony

- We ran into a similar succinctness problem with SL in string land.

Example: Samala (Applegate 1972)

* $ h a **s** x i n t i l a w a ʃ $

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- Our solution then was to move **from SL to TSL**.

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1. Project sibilant tier
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- We can do the same over trees!

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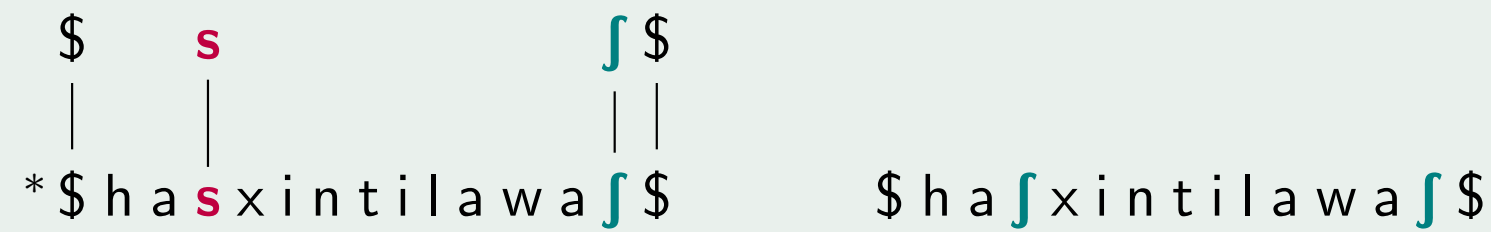

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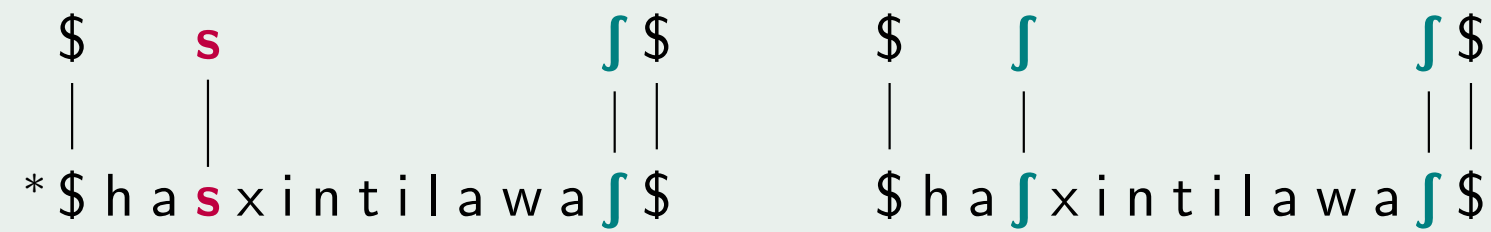

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- Our solution then was to move **from SL to TSL**.

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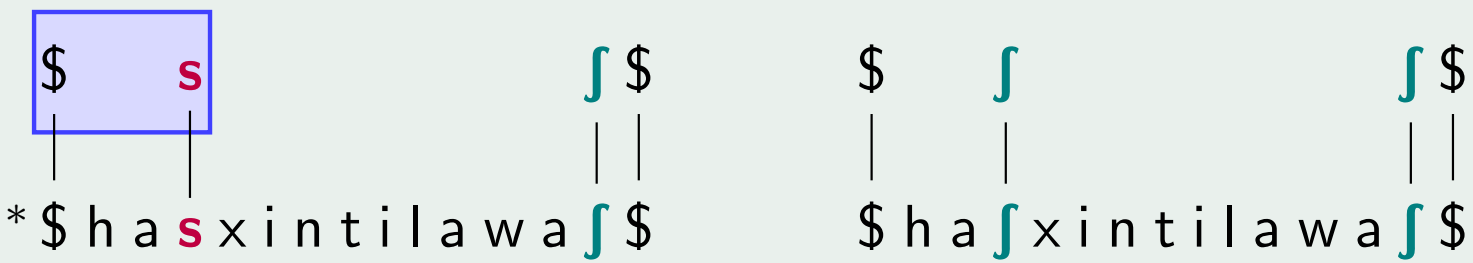

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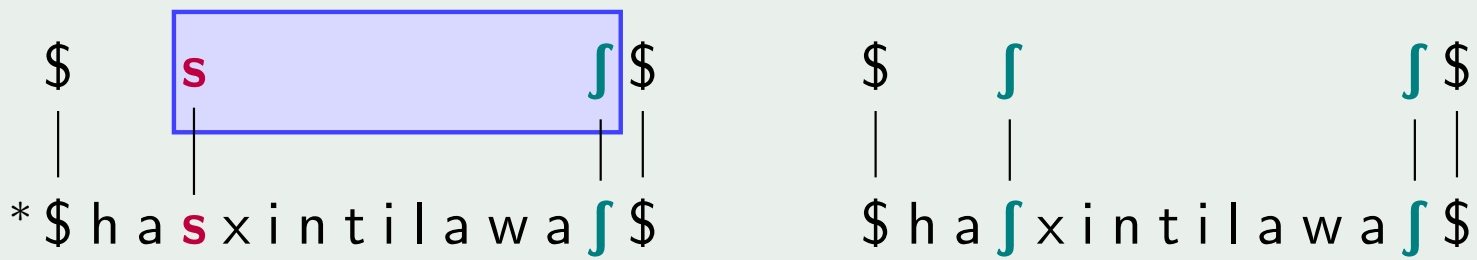

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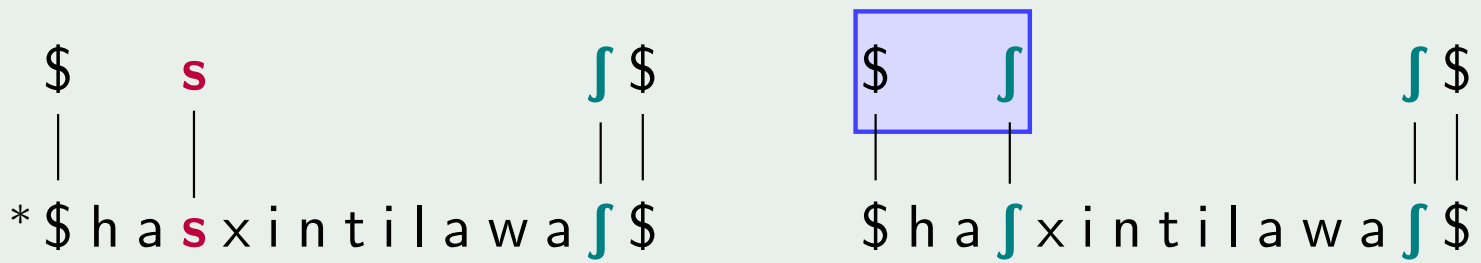

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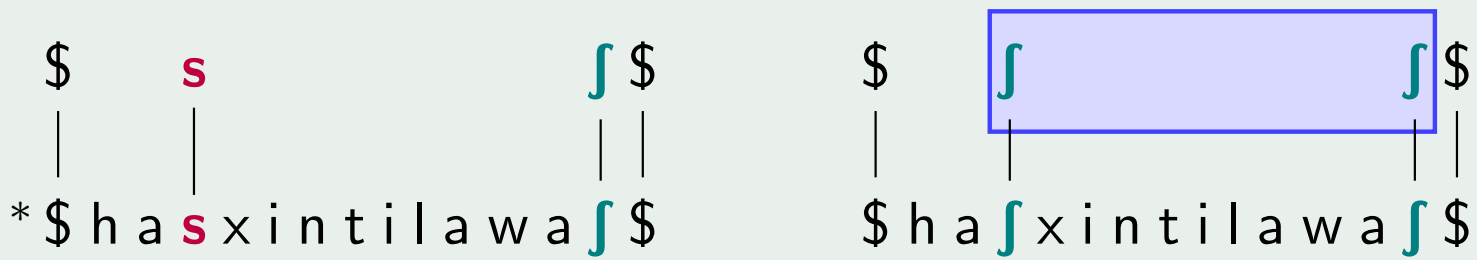

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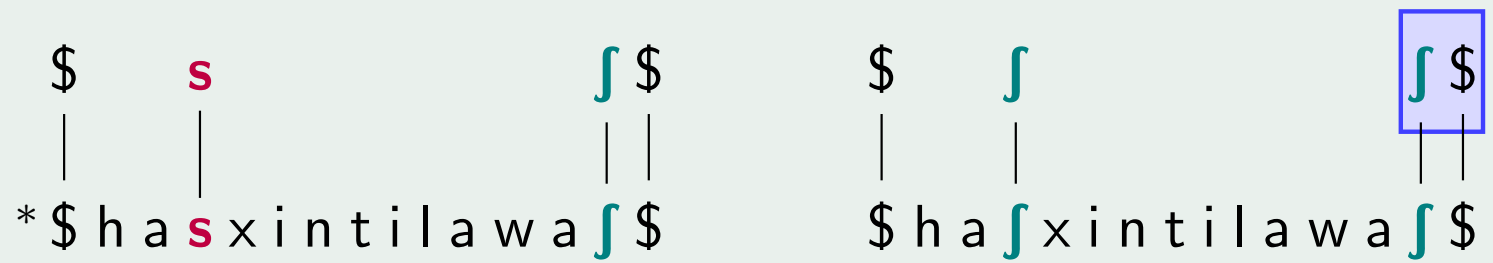

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Category Tiers for Merge

- Project tree tier for each category X:
  1. Project every lexical item with X^-.
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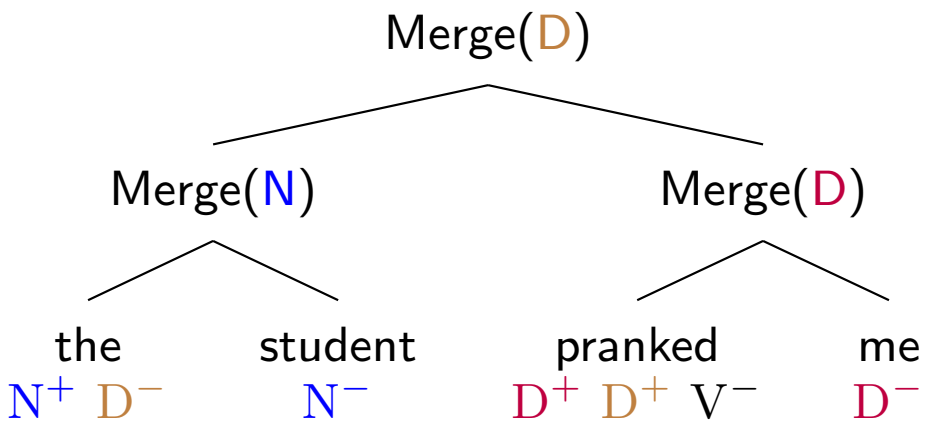

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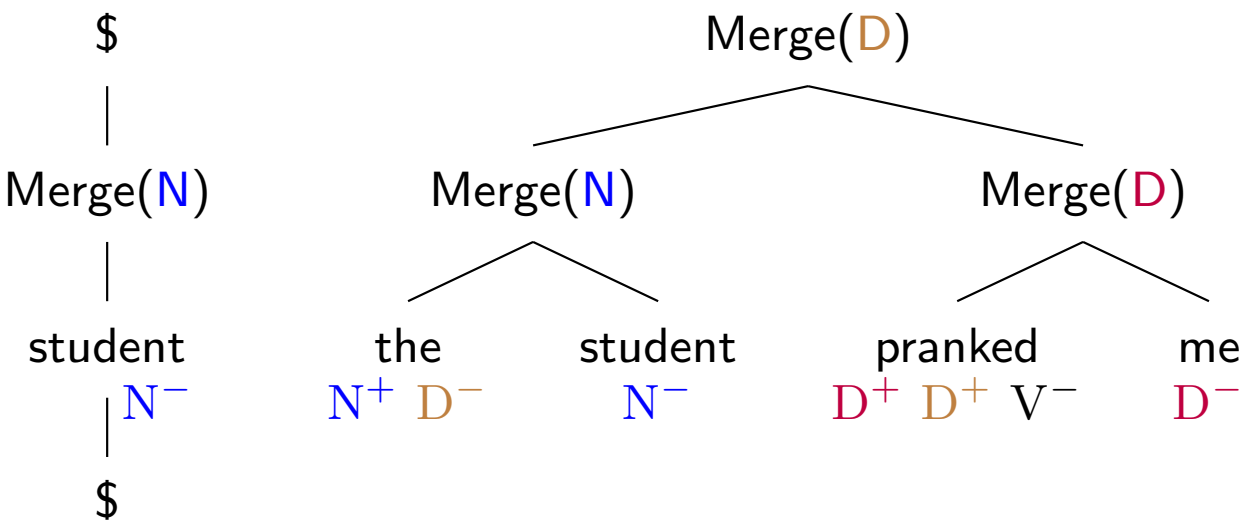

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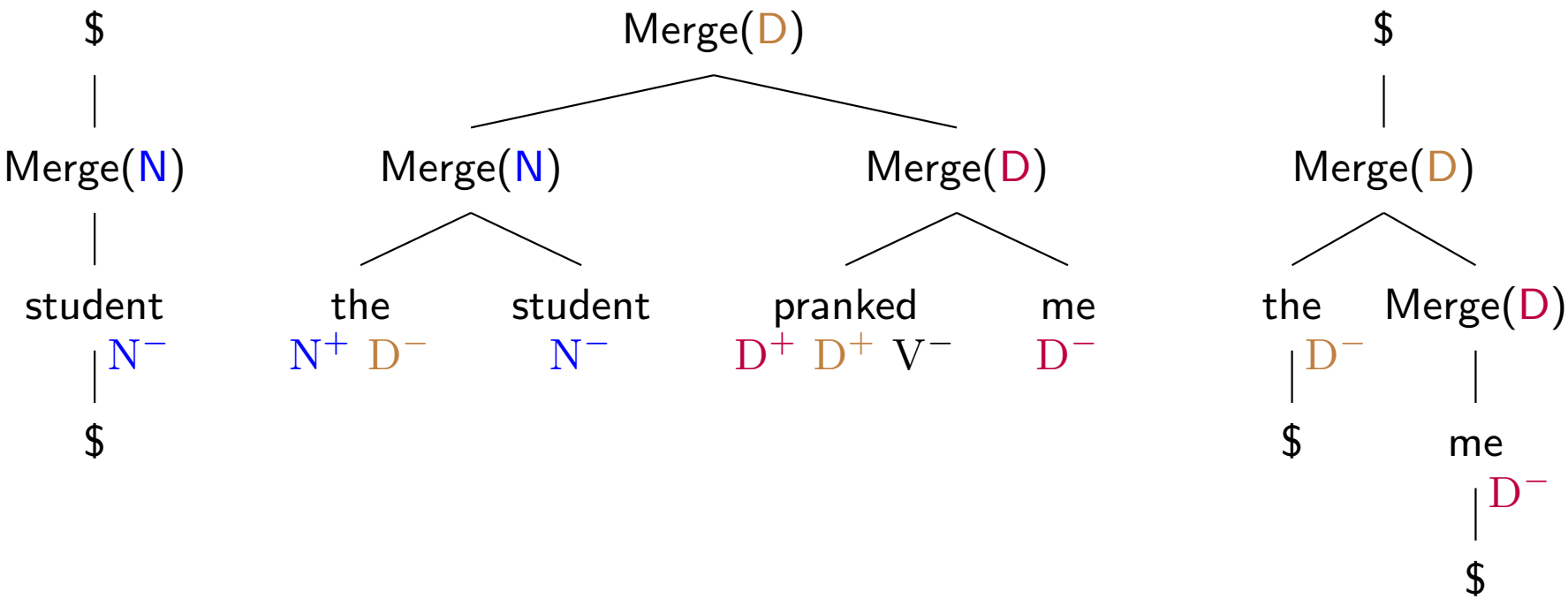
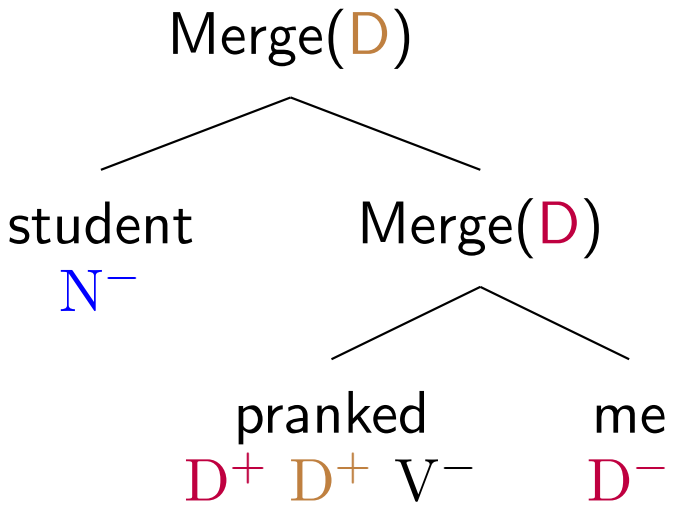


Illicit Merge Yields Ill-Formed Tiers



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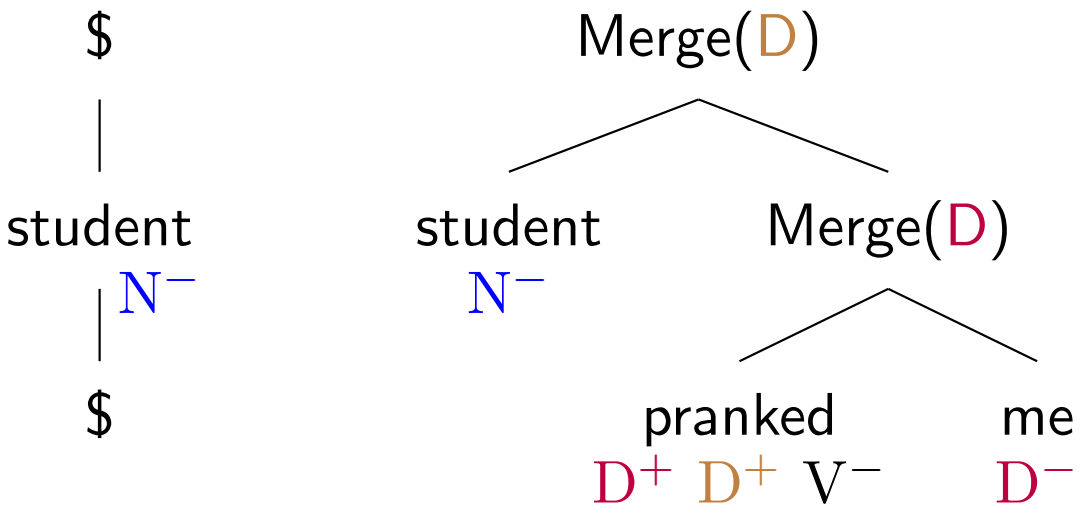

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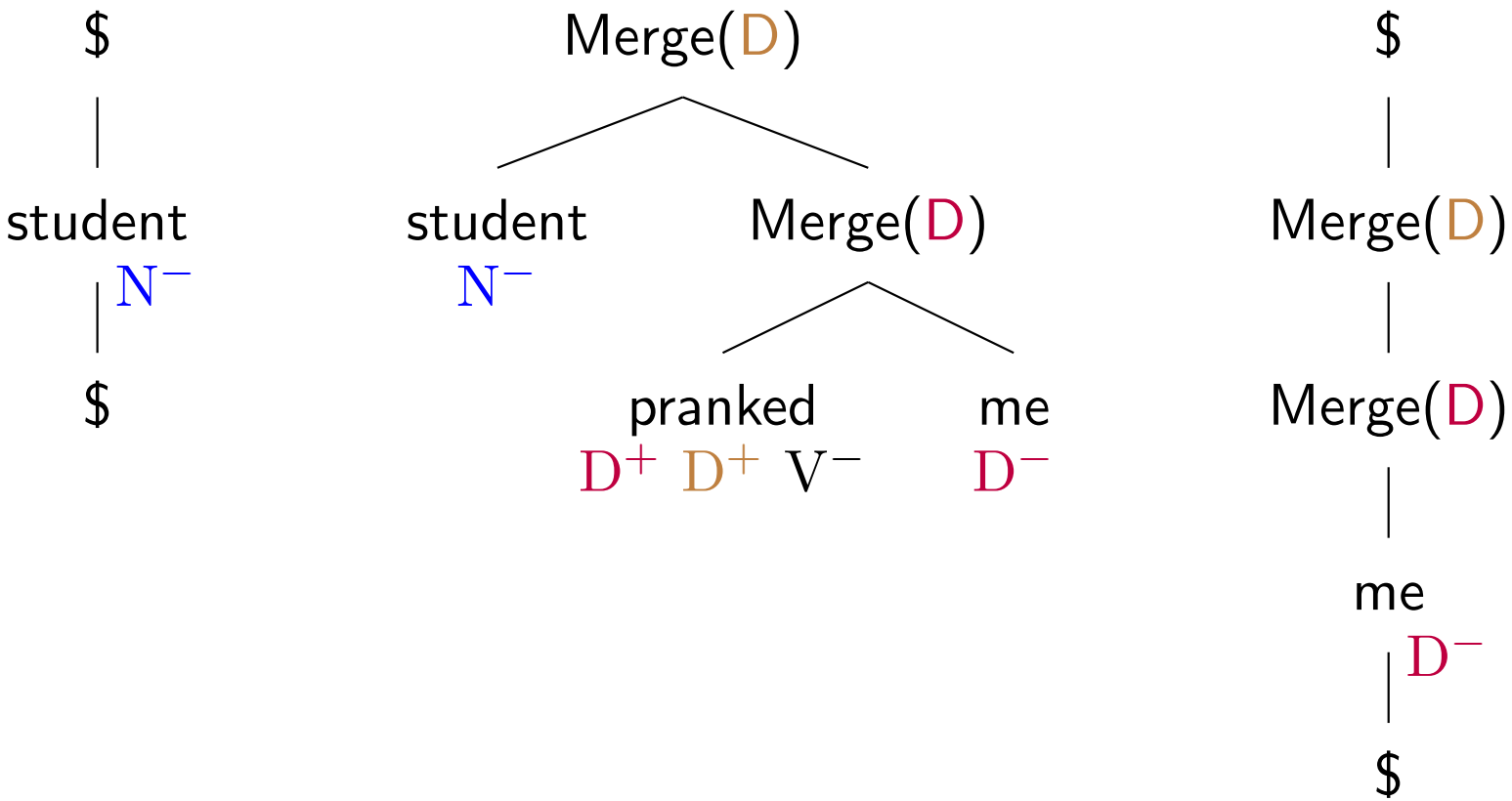

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Remark: TSL or ITSL?

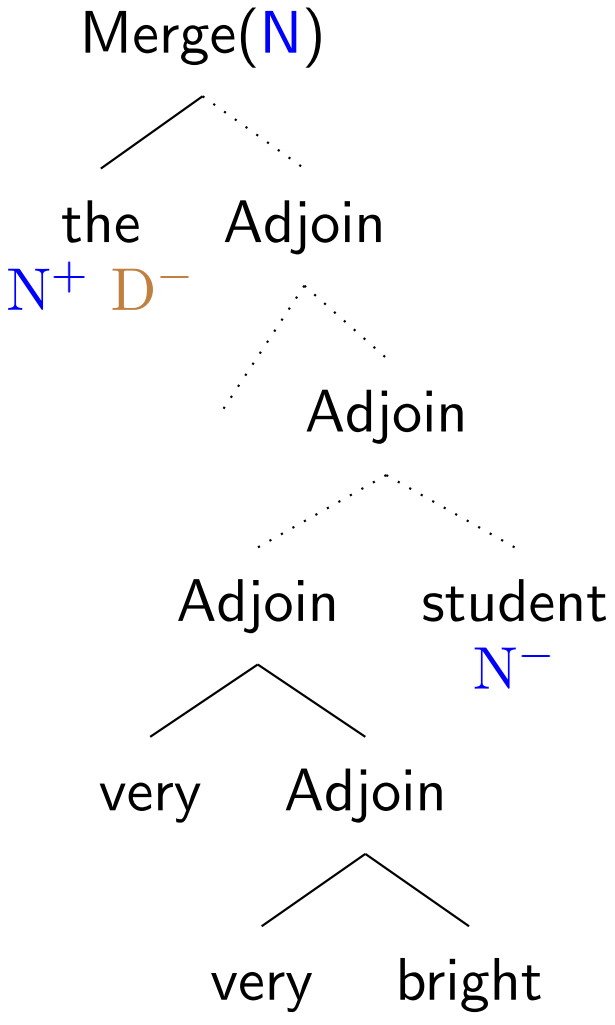
ITSL tier projection considers node label and local context

- Whether Merge is TSL or ITSL depends on whether we assume that interior nodes are labeled
  - Merge, or
  - Merge(**X**).
- The former is preferable as it does not "fossilize" computation into the representation.

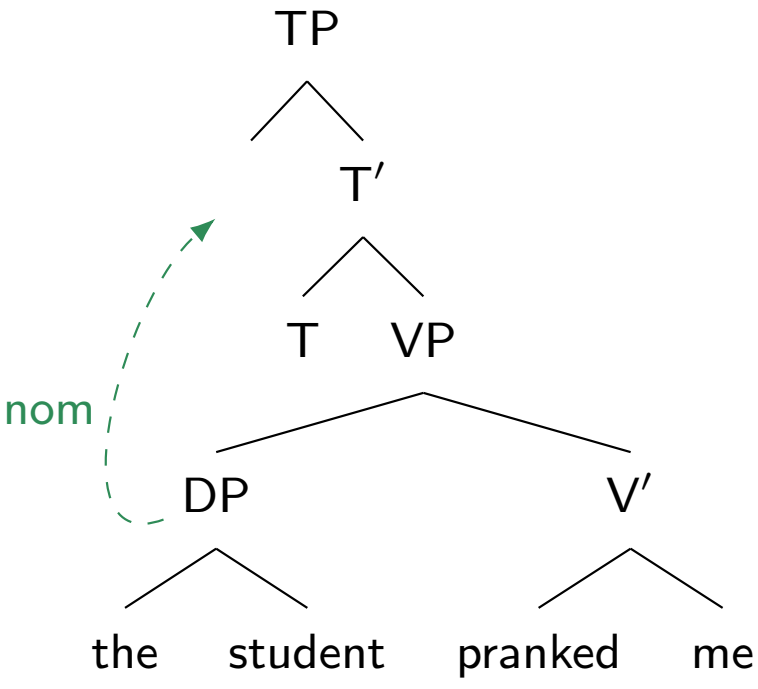
TSL-Merge Enables Adjunction

- Because adjunction is
  - recursive, and
  - iterable

  Merge cannot be SL
  in grammars with adjunction.
- **Corollary**
  Adjunction requires TSL Merge.



Feature-Driven Move



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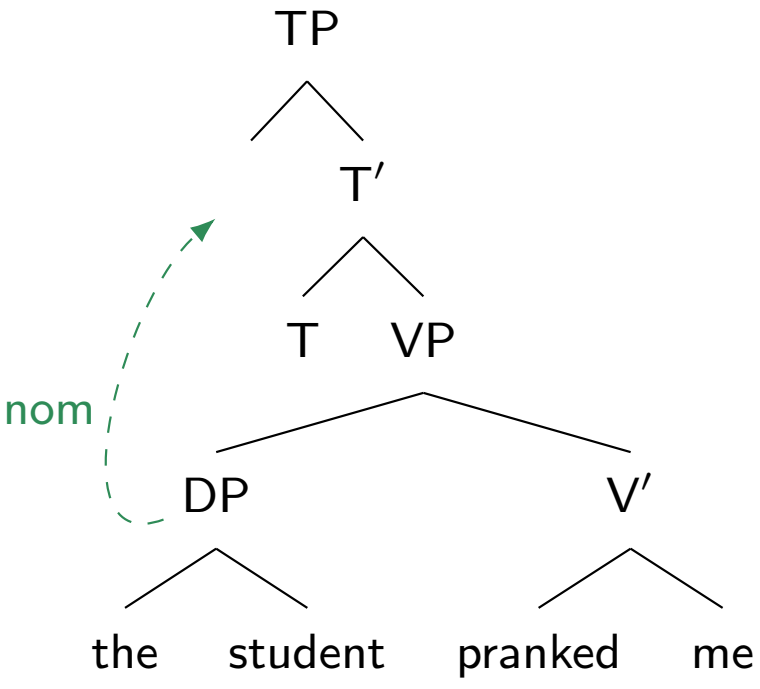

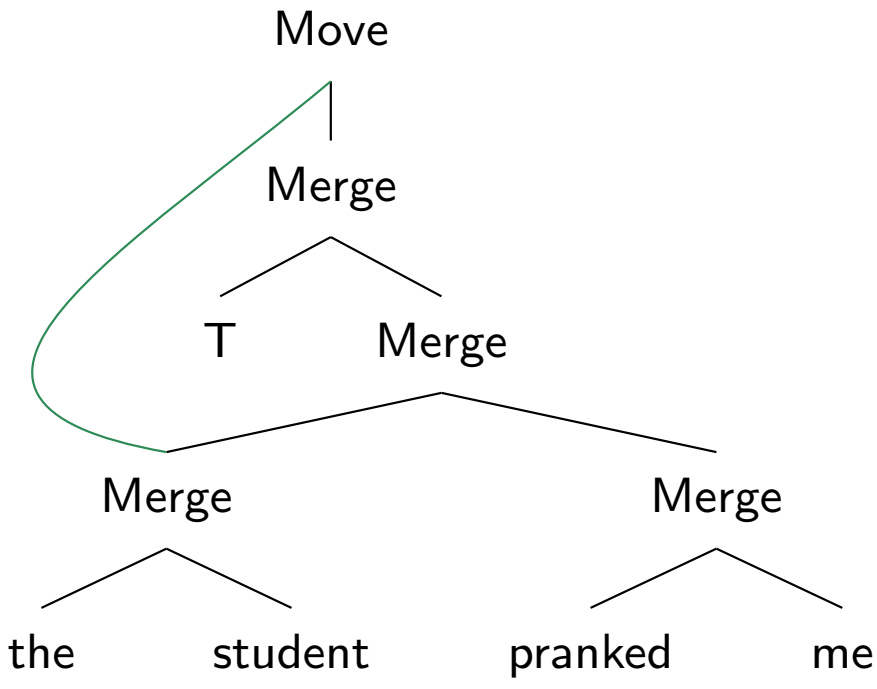

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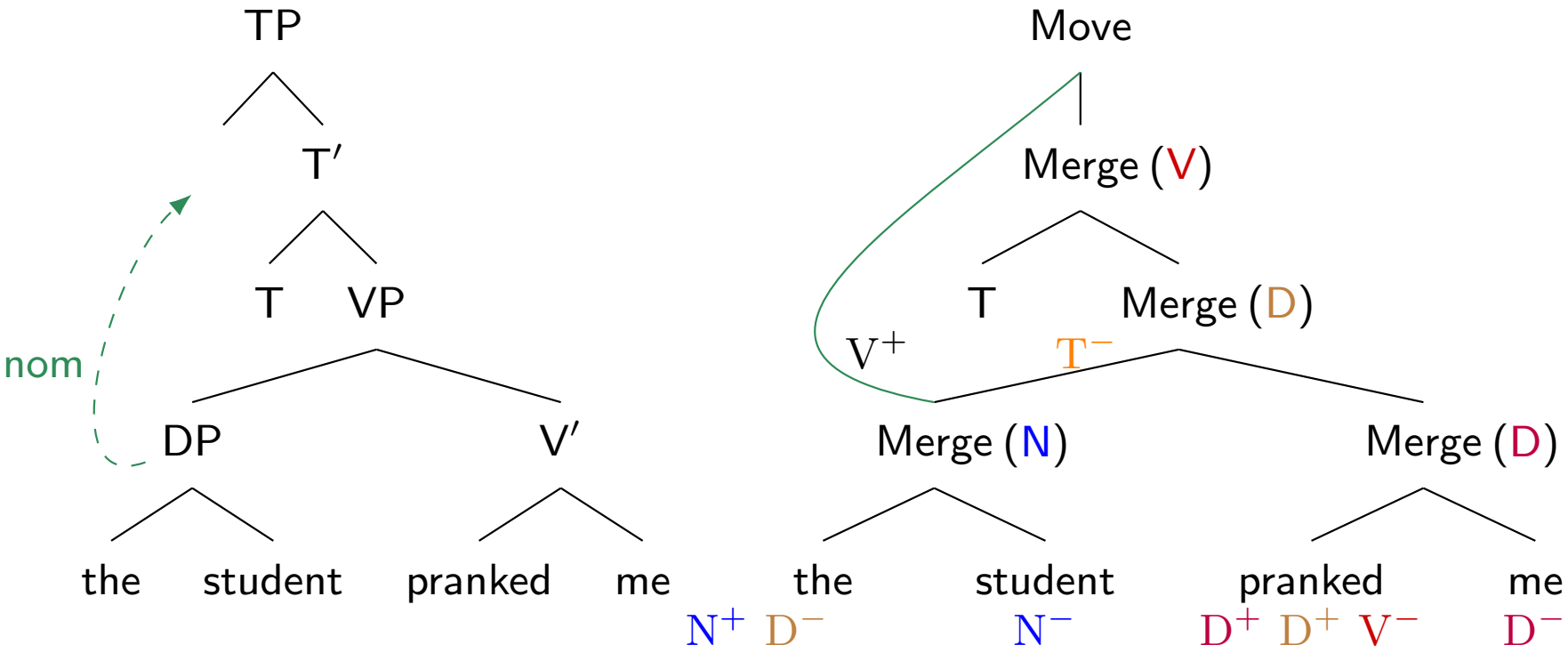

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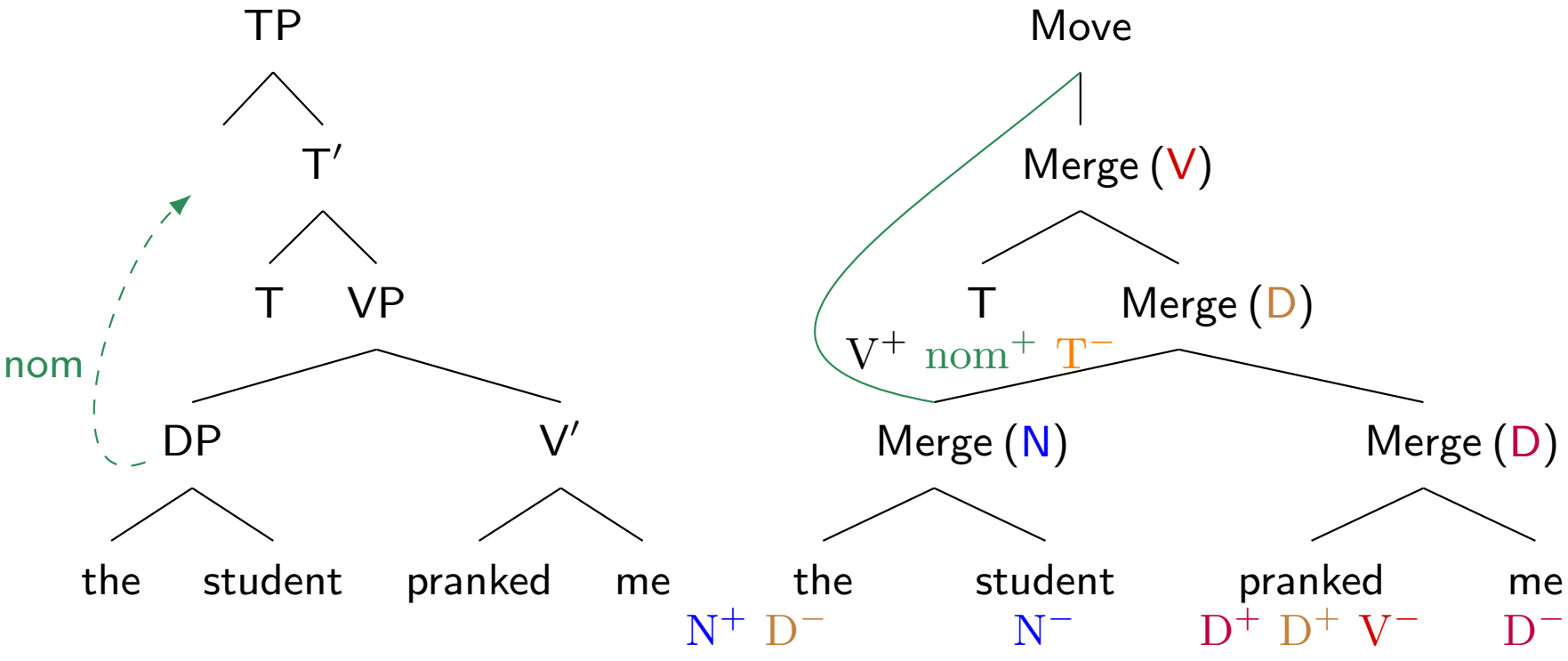

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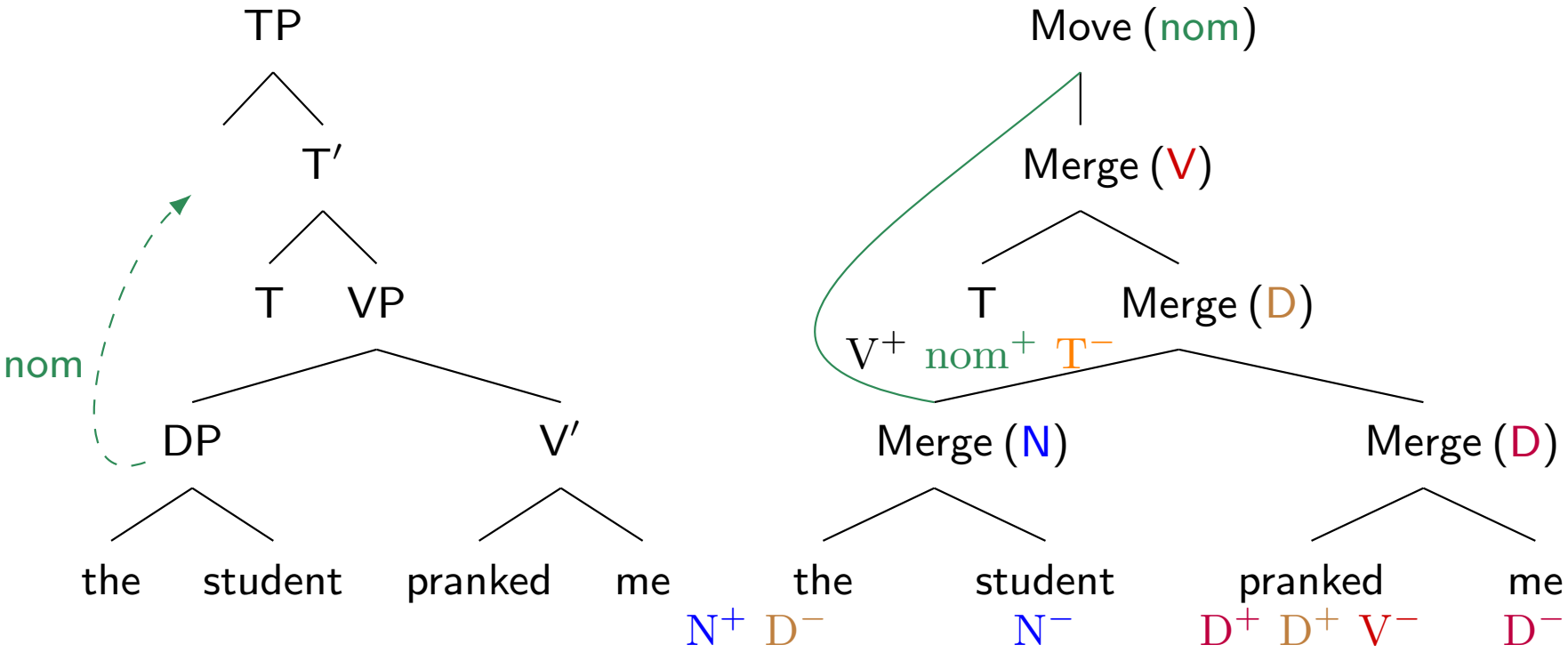

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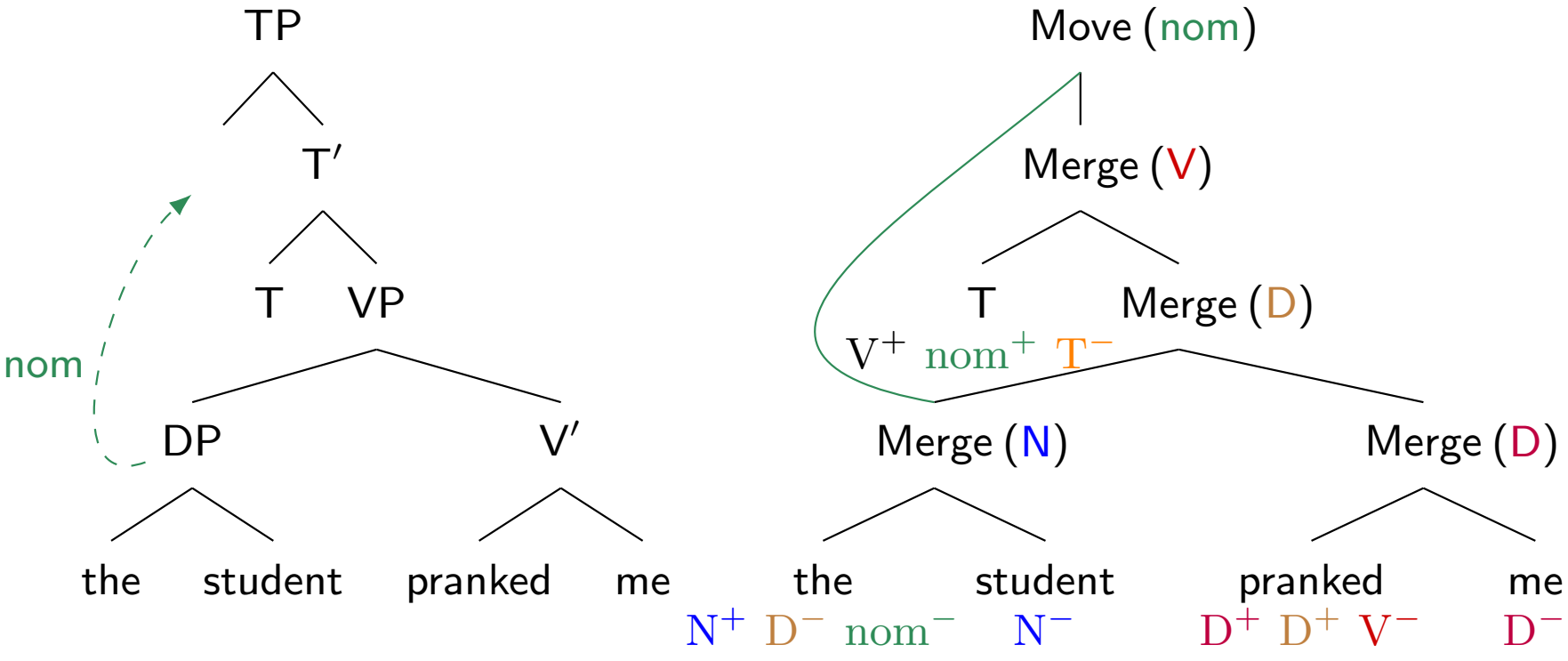

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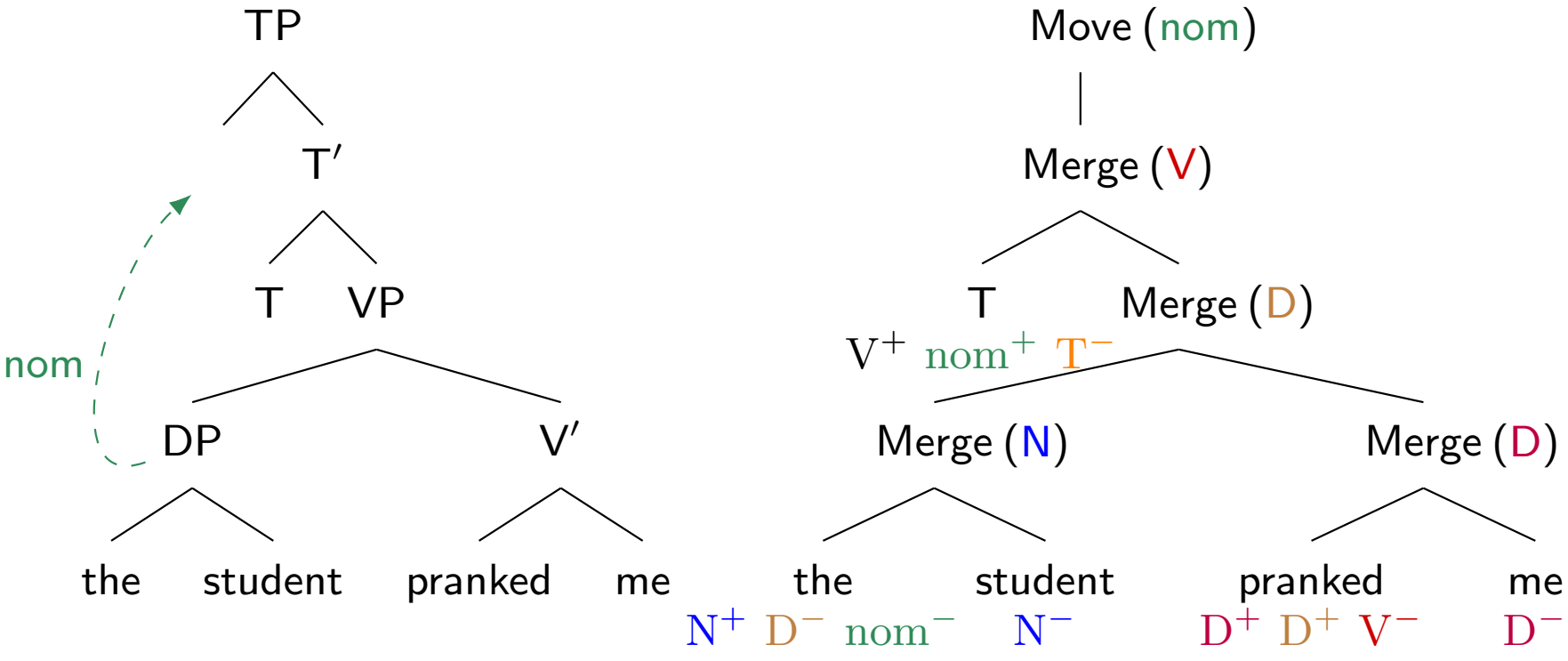

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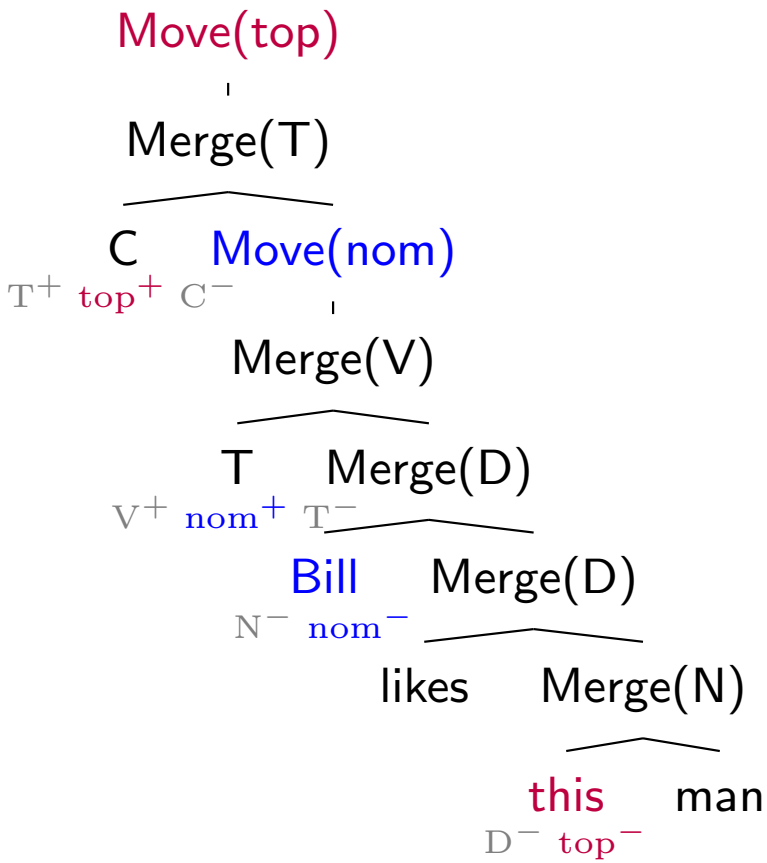

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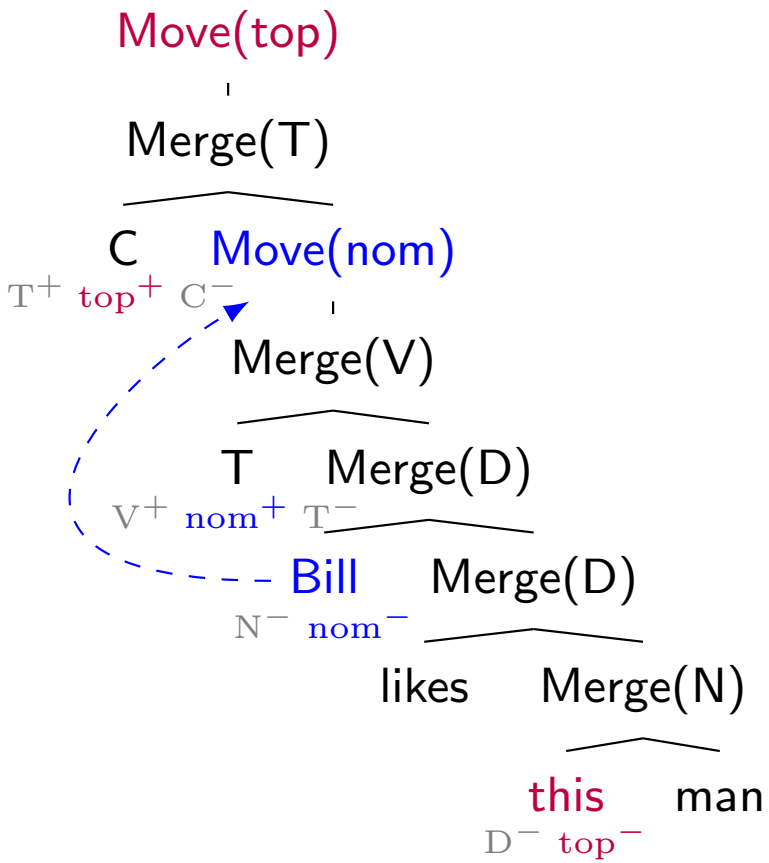

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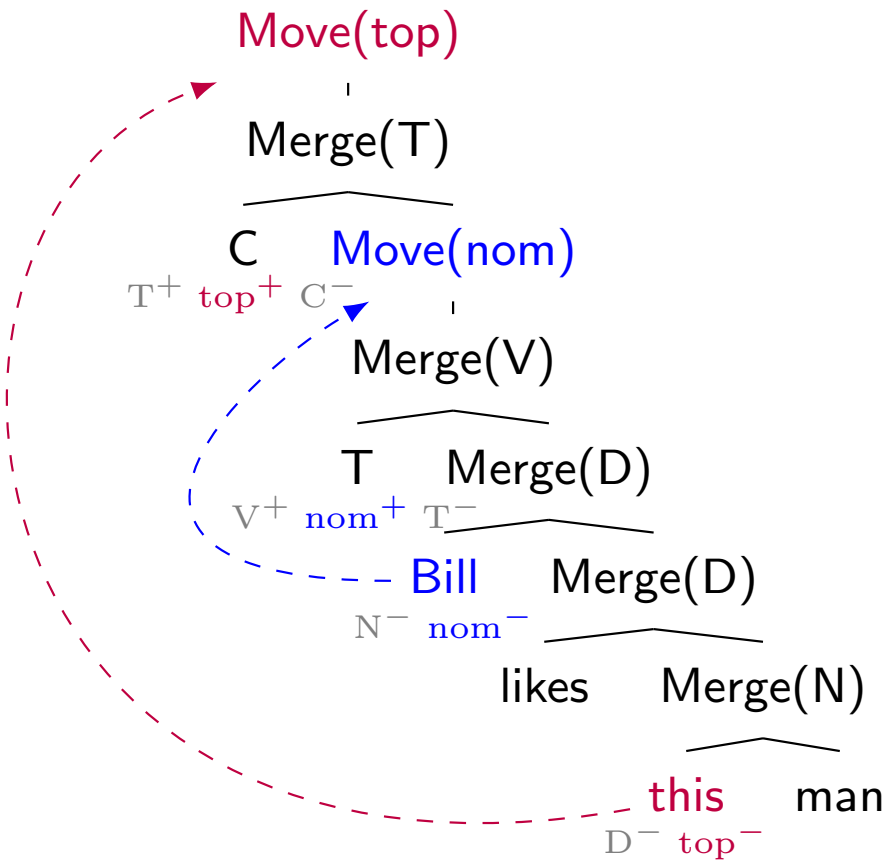

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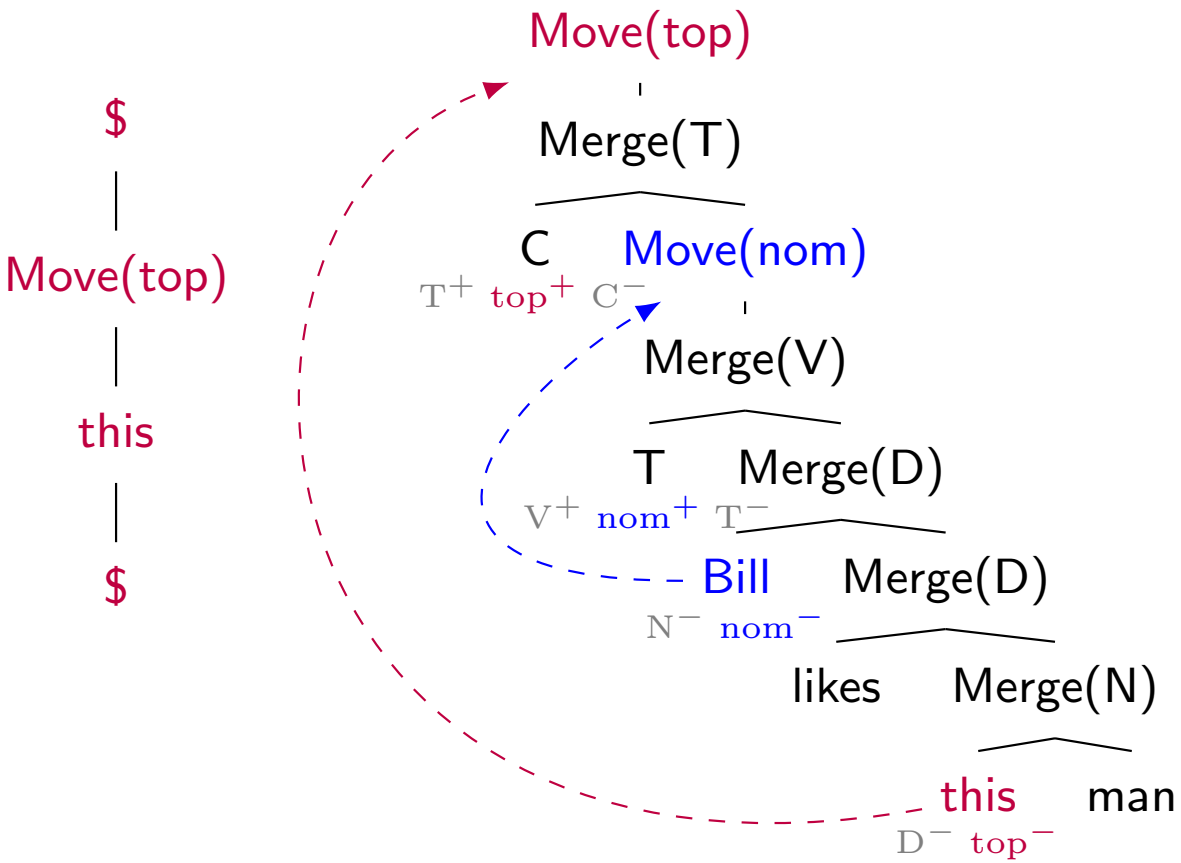

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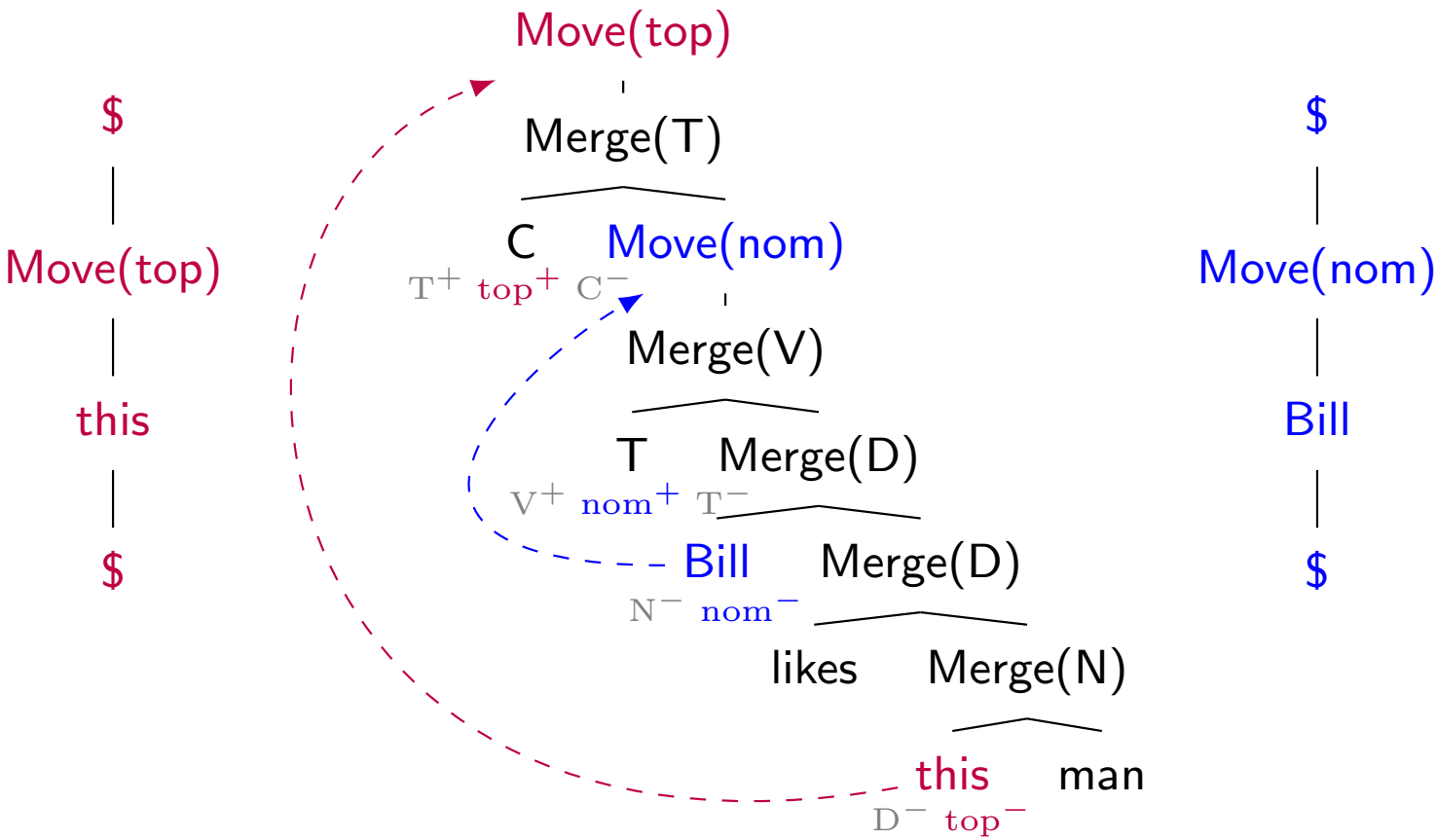
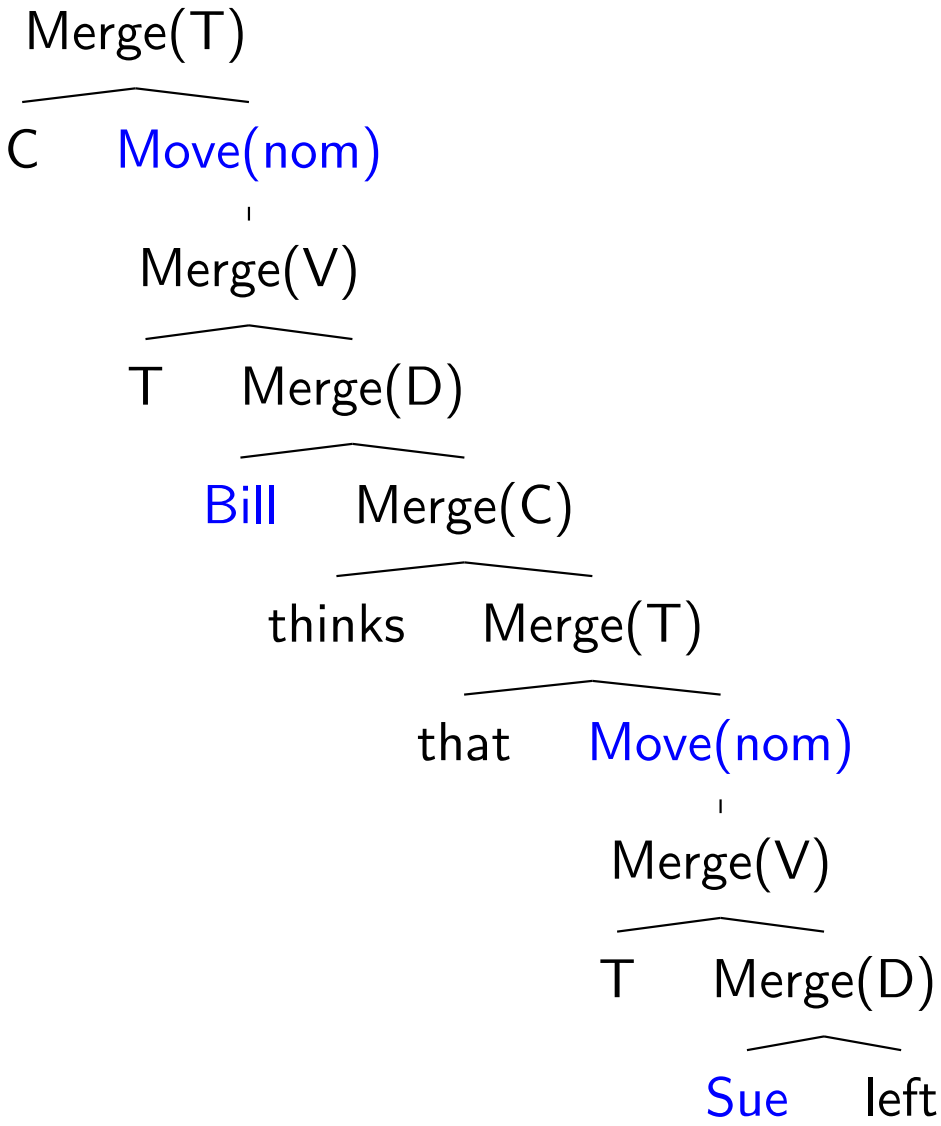


A Tier With Multiple Movers



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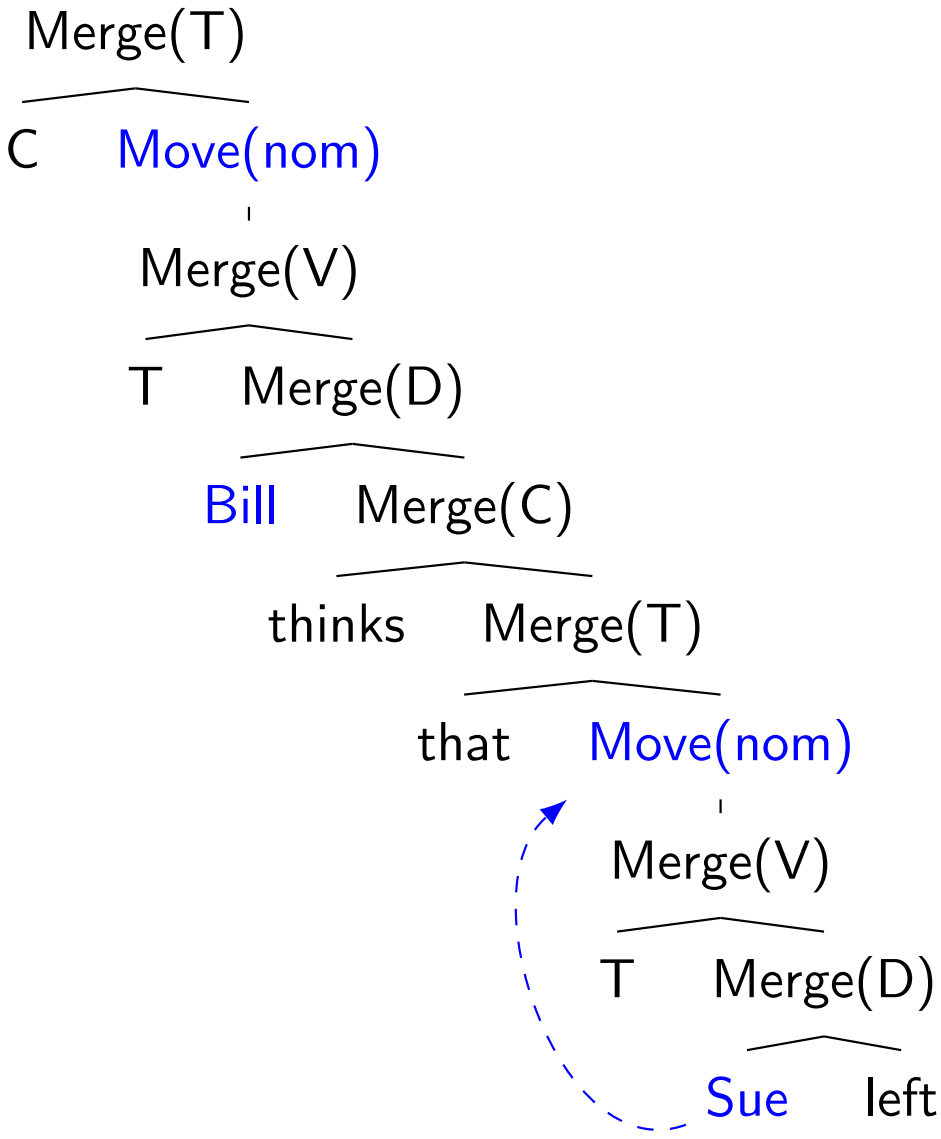

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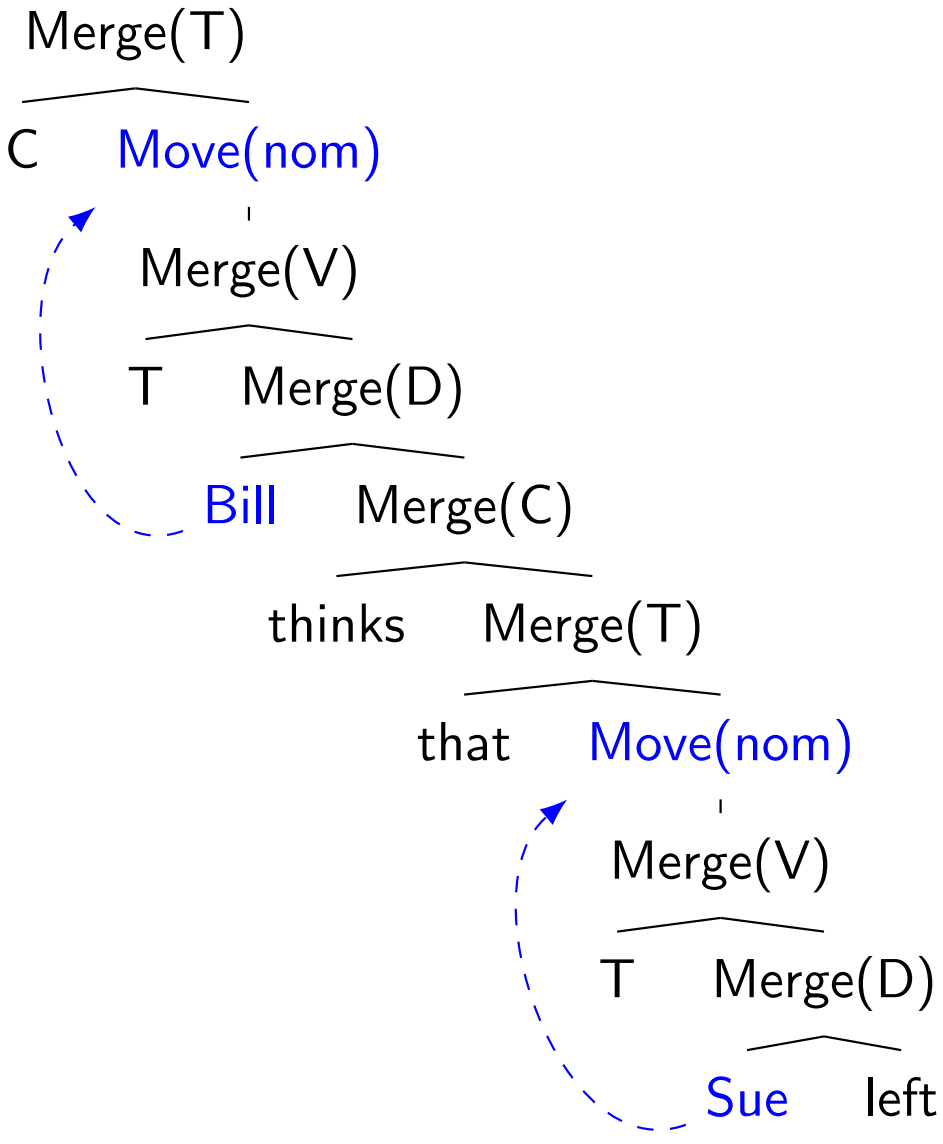

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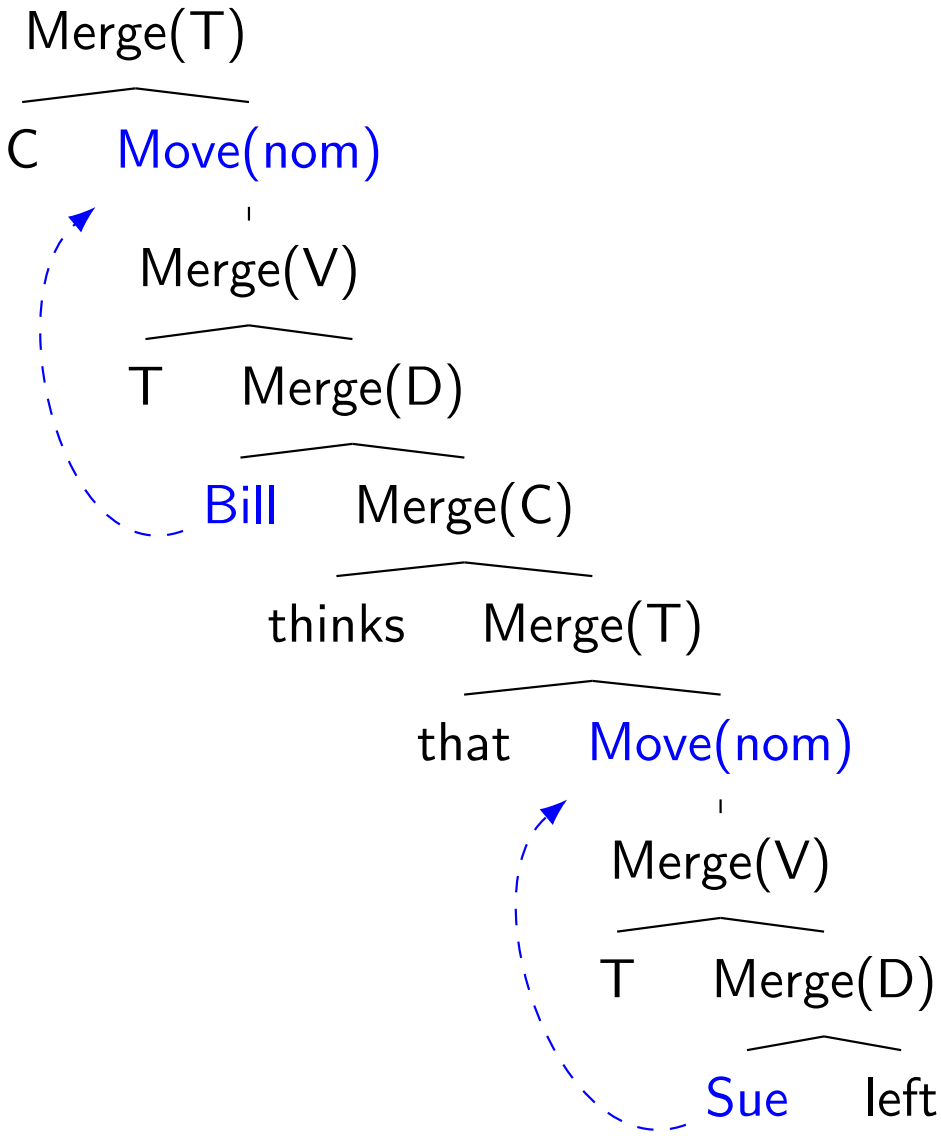

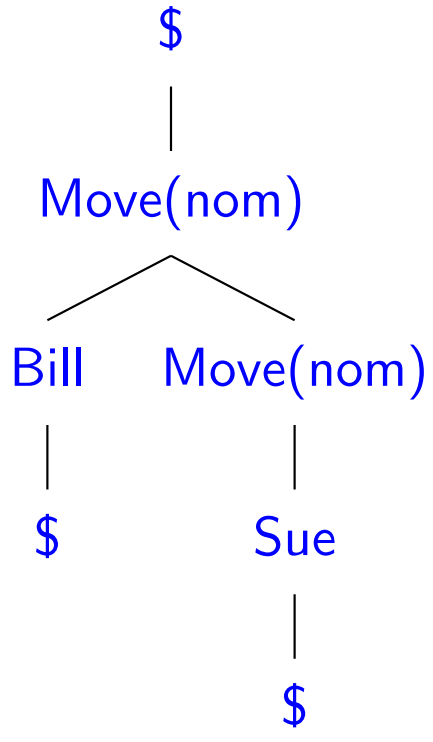

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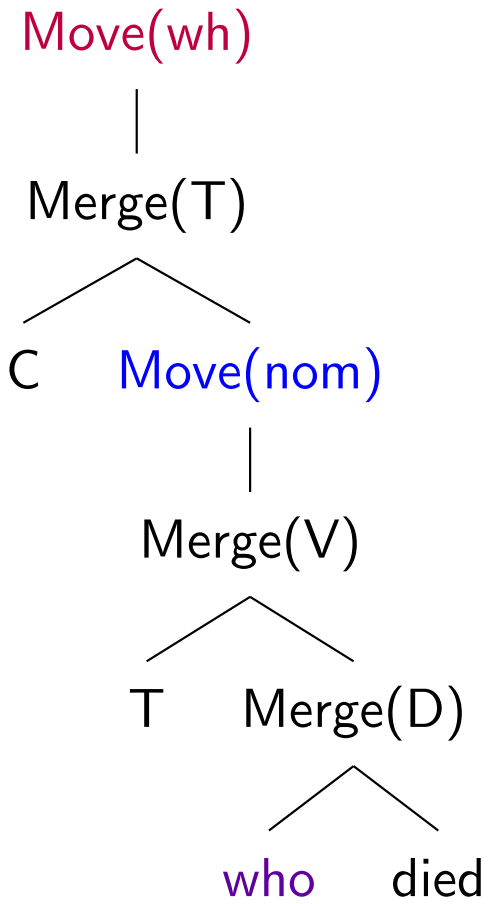

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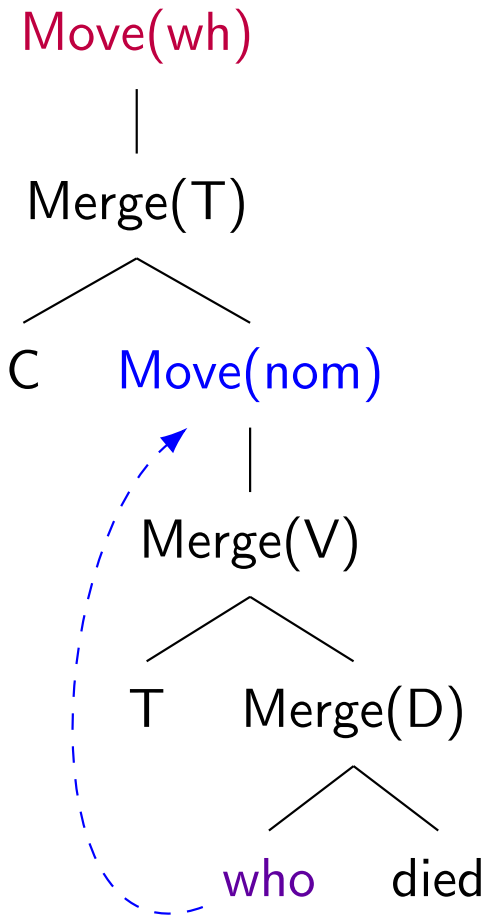

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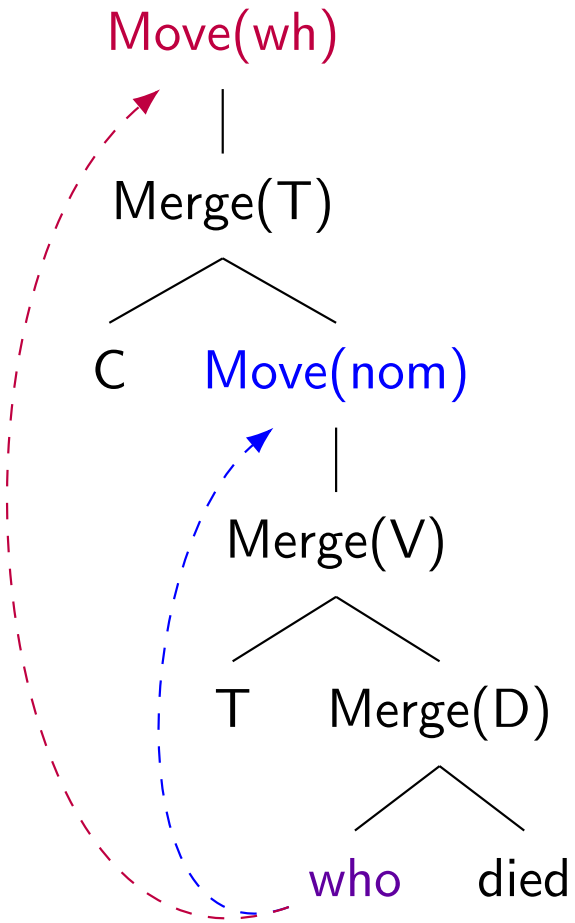

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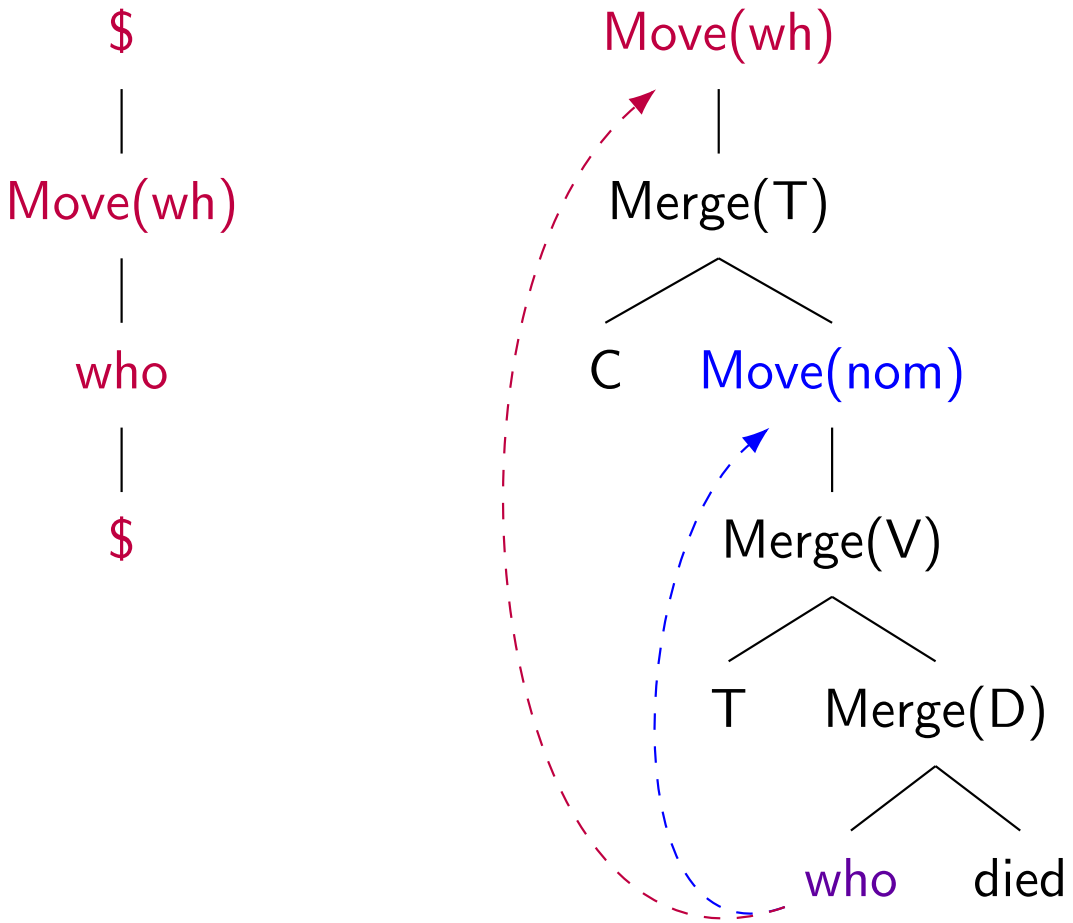

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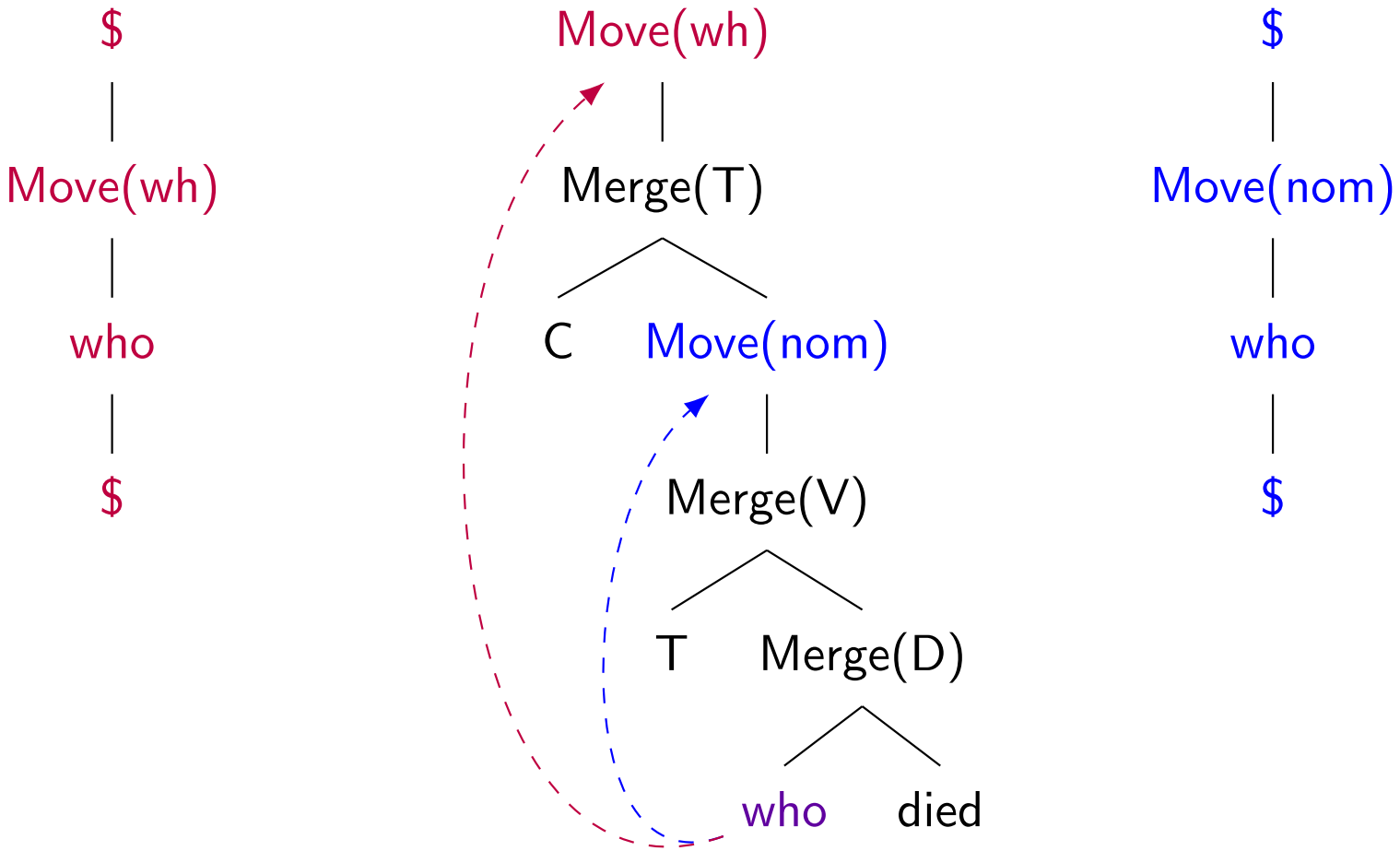
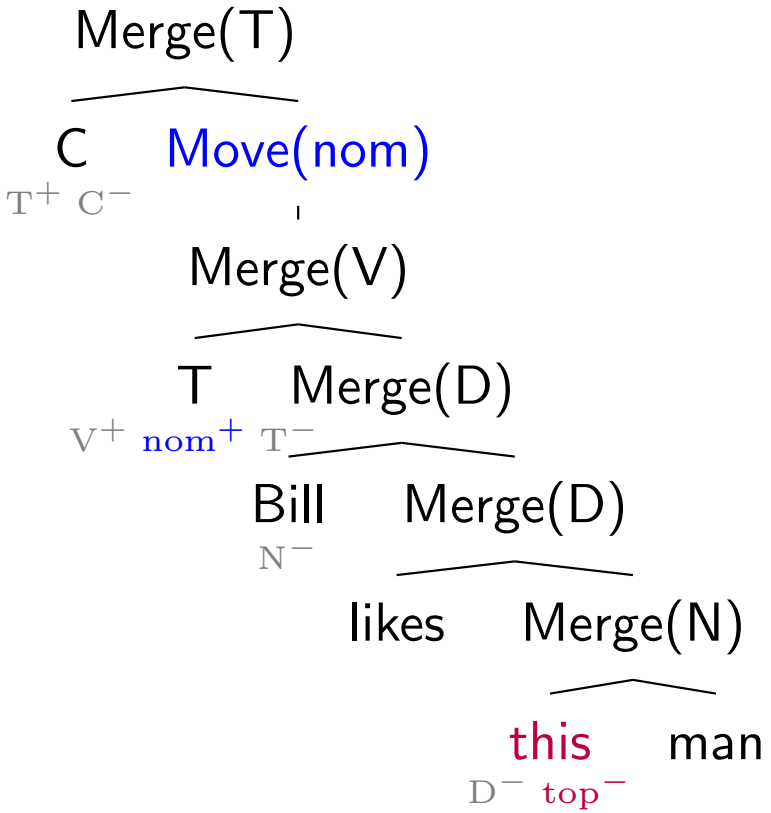


Blocking Simple Cases of Illicit Movement

The derivation below has

1. a nom-landing site with no mover,
2. a top-mover with no landing site.



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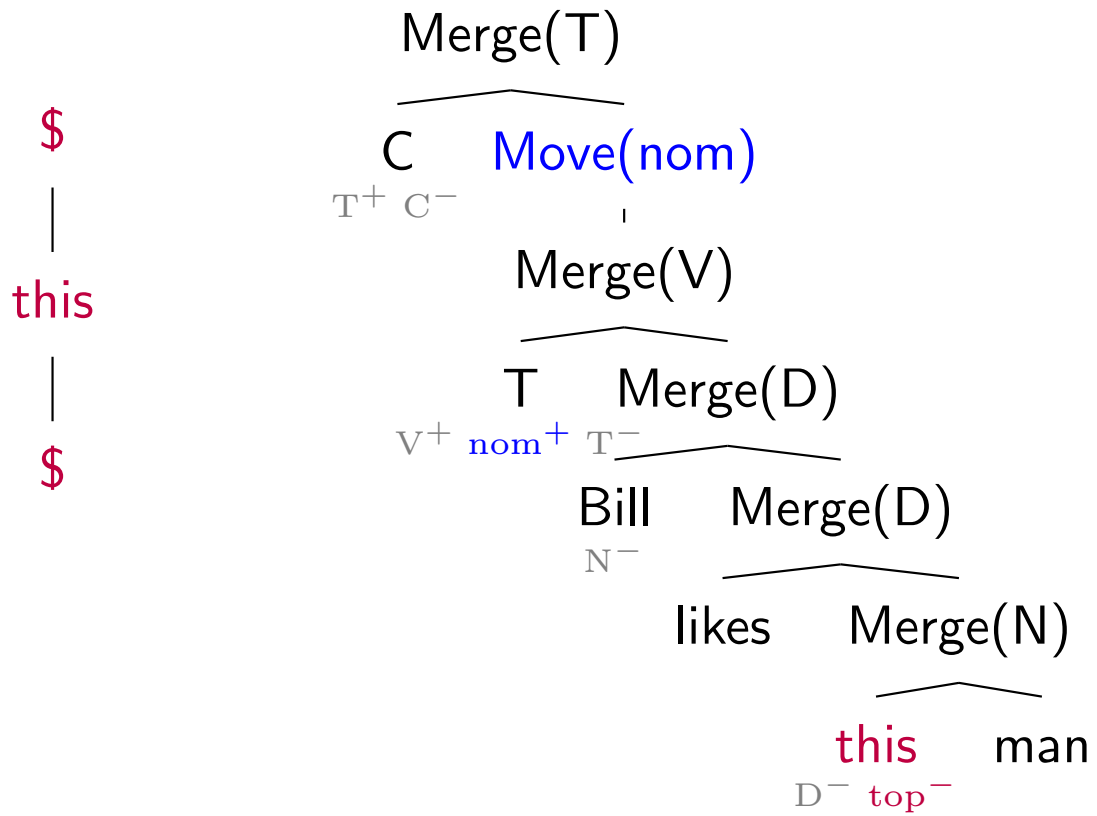

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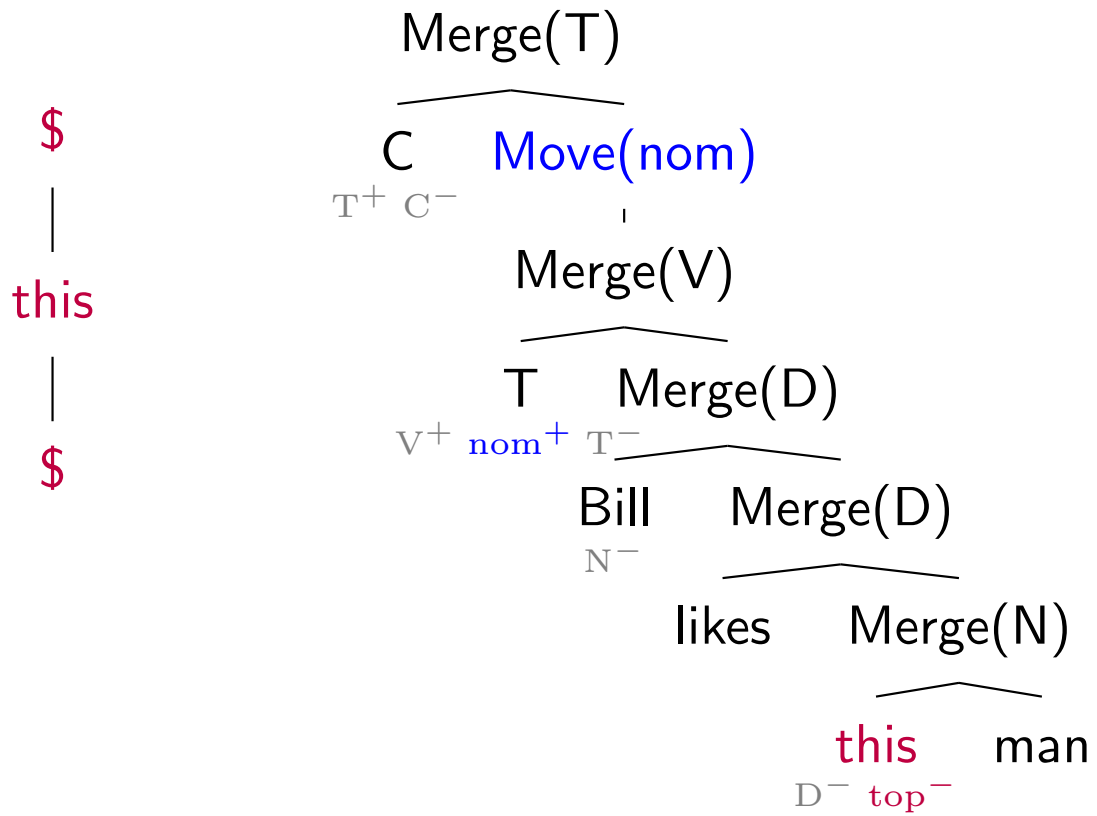

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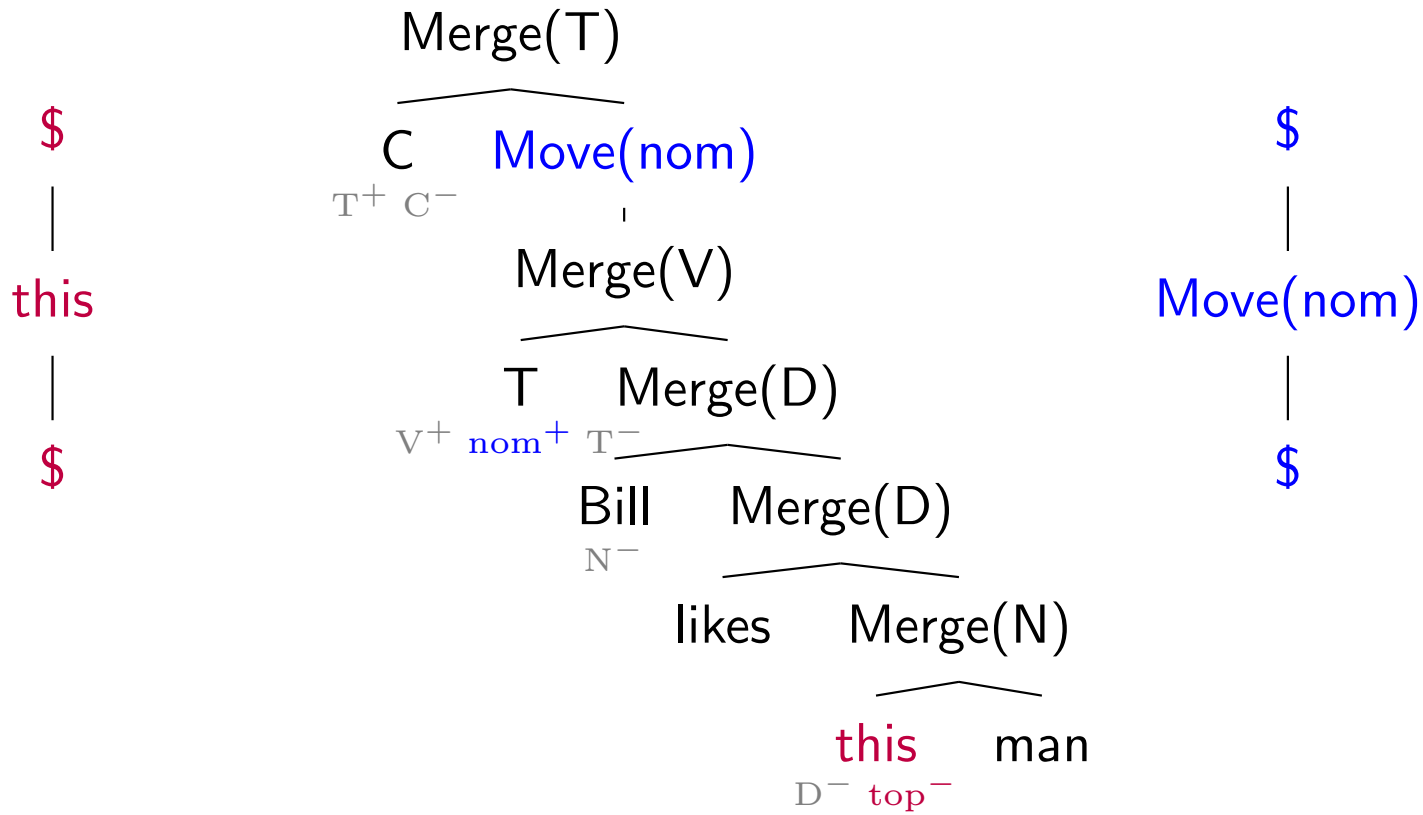

The TSL-2 Core of Merge and Move

TSL Strategy for Merge

- Project tree tier for each **category** X.
- Every X^- has a **Merge** node as its mother.
- Every **Merge** node has exactly one X^- among its daughters.

TSL Strategy for Move (Spoilers: it's exactly the same)

- Project tree tier for each **movement type** x.
- Every x^- has a **Move** node as its mother.
- Every **Move** node has exactly one x^- among its daughters.

Note: constraints again **highly local**

The Minimality of Merge and Move

- TSL-2 is the weakest non-trivial TSL class.
- TSL-1 is equivalent to SL-1.
  (Tiers don't help if you only look at individual nodes)
- TSL-2 is the minimal step from local to unbounded.
- Merge and Move are **maximally non-trivially simple**.

Multiple wh-Movement

- The "exactly one" part is actually two separate conditions:
  1. Every **Move** node has **at least one** x^{-}-daughter.
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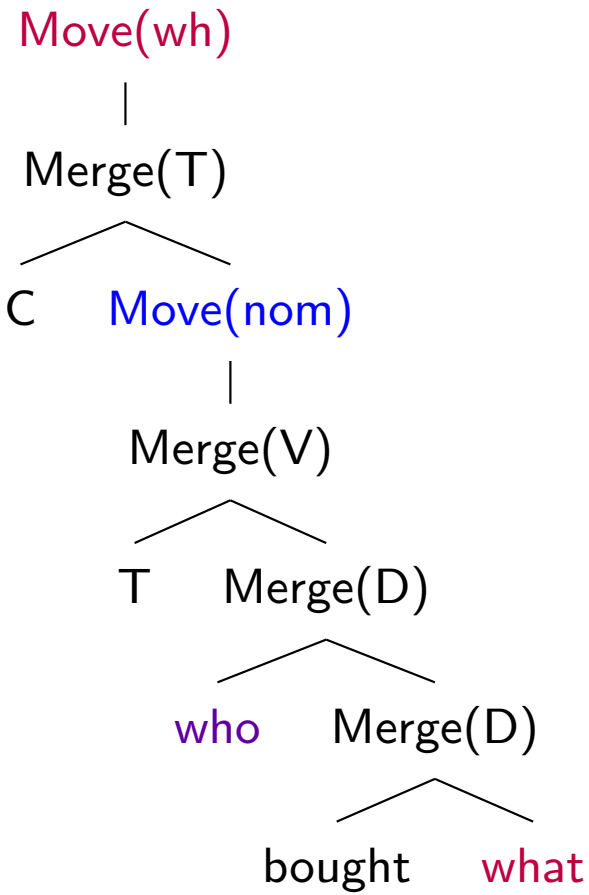
- Dropping the second requirement gives us multiple movement.



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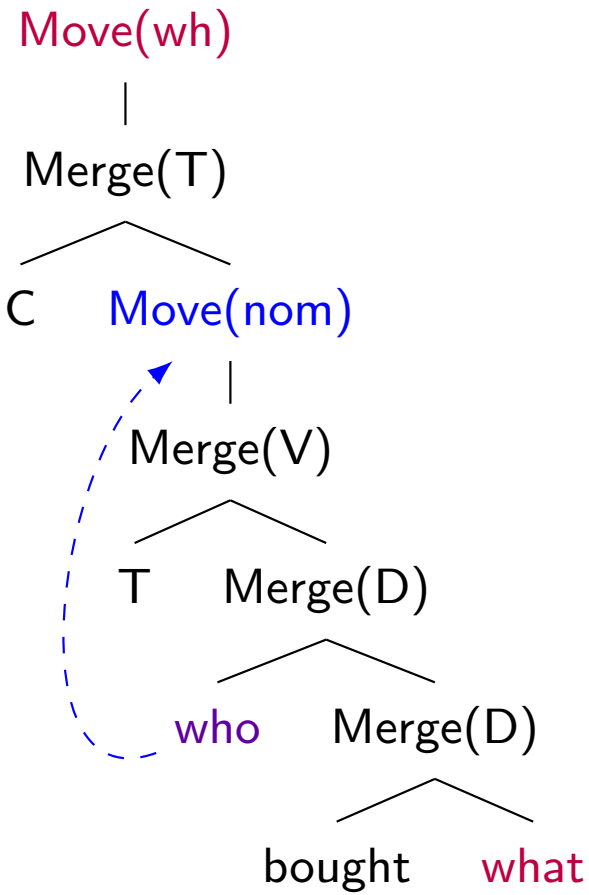

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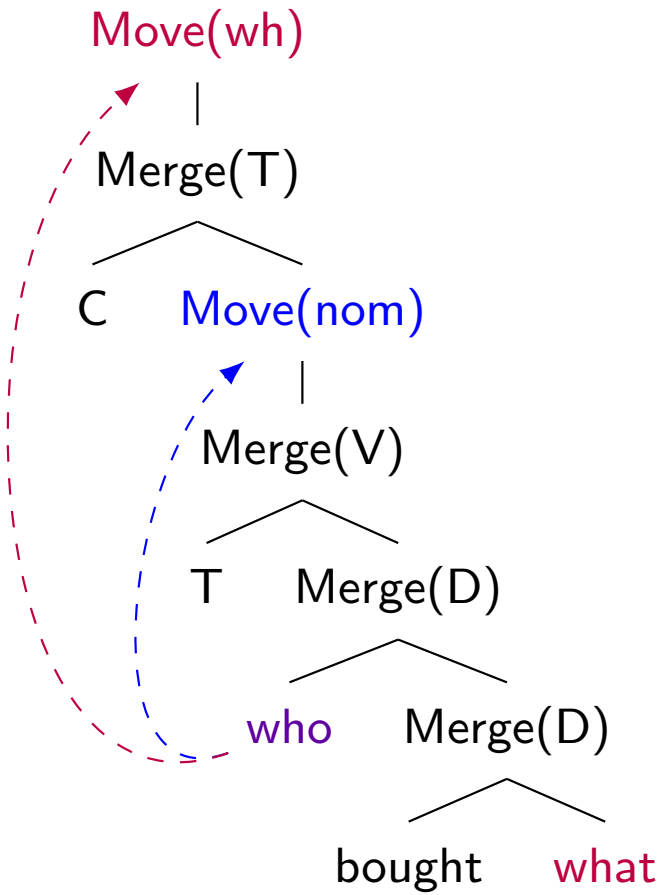

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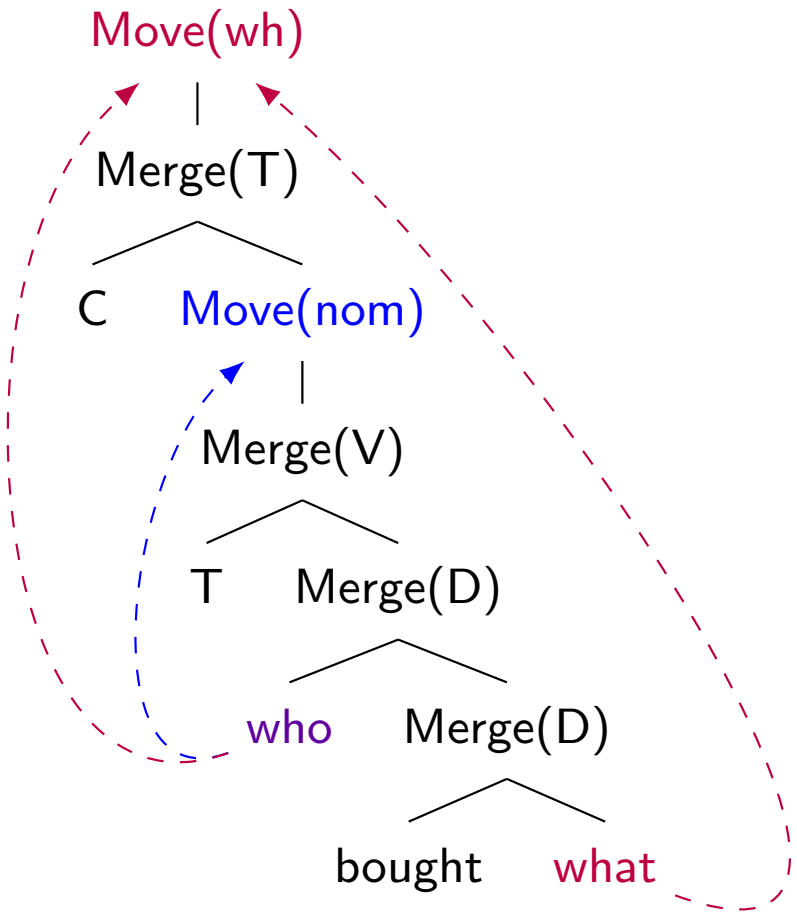

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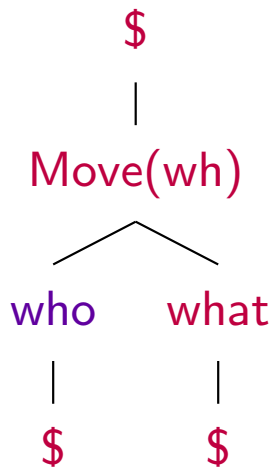
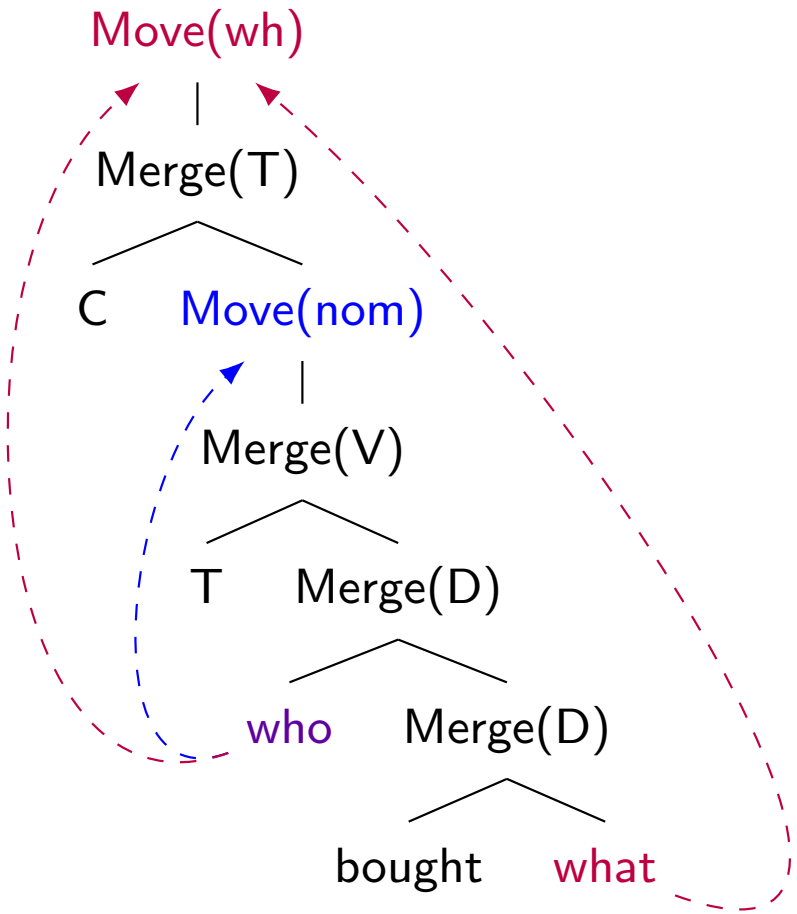
- Dropping the second requirement gives us multiple movement.





What Gives?

- A system that has the means for standard movement, also has the means for multiple wh-movement.
- **Caution**: this only holds for the derivational part.

Additional Complications of Multiple wh-Movement

- How do we determine c-command/scope?
- How do we linearize the movers?
- Why isn't there multiple Merge?

Islands Come for Free

Two Fundamental Questions of Syntax

- Why do islands exist?
- Why do island exceptions exist?

A computational argument

1. Movement requires the power of TSL-2.
2. TSL-2 can model islands as blocking effects.
3. The cognitive ability for movement entails the cognitive ability for islands.

Reminder: Blocking is TSL

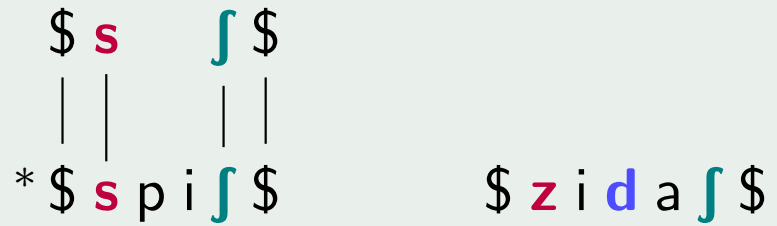
Example: Slovenian (Jurgec 2011; McMullin 2016)

* $ s p i ʃ $ $ z i d a ʃ $

- Generalizing from phonology to syntax:
  islands are pushy guys that add useless nodes to tiers.

Reminder: Blocking is TSL

Example: Slovenian (Jurgec 2011; McMullin 2016)



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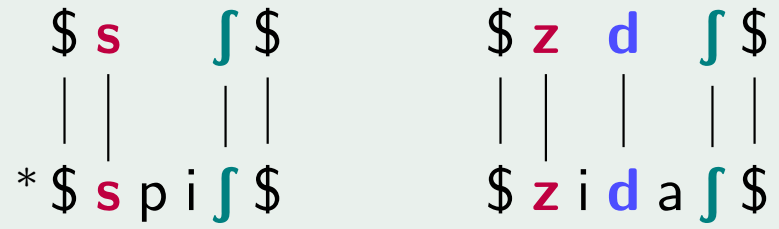

- Generalizing from phonology to syntax:
  islands are pushy guys that add useless nodes to tiers.

Island Examples

(1) * Which car did John complain [**because** Bill damaged t].

(2) * Which car did John deny [the **fact** that Bill damaged t].

(3) Which car did John drive Mary crazy [**while** trying to fix t].

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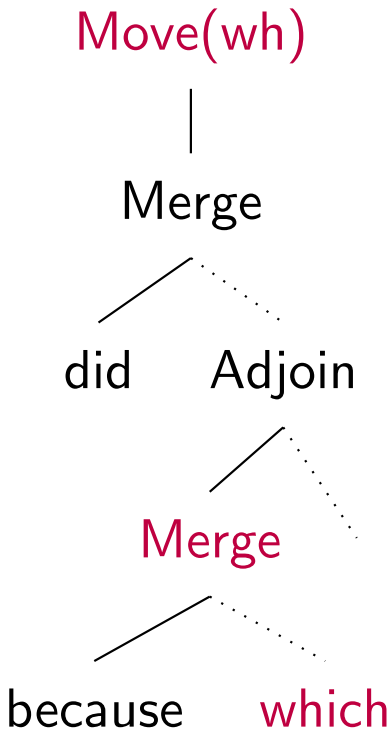

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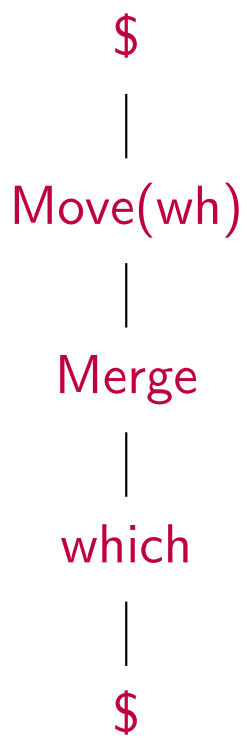

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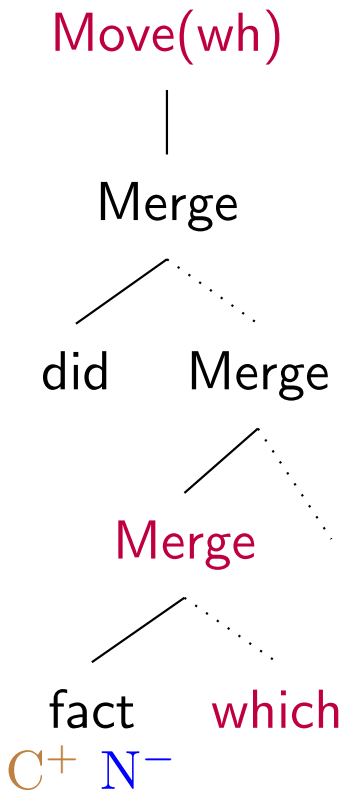

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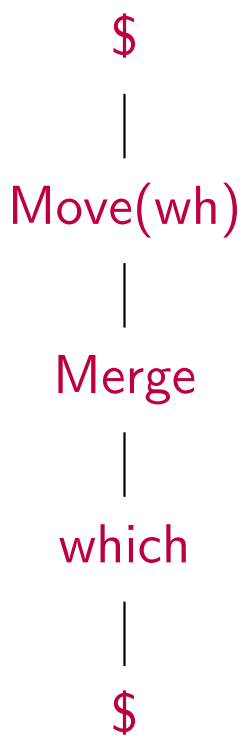

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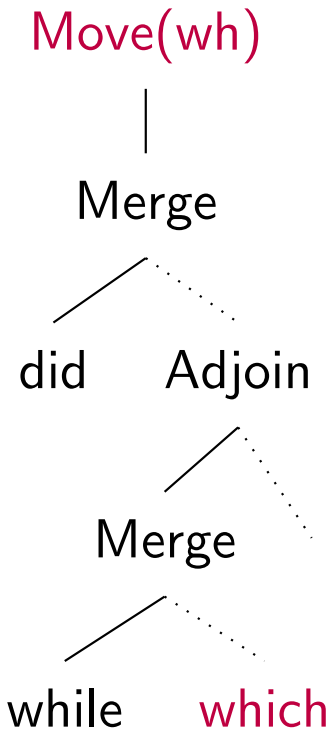

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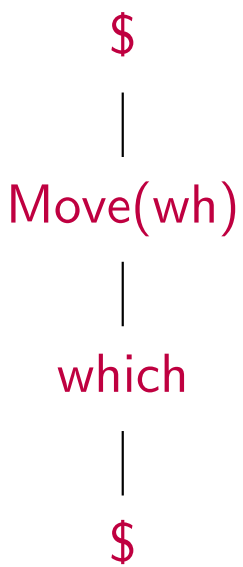


Impossible Islands

- Islands arise when a blocker is projected onto a tier.
- Tier projection is very limited.
- TSL-2 theory of islands hence rules out:
  - **Gang-up islands**
    "A mover can escape n islands, but not more than that."
  - **Configurational islands**
    "An adjunct is an island iff it is inside an embedded clause."
  - **Cowardly islands**
    "An adjunct is an island iff
    there are at least two adjuncts in the same clause."
  - **Rationed islands**
    "Only one adjunct per clause can be an island."
  - **Discerning islands**
    "Adjuncts only block movers that contain an adjective."

Islands are Still Mysterious, Though

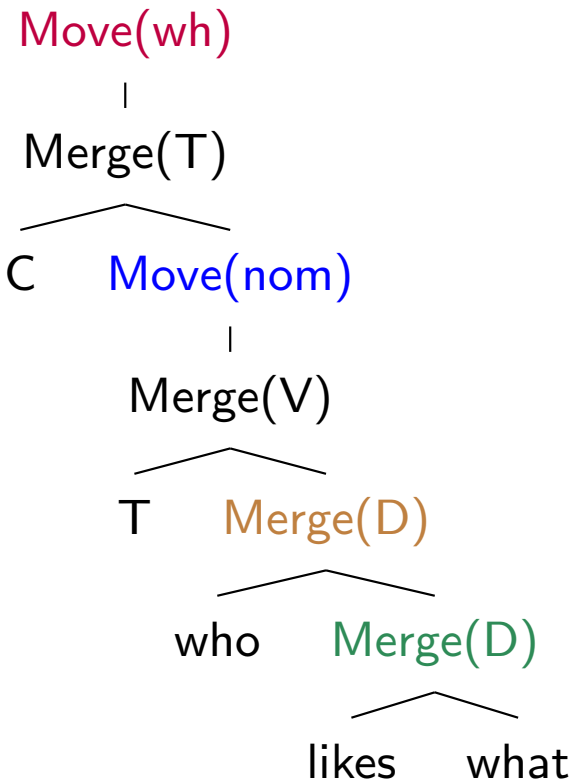
- The existence of islands is unsurprising under the TSL-view.
- What is surprising is that
  1. islands do no vary more across languages,
  2. islands form natural classes,
     (e.g. almost all adjuncts are islands, not just *because*)
  3. some things are never islands.
- There are alternative stories that address some of that.

Superiority

- Superiority effects can be analyzed as conditional islands.

Example

A wh-item that does not carry wh^- causes a Merge node to be projected onto the wh-tier.



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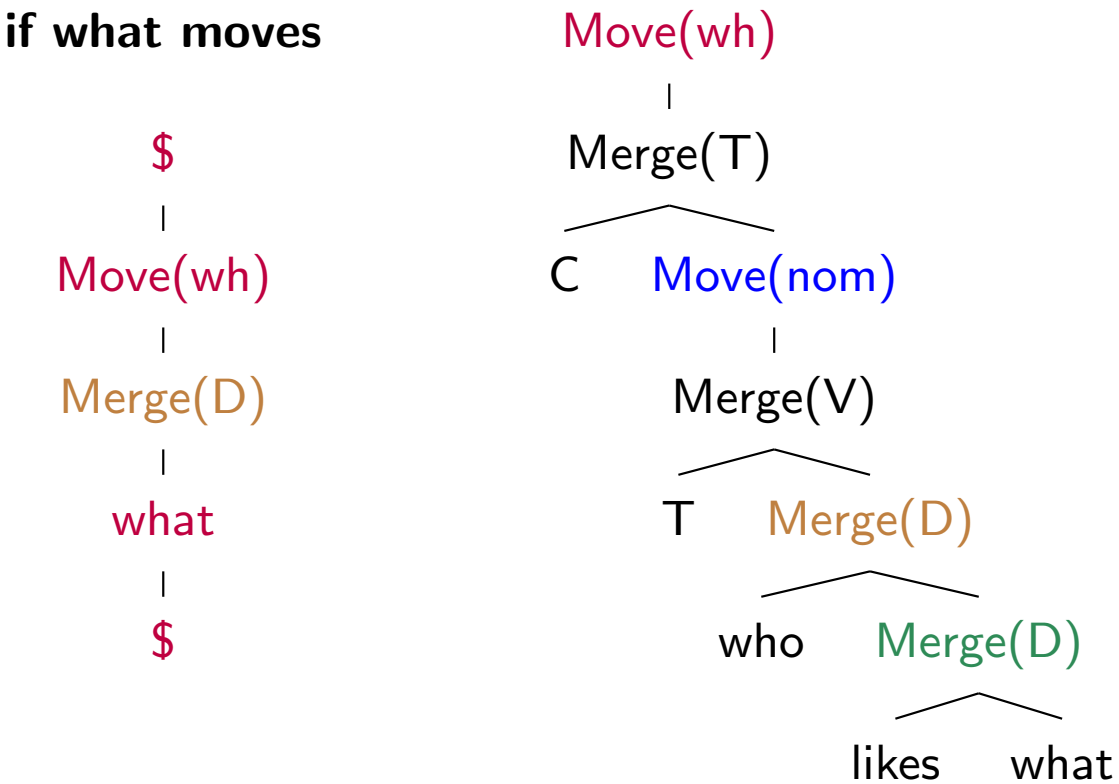

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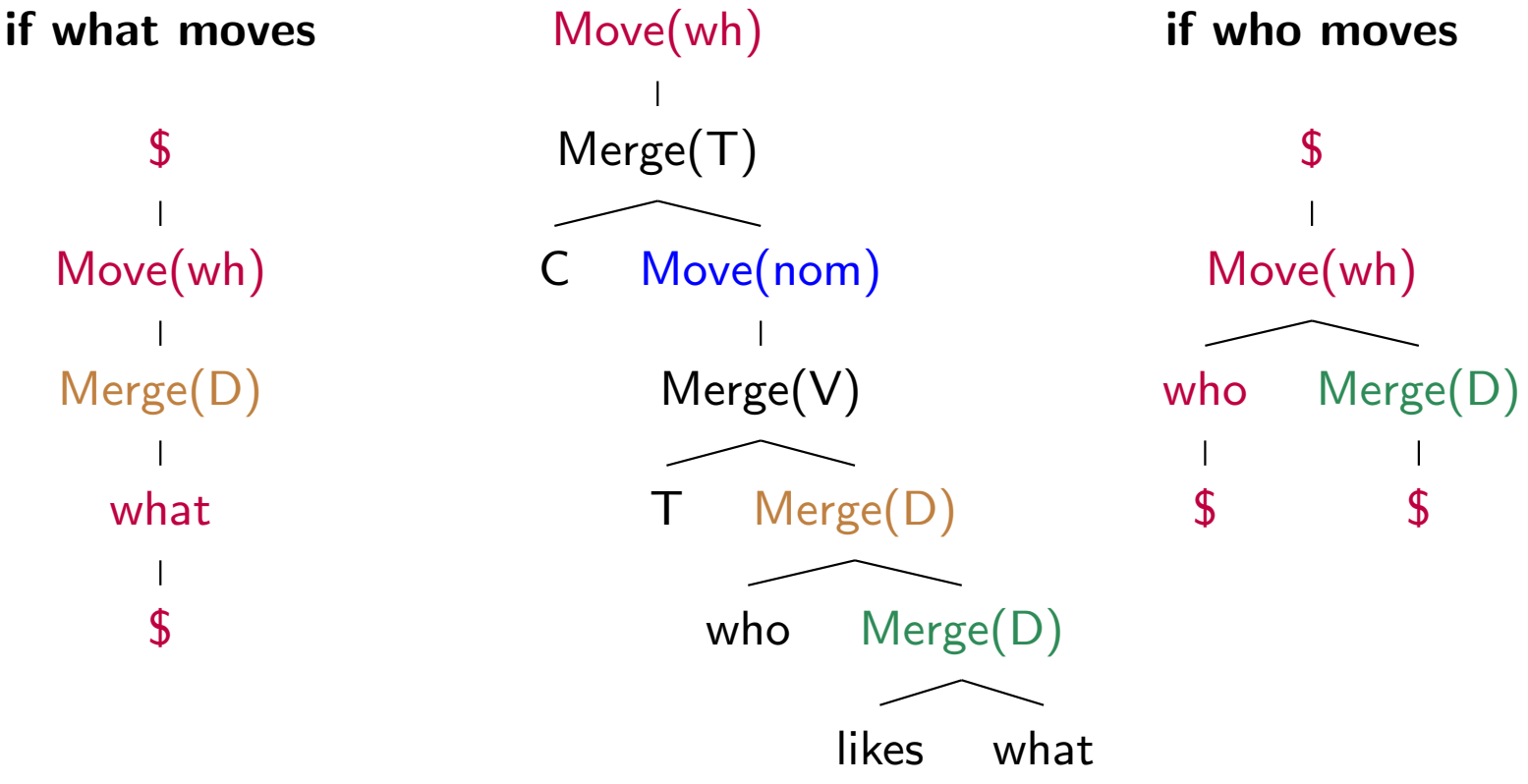


But What About Actual Movement?

- We're only handling the feature checking part of Move.
- The actual displacement is handled differently.

Two-Step Approach to Syntax

- Derivation tree is locus of syntactic dependencies.
- Derivation tree can be rewritten into
  - phrase structure tree
  - multi-dominance tree
  - LF
  - prosodic structure
  - string yield
  - much more
- Formalized as tree transduction
- Mapping to multi-dominance tree is SL with a bit of TSL

Wrapping up: Concrete Results

- SL and TSL can be generalized to trees.
- Succinctness drives us from SL Merge to TSL Merge.
- TSL Merge paves the way for
  - movement
  - adjunction
  - multiple wh-movement
  - island effects
  - superiority

Join the Program

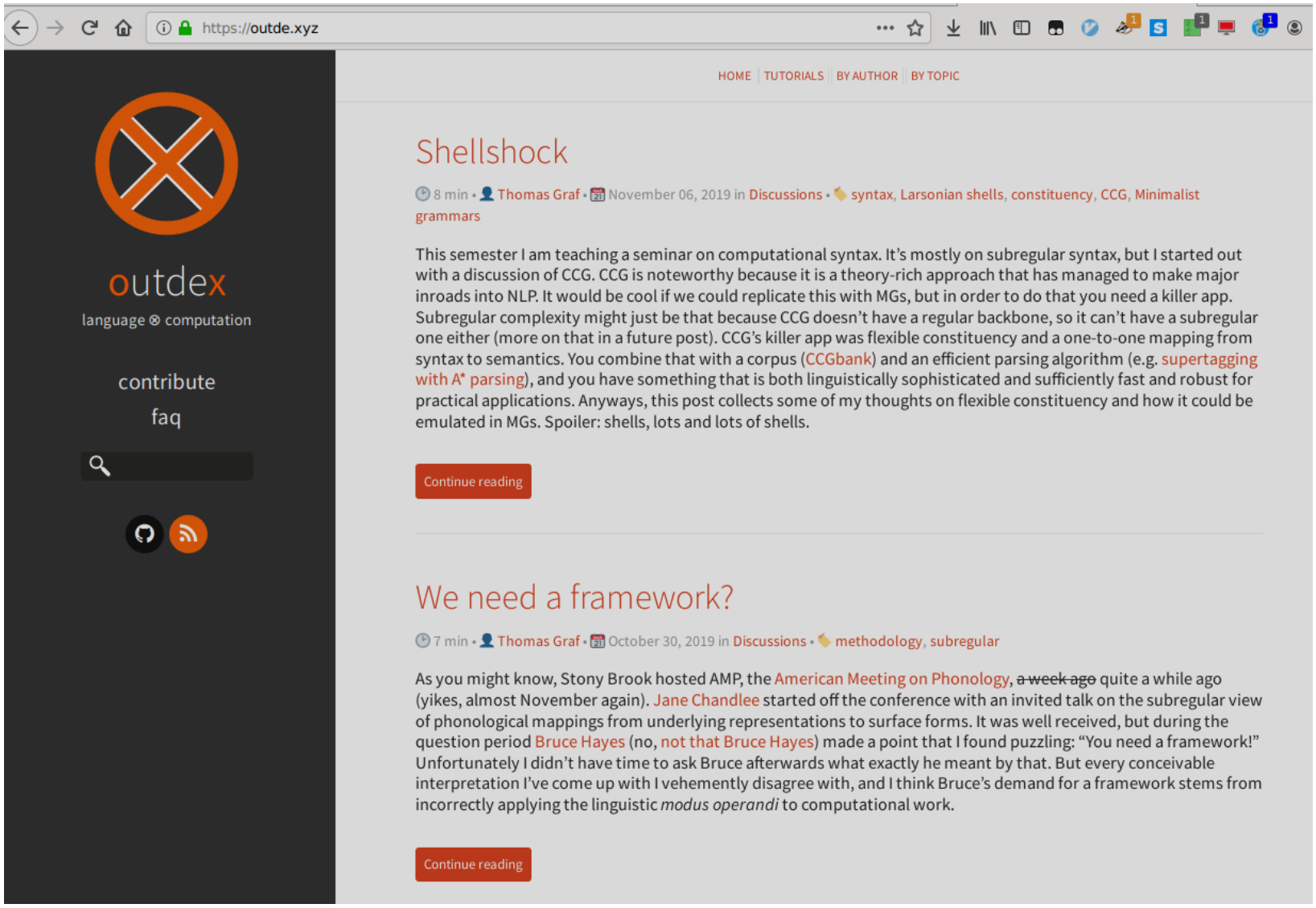
Everybody has something to contribute!

- Do you have data that contradicts current predictions?
- In-depth analysis of specific phenomena
- Grammar fragments

Follow-Up Projects

1. Agree
2. Contiguity theory
3. Parasitic gaps
4. Smuggling
5. Movement as a transformation (Graf 2020)
6. Applications of weighted/probabilistic TSL for trees

Follow Along (`https://outde.xyz`)



Learning More About Tree Land

1. **TSL syntax:** Graf (2012, 2018); Graf and Shafiei (2019); Graf and Kostyszyn (2021); Shafiei and Graf (2020); Vu (2018); Vu et al. (2019)
2. **SL tree mappings**: Graf (2020)
3. **Sensing tree automata (not discussed)**: Graf and De Santo (2019)

Acknowledgments

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