Harmonic Grammar in phrasal movement: an account of probe competition and blocking

Brian Hsu
51st Annual Meeting of the North East Linguistic society (NELS 51)
November 8, 2020

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Organization of the talk

1. **Overview**
2. Probe competition and blocking
3. Challenges in current movement theories
4. Harmonic Grammar analysis
5. Conclusion

Two movement patterns of interest

Probe competition: A head contains multiple probes, only one of which can trigger phrasal movement in a given derivation.

Probe blocking: A probe that typically triggers movement fails to do so if it creates an illicit structure by a separate criterion.

Illustration with movement to Spec,CP in German verb-second (V2) clauses.

Two movement patterns of interest

Such patterns are challenging for Minimalist theories of Agree and movement. Specifically, it is difficult to account for:

- How the grammar *chooses* between competing grammatical structures.
- The probabilistic nature of these choices; not all grammatical options are equally likely.

Proposal preview

These patterns are best accounted for in a **constraint-based grammar** (Prince and Smolensky 1993).

- Structure is built derivationally from the bottom up (Chomsky 1993 et seq.). The output of each step is determined by constraint interaction (Heck & Müller 2013).
- Constraints are weighted, rather than strictly ranked (Harmonic Grammar; Legendre et al. 1990).
- Surface probabilities of output forms are determined by their relative harmony (Goldwater and Johnson 2000).

Organization of the talk

1. Overview
2. **Probe competition and blocking**
3. Challenges in current movement theories
4. Harmonic Grammar analysis
5. Conclusion

Probe competition in German V2

In verb-second main clauses, the first position (Spec, CP) can be filled by several types of phrase: a **(i) topic**, (ii) contrast, (iii) frame-setting adverbial, or (iv) grammatical subject.

Diesen	*Posten*	hatte	er	bis	zum	Ende	von	Cheneys	Amtszeit…
This	post	had	he	until	to.the	end	of	Cheney's	tenure

'He had this post until the end of Cheney's tenure …' (Bader 2020)

- Context: The previous sentence introduces a position held by an individual.
- These are typically *aboutness-shift topics* (Frascarelli & Hinterhölzl), distinct from the topic of the preceding clause (Rambow 1993, Bader 2020)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Probe competition in German V2

In verb-second main clauses, the first position (Spec, CP) can be filled by several types of phrase: a (i) topic, **(ii) contrast**, (iii) frame-setting adverbial, or (iv) grammatical subject.

Den Roman	*Anayurt Oteli*	veröffentlichte	er	1973	nach	einer	8-jährigen	Schaffenspause
The novel	Anayurt Oteli	published	he	1973	after	a	8-year	creation.pause

'After a break of 8 years he published the novel Anayurt Oteli in 1973.' (Bader 2020)

- Context: listing of works published by Yusuf Atılgan.

Probe competition in German V2

In verb-second main clauses, the first position (Spec, CP) can be filled by several types of phrase: a (i) topic, (ii) contrast, **(iii) frame-setting adverbial**, or (iv) grammatical subject.

Bis	*1750*	besuchte	er	fünf	Jahre	lang	die	Volksschule	des Ortes.
Until	1750	attended	he	five	years	long	the	elementary.school	of.the town

‘Ending in 1750, he went for five years to the elementary school.’ (Bader 2020)

Probe competition in German V2

In verb-second main clauses, the first position (Spec, CP) can be filled by several types of phrase: a (i) topic, (ii) contrast, (iii) frame-setting adverbial, or **(iv) grammatical subject**.

Peter Albright	wächst	in	einem	Waisenhaus	auf.
Peter Albright	grows	in	an	orphanage	up

‘Peter Albright grows up in an orphanage.’ (Bader 2020)

Key properties of the pattern

Frame-setters and subjects in first-position can be *pragmatically unmarked* – neither topics nor contrasts (Speyer 2008; Fanselow 2009).

Each type of item can occur lower in the clause when another item is in Spec, CP.

The flexibility makes it difficult to attribute all movements to a single probing feature on C (Frey 2006; Fanselow and Lenertová 2010).

Other attested cases (suggestions welcome)

Spec, TP in Finnish (Vilkuna 1995; Holmberg and Nikanne 2002; Doner 2019)

- Filled by a DP of any case or thematic role, or a referential adverb (*now*, *here*)

Spec, AspP in Gungbe (Aboh 2009)

- Filled by an object, reduplicated adverb, or gerund.

Spec, Pers/PossP in Mandarin (Hsu and Syed 2020)

- Filled by a possessor or an adnominal pronoun / proper name.

Probe competition

Speyer (2008) identifies corpus sentences where the 4 potential first-position items can be separately labeled, and notes which item is in Spec,CP.

- Preferences are *probabilistic.*
- Across conditions (combinations of available goals), results converge on a single (transitive) preference hierarchy:

  frame-setter > *contrast* > *topic* > *subject*

Probe competition

Speyer's (2008) preference hierarchy:

- *frame-setter* > ***contrast > topic > subject***

	Contrast first	Topic first	Subject first	Total
Number	20	9	3	32
Percent	63%	28%	9%	100%

Table 1: Contrast + topic (from Speyer 2008; Table 1)

Probe competition

Speyer's (2008) preference hierarchy:

- ***frame-setter*** > *contrast* > ***topic*** > ***subject***

	Frame-setter first	Topic first	Subject first	Total
Number	25	4	0	29
Percent	86%	14%	0%	100%

Table 2: Frame-setter + topic (from Speyer 2008; Table 2)

Probe competition

Speyer's (2008) preference hierarchy:

- ***frame-setter*** > ***contrast*** > *topic* > ***subject***

	Frame-setter first	Contrast first	Subject first	Total
Number	12	3	1	16
Percent	75%	19%	6%	100%

Table 3: Frame-setter + contrast (from Speyer 2008; Table 3)

Probe competition

Speyer's (2008) preference hierarchy:

- ***frame-setter*** > ***contrast*** > ***topic*** > ***subject***

	Frame-setter first	Contrast first	Topic first	Subject first	Total
Number	6	1	0	0	7
Percent	86%	14%	0%	0%	100%

Table 4: Frame-setter + contrast+ topic (Speyer 2008; Table 4)

Probe blocking

However, these general preferences are affected by other factors.

- Objects can be realized as a **d(emonstrative)-pronoun** (*den*) or **personal pronoun** (here, *ihn*).

a. Ich habe gestern einen ehemaligen Kollegen getroffen
I have yesterday a.ACC former colleague met
'I met a former colleague yesterday.'

b. *Ihn / Den* habe ich sofort wiedererkannt
Him / DEM.ACC have I immediately recognized
'Him, I recognized immediately.' (Bader & Portele 2019)

Probe blocking

However, these general preferences are affected by other factors.

- Pers. pronoun objects are rated lower (but still grammatical) in judgment tasks, even in the same context (Bader & Portele 2019)

a. Ich habe gestern einen ehemaligen Kollegen getroffen
I have yesterday a.ACC former colleague met
'I met a former colleague yesterday.'

b. *Ihn / Den* habe ich sofort wiedererkannt
Him / DEM.ACC have I immediately recognized
'Him, I recognized immediately.' (Bader & Portele 2019)

Probe blocking

A more striking asymmetry in corpus results (Bader 2020):

	D-pronoun	Personal pronoun
Object pron. in first position	76%	2%
Object pron. not in first position	24%	98%

Table 5 (from Bader 2020; Table 2.2)

- Results for sentences with subject topic pronoun *er* and a object pronoun (compatible with contrast or aboutness-shift topic reading).

Probe blocking

Although topicalized and contrasted objects can typically move to Spec, CP, the movement is *blocked* (highly unlikely, though not ungrammatical) if it would put an object personal pronoun in this position.

The blocking property (a combination of person, case features on the pronoun) is **featurally unrelated** to the probe on C (topic, contrast).

Organization of the talk

1. Overview
2. Probe competition and blocking
3. **Challenges in current movement theories**
4. Harmonic Grammar analysis
5. Conclusion

Structural assumptions

Information structure features are present in syntactic representations (Rizzi 1997; Aboh 2016; Baier & Baclawski 2020; Kratzer & Selkirk to appear; a.o.)

Further support for syntactic treatment: Other languages with V2 show different restrictions on which items can move to Spec, CP.

- Initial contrast not permitted in Swedish (Holmberg 2015).
- Intial topics not permitted in Kashmiri (Manetta 2011).

Each of these 4 items can have a dedicated positions in “relaxed” V2 languages (Hsu 2017 for an overview).

Structural assumptions

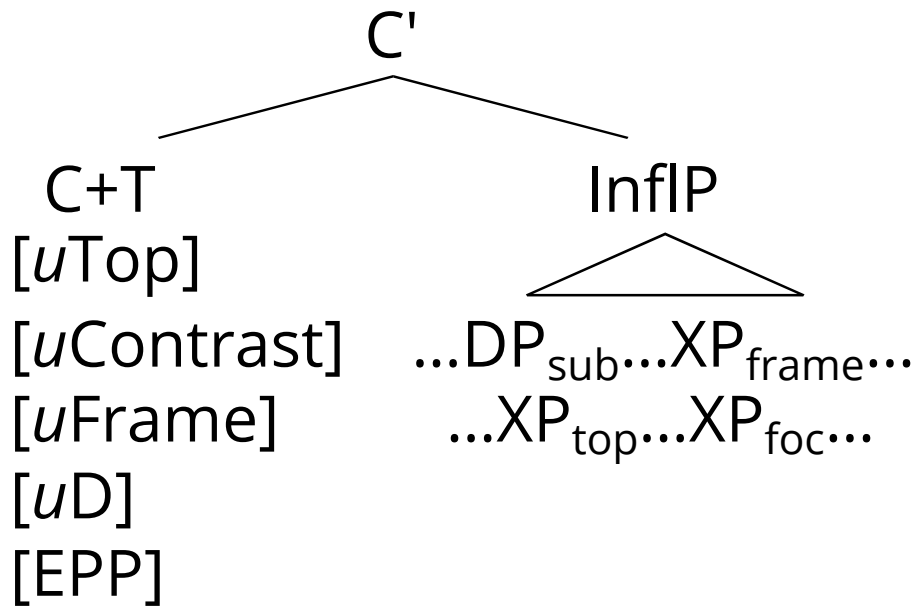
Probe competition has provided key arguments that heads and their features are parametrically split or bundled (Giorgi and Pianesi 1997; Bobaljik and Thráinsson 1998; a.o.).

Hsu (2017; 2019): In German V2, multiple left-peripheral heads (with distinct probes) are bundled in one C head.

- Each moved XP type is the goal of a corresponding probe (Rizzi 1997; Benincà and Poletto 2004).
- Probes *compete* to associate with the [EPP] property on C, which triggers phrasal movement (see also Frey 2006).

Structural assumptions

The state of the derivation immediately after T-to-C movement:



- For illustrative purposes, this figure assumes that all four goal types are present, which need not be true in a given sentence.

Accounting for choice in formal syntax

How does the grammar determine which probe wins the competition to associate with [EPP]?

C+T
[*u*Top]
[*u*Contrast]
[*u*Frame]
[*u*D]
[EPP]

- Not to be confused with *probe competition* in Oxford (2015), referring to patterns where one phrase is the goal of more than one probe.

Accounting for choice in syntax

The pattern is particularly challenging to theories where ability to trigger movement is an inherent property of probing features (i.e. *strength* in Chomsky 1993)

Probe competition requires an ad hoc stipulation that strength depends on *context* – the presence of competing probes.

Accounting for choice in syntax

Some aspects of the pattern are captured if features on C are arranged in an **ordered stack** (Lahne 2010; Manetta 2011):

- C probes are ordered in the priority with which they trigger movement: [*u*Frame]>[*u*Contrast]>[*u*Topic]>[*u*D].
- This does not account for:
  - Probabilistic nature of the preference hierarchy.
  - Differences among feature pairs in the acceptability of ordering reversals (e.g. *frame-setter* > *contrast* preference is more often maintained than *contrast* > *topic*).

Accounting for choice in syntax

No prior approach accounts for probe blocking, where [*u*Top] or [*u*Contrast] fails to move topics with personal pronoun features.

However, “do something except when …” patterns are a hallmark of *constraint-based grammars*.

Next: A Harmonic Grammar account of formal and probabilistic properties of probe competition and blocking.

Organization of the talk

1. Overview
2. Probe competition and blocking
3. Challenges in current movement theories
4. **Harmonic Grammar analysis**
5. Conclusion

Proposal

These patterns are best understood in a particular type of **constraint-based syntactic grammar**:

- Syntactic structures are built derivationally from the bottom up (Chomsky 1993, et seq.).

- *At each derivational step*, the grammar examines the existing structure, and compares output candidates that apply different syntactic operations (Heck & Müller 2013).

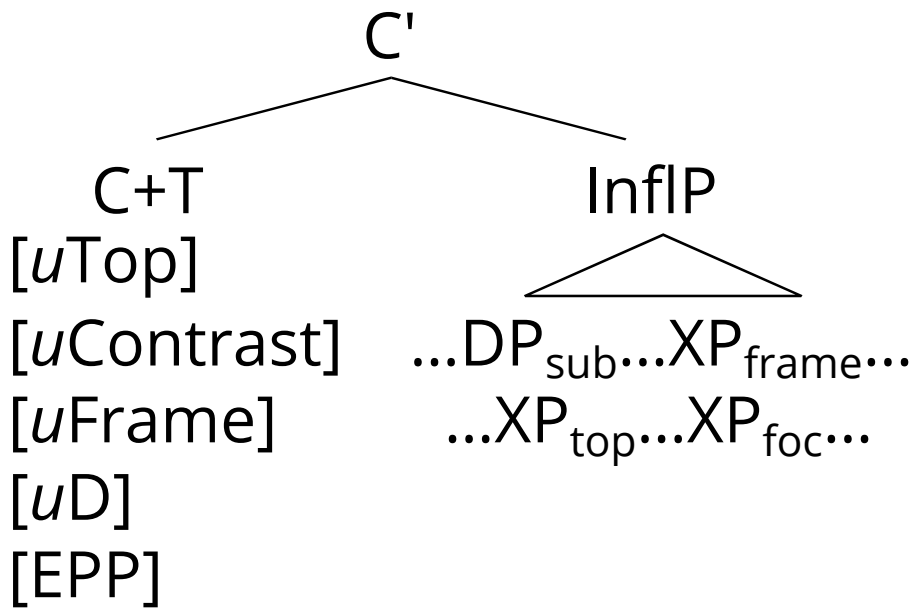
Proposal

Constraint evaluation occurs in a **Maximum Entropy Harmonic Grammar** (MaxEnt: Goldwater and Johnson 2000; Hayes and Wilson 2008):

- Constraints have numerical weights (Legendre et al. 1990), rather than strict rankings (Prince and Smolensky 1993).
- Probabilities of output types are computed from their harmony scores.
- Less well-formed candidates are not categorically banned, but *less likely to surface*.

Proposal

We restrict attention to the derivational step immediately after verb movement to C, before movement to Spec, CP.



Relevant constraint set

Phrasal movement satisfies the MERGE CONDITION constraint (Heck & Müller 2013).

I propose multiple versions of this constraint, *each indexed to a distinct probe* and weighted separately.

- MERGE CONDITION (FRAME):
  For each [*u*Frame] and XP with matching [Frame], the XP occurs in the specifier of the head with [*u*Frame].

  There is no constraint violation if no potential goal is in the structure.

Relevant constraint set

- MERGE CONDITION (CONTRAST):
  For each [*u*Con] and XP with matching [Con], the XP occurs in the specifier of the head with [*u*Con].

- MERGE CONDITION (TOPIC):
  For each [*u*Top] and XP with matching [Top], the XP occurs in the specifier of the head with [*u*Top].

- MERGE CONDITION (SUBJECT):
  For each [*u*D] and XP with matching [D], the XP occurs in the specifier of the head with [*u*D].

Relevant constraint set

The input consists of the C head with its probes.

The grammar compares output candidates with each goal type moved to Spec,CP.

- Each output candidate violates MERGE CONDITION constraints for probes with matching goals that do not move.
- Sample violation profiles for an input where all 4 goal types are present shown on next slide. Actual constraint weights to be discussed shortly.

Relevant constraint set

Constraint violation profiles of different moved goals in Spec, CP:

$[_C\ [_{InflP}...XP_{frame}...XP_{sub}...XP_{con}...XP_{top}...$	MERGE (FRAME)	MERGE (TOP)	MERGE (CON)	MERGE (SUB)
$[_{CP}\ XP_{frame}\ [_C\ [_{InflP}...$ (frame-setter first)		-1	-1	-1
$[_{CP}\ XP_{con}\ [_C\ [_{InflP}...$ (contrast first)	-1	-1		-1
$[_{CP}\ XP_{top}\ [_C\ [_{InflP}...$ (topic first)	-1		-1	-1
$[_{CP}\ XP_{subj}\ [_C\ [_{InflP}...$ (subject first)	-1	-1	-1	

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Learning constraint weights

A set of weights that accounts for the preference hierarchy was identified using the MaxEnt Grammar Tool learner (Wilson & George 2009).

- The learner is fed tableaux consisting of:
  - (i) candidate output forms
  - (ii) their constraint violation profiles
  - (iii) their frequencies.
- Concretely, the learner was given the data in each table in Speyer (2018), paired with violation profiles of all candidates.

Learning constraint weights

Constraint weights acquired by the learner:

MERGE CONDITION (FRAME-SETTER)	$w = 3.45$
MERGE CONDITION (CONTRAST)	$w = 2.10$
MERGE CONDITION (TOPIC)	$w = 1.28$
MERGE CONDITION (SUBJECT)	$w = 0.00$

- Consistent with Speyer's preference hierarchy, as expected:
  frame-setter > *contrast* > *topic* > *subject*

Learning constraint weights

These weights generate candidate probabilities that approximate the attested patterns.

On next slides:

- Tableaux showing violation profiles, harmony scores (*H*), and predicted probabilities (*P*) of output candidates.
- Corresponding tables from Speyer (2008), with attested probabilities.
- Predicted and attested frequencies shown in **bold**.

Acquired grammar corresponding to Speyer's Table 1

$[_C\ [_{InflP}...XP_{sub}...XP_{con}...XP_{top}...$	MERGE (TOP) *w*=1.28	MERGE (CON) *w*=2.01	MERGE (SUB) *w*=0	*H*	*P*
$[_{CP}\ XP_{con}\ [_C\ [_{InflP}...$ (*contrast first*)	-1		-1	-1.28	**.62**
$[_{CP}\ XP_{top}\ [_C\ [_{InflP}...$ (*topic first*)		-1	-1	-2.01	**.30**
$[_{CP}\ XP_{subj}\ [_C\ [_{InflP}...$ (*subject first*)	-1	-1		-3.29	**.08**

	Contrast first	Topic first	Subject first	Total
Number	20	9	3	32
Percent	**63%**	**28%**	**9%**	100%

Table 1: Contrast + topic (from Speyer 2008; Table 1)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Acquired grammar corresponding to Speyer's Table 2

$[_C\ [_{InflP}...XP_{sub}...XP_{frame}...XP_{top}...$	MERGE (FRAME) *w*=3.48	MERGE (TOP) *w* =1.28	MERGE (SUB) *w* =0	*H*	*P*
$[_{CP}\ XP_{con}\ [_C\ [_{InflP}...$ (*frame-setter first*)		-1	-1	-1.28	**.87**
$[_{CP}\ XP_{top}\ [_C\ [_{InflP}...$ (*topic first*)	-1		-1	-3.48	**.10**
$[_{CP}\ XP_{subj}\ [_C\ [_{InflP}...$ (*subject first*)	-1	-1		-4.68	**.03**

	Frame-setter first	Topic first	Subject first	Total
Number	25	4	0	29
Percent	**86%**	**14%**	**0%**	100%

Table 2: Frame-setter + topic (from Speyer 2008; Table 2)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Acquired grammar corresponding to Speyer's Table 3

$[_C\ [_{InflP}...XP_{sub}...XP_{frame}...XP_{con}...$	MERGE (FRAME) *w*=3.48	MERGE (CON) *w* =2.10	MERGE (SUB) *w* =0	*H*	*P*
$[_{CP}\ XP_{con}\ [_C\ [_{InflP}...$ (*frame-setter first*)		-1	-1	-2.10	**.79**
$[_{CP}\ XP_{top}\ [_C\ [_{InflP}...$ (*contrast first*)	-1		-1	-3.48	**.19**
$[_{CP}\ XP_{subj}\ [_C\ [_{InflP}...$ (*subject first*)	-1	-1		-5.58	**.02**

	Frame-setter first	Contrast first	Subject first	Total
Number	12	3	1	16
Percent	**75%**	**19%**	**6%**	100%

Table 3: Contrast+ Frame-setter (from Speyer 2008; Table 3)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Acquired grammar corresponding to Speyer's Table 4

$[_C\ [_{InflP}...XP_{frame}...XP_{sub}...XP_{con}...XP_{top}...$	MERGE (FRAME) *w*=3.45	MERGE (TOP) *w*=1.28	MERGE (CON) *w*=2.10	MERGE (SUB) *w*=0.0	*H*	*P*
$[_{CP}\ XP_{frame}\ [_C\ [_{InflP}...$ (*frame-setter first*)		-1	-1	-1	-3.3	**.72**
$[_{CP}\ XP_{con}\ [_C\ [_{InflP}...$ (*contrast first*)	-1	-1		-1	-4.73	**.17**
$[_{CP}\ XP_{top}\ [_C\ [_{InflP}...$ (*topic first*)	-1		-1	-1	-5.1	**.08**
$[_{CP}\ XP_{subj}\ [_C\ [_{InflP}...$ (*subject first*)	-1	-1	-1		-6.83	**.02**

	Frame-setter first	Contrast first	Topic first	Subject first	Total
Number	6	1	0	0	7
Percent	**86%**	**14%**	**0%**	**0%**	100%

Table 4: Frame-setter + contrast+ topic (Speyer 2008; Table 4)

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Probe blocking analysis

How do we account for the probe blocking pattern?

- In a constraint-based grammar, this can be due to a constraint or group of constraints that collectively outweigh MERGE CONDITION (TOPIC).
- However, it is not yet clear to me which well-formedness principle(s) are violated by movement of personal object pronouns, but not of demonstrative object pronouns (cf. Müller 2002). Suggestions are welcome!

Organization of the talk

1. Overview
2. Probe competition and blocking
3. Challenges in current movement theories
4. Harmonic Grammar analysis
5. **Conclusion**

Conclusion

Probe competition and probe blocking patterns support a particular application of Harmonic Grammar in syntax:

- It provides a formal explanation for how choices are made in the presence of competing *grammatical* derivational options.
- Transitive preference hierarchies, and their probabilistic nature, are accounted for in terms of regular constraint interaction.

Conclusion

Prior uses of weighted constraints to account for word order variation, with key differences:

- The constraint inventory consists of global restrictions on structure, not tied to a derivational syntactic theory.
  - Speyer (2010) : A stochastic OT account of the same pattern
- Differences in candidate harmonies account for differences in *acceptability*, rather than frequency (Linear OT; Keller 2000, 2006)

Conclusion

Probabilistic weighted constraint grammars can expand the explanatory reach of syntactic theory:

While grammar is not reducible to usage, and usage is not reducible to grammar (Newmeyer 2003), *some* aspects of usage can help resolve problems in formal theory, like probe competition.

Future directions

Probe competition may be affected by properties of candidate moved items:

- Ex. Some XPs may be better topics than others, and more likely to move.

These may be accounted for in a Gradient Harmonic Grammar, in which input structures can vary in underlying activity (Smolensky & Goldrick 2016):

- Features on goal XPs can vary in activity, ex. $[\text{TOPIC}]_{1.0}$ vs. $[\text{TOPIC}]_{0.7}$, such that less active topics incur smaller Merge Condition penalties (Lee and Müller 2018; Müller 2019; a phonological parallel in Hsu 2019)

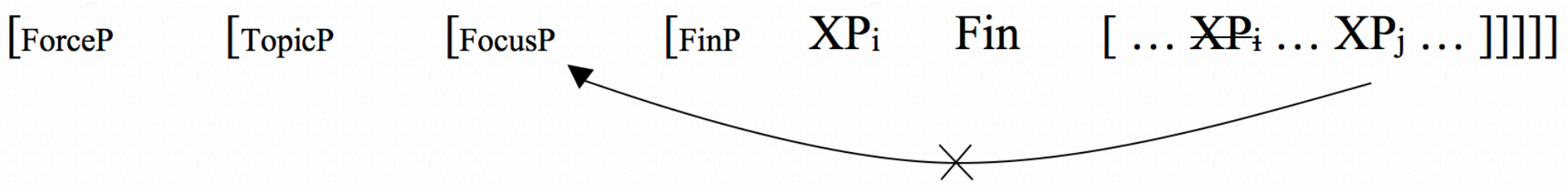
Thank you!

THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

A cartographic alternative?

The problem is not obviated in an analysis of V2 with an articulated CP structure (Rizzi 1997).

- Haegeman (1996): Left-peripheral fronting goes through the specifier of the lowest C-projection FinP.
- Once one phrase has moved, further movement through this position is blocked.

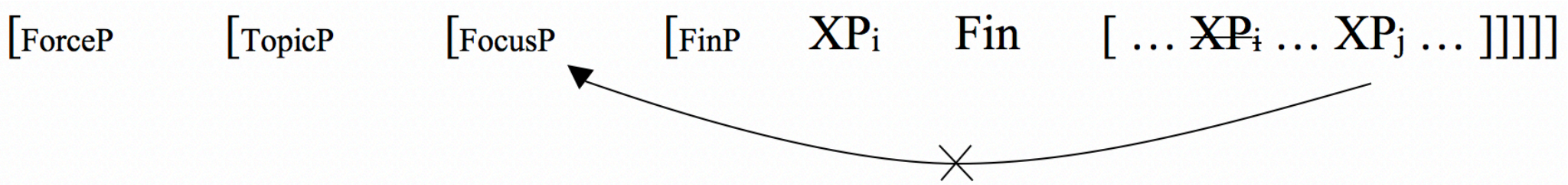


A cartographic alternative?

Here, competition occurs among the probes of distinct heads: [*u*Frame] on Force, [*u*Topic] on Topic, etc.

Assuming that structure is built from the bottom up (Chomsky 1993, et. seq), there is a **look-ahead problem**:

- The choice of which item moves to Spec,FinP is made before the higher heads with their competing probes have been Merged.



References

Aboh, Enoch Oladé. 2009. Clause Structure and Verb Series. *Linguistic Inquiry* 40.1–33.

Aboh, Enoch Oladé. 2016. Information structure: a cartographic perspective. *The Oxford Handbook of Information Structure*.

Baclawski Jr., Kenneth.; and Nico Baier. 2020. Morphological evidence for syntactic information structural features. Paper presented at Cambridge Comparative Syntax 9, September 9, 2020. Held online. https://camcos9.files.wordpress.com/2020/09/backlawskibaier.pdf

Bader, Markus. 2020. Objects in the German prefield. *Rethinking verb second*, ed. by Rebecca Woods and Sam Wolfe, 15–39. Oxford: Oxford University Press.

Bader, Markus.; and Yvonne Portele. 2019. Givenness and the licensing of object-first order in German: the effect of referential form. *Proceedings of Linguistic Evidence 2018: Experimental Data Drives Linguistic Theory*, ed. by Anja Gattnar, Robin Hörnig, Melanie Störzer, and Sam Featherston, 208–228. Tübingen: University of Tübingen.

Benincà, Paola.; and Cecilia Poletto. 2004. Topic, focus, and V2. *The Structure of CP and IP*, ed. by Luigi Rizzi, 52–75. Oxford: Oxford University Press.

References

Bobaljik, Jonathan David.; and Höskuldur Thráinsson. 1998. Two heads aren't always better than one. *Syntax* 1.37–71.

Chomsky, Noam. 1993. A minimalist program for linguistic theory. *The View from Building 20*, ed. by Kenneth Hale and Samuel Jay Keyser, 1–52. Cambridge, MA: MIT Press.

Doner, Julianne Margaret. 2019. The EPP across languages. Ph. D dissertation, University of Toronto.

Fanselow, Gisbert.; and Denisa Lenertová. 2010. Left peripheral focus: mismatches between syntax and information structure. *Natural Language & Linguistic Theory* 29.169–209. doi:10.1007/s11049-010-9109-x.

Frey, Werner. 2006. Contrast and movement to the German prefield. *The architecture of focus*, ed. by Valéria Molnár and Susanne Winkler, 235–264. Berlin: De Gruyter Mouton.

Giorgi, Alessandra.; and Fabio Pianesi. 1997. *Tense and aspect: from semantics to morphosyntax*. New York: Oxford University Press.

References

Goldwater, Sharon.; and Mark Johnson. 2003. Learning OT Constraint Rankings Using a Maximum Entropy Model. *Proceedings of the Stockholm Workshop on Variation within Optimality Theory*, ed. by Jennifer Spenader, Anders Erkisson, and Östen Dahl, 111–120. Stockholm: Department of Linguistics, Stockholm University.

Haegeman, Liliane. 1996. Verb second, the split CP, and null subjects in early Dutch finite clauses. *Geneva Generative Papers* 4.135–175.

Heck, Fabian.; and Gereon Müller. 2013. Extremely local optimization. *Linguistic derivations and filtering*, ed. by Hans Broekhuis and Ralf Vogel, 135–166. Sheffield: Equinox.

Holmberg, Anders. 2015. Verb second. *Syntax – an International Handbook of Contemporary Syntactic Research*, ed. by Tibor Kiss and Artemis Alexiadou, 342–383. Berlin: Walter de Gruyter Verlag.

Holmberg, Anders.; and Urpo Nikanne. 2002. Expletives , Subjects and Topics in Finnish. *Subjects, expletives, and the EPP*, ed. by Peter Svenonius, 1–45. Oxford: Oxford University Press.

References

Hsu, Brian. 2017. Verb second and its deviations: An argument for Feature Scattering in the left periphery. *Glossa: a journal of general linguistics* 2.35. 1–3. doi:10.1016/0025-326X(78)90261-8.

Hsu, Brian. 2019. Exceptional prosodification effects revisited in Gradient Harmonic Grammar. *Phonology* 36.225–263. doi:10.1017/S095267571900012 5.

Hsu, Brian. 2019. Coalescence: a unification of bundling operations in syntax. *Linguistic Inquiry*. Early Access. doi:https://doi.org/10.1162/ling_a_00372.

Hsu, Brian.; and Saurov Syed. 2020. Cooccurrence of nonarticle determiners as evidence for split DPs and bundled projections. *Language* 96.e114–e134.

Keller, Frank. 2010. Linear Optimality Theory as a model of gradience in grammar. *Gradience in grammar: generative perspectives*, ed. by Gisbert Fanselow, Caroline Féry, Mattias Schlesewski, Ralf Vogel, 270-287. Oxford: Oxford University Press.

Kratzer, Angelika.; and Elisabeth Selkirk. To appear. Deconstructing information structure. *Glossa*.

References

Lahne, Antje. 2010. A multiple specifier approach to left-peripheral architecture. *Linguistic Analysis* 35.73–108.

Lee, Hyunjung.; and Gereon Müller. 2018. Asymmetries in long-distance dependencies: a view from Gradient Harmonic Grammar. Paper presented at the Workshop on Long-Distance Dependencies, Humboldt-Universität zu Berlin, October 4-5. https://home.uni-leipzig.de/muellerg/idioms/asym.pdf

Legendre, Géraldine.; Yoshiro Miyata.; and Paul Smolensky. 1990. Can connectionism contribute to syntax?: Harmonic Grammar, with an application. *Proceedings of the 26th regional meeting of the Chicago Linguistic Society*, ed. by M. Ziolkowski, M. Noske, and K. Deaton, 237–252. Chicago: Chicago Linguistic Society.

Manetta, Emily. 2011. *Peripheries in Kashmiri and Hindi-Urdu: The syntax of discourse-driven movement*. Amsterdam/Philadelphia: John Benjamins.

Müller, Gereon. 2002. Harmonic alignment and the hierarchy of pronouns in German. *Pronouns – Grammar and Representation*, ed. by Horst J. Simon and Heike Wiese, 205–232. Amsterdam/Philadelphia: John Benjamins.

References

Müller, Gereon. 2019. The third construction and strength of C: a gradient harmonic grammar approach. *The sign of the V - Papers in honour of Sten Vikner*, ed. by Ken Ramshøj Christensen, Henrik Jørgensen, and Johanna L. Wood, 419–448. doi:10.7146/aul.348.107.

Newmeyer, Frederick J. 2003. Grammar Is grammar and usage Is usage. *Language* 79.682–707.

Prince, Alan.; and Paul Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms., Rutgers University & University of Colorado, Boulder. Published 2004, Malden, MA & Oxford: Blackwell.

Rambow, Owen. 1993. Pragmatic aspects of scrambling and topicalization in German: a centering approach. Paper presented at the Workshop on Centering Theory in Naturally-Occurring Discourse, IRCS, University of Pennsylvania, May 8-10.

Rizzi, Luigi. 1997. The fine structure of the left periphery. *Elements of Grammar*, ed. by Liliane Haegeman, 281–337. Dordrecht: Kluwer.

References

Smolensky, Paul.; and Matthew Goldrick. 2016. Gradient symbolic representations in grammar: the case of French liaison. Ms., Johns Hopkins University & Northwestern University. Available as ROA-1286 from the Rutgers Optimality Archive.

Speyer, Augustin. 2008. German vorfeld-filling as constraint interaction. *Constraints in discourse*, ed. by Anton Benz and Peter Kühnlein, 267–290. Amsterdam: John Benjamins.

Speyer, Augustin. 2010. Filling the German vorfeld in written and spoken discourse. *Discourses in interaction*, ed. by Sanna-Kaisa Tanskanen, Marja-Liisa Helasvuo, Marjut Johansson, and Mia Raitaniemi, 263–290. Amsterdam/Philadelphia: John Benjamins.

Vilkuna, Maria. 1995. Discourse Configurationality in Finnish. *Discourse configurational languages*, ed. by Katalin É. Kiss, 244–268.

Wilson, Colin; and Ben George. 2009. Maxent grammar tool. Software program. https://linguistics.ucla.edu/people/hayes/MaxentGrammarTool/