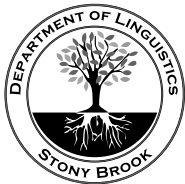


Monotonicity as a High-Level Principle of Grammar

Thomas Graf



Stony Brook University
mail@thomasgraf.net
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University of Leipzig
June 16, 2021



Take-home message

Descriptive observation: Monotonicity beyond semantics

- ▶ Monotonicity shows up **a lot** across linguistics domains.
- ▶ Monotonicity ties together seemingly unrelated phenomena.

A bigger picture

- ▶ Monotonicity as a high-level principle (cf. third factor)
- ▶ Supra-grammatical analysis of data

Take-home message

Descriptive observation: Monotonicity beyond semantics

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- ▶ Monotonicity as a high-level principle (cf. third factor)
- ▶ Supra-grammatical analysis of data

Third factors as an analytical tool

Phenomenon

A

B

C

D

E

Third factors as an analytical tool

Machinery

Phenomenon

A

Syntax

B

C

Morphology

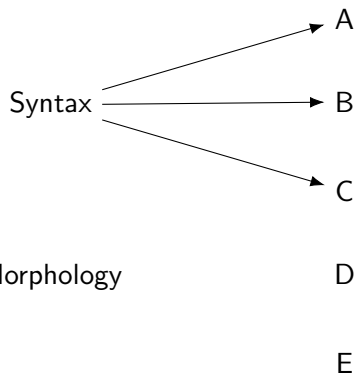
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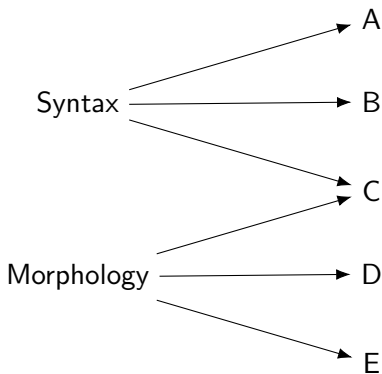


Morphology

Third factors as an analytical tool

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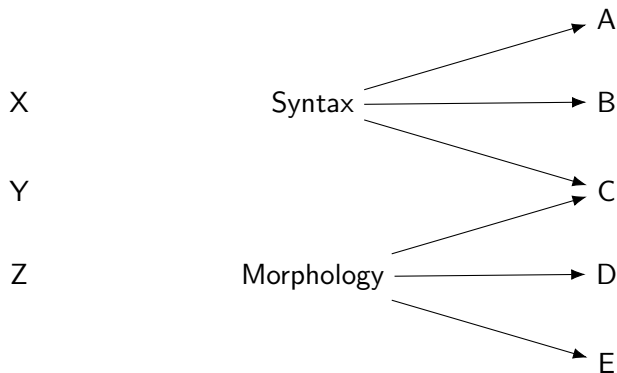


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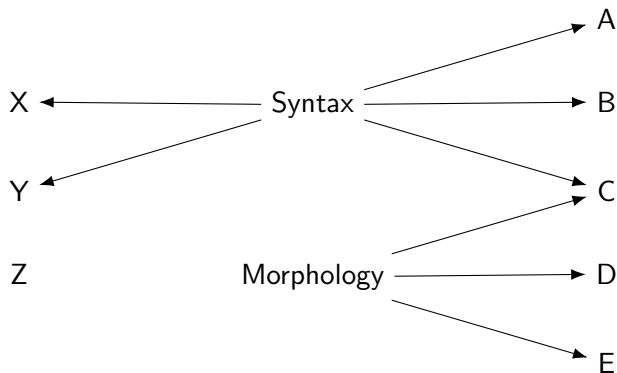


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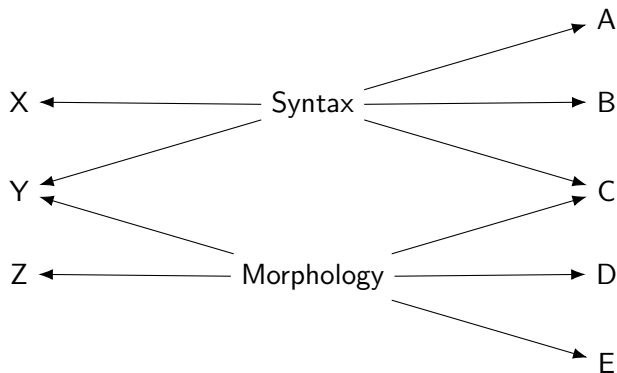


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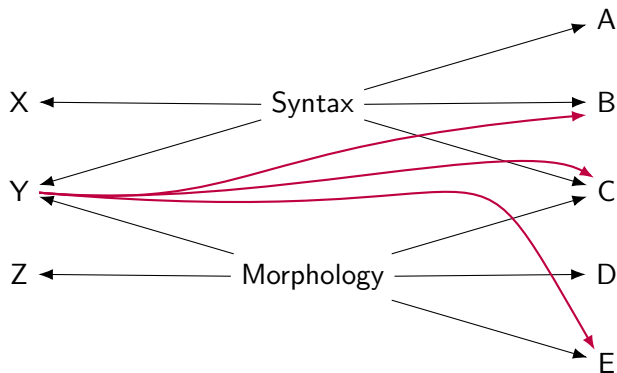


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Outline

- 1 Monotonicity: what and why?
- 2 Monotonicity in morphology and morphosyntax
 - Adjectival gradation and person pronoun syncretism
 - Tense syncretism
 - Person Case Constraint & Gender Case Constraint
 - Omnivorous number
- 3 Monotonicity in syntax
 - Expletive negation and 3/4 splits
 - Ban against improper movement
 - Corollary: Ban against improper selection
 - Order preservation in Fox & Pesetsky (2005)
 - Freezing effects

Monotonicity

Definition (Monotonicity)

- ▶ Let **A** and **B** be two sets with orders $\leq_{\mathbf{A}}$ and $\leq_{\mathbf{B}}$, respectively.
- ▶ A function **f** from **A** to **B** is **monotonic**(ally increasing) iff

$$x \leq_{\mathbf{A}} y \Rightarrow \mathbf{f}(x) \leq_{\mathbf{B}} \mathbf{f}(y)$$

- ▶ Monotonicity is similar to **No Crossing Branches** constraint.

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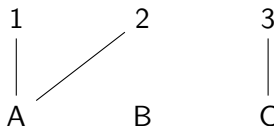
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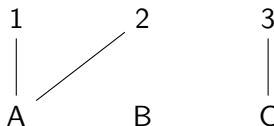
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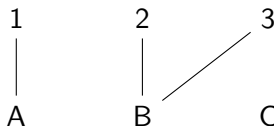
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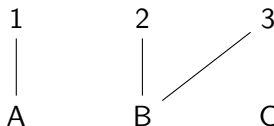
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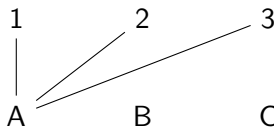
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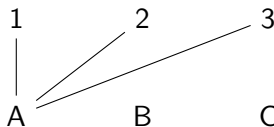
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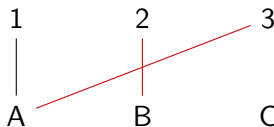
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Monotonicity as a third factor

- ▶ Why should monotonicity be a third factor? **Learnability!**
- ▶ In mathematical learning theory, monotonicity provides safe and efficient inference.
- ▶ Modeling-based work shows similar trend (Carcassi et al. 2021)
- ▶ Cognition in general shows trend towards monotonicity (Gärdenfors 2000)

*ABA as a special case of monotonicity

*ABA generalization (Bobaljik 2012)

Given an underlying hierarchy $x < y < z$,
 z cannot pattern with x to the exclusion of y .

Example

- ▶ Adjectival gradation: *good — better — goodest
- ▶ Pronoun paradigm: *I — you — I (cf. Harbour 2015)

Usually explained via

- ▶ containment (Bobaljik 2012)
- ▶ feature combinatorics (Bobaljik and Sauerland 2017)

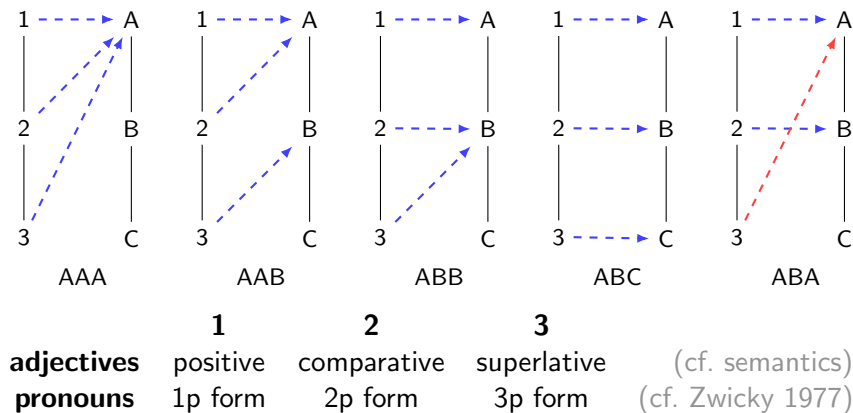
Monotonicity subsumes *ABA

- ▶ Monotonicity provides a high-level account that abstracts away from causal mechanisms.
- ▶ **General recipe** (Graf 2019)
 - 1 Identify a base hierarchy
(ideally: grounded, non-arbitrary)
 - 2 Map from hierarchy into another structure
(surface forms, well-/ill-formed, ...)
 - 3 Mapping must be monotonic

A corollary of monotonicity

- ▶ If $x \leq y \leq z$, then it cannot hold that $f(x) = f(z) \neq f(y)$.
- ▶ Hence monotonicity enforces *ABA for linear orders.

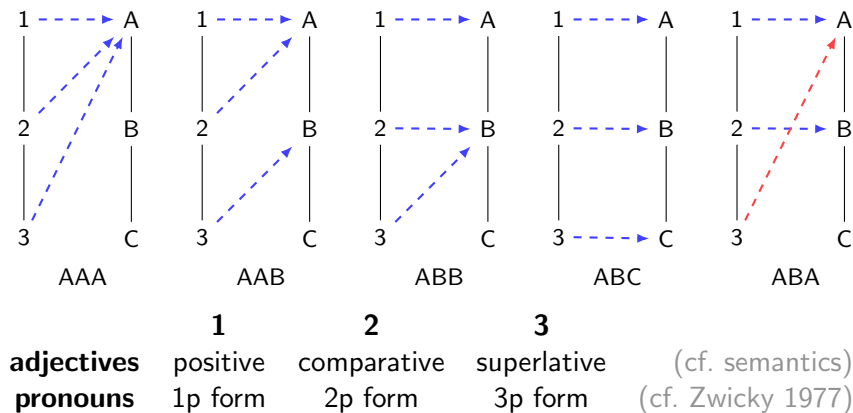
*ABA for adjectives and pronouns



What about *AAB in adjectival gradation?

Monotonicity carves out general space of options,
grammar may not be able to realize all of them.

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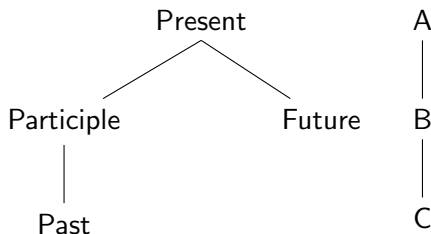
Collateral monotonicity damage in the grammar

- ▶ Suppose the mechanism's of the grammar allow us to build
 - 1 patterns AAA, ABB, ABC via mechanism X,
 - 2 patterns AAB and ABA via mechanism Y.

Mechanism X	Mechanism Y
AAA	AAB
ABB	ABA
ABC	

- ▶ Then monotonicity, by virtue discriminating against ABA, pushes the grammar away from mechanism Y.
- ▶ The AAB pattern is **collateral damage**.
- ▶ **Disclaimer:** Pure speculation; meant to show how monotonicity approach could integrate with grammar approach

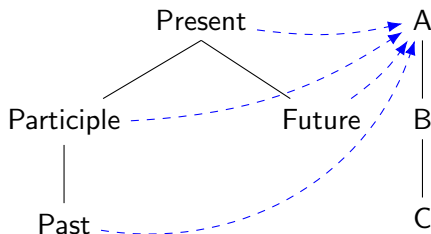
Beyond linear orders: *ABA for tense



**Sophie
Moradi**

- **Forbids:**
present = past $\neq$ participle
- **Allows:**
present = participle $\neq$ future, past
present = future $\neq$ participle = past
present $\neq$ participle = future $\neq$ past
- Hierarchy derived from Reichenbach

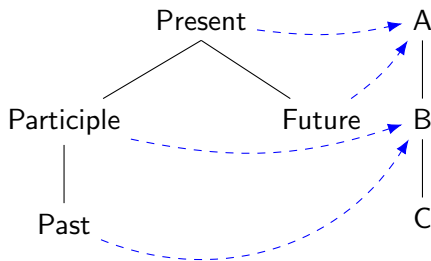
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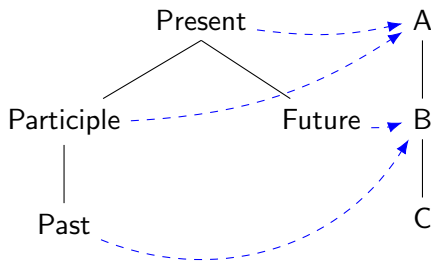
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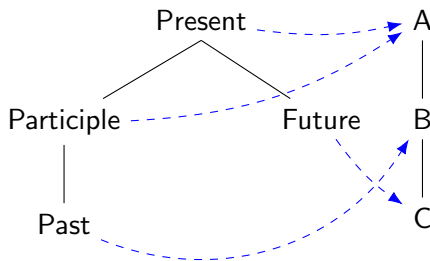
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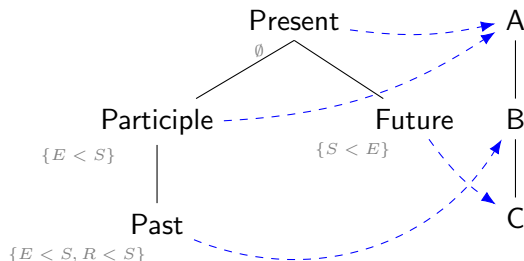
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Person Case Constraint

- ▶ Monotonicity handles the attested PCCs, too. (Graf 2019)

Example: Person Case Constraint (PCC; Bonet 1994)

The well-formedness of clitic combinations is contingent on their person specification.

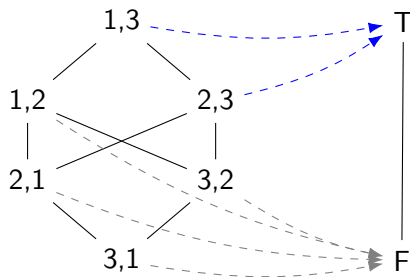
- (1) Roger *le/*me* *leur* a présenté.
Roger 3SG.ACC/1SG.ACC 3PL.DAT has shown
'Roger has shown me/him to them.'

- ▶ Out of 64 conceivable PCC variants, **only 5 are attested**.
- ▶ Monotonicity explains why.

The PCC mappings

IO↓/DO→	1	2	3
1	NA	*	✓
2	*	NA	✓
3	*	*	NA

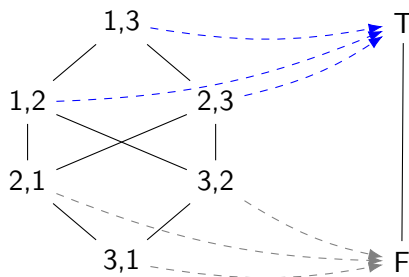
Strong PCC



The PCC mappings

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3	*	*	NA

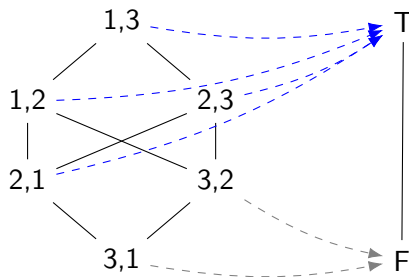
Ultrastrong PCC



The PCC mappings

IO↓/DO→	1	2	3
1	NA	✓	✓
2	✓	NA	✓
3	*	*	NA

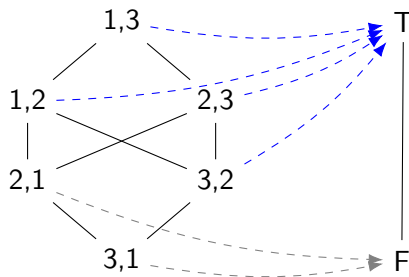
Weak PCC



The PCC mappings

IO↓/DO→	1	2	3
1	NA	✓	✓
2	*	NA	✓
3	*	✓	NA

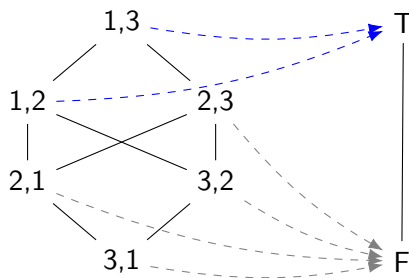
Me-first PCC



The PCC mappings

IO↓/DO→	1	2	3
1	NA	✓	✓
2	*	NA	*
3	*	*	NA

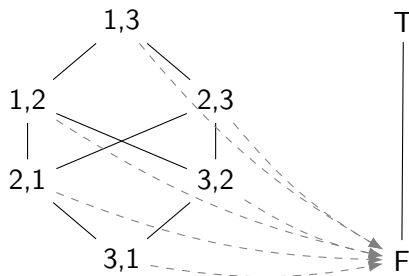
Choctaw PCC (Tyler 2017)



The PCC mappings

IO↓/DO→	1	2	3
1	NA	*	*
2	*	NA	*
3	*	*	NA

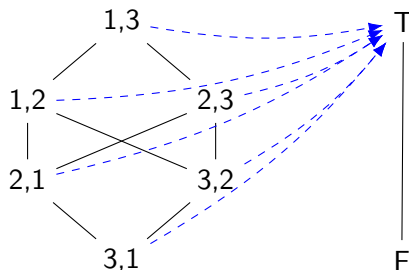
Cairene Arabic (Shlonsky 1997)



The PCC mappings

IO↓/DO→	1	2	3
1	NA	✓	✓
2	✓	NA	✓
3	✓	✓	NA

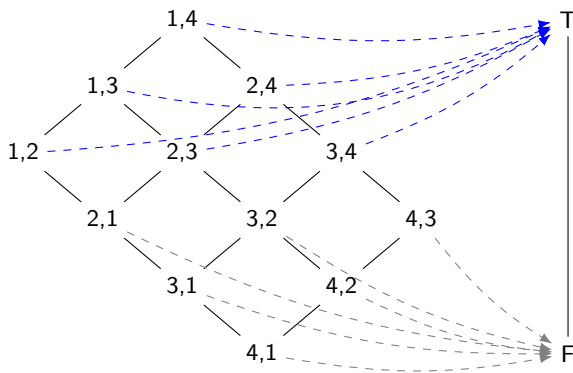
Free combination



Gender Case Constraint

IO↓/DO→	1	2	3	4
1	NA	✓	✓	✓
2	*	NA	✓	✓
3	*	*	NA	✓
4	*	*	*	NA

Zapotec GCC (Foley et al. 2017)



Interim summary

General approach

- 1 Pick an underlying hierarchy
 - 2 Map to output values (surface forms, grammaticality, ...)
 - 3 Monotonic?
- ▶ Monotonicity provides a succinct, unified description of seemingly unrelated phenomena.
 - ▶ Let's look at one more case that's odd from the standard perspective.

Omnivorous number (Nevins 2011)

- ▶ In some languages, verbs agree with **subject and object**
- ▶ Some of these languages display **omnivorous number**.

Omnivorous number: √ for agreement

If subject or object is plural, verbal agreement is plural.

S	O	V
sg	sg	sg
sg	pl	pl
pl	sg	pl
pl	pl	pl

(2) g- xedav- t
 2NDOBJ- saw- PL
 Georgian (Nevins 2011:950)

- 1 I saw y'all
- 2 We saw you
- 3 We saw y'all

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A curious typological gap...

Unattested: $\wedge$ for agreement

If subject or object is singular, verbal agreement is singular.

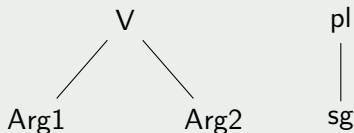
S	O	V
sg	sg	sg
sg	pl	sg
pl	sg	sg
pl	pl	pl

- Syntactic explanations of this fact exist.
- They make omnivorous number look special.

The monotonicity perspective

- ▶ both arguments must receive number before V does
- ▶ but number values of arguments are independent of each other

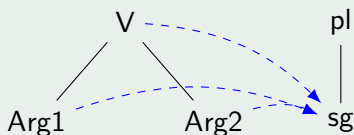
Monotonicity + agreement order = Omnivorous number



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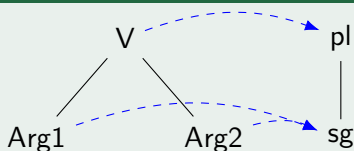


Uniform agreement

The monotonicity perspective

- ▶ both arguments must receive number before V does
- ▶ but number values of arguments are independent of each other

Monotonicity + agreement order = Omnivorous number

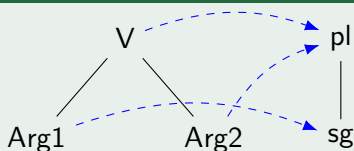


Unattested?

The monotonicity perspective

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Monotonicity + agreement order = Omnivorous number

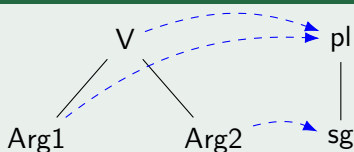


Omnivorous number

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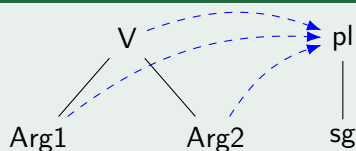


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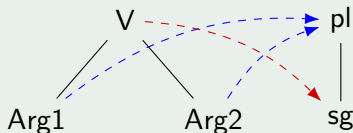
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The monotonicity perspective

- ▶ both arguments must receive number before V does
- ▶ but number values of arguments are independent of each other

Monotonicity + agreement order = Omnivorous number



Impossible

But what if...?

- ▶ We could have used the **dual** of one of those hierarchies.
- ▶ We could we have replaced monotonicity with **antitonicity**.
- ▶ Either one allows for $\wedge$ -agreement.

What this approach is about

- ▶ Correct, we could have done things differently.
- ▶ The point is not that $\vee$ -agreement is more natural than $\wedge$ -agreement.
- ▶ But monotonicity predicts that it is impossible to have both.
- ▶ Since $\vee$ -agreement exists, $\wedge$ -agreement is ruled out.

Venturing into syntax: Expletive negation and 3/4 splits

- ▶ Typology often reveals **3/4 splits**:
out of 4 conceivable options, only 3 are found.
- ▶ Those could all be instances of monotonicity.

Expletive negation

- (3) Bevor die Lage sich **nicht** entspannt, können wir
before the situation SE not improves, can we
nicht reisen.
not travel
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Languages may allow expletive negation

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Venturing into syntax: Expletive negation and 3/4 splits

- Typology often reveals **3/4 splits**:
out of 4 conceivable options, only 3 are found.
- Those could all be instances of monotonicity.

Expletive negation

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T

|

F

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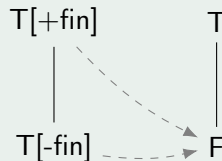
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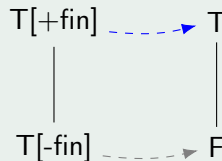
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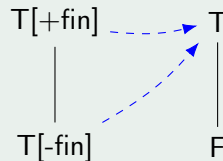
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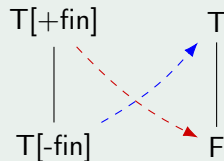
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A-movement and A'-movement

► A-movement phenomena

- (4) a. John was attacked *t*.
b. John seems *t* to have *t* cut the carrot.

► A'-movement phenomena

- (5) a. This girl, John thinks that Mary likes *t*.
b. Who does John think *t* might *t* cut the carrot?

Ban Against Improper Movement

Once a phrase undergoes A'-movement,
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(But: possible exception in Brazilian Portuguese; Kobayashi 2020)

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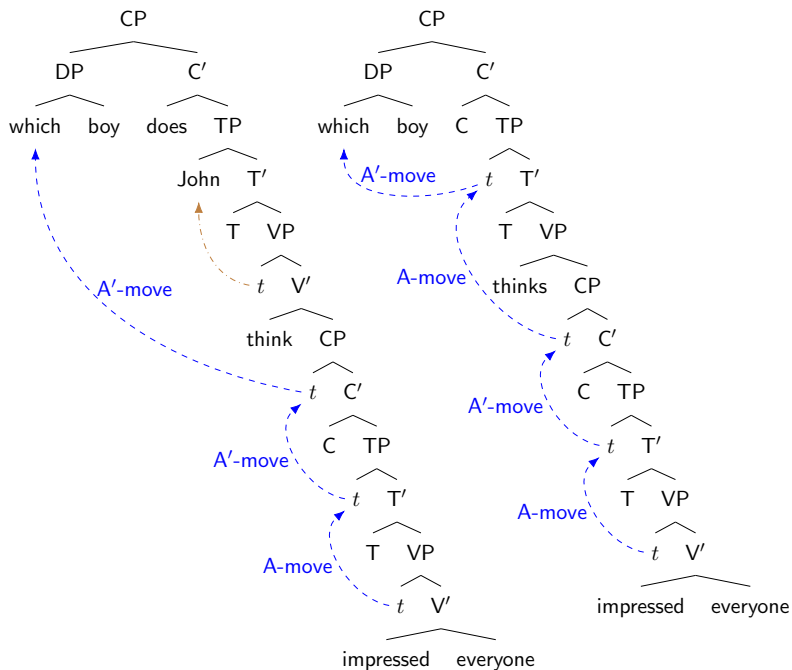
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Why should there be a ban against improper movement?

- ▶ Formalisms vary in how they derive this ban.
- ▶ They usually require extra stipulations.
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Monotonicity + locality = Ban Against Improper Movement

Locality hierarchy: A-move < A'-move

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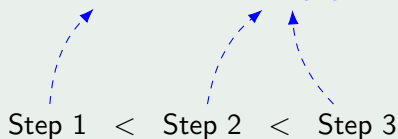
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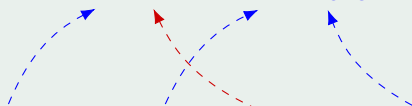
Monotonicity + locality = Ban Against Improper Movement

Locality hierarchy:

A-move < A'-move

Derivation:

Step 1 < Step 2 < Step 3 < Step 4



A welcome corollary: Ban Against Improper Selection

- ▶ Selection combines heads with their arguments.
- ▶ Selection is even more local than A-movement:

Select < A-move < A'-move

- ▶ **Corollary:**
Once a phrase undergoes any movement, it can no longer select an argument or be selected as an argument.
- ▶ This is widely considered to be the case.
(But: Late Merge of arguments; Takahashi and Hulsey 2009; Stanton 2016)

Williams Cycle

General definition (paraphrasing Williams 1974)

- ▶ Assume some fixed order $<$ of heads. For example:

$$V < v < T < C$$

- ▶ If a phrase resides in in Spec,**X**P, then it cannot move to any Spec,**Y**P such that **Y** $<$ **X**.

Monotonicity + head order = Williams Cycle

Head hierarchy: $V < v < T < C$

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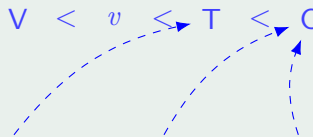
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$$\text{Step 1} < \text{Step 2} < \text{Step 3}$$



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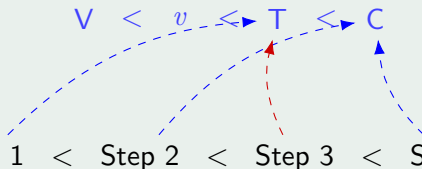
Monotonicity + head order = Williams Cycle

Head hierarchy:

$$V < v \Leftarrow T \Leftarrow C$$

Derivation:

Step 1 < Step 2 < Step 3 < Step 4



Ban Against Improper Case

A constraint on Dependent Case Theory (Poole 2018)

- ▶ Assume some fixed order $<$ of syntactic positions.
- ▶ NP in position **X** cannot license case on NP in position **Y** if there is some position **Z** such that
 - 1 **Z** occurs between **X** and **Y**, and
 - 2 **X** $<$ **Z**

Example

(6) [_{TP} John [_{vP} told [_{VP} Mary [_{CP} that [_{TP} Bill had left]]]]].

- 1 *Mary* licensed by *John*: $V < v < T$
- 2 **Bill* licensed by *Mary*: $T < C < V$

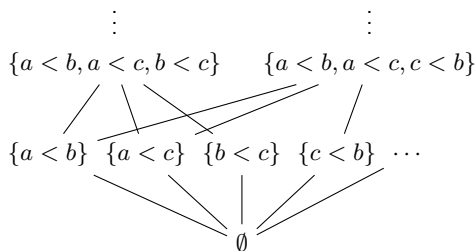
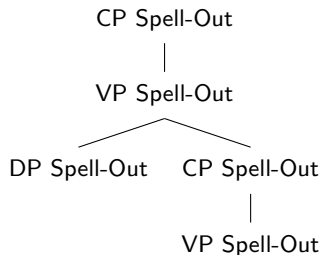
Order preservation in Fox and Pesetsky (2005)

System in a nutshell

- 1 When phase completed, determine ordering statements ($a < b$) between nodes
- 2 New ordering statements must not contradict old ones.

Formally:

Monotonic map from Spell-Outs to sets of ordering statements



Freezing effects

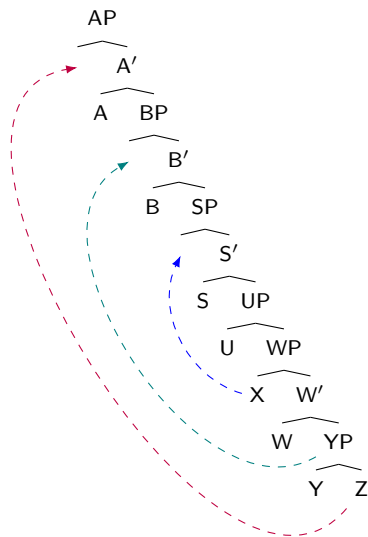
General observation

- ▶ A phrase cannot be extracted from a containing phrase that has already undergone movement.
- ▶ **But:** you can escape by moving out first.

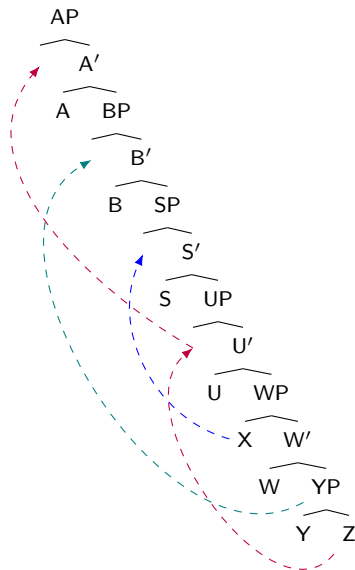
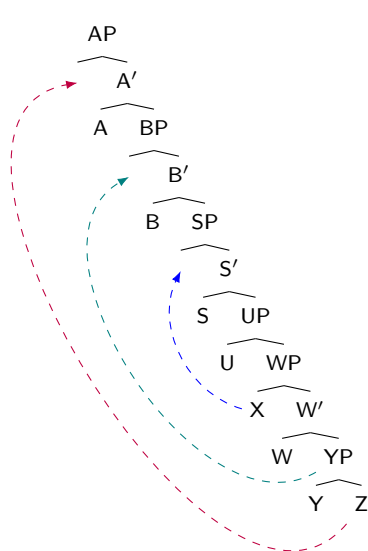
Intuitive solution

- ▶ Two phases in “life” of a head/phrase
 - 1 Merge phase
 - 2 Move phase
- ▶ Two orderings connected via monotonicity:
 - 1 relative prominence established by Merge
 - 2 relative order in which heads transition into Move phase

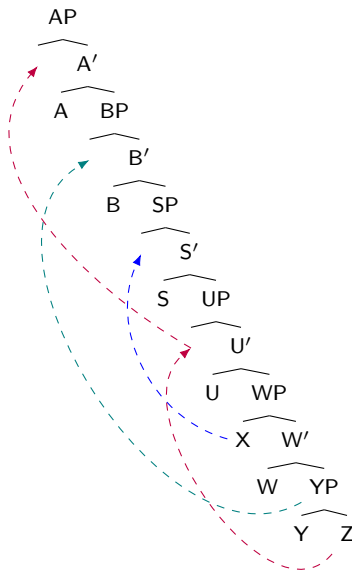
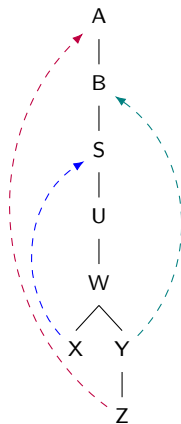
An abstract freezing example



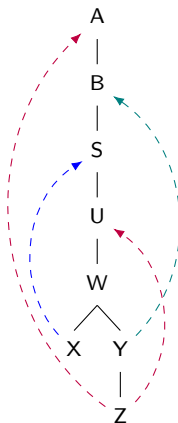
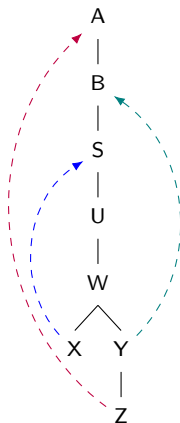
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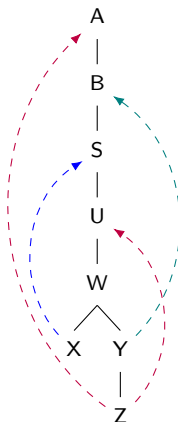
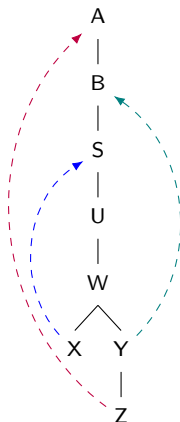
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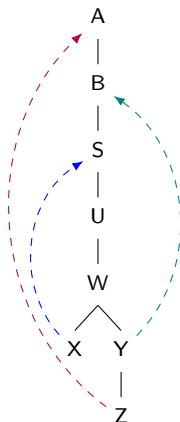


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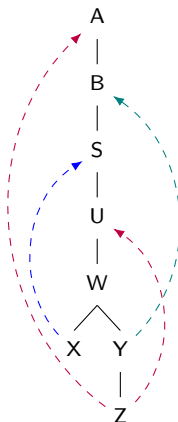


Move transition: $X < Y < Z$

An abstract freezing example



Move transition: $X < Y < Z$



Move transition: $Z < X < Y$

Monotonicity in morphology

- ▶ Adjectival gradation (Graf 2019)
- ▶ Pronoun syncretism (Graf 2019)
- ▶ Case syncretism (Graf 2019)
- ▶ Case stem syncretism (Graf 2019)
- ▶ Tense syncretism (Sophie Moradi's thesis)
- ▶ Resolved gender agreement (Sophie Moradi's thesis)
- ▶ Person-number syncretism (Sophie Moradi's thesis)
- ▶ Inverse marking (Sophie Moradi, in progress)

Monotonicity in syntax

- ▶ Ban Against Improper Movement/Selection
- ▶ Williams Cycle
- ▶ Ban Against Improper Case
- ▶ Omnivorous number
- ▶ Person Case Constraint (Graf 2019)
- ▶ Gender Case Constraint (Graf 2019)
- ▶ Adjunct Island Constraint (appendix; Graf 2013)
- ▶ Coordinate Structure Constraint (appendix)
- ▶ Keenan-Comrie hierarchy (by definition)
- ▶ Freezing effects

Conclusion

- ▶ Monotonicity goes beyond semantics
- ▶ Unified perspective on seemingly unrelated phenomena

The general approach

linguistically motivated hierarchies + monotonicity = bingo

The road ahead: From cute idea to research program

- ▶ proper theory of what is a possible hierarchy
- ▶ dealing with exceptions
- ▶ phenomena that do not care about monotonicity at all

Acknowledgments

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Appendix

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