Linearity determines chain pronunciation

Background. There is a linearity-based asymmetry regarding movement operations: while 'leftward movement' (i.e., a configuration where the filler precedes the gap) is fairly common, what is usually called 'rightward movement' (i.e., a case where the gap precedes the filler) is restricted to a very narrow set of constructions, and displays specific properties. Given that the distribution of movement gaps is standardly determined in purely hierarchical terms (i.e., the filler must c-command its respective gaps), explaining such an asymmetry requires additional assumptions. The lack of rightward derived specifiers may be taken to follow from Kayne's (1994) *Linear Correspondence Axiom* (LCA). However, the LCA also bans base-generated rightward specifiers, which are attested in some VOS languages (cf. Chung 2006). An alternative is adopting a specific ban on rightward movement (cf. Abels & Neeleman 2012, Zeijlstra 2015), but such a restriction must be derived from independent grammatical principles.

Main proposal. We argue that the lack of (overt) 'rightward movement' follows directly from the mechanism in charge of determining the distribution of traces under *Copy Theory* (Chomsky 1993). While the general approach involves pronouncing (in the general case) the highest member of a movement chain (e.g., Nunes 2004), we advance that the relevant relation determining chain pronunciation is not *c-command*, but *precedence:* the 'leftmost' member of a chain receives phonological realization (in the general case), no matter its position in the syntactic structure; this determines that rightward derived specifiers, being the 'rightmost' members of their chains, must remain silent. We propose a fully explicit version of such a mechanism and discuss two potential counterexamples: cases of pronunciation of the tail of the chain and remnant movement.

The system. A *Late Insertion* model is adopted (cf. Halle & Marantz 1993). In this framework, pronouncing a constituent α follows from applying *Vocabulary Insertion* (VI) to the terminals of α. Following Arregi & Nevins (2012), VI is taken to apply on a (partially) linearized representation. The linearization mechanism proceeds as proposed by Embick & Noyer (2007): the operation *Lin* determines relations of immediate precedence to sister nodes by introducing a binary operator '*' (e.g., Lin[$_{XP}$ X^0 YP] produces [$_{XP}$ X^0 * YP] or [$_{XP}$ YP * X^0] as possible linearization statements). Additionally, VI is taken to apply according to speech order by complying with *Earliness* and *Last Resort*. That is, VI assigns phonological exponents "traveling" the representation "from left to right", applying "as soon as possible" and targeting every constituent that is not recoverable from an already pronounced related constituent.

Sample sentences. For a passive structure as (1), three applications of Lin determine the linearization statements (i) [$_{TP}$ John^1 * T'], (ii) [$_{T'}$ was * VP], and (iii) [$_{VP}$ arrested * John^2]. According to them, VI assigns phonological exponents first to *John^1,* then to *was*, and finally to *arrested*. It omits the 'rightmost' copy of *John*, i.e., *John^2*, because of Last Resort: there is no need to apply VI for a second time to a member of the same chain given that *John^2* is already recoverable from *John^1*. The result is summarized in (2).

(1) [$_{TP}$ John^1 [$_{T'}$ was [$_{VP}$ arrested John^2]]] *(2) John^1 < was < arrested < ~~John~~^{2}*

Serbo-Croatian is a multiple wh-fronting language: e.g., *ko šta kupuje?* 'who what buys?'. However, two identical pronouns cannot appear in the left periphery at the same time: e.g., ***šta šta uslovljava?*** 'what what conditions?' vs *šta uslovljava šta?* 'what conditions what?'. According to Bošković (2000, 2002), all these sentences have the same syntactic derivation (cf. (3)), but the latter requires pronouncing the lower copy of the object wh-pronoun to comply with a ban on adjacent homophones.

(3) [$_{CP}$ Wh$_{SUBJ}^1$ ... [$_{CP}$ Wh$_{OBJ}^1$ ... [$_{TP}$ Wh$_{SUBJ}^2$ ... [$_{VP}$ V Wh$_{OBJ}^2$]]]]

Cases where the tail of the chain gets pronounced follow mechanically from the same premises as (2). After VI applies to the subject pronoun *šta$_{SUBJ}^1$*, *šta$_{OBJ}^1$* does not receive phonological realization to avoid a PF violation caused by two adjacent homophones. The derivation continues until *šta$_{OBJ}^2$* is evaluated for pronunciation. Since it is not recoverable from other members of its chain, it receives phonological realization (cf. (4)).

(4) Šta$_{SUBJ}^1$ < ~~šta~~$_{OBJ}^1$ < ~~šta~~$_{SUBJ}^2$ < uslovljava < šta$_{OBJ}^2$

Other analyses appealing to pronunciation of low copies also involve considerations of linear adjacency (e.g., Franks 1998, Bobaljik 2002), showing that the algorithm of phonological realization of chains does apply after linear order has been computed. Algorithms determining chain pronunciation based on

hierarchical relations (e.g., "pronounce the copy without uninterpretable features") face technical complexities when implementing this kind of analysis (e.g., they require global computations).

Rightward derived specifiers are vacuous at PF. The distribution of movement gaps is classically determined in terms of c-command (cf. Chomsky 1981, i.a.). In principle, such an approach predicts that rightward derived specifiers should be available in exactly the same way as leftward derived specifiers. Still, a strong asymmetry favoring leftward specifiers is observed: many movement-based word orders attested in the left periphery of a syntactic representation do not find their corresponding mirror image in the right periphery. Since pure c-command cannot explain these patterns, these are usually taken as evidence for the LCA. On the other hand, once a linearity-based mechanism of copy pronunciation is adopted, the left-right movement asymmetry follows straightforwardly.

Kayne (1994, 2003) observes that there are no verb-penultimate languages, the hypothetical right-peripheral version of V2 languages. Under a traditional analysis (cf. den Besten 1977), V2 involves (i) movement of the inflected verb to the C head, and (ii) topicalization of an XP. Under a linearity-based approach to chain pronunciation, V2 phenomena is expected: derived copies occupy positions at the left of their original counterparts (cf. (5)), so they receive phonological representation (cf. (6)).

(5) $[_{CP}\ XP^1\ [_{C'}\ V^1{+}C\ \ldots\ [\ \ldots\ XP^2\ \ldots\ V^2]]]$ *(6)* $XP^1 < V^1{+}C < \ldots < \sout{XP^2} < \ldots < \sout{V^2}$

However, if derived specifiers are linearized to the right, the unavailability of verb-penultimate constructions is predicted: the original copies precede their c-commanding counterparts, so no overt movement can be attested at PF.

(7) $[_{CP}\ [_{C'}\ [V^1\ \ldots\ XP^1 \ldots\ ]\ V^2{+}C]\ XP^2]$ *(8)* $V^1 < \ldots < XP^1 < \ldots < \sout{V^2}{+}C < \sout{XP^2}$

Abels & Neeleman (2012) offer an alternative account of Cinque's (2005) analysis of *Universal 20*. Their proposal rejects the LCA and derives the many orderings between demonstrative, numeral, adjective and noun in the nominal domain by assuming (i) that the relative hierarchy between these elements is [Dem [Num [A [N]]]], and (ii) that all movement must target a constituent containing the noun. However, they are also obliged to adopt as an axiom a ban on rightward movement. Otherwise, their proposal derives incorrectly unattested orderings as **A-Num-Dem-N* (cf. (9a)) or **Num-A-Dem-N (cf. (10a))*. Under a linearity-based approach to chain pronunciation, such a stipulation is not necessary: both orders are ruled out as they involve pronouncing the 'rightmost' member of a movement chain (cf. (9b) and (10b)).

(9) *a. [[[[A [N]] Num] Dem] N]* *b.* $*A < \sout{N} < Num < Dem < N$

(10) *a. [[[Num [A [N]]] Dem] N]* *b.* $*A < \sout{N} < Num < Dem < N$

There is a complementary prediction that has been already explored by Fox & Nissenbaum (1999) and Fox (2002): if rightward derived specifiers are vacuous at PF, then they involve *covert movement*. These authors explore such a prediction regarding extraposition and Antecedent Contained Deletion, showing that *Quantifier Raising* can be modeled as covert rightward movement.

Remnant Movement. A potential counterexample for our approach involves cases of remnant movement. These constructions contain gap-filler dependencies that are, in principle, ruled out by a linearity-based approach to chain pronunciation. In the sentence in (11), the 'leftmost' copy of *John* is not pronounced.

(11) *... and* $[_{VP}$ *arrested* ~~*John*~~*],* *John was* $[_{VP}$ ~~*arrested John*~~*]*

We argue that this follows from cyclic linearization of syntactic structure. Particularly, we propose that the operation Lin applies on different cycles to distinct *c-command units* (cf. Uriagereka 1999). For example, Lin applies first to the main skeleton of a syntactic representation, and then to specifiers and adjuncts. Regarding (12), Lin first generates the linearization statements $[_{XP}\ VP^1 * X']$, $[_{X'}\ X^o * TP]$, $[_{TP}\ DP^1 * T']$, $[_{T'}\ T^o * VP^2]$, and $[_{VP}{}^2\ V * DP^2]$.

(12) a. $[_{XP}\ VP^1\ [_{X'}\ X^o\ [_{TP}\ DP^1\ [_{T'}\ T^o\ [_{VP}{}^2\ V\ DP^2]]]]]$

After this first cycle, Lin should now apply to specifiers. However, the specifier VP^1 does not require new applications of Lin, since its linear order has been already determined in the main cycle. Therefore, VP^1 "recycles" the linearization statements that have been already computed. According to them, DP^2 is the rightmost copy of its chain, so it should not be pronounced. Consequently, the copy of DP_2 inside VP^1 does not receive phonological representation.