

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

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NELS 51, 6-8 November 2020, UQAM

**Overview** In *probe competition* patterns, a head contains multiple probes, only one of which can trigger phrasal movement in a given derivation. In *probe blocking*, a probe that typically triggers movement fails to do so if it creates an illicit output by a separate criterion. I illustrate basic properties of these patterns in movement to Spec,CP in German verb-second (V2) clauses. Although the choice and probabilistic nature of which probe “wins” to trigger movement is difficult to explain formally in current theories of Agree and movement; I argue that such patterns are successfully accounted for in a grammar where derivational steps are determined by constraint interaction (Heck & Müller 2013), and that probabilistic differences in the relative priority of probes support a grammar with weighted constraints (Harmonic Grammar; Legendre et al. 1990).

**Probe competition and blocking** In probe (1) a. [CP XP<sub>topic</sub> [C' T+C [InflP ... competition patterns, more than one type of phrase can b. [CP XP<sub>contrast</sub> [C' T+C [InflP ... potentially fill a position, but not simultaneously. In c. [CP XP<sub>frame-setter</sub> [C' T+C [InflP ... German V2 clauses, the first position (Spec,CP) can be d. [CP XP<sub>subject</sub> [C' T+C [InflP ... filled by either a (shifted) topic, contrast, frame-setting adverbial, or the subject, the latter two of which can be “pragmatically unmarked” (Speyer 2008; Fanselow 2009); when not moved to Spec,CP each item can grammatically remain lower in the clause (examples of similar patterns: Spec,TP in Finnish; Vilkuna 1995, Spec,AspP in Gungbe; Aboh 2009).

In clauses with more than one potential first-position item, *relative preferences* can be identified, but they are crucially probabilistic. I consider in depth the corpus and production studies in Speyer (2008) and Bader (2020). As an example: in German clauses with distinct contrast, topic, and subject, Speyer notes the corpus probabilities in Table 1. Across conditions, studies converge on the preference hierarchy: *frame-setter* > *contrast* > *topic* > *subject*. The hierarchy varies in languages with V2, seen in the dispreferences against initial foci in Swedish (Holmberg 2015) and topics in Kashmiri (Manetta 2011), even though these are likely universal C-probes.

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

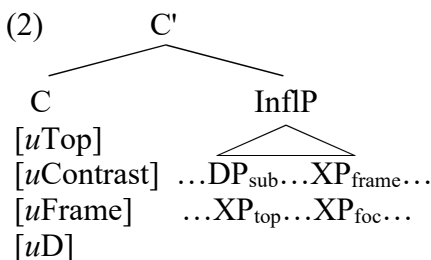
**Table 1** (from Speyer 2008; Table 1)

	Dem. pronoun	Personal pronoun
Topic pron. in first position	76%	2%
Topic pron. not in first position	24%	98%

**Table 2** (from Bader 2020; Table 2.2)

Some movements are *blocked* by independent restrictions. Despite the preference for non-subject topics to front, only demonstrative pronoun topics but not personal pronoun topics can move, even as information structure properties of other items are held constant (Table 2; Bader 2020); Topic movement is blocked if it would put a non-subject personal pronoun in Spec,CP.

**Proposal** Probe competition effects have provided key (2) arguments for theories where heads and their features are parametrically split or bundled (Giorgi & Pianesi 1997; Martinović 2015; Hsu 2020). In the German V2 example, I assume that each potential first position item (1) is first Merged within InflP, and is the goal of a corresponding probe on C (2). The choice in which probe triggers phrasal



movement is formally determined in a Maximum Entropy Harmonic Grammar (MaxEnt; Goldwater & Johnson 2003) that generates an optimal output at each step of the derivation (Heck & Müller 2013). The interaction of weighted constraints accounts for relative priority of probes and blocking patterns; probabilities of output types are computed from their harmony scores. The relevant input is structure (2) where C carries competing probes; the grammar compares output candidates with each goal type moved to Spec,CP. I assume that movement satisfies the MERGE CONDITION constraint (Heck & Müller 2013), but propose multiple versions of the constraint, indexed to distinct probes (e.g. MERGETOPIC, MERGECONTRAST) and weighted separately.

(3) MERGE CONDITION (F): For each [*uF*] and XP with matching [F], [*uF*] triggers Merge of XP.

I show that a MaxEnt learner (Hayes & Wilson 2008) with minimal assumptions acquires a set of weights that generates the attested probabilities of the probe competition patterns in Speyer (2008) and Bader (2020). Tableau (4) shows the learned weights, harmony scores (*H*), and predicted probabilities (*P*) corresponding to Speyer’s results in Table 1 (frame-setters omitted in this ex.).

(4)

[C [InflP...XP <sub>sub</sub> ...XP <sub>con</sub> ...XP <sub>top</sub> ...]	MERGETOP <i>w</i> =1.28	MERGECON <i>w</i> =2.01	MERGESUB <i>w</i> =0	<i>H</i>	<i>P</i>
[CP XP <sub>con</sub> [C [InflP... ( <i>contrast first</i> )	-1		-1	-1.28	.62
[CP XP <sub>top</sub> [C [InflP... ( <i>topic first</i> )		-1	-1	-2.01	.30
[CP XP <sub>subj</sub> [C [InflP... ( <i>subject first</i> )	-1	-1		-3.29	.08

While the exact nature of the restriction is yet uncertain, the blocking of topic movement of personal pronoun objects can be ensured by constraint(s) on pronoun placement with sufficiently higher weight than MERGETOPIC. The indexing of MERGE CONDITION constraints to individual probes allows them to be reweighted across languages, accounting for variation in languages with V2 in the items that can move to first position. Probe weights (or activities) cannot follow a universal implicational scale (Müller 2019), as it would preclude this attested variation.

**Problems in current movement theories** Probe competition patterns cast doubt on theories in which the need to trigger phrasal movement is inherent to individual probes (Chomsky 1993), as crashes are avoided only by stipulation that only one feature at a time is strong on C. Alternatively, accounts in which all probes are checked by Agree and only trigger phrasal movement by association with a separate [EPP] property (Chomsky 2000) allow the preference for a spec-head configuration of probes and goals to be violable, but they cannot alone explain differences in the relative priority of probes. Aspects of this are captured if features on C are arranged in an ordered stack (Lahne 2010; Manetta 2011), i.e. [*uFrame*] > [*uContrast*] > [*uTopic*], and C is limited to one [EPP] feature; but this does not account for variation in which probe is checked first, or differences in the acceptability of reversals in the checking of contiguous feature pairs (ex. the *frame-setter* > *contrast* preference is stricter than *contrast* > *topic*). No prior approach accounts for failure of [*uTop*] to move topics with (featurally unrelated) personal pronoun features. However, “do something except when ...” blocking patterns are a hallmark of constraint-based grammars.

**Conclusion** Probe competition and blocking patterns illustrate the power of weighted constraint grammars to solve a key problems in formal grammar – how “winners” are chosen among competing derivational options. The MaxEnt implementation expands the empirical reach of syntactic theory: probabilistic patterns bear directly on formal representations, and vice versa.

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