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*On the Ungrammaticality of Remnant Movement  
in the Derivation of Greenberg's Universal 20*

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# Remarks and Replies

## On the Ungrammaticality of Remnant Movement in the Derivation of Greenberg's Universal 20

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We propose an analysis that derives Cinque's (2005) typology of linear orders involving a demonstrative, numeral, adjective, and noun through four Optimality Theory constraints requiring leftward alignment of these items. We show that remnant movement is ungrammatical whenever it produces universally suboptimal alignments, compared with remnant-movement-free structures. Any movement is permitted, but only the best alignment configurations surface as grammatical. We also show that Cinque's original analysis must encode the structural derivations of all attested orders as parametric values of the associated languages. Our analysis need not make similar structural stipulations, as the different attested structures emerge from constraint reranking.

*Keywords:* DP, NP, remnant movement, Universal 20, harmonic bounding

### 1 Introduction

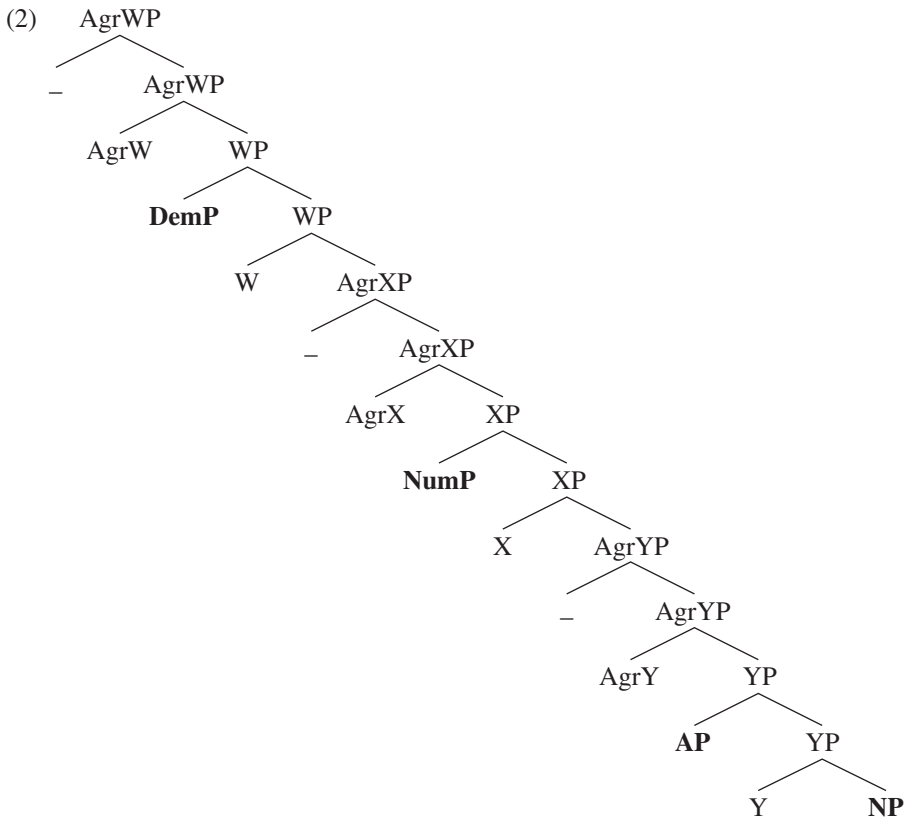
As Cinque (2005) shows, of the 24 conceivable linear orders involving a demonstrative (Dem), a numeral (Num), an adjective (A), and a noun (N), only 14 are attested. The remaining 10 appear to be universally ungrammatical. The 24 orders are listed in (1) under the same letter indices used by Cinque. Unattested orders are marked with a star.

- (1) a. Dem - Num - A - N                    \*e. Num - Dem - A - N  
b. Dem - Num - N - A                    \*f. Num - Dem - N - A  
c. Dem - N - Num - A                    \*g. Num - N - Dem - A  
d. N - Dem - Num - A                    \*h. N - Num - Dem - A

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- |                       |                       |
|-----------------------|-----------------------|
| *i. A - Dem - Num - N | *m. Dem - A - Num - N |
| *j. A - Dem - N - Num | n. Dem - A - N - Num  |
| k. A - N - Dem - Num  | o. Dem - N - A - Num  |
| l. N - A - Dem - Num  | p. N - Dem - A - Num  |
| *q. Num - A - Dem - N | *u. A - Num - Dem - N |
| r. Num - A - N - Dem  | *v. A - Num - N - Dem |
| s. Num - N - A - Dem  | w. A - N - Num - Dem  |
| t. N - Num - A - Dem  | x. N - A - Num - Dem  |

We propose a new analysis that derives Cinque's typology from the interaction of four universal constraints requiring alignment of NP, AP, NumP, and DemP with the left edge of the top projection AgrWP in Cinque's universal base-generated structure (2) (landing positions in Spec,Agr<sub>W</sub>, Spec,Agr<sub>X</sub>, and Spec,Agr<sub>Y</sub> are represented as “-”). Since no more than one phrase can occur in Spec,Agr<sub>W</sub>, the constraints conflict with each other. We show that the attested word orders coincide with the best possible left-alignment configurations that can be built by freely moving constituents containing NP or its traces. All the unattested orders, in turn, coincide with structures showing suboptimal alignment.



Crucially, the new analysis need not stipulate a ban on remnant movement, as is the case in Cinque's (2005) analysis and the related analysis proposed by Abels and Neeleman (2006). As we show in section 2, a ban on remnant movement is unnecessary because remnant movement in the relevant derivations produces alignment configurations that are inevitably suboptimal, and hence universally ungrammatical. Furthermore, it is incorrect to place a ban on remnant movement, since remnant movement can yield optimal configurations, and hence attested orders, under specific structural circumstances explained later.

In section 3, we also show that Cinque's original analysis, while extremely useful and informative, cannot actually account for some of the attested orders, either because they turn out to require contradictory parametric values, or because they cannot be derived under the specific assumptions proposed to exclude remnant movement. We also examine in detail the parametric values underlying Cinque's analysis, showing that they provide an exhaustive description of the movement operations involved in the derivation of each attested order. In other words, each derivation is described in the parametric values of the associated language. In contrast, our analysis contains no primitives stipulating—or in any other way referring to—the necessary derivational steps, letting them emerge from the interaction of the proposed constraints.

## 2 Optimal Alignment Blocking Remnant Movement

We start our discussion in section 2.1 by considering the structural representations for the word orders in Cinque's typology. We present the analysis proper in sections 2.2–2.4, explaining how the proposed alignment constraints determine which structures (and corresponding orders) are optimal, and hence grammatical, and which are suboptimal, and therefore universally ungrammatical. Finally, in section 2.5 we extend the analysis to additional conceivable representations of the orders, and we consider some related predictions.

### 2.1 *Conceivable Word Orders and Their Structural Representation*

Like Cinque (2005), we consider only structures that can be built from structure (2) by moving constituents containing either NP or silent copies of NP.<sup>1</sup> For reasons of space, we represent NP copies as  $t_{NP}$  while still adopting Chomsky's (1995) copy theory of movement. To keep the analysis comparable with Cinque 2005, we also disallow structures with Comp-to-Spec movement within the same projection.

These assumptions exclude structures where AP, NumP, or DemP raises on its own, much as in Cinque 2005.<sup>2</sup> Unlike in Cinque's analysis, however, they allow for remnant movement,

<sup>1</sup> For an analysis deriving this assumption, see Georgi and Müller 2008. For the possibility that N might raise as a head, see Dehé and Samek-Lodovici 2009 and references therein. Here, to facilitate a comparison with Cinque 2005, we maintain that the entire NP moves, but the proposed analysis does not hinge on this assumption and remains valid even under N-raising.

<sup>2</sup> As an anonymous reviewer points out, the assumption that DemP, NumP, and AP do not move on their own would be unnecessary if these projections formed the main spine of the tree, replacing WP, XP, and YP. Phrasal movement of any of them would then necessarily involve movement of their complement too, as required.

that is, movement of constituents containing silent NP copies. For example, they allow for structure (3), with NP raised to Spec,Agr<sub>Y</sub>, followed by remnant movement of [<sub>YP</sub> AP t<sub>NP</sub>] to Spec,Agr<sub>X</sub>, yielding order *m*, ‘Dem A Num N’. Its unattested status will follow from the alignment properties of structure (3) rather than from a ban on the movement operations involved. (Moved constituents are shown in italics. Sets of closed square brackets at the end of the structure are henceforth represented as ‘:]’)

- (3) [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> [<sub>YP</sub> *AP* Y t<sub>NP</sub>]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** X  
[<sub>AgrYP</sub> *NP* AGR<sub>Y</sub> t<sub>YP</sub>]]]

We also maintain that phrases raise to higher positions through a single movement rather than a series of successive steps. For example, the structure for order *d*, ‘N Dem Num A’, is (4), with no intermediate t<sub>NP</sub> copies, rather than (5), where NP moves through the intermediate Spec, Agr<sub>Y</sub> and Spec,Agr<sub>X</sub>. Favoring movement lacking intermediate copies is a property of the analysis and will be discussed in more detail in section 2.5.

- (4) [<sub>AgrWP</sub> *NP* AGR<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> – AGR<sub>X</sub> [<sub>XP</sub> **NumP** X [<sub>AgrYP</sub> –  
AGR<sub>Y</sub> [<sub>YP</sub> *AP* Y t<sub>NP</sub>]]]]]
- (5) [<sub>AgrWP</sub> *NP* AGR<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> t<sub>NP</sub> AGR<sub>X</sub> [<sub>XP</sub> **NumP** X [<sub>AgrYP</sub> t<sub>NP</sub>  
AGR<sub>Y</sub> [<sub>YP</sub> *AP* Y t<sub>NP</sub>]]]]]

Whenever an order can be obtained by raising either an AgrP projection or its WP, XP, or YP complement, what raises is the complement. For example, order *n*, ‘Dem A N Num’, can be derived by raising either AgrYP or its YP complement to Spec,Agr<sub>X</sub>; see (6) and (7). The assumed representation is (7), raising YP. In section 2.5, we show that both structures perform equally well and the analysis need not distinguish between them.

- (6) [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> [<sub>AgrYP</sub> – AGR<sub>Y</sub> [<sub>YP</sub> *AP* Y *NP*]]] AGR<sub>X</sub>  
[<sub>XP</sub> **NumP** X t<sub>AgrYP</sub>]]]
- (7) [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> [<sub>YP</sub> *AP* Y *NP*]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** X  
[<sub>AgrYP</sub> – AGR<sub>Y</sub> t<sub>YP</sub>]]]

We may now consider what structures can be built from Cinque’s base-generated structure under these assumptions. Their number is constrained by the few landing positions that can be targeted by movement. Assuming absence of multiple specifiers, as in Cinque 2005 and Kayne 1994:22, these are limited to Spec,Agr<sub>W</sub>, Spec,Agr<sub>X</sub>, and Spec,Agr<sub>Y</sub>, excluding any structure involving more than three movement operations. All logically possible structures consistent with the above assumptions are listed in (8) with the corresponding word order letter in the first column and a short summary of the necessary derivational steps in the last column. *A<sub>W</sub>*, *A<sub>X</sub>*, and *A<sub>Y</sub>* stand for *Spec,Agr<sub>W</sub>*, *Spec,Agr<sub>X</sub>*, and *Spec,Agr<sub>Y</sub>*, respectively.

(8) *Word orders and corresponding structures*

a.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	<b>NP</b> ]	No movement				
b.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	tNP]]	NP>A <sub>Y</sub>				
c.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	<b>NP</b>	[AgrXP	x	[AgrYP	[YP	<b>AP</b>	Y	tNP]]	NP>A <sub>X</sub>				
d.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	tNP]]	NP>A <sub>w</sub>				
*e.	[AgrWP	[XP	<b>NumP</b>	x	[AgrYP	tYP]]	[WP	<b>DemP</b>	w	[AgrXP	[YP	<b>AP</b>	Y	<b>NP</b> ]	tXP]]	YP>A <sub>X</sub> , XP>A <sub>w</sub>		
*f.	[AgrWP	[XP	<b>NumP</b>	x	tAgrYP	]	[WP	<b>DemP</b>	w	[AgrXP	[AgrYP	<b>NP</b>	[YP	<b>AP</b>	Y	tNP]]	tXP]]	AgrYP>A <sub>X</sub> , XP>A <sub>w</sub> , NP>A <sub>Y</sub>
*g.	[AgrWP	[XP	<b>NumP</b>	x	[AgrYP	<b>NP</b>	tYP]]	[WP	<b>DemP</b>	w	[AgrXP	[YP	<b>AP</b>	Y	tNP]	tXP]]	NP>A <sub>Y</sub> , YP>A <sub>X</sub> , XP>A <sub>w</sub>	
*i.	[AgrWP	[YP	<b>AP</b>	Y	tNP]	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	[AgrYP	<b>NP</b>	tYP]]	NP>A <sub>Y</sub> , YP>A <sub>w</sub>		
*j.	[AgrWP	[YP	<b>AP</b>	Y	tNP]	[WP	<b>DemP</b>	w	[AgrXP	<b>NP</b>	[AgrXP	x	[AgrYP	tYP]]	NP>A <sub>X</sub> , YP>A <sub>w</sub>			
k.	[AgrWP	[YP	<b>AP</b>	Y	<b>NP</b> ]	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	[AgrYP	tYP]]	YP>A <sub>w</sub>			
l.	[AgrWP	[AgrYP	<b>NP</b>	[YP	<b>AP</b>	Y	tNP]]	[WP	<b>DemP</b>	w	[AgrXP	[XP	<b>NumP</b>	x	tAgrYP	]	NP>A <sub>Y</sub> , AgrYP>A <sub>w</sub>	
*m.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[YP	<b>AP</b>	Y	tNP]	[XP	<b>NumP</b>	x	[AgrYP	<b>NP</b>	tYP]]	NP>A <sub>Y</sub> , YP>A <sub>X</sub>		
n.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[YP	<b>AP</b>	Y	<b>NP</b> ]	[XP	<b>NumP</b>	x	[AgrYP	tYP]]	YP>A <sub>X</sub>			
o.	[AgrWP	[WP	<b>DemP</b>	w	[AgrXP	[AgrYP	<b>NP</b>	[YP	<b>AP</b>	Y	tNP]]]	[XP	<b>NumP</b>	x	tAgrYP	]	NP>A <sub>Y</sub> , AgrYP>A <sub>X</sub>	
p.	[AgrWP	<b>NP</b>	[WP	<b>DemP</b>	w	[AgrXP	[YP	<b>AP</b>	Y	tNP]	[XP	<b>NumP</b>	x	[AgrYP	tYP]]	NP>A <sub>w</sub> , YP>A <sub>X</sub>		
*q.	[AgrWP	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	tNP]]]	[WP	<b>DemP</b>	w	[AgrXP	<b>NP</b>	tXP]]	NP>A <sub>X</sub> , XP>A <sub>w</sub>		
r.	[AgrWP	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	<b>NP</b> ]]]	[WP	<b>DemP</b>	w	[AgrXP	tXP]]	XP>A <sub>w</sub>			
s.	[AgrWP	[XP	<b>NumP</b>	x	[AgrYP	<b>NP</b>	[YP	<b>AP</b>	Y	tNP]]]	[WP	<b>DemP</b>	w	[AgrXP	tXP]]	NP>A <sub>Y</sub> , XP>A <sub>w</sub>		
t.	[AgrWP	[AgrXP	<b>NP</b>	[XP	<b>NumP</b>	x	[AgrYP	[YP	<b>AP</b>	Y	tNP]]]]]	[WP	<b>DemP</b>	w	tAgrXP	]	NP>A <sub>X</sub> , AgrXP>A <sub>w</sub>	
*v.	[AgrWP	[AgrXP	[YP	<b>AP</b>	Y	tNP]	[XP	<b>NumP</b>	x	[AgrYP	<b>NP</b>	tYP]]]]]	[WP	<b>DemP</b>	w	tAgrXP]]	NP>A <sub>Y</sub> , YP>A <sub>X</sub> , AgrXP>A <sub>w</sub>	
w.	[AgrWP	[AgrXP	[YP	<b>AP</b>	Y	<b>NP</b> ]	[XP	<b>NumP</b>	x	[AgrYP	tYP]]]]]	[WP	<b>DemP</b>	w	tAgrXP]]	YP>A <sub>X</sub> , AgrXP>A <sub>w</sub>		
x.	[AgrWP	[AgrXP	[AgrYP	<b>NP</b>	[YP	<b>AP</b>	Y	tNP]]]	[XP	<b>NumP</b>	x	tAgrYP	]	[WP	<b>DemP</b>	w	tAgrXP]]	AgrYP>A <sub>X</sub> , AgrXP>A <sub>w</sub> , NP>A <sub>Y</sub>

Consider, for example, how the structures for the first seven orders are obtained. Order *a* leaves NP in situ. Orders *b–d* move NP to Spec,Agr<sub>Y</sub>, Spec,Agr<sub>X</sub>, and Spec,Agr<sub>W</sub>, respectively. Order *e* is obtained when NP remains in situ, YP moves to Spec,Agr<sub>X</sub>, and XP moves to Spec,Agr<sub>W</sub>. Order *f* moves AgrYP to Spec,Agr<sub>X</sub>, then the remnant XP moves to Spec,Agr<sub>W</sub>, and finally NP moves to Spec,Agr<sub>Y</sub>.<sup>3</sup> Order *g* moves NP to Spec,Agr<sub>Y</sub>, the remnant YP to Spec,Agr<sub>X</sub>, and XP containing NumP and NP to Spec,Agr<sub>W</sub>.

Orders *h* and *u* lack a representation because none is possible. For example, order *h*, ‘N Num Dem A’, requires raising NP to Spec,Agr<sub>X</sub>, to precede NumP, and then AgrXP, containing NP and NumP, to Spec,Agr<sub>W</sub>, so that NP and NumP precede DemP. This, however, makes it impossible to strand AP lower than DemP; there is no possible position for it, since AgrXP has been raised. Similar considerations apply to *u*.<sup>4</sup>

The structures for all the other orders are determined in a similar fashion. The structures listed in (8) are the only ones that match each order while adhering to the assumptions spelled out above.

## 2.2 Deriving Cinque’s Typology

Following studies on the relevance of alignment in phonology and syntax (e.g., McCarthy and Prince 1993, Choi 1996, 1999, Legendre 1996, Samek-Lodovici 1996, 1998, 2001, Costa 1998, Grimshaw 2001a,b, Sells 2001, Gerlach 2002), we propose that movement in the above structures is governed by the constraints in (9), which favor alignment of NP, AP, NumP, and DemP with the left edge of AgrWP (possibly coinciding with the extended projection of N; see Grimshaw 1991, 2000). Their definition is based on McCarthy and Prince’s (1993) theory of generalized alignment.

### (9) Alignment constraints

- a. *N-L* – Align(NP, L, AgrWP, L)  
Align NP’s left edge with AgrWP’s left edge.
- b. *A-L* – Align(AP, L, AgrWP, L)  
Align AP’s left edge with AgrWP’s left edge.
- c. *NUM-L* – Align(NumP, L, AgrWP, L)  
Align NumP’s left edge with AgrWP’s left edge.
- d. *DEM-L* – Align(DemP, L, AgrWP, L)  
Align DemP’s left edge with AgrWP’s left edge.

<sup>3</sup> The structure for *f* must raise AgrYP rather than YP because the raising phrase pied-pipes the NP in Spec,Agr<sub>Y</sub>. Whenever a structure in (8) shows movement of an AgrP projection, it is because its specifier is filled and pied-piped along with the raising AgrP.

<sup>4</sup> Cinque (2005:321–324) accounts for all unattested orders, *h* and *u* included, by showing that they cannot be built from the initial structure without resorting to remnant movement. Allowing for remnant movement, as we do, uncovers a fundamental difference between *h* and *u*—which lack a corresponding structure—and the other unattested orders, which can be built but are never grammatical, as explained later.

The constraints apply to the head of a chain and are violated once for every instance of DemP, NumP, AP, or NP—silent copies included—that intervenes between the chain’s head and the left edge of AgrWP. Consider, for example, structure (10) for the unattested order *m*. The constraint N-L is assessed on the head of the NP chain (namely, the overt NP), and it is violated four times because of the intervening DemP, AP,  $t_{NP}$ , and NumP. As we will show, counting  $t_{NP}$  as an alignment violation is crucial to derive the ungrammatical status of remnant movement. This shows that the constraints have a syntactic nature, since they are sensitive to the presence of syntactic structure independently of its overt or silent phonological status.

(10) \**m*. [<sub>AgrWP</sub> – [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>YP</sub> **AP** Y  $t_{NP}$ ] [<sub>XP</sub> **NumP** x [<sub>AgrYP</sub> **NP**  $t_{YP}$ ]]

Tableau 1 in (11) on page 452 shows the constraint violations for all the structures in (8). For reasons of space, all heads have been omitted, and phrasal suffixes are reduced to a subscript so that *ZP* becomes *Z<sub>P</sub>*. Constraint violations are represented as stars and are generally easily determined by counting the items blocking alignment in each structure. The six structures for *e–g* and *v–x* show copies of YP or AgrYP. Being copies, they contain silent copies of AP and NP and hence cause two additional alignment violations on any following overt instance of DemP, NumP, AP, or NP. For example, in *e* the copy  $t_{YP}$  adds two violations to DEM-L, A-L, and N-L.

As the tableau shows, the structures corresponding to unattested orders are *harmonic bounded* (henceforth *h-bounded*)—that is, beaten by some competing structure across all constraint rankings because they perform worse on some constraints and do not perform better on any (Prince and Smolensky 1993, 2004, Samek-Lodovici and Prince 1999, 2002). Their h-bounded status is signaled by the symbol ‘ $\otimes$ ,’ followed by the letter for one of the structures harmonically bounding them. For example, structure *m*, repeated in (12), is h-bounded by structure *n*, shown in (13). The two structures violate DEM-L, NUM-L, and A-L equally, being equally effective in aligning DemP, NumP, and AP; crucially, though, *n* incurs fewer violations of N-L, reflecting its better alignment of NP. Consequently, *n* is preferred to *m* under every possible constraint ranking, ensuring that *m* is never optimal, hence is never grammatical, hence is unattested.

(12) \**m*. [<sub>AgrWP</sub> – [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>YP</sub> **AP** Y  $t_{NP}$ ] [<sub>XP</sub> **NumP** x [<sub>AgrYP</sub> **NP**  $t_{YP}$ ]]

(13) *n*. [<sub>AgrWP</sub> – [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>YP</sub> **AP** Y **NP**] [<sub>XP</sub> **NumP** x [<sub>AgrYP</sub> –  $t_{YP}$ ]]



(11) *Tableau 1*

	DEM-L	NUM-L	A-L	N-L
a. [ [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ]]]]		*	**	***
b. [ [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]]]		*	***	**
c. [ [WP <b>Dem<sub>P</sub></b> [ <b>N<sub>P</sub></b> [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]]]		**	***	*
d. [ <b>N<sub>P</sub></b> [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]]]	*	**	***	
⊗ r. *e. [[XP <b>Num<sub>P</sub></b> [ t <sub>YP</sub> ]] [WP <b>Dem<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ] t <sub>XP</sub> ]]	***		****	*****
⊗ r. *f. [[XP <b>Num<sub>P</sub></b> t <sub>Ag<sub>YP</sub></sub> ]] [WP <b>Dem<sub>P</sub></b> [[Ag <sub>YP</sub> <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] t <sub>XP</sub> ]]	***		*****	****
⊗ s. *g. [[XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> t <sub>YP</sub> ]]] [WP <b>Dem<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] t <sub>XP</sub> ]]	****		*****	*
⊗ k. *i. [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> t <sub>YP</sub> ]]]]	**	***		****
⊗ k. *j. [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] [WP <b>Dem<sub>P</sub></b> [ <b>N<sub>P</sub></b> [XP <b>Num<sub>P</sub></b> [ t <sub>YP</sub> ]]]]	**	****		***
k. [ [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ] [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> [ t <sub>YP</sub> ]]]]	**	***		*
l. [[Ag <sub>YP</sub> <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] [WP <b>Dem<sub>P</sub></b> [ [XP <b>Num<sub>P</sub></b> t <sub>Ag<sub>YP</sub></sub> ]]]	***	****	*	
⊗ n. *m. [ [WP <b>Dem<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] [XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> t <sub>YP</sub> ]]]]		***	*	****
n. [ [WP <b>Dem<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ] [XP <b>Num<sub>P</sub></b> [ t <sub>YP</sub> ]]]]		***	*	**
o. [ [WP <b>Dem<sub>P</sub></b> [[Ag <sub>YP</sub> <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] [XP <b>Num<sub>P</sub></b> t <sub>Ag<sub>YP</sub></sub> ]]]		****	**	*
p. [ <b>N<sub>P</sub></b> [WP <b>Dem<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] [XP <b>Num<sub>P</sub></b> [ t <sub>YP</sub> ]]]]	*	****	**	
⊗ r. *q. [ [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] [WP <b>Dem<sub>P</sub></b> [ <b>N<sub>P</sub></b> t <sub>XP</sub> ]]	***		*	****
r. [ [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub>]]] [WP <b>Dem<sub>P</sub></b> [ t<sub>XP</sub>]]</b>	***		*	**
s. [ [XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] [WP <b>Dem<sub>P</sub></b> [ t <sub>XP</sub> ]]	****		**	*
t. [[Ag <sub>XP</sub> <b>N<sub>P</sub></b> [XP <b>Num<sub>P</sub></b> [ [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]]]] [WP <b>Dem<sub>P</sub></b> t <sub>Ag<sub>XP</sub></sub> ]]	****	*	**	
⊗ w. *v. [[Ag <sub>XP</sub> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ] [XP <b>Num<sub>P</sub></b> [ <b>N<sub>P</sub></b> t <sub>YP</sub> ]]] [WP <b>Dem<sub>P</sub></b> t <sub>Ag<sub>XP</sub></sub> ]]	*****	**		***
w. [[Ag <sub>XP</sub> [YP <b>A<sub>P</sub></b> <b>N<sub>P</sub>] [XP <b>Num<sub>P</sub></b> [ t<sub>YP</sub>]]] [WP <b>Dem<sub>P</sub></b> t<sub>Ag<sub>XP</sub></sub>]]</b>	*****	**		*
x. [[Ag <sub>XP</sub> [Ag <sub>YP</sub> <b>N<sub>P</sub></b> [YP <b>A<sub>P</sub></b> t <sub>NP</sub> ]]] [XP <b>Num<sub>P</sub></b> t <sub>Ag<sub>YP</sub></sub> ]] [WP <b>Dem<sub>P</sub></b> t <sub>Ag<sub>XP</sub></sub> ]]	*****	***	*	

Under this analysis, Cinque's unattested orders are universally ungrammatical because the corresponding structures instantiate alignment configurations that are always and inevitably outperformed by some other competing structure.

### 2.3 On the Ungrammaticality of Remnant Movement

The analysis explains why remnant movement yields inherently suboptimal structures in Cinque's typology. Leftward movement is good for the alignment of what is moved, but not for the alignment of what follows the moved item. For example, given the order ABCD, moving [CD] leftward

and forming A[CD]B improves the alignment of C and D, but worsens the alignment of B, while the alignment of A remains invariant.

In the case of remnant movement, an item is extracted from a larger phrase before the phrase itself—the remnant—moves. When the extracted item precedes the moved remnant, remnant movement is unproblematic. For example, given ABCD, if D moves above A and the remnant [C  $t_D$ ] moves above B, the copy  $t_D$  in the resulting structure DA[C  $t_D$ ]B adds one violation to the alignment of B, but D itself is better aligned than if it had not been extracted. This kind of countercyclic remnant movement is grammatical under specific constraint rankings because it is favored by the constraint governing the alignment of the extracted item. The derivation for the attested order  $p$  in (14) is based on remnant movement of this kind. The first step extracts NP to Spec,Agr<sub>W</sub>, maximizing its left-alignment; then the remnant AgrYP moves to Spec,Agr<sub>X</sub>, hence following the extracted NP and not affecting its alignment.<sup>5</sup>

- (14) 1. [<sub>AgrWP</sub> – Agr<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> – Agr<sub>X</sub> [<sub>XP</sub> **NumP** X [<sub>AgrYP</sub> – Agr<sub>Y</sub> [<sub>YP</sub> **AP** Y **NP**]]]]]  
 2. [<sub>AgrWP</sub> **NP** Agr<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> – Agr<sub>X</sub> [<sub>XP</sub> **NumP** X [<sub>AgrYP</sub> – Agr<sub>Y</sub> [<sub>YP</sub> **AP** Y  $t_{NP}$ ]]]]]  
 3. [<sub>AgrWP</sub> **NP** Agr<sub>W</sub> [<sub>WP</sub> **DemP** W [<sub>AgrXP</sub> [<sub>YP</sub> **AP** Y  $t_{NP}$ ] Agr<sub>X</sub> [<sub>XP</sub> **NumP** X [<sub>AgrYP</sub> – Agr<sub>Y</sub>  $t_{YP}$ ]]]]]

When the extracted item follows the remnant, however, alignment becomes inevitably worse than if extraction had not occurred.<sup>6</sup> For example, given ABCD, raising D above B and the remnant [C  $t_D$ ] above D yields the order A[C  $t_D$ ]DB, where  $t_D$  adds violations to D and B's alignment. These violations are avoided if D remains in situ and only [C D] moves. The corresponding structure, A[CD]B, achieves the same alignment for A and C but also improves the alignment of D and B by eliminating  $t_D$ . This is shown again for a hypothetical NP in (15). Raising [A NP] in structure (15b) is favored by the constraints A-L and N-L, which incur fewer violations than in (15a). Extracting NP first and then moving the remnant [A  $t_{NP}$ ], as in structure (15c), inevitably produces a worse-aligned structure than (15b), since it adds the violations caused by  $t_{NP}$  to N-L and B-L while preserving the same number of violations for A-L.

- (15) a. Initial structure: [B [A NP]] \*A-L, \*\*N-L, B-L  
 b. Remnant-free: [[A NP]<sub>i</sub>] [B  $t_i$ ] A-L, \*N-L, \*\*B-L  
 c. Remnant movement: [[A  $t_{NP}$ ]<sub>i</sub>] [NP [B  $t_i$ ]] A-L, \*\*N-L, \*\*\*B-L

Cyclic remnant movement thus necessarily produces a worse alignment configuration than the corresponding remnant-free structure, and consequently it is h-bounded by it. This relation

<sup>5</sup> When assessed as a derivation, rather than as a final representation, (14) does not violate the conditions against extraction from unselected specifiers in Cinque 1990. Other derivations that do violate these conditions are possible too; see derivation (31) in section 3.4. The grammaticality of order  $p$  shows that countercyclic remnant movement and extraction from unselected specifiers cannot both be stipulated against. For additional instances of countercyclic remnant movement, see Müller 2002:213.

<sup>6</sup> Thanks to Jane Grimshaw for particularly useful comments about this point.

is responsible for the ungrammaticality of all unattested structures in Cinque's typology. We already showed in (12) and (13) that the remnant-free structure  $n$  h-bounds the remnant movement structure  $m$  because of the additional violations caused by the  $t_{NP}$  copy. The same holds for  $i$  and  $j$ , h-bounded by the remnant-free structure  $k$  where NP has pied-piped with the raising YP, thus avoiding the  $t_{NP}$  copy causing the additional violations in  $i$  and  $j$ . The same also holds for  $q$  and  $v$ , respectively h-bounded by  $r$  and  $w$ , which keep NP within the raised XP and YP.

Similarly, the slightly more complex  $e$  and  $f$ —which respectively extract YP and AgrYP to Spec,Agr<sub>X</sub>, followed by remnant movement of XP to Spec,Agr<sub>W</sub>—are h-bounded by  $r$ , which pied-pipes AgrYP and its YP complement with the raising XP, thus avoiding the violations caused by the AP and NP copies contained in  $t_{YP}$  and  $t_{AgrYP}$ .

The most complex case is provided by  $g$ , which is h-bounded by  $s$ . As the structure for  $g$  in (16) shows, first the NP raises to Spec,Agr<sub>Y</sub>, then YP raises to Spec,Agr<sub>X</sub> (remnant movement), and finally XP raises to Spec,Agr<sub>W</sub> (remnant movement), taking the NP with it. The AP and NP within the copy of YP, shown with overstrikes, force two additional violations to the following DemP and AP. In contrast, the remnant-free structure  $s$  in (17) pied-pipes YP—and hence AP—with the raising AgrYP, hence avoiding the additional violations caused by the AP copy.

(16) \*g. [<sub>AgrWP</sub> [<sub>XP</sub> NumP x [<sub>AgrYP</sub> NP [<sub>YP</sub> ~~AP~~ Y ~~NP~~]]] [<sub>WP</sub> DemP w  
[<sub>AgrXP</sub> [<sub>YP</sub> AP Y  $t_{NP}$ ]  $t_{XP}$ ]]

(17) s. [<sub>AgrWP</sub> [<sub>XP</sub> NumP x [<sub>AgrYP</sub> NP [<sub>YP</sub> AP Y NP]]] [<sub>WP</sub> DemP w  
[<sub>AgrXP</sub> –  $t_{XP}$ ]]

In conclusion, structures based on cyclic remnant movement always produce universally suboptimal alignment configurations because the copies of the extracted items increase the misalignment of the extracted items following them while yielding no compensating benefits. Therefore, there is no need to stipulate against remnant movement. Rather, remnant movement is impossible whenever it fails to deliver any benefit in the quest for optimal alignment.

This result appears to be independent from the specific assumptions on Kayne's (1994) Linear Correspondence Axiom followed by Cinque (2005). For example, the analysis should remain valid even under the weaker assumptions made by Abels and Neeleman (2006), where DemP, NumP, and AP are allowed to be base-generated to the right of N and movement is stipulated to be strictly leftward. Even under these weaker assumptions, remnant movement of a phrase containing  $t_{NP}$  to the left of the final position of NP inevitably produces a worse alignment configuration than movement of the same phrase with NP pied-piped with it, because N-L incurs the additional violation caused by  $t_{NP}$ . Interestingly, the Optimality Theory analysis need not stipulate against rightward movement as Abels and Neeleman's analysis does. The effects of this stipulation already follow from the proposal that the constraints favor leftward rather than rightward alignment. Since any instance of rightward movement leaves silent copies of DemP, NumP, AP, and NP to the left of the moved phrase, rightward movement inevitably causes additional alignment violations while producing no alignment gains. In other words, the bias for leftward movement that Abels and Neeleman's analysis—and also Cinque's—must encode as an independent condition, is encoded as a bias for leftward alignment in the OT analysis. In the latter form,

it still prevents rightward movement, but it also accounts for the distribution of remnant movement as explained above.

#### 2.4 *Optimal Word Orders*

All attested orders correspond to structures that provide an optimal solution to the conflicting requests made by the alignment constraints. In all these cases, there is no alternative structure providing a superior alignment configuration. To show this, we have to briefly introduce some formal aspects of Optimality Theory (OT; Prince and Smolensky 1993, 2004). Under OT, crosslinguistic variation follows from the different rankings that distinct languages assign to the universal constraints of grammar. Each ranking dictates how constraint conflicts are to be resolved, letting higher-ranked constraints take priority over lower-ranked ones. For example, the ranking DEM-L >> NUM-L >> A-L >> N-L favors alignment of DemP over NumP, NumP over AP, and AP over NP. Conversely, the ranking N-L >> A-L >> NUM-L >> DEM-L favors alignment of NP over AP, AP over NumP, and NumP over DemP.

Each ranking imposes its own preference order over the available structures: given a ranking R and two structures *s1* and *s2*, *s1* beats *s2* relative to R whenever the highest-ranked constraint on which *s1* and *s2* differ is violated fewer times by *s1*.

The *optimal* structure for a specific ranking R is the one that remains unbeaten in R. What is optimal is the alignment configuration relative to the alignment priorities specified in the ranking, yielding an optimal allocation of constraint violations. Any alternative structure with fewer violations on some constraint C will necessarily incur more violations than the optimal structure on some higher-ranked constraint; if it did not, the optimal structure would be beaten on C and could not be optimal.

Consider, for example, the structure for order *a*, where nothing moves. This structure is optimal under the ranking DEM-L >> NUM-L >> A-L >> N-L because no other structure beats it under this ranking. There are structures that outperform *a* on specific constraints, but they also incur more violations than *a* on higher-ranked constraints in this ranking. For example, the structure for order *b* violates N-L one time fewer than *a*, but incurs one additional violation on the higher-ranked constraint A-L. The same holds for all remaining structures, making *a* the optimal structure for this ranking, that is, the structure with the best possible alignment relative to it. The same is true for all other attested orders. They are attested because the corresponding structure is optimal under at least one ranking of the alignment constraints.

This result is summarized in table (18) together with the other results discussed so far. The first column recapitulates Cinque's typology, with each letter identifying the order at its right. The second column provides the set of rankings that select the corresponding structure as optimal, provided such a ranking exists. As shown above, structures involving cyclic remnant movement are inherently suboptimal across all rankings; therefore, no ranking selects them as optimal and the corresponding order is unattested. The other structures are all optimal under one or more rankings; hence, they are grammatical and the associated order is attested. As the table exhausts all the 24 distinct rankings that can be built out of four constraints, no other optimal structure is possible, thus deriving Cinque's typology.

(18) *Possible rankings and selected optima*

Identifier and order	Rankings selecting the structure as optimal
a. Dem Num A N	DEM-L >> NUM-L >> A-L >> N-L
b. Dem Num N A	DEM-L >> NUM-L >> N-L >> A-L
c. Dem N Num A	DEM-L >> N-L >> NUM-L >> A-L
d. N Dem Num A	N-L >> DEM-L >> NUM-L >> A-L
*e. Num Dem A N	<i>None</i>
*f. Num Dem N A	<i>None</i>
*g. Num N Dem A	<i>None</i>
*h. N Num Dem A	<i>Structurally impossible</i>
*i. A Dem Num N	<i>None</i>
*j. A Dem N Num	<i>None</i>
k. A N Dem Num	A-L >> N-L >> DEM-L >> NUM-L A-L >> DEM-L >> NUM-L >> N-L A-L >> DEM-L >> N-L >> NUM-L
l. N A Dem Num	N-L >> A-L >> DEM-L >> NUM-L
*m. Dem A Num N	<i>None</i>
n. Dem A N Num	DEM-L >> A-L >> N-L >> NUM-L DEM-L >> A-L >> NUM-L >> N-L
o. Dem N A Num	DEM-L >> N-L >> A-L >> NUM-L
p. N Dem A Num	N-L >> DEM-L >> A-L >> NUM-L
*q. Num A Dem N	<i>None</i>
r. Num A N Dem	NUM-L >> A-L >> N-L >> DEM-L NUM-L >> A-L >> DEM-L >> N-L NUM-L >> DEM-L >> A-L >> N-L NUM-L >> DEM-L >> N-L >> A-L
s. Num N A Dem	NUM-L >> N-L >> A-L >> DEM-L NUM-L >> N-L >> DEM-L >> A-L
t. N Num A Dem	N-L >> NUM-L >> A-L >> DEM-L N-L >> NUM-L >> DEM-L >> A-L
*u. A Num Dem N	<i>Structurally impossible</i>
*v. A Num N Dem	<i>None</i>
w. A N Num Dem	A-L >> N-L >> NUM-L >> DEM-L A-L >> NUM-L >> DEM-L >> N-L A-L >> NUM-L >> N-L >> DEM-L
x. N A Num Dem	N-L >> A-L >> NUM-L >> DEM-L

The set of rankings deriving each attested order always includes a ranking matching the order itself. For example, the rankings selecting structure  $w$  with order ‘A N Num Dem’ include the matching ranking  $A-L \gg N-L \gg NUM-L \gg DEM-L$ . Yet the model does not simply describe the desired orders through matching rankings. If this were the case, then all logically conceivable orders would be attested, since the corresponding structures would be optimal under the corresponding matching ranking. For example, the unattested order  $q$ , ‘Num A Dem N’, should be optimal under the ranking  $NUM-L \gg A-L \gg DEM-L \gg N-L$ . But this is not the case: unattested word orders are unattested precisely because the corresponding rankings cannot select a matching structure as optimal. Instead, these rankings select other structures, showing that the relation between rankings and word order is not one to one. For example, as tableau 2 shows, the above-mentioned ranking  $NUM-L \gg A-L \gg DEM-L \gg N-L$  selects structure  $r$  as optimal, rather than  $q$ , because  $r$  incurs fewer violations of N-L. (The optimal structure is marked with ‘ $\text{\textcircled{E}}$ ’ as per OT conventions.)

(19) *Tableau 2*

	NUM-L	A-L	DEM-L	N-L
* $q$ . $[[_{XP} \text{Num}_P [[_{YP} \text{A}_P t_{NP}]]] [_{WP} \text{Dem}_P [N_P t_{XP}]]$		*	***	****
$\text{\textcircled{E}}$ $r$ . $[[_{XP} \text{Num}_P [[_{YP} \text{A}_P N_P]]] [_{WP} \text{Dem}_P [ t_{XP}]]$		*	***	**

In conclusion, the alignment constraints trigger raising of the relevant phrases, much as overt agreement checking does in Cinque 2005 (although unlike agreement checking, they do not specify the target positions for the triggered movement; see section 3). Their distinct rankings, in turn, determine which structures provide the best possible alignment configurations, giving rise to Cinque’s typology.

### 2.5 Additional Structures and Predictions

To complete the analysis, we consider the potential alternative structures available for the examined orders, as well as the predicted changes when one or more items are missing.

As mentioned above, the structures in tableau 1 exclude movement through intermediate positions. This property is a consequence of the proposed constraints, because intermediate traces worsen the alignment of any item following them. Structures involving intermediate traces are therefore inevitably beaten by the corresponding single-movement alternative across all rankings. Compare structure  $d$  in tableau 3, where NP raises to  $\text{Spec, Agr}_W$  directly, with the alternative  $d'$ , involving intermediate traces in  $\text{Spec, Agr}_Y$  and  $\text{Spec, Agr}_X$ . As tableau 3 shows, the silent copies in the intermediate positions add violations to NUM-L and A-L, leaving  $d'$  h-bounded by  $d$ . The same would hold if the intermediate traces involved only  $\text{Spec, Agr}_Y$  or only  $\text{Spec, Agr}_X$ .

(20) *Tableau 3*

	DEM-L	NUM-L	A-L	N-L
$\text{\textcircled{E}}$ $d$ . $[N_P [_{WP} \text{Dem}_P [- [_{XP} \text{Num}_P [- [_{YP} \text{A}_P t_{NP}]]]]]$	*	**	***	
$d'$ . $[N_P [_{WP} \text{Dem}_P [t_{NP} [_{XP} \text{Num}_P [t_{NP} [_{YP} \text{A}_P t_{NP}]]]]]$	*	***	*****	

The absence of intermediate traces is thus predicted by the analysis, provided they are not forced by other, higher-ranked constraints ignored here.<sup>7</sup> It potentially distinguishes this analysis from Cinque's account, where intermediate traces are expected. The clearest contrast occurs in languages with order *d*, found in languages such as Kikuyu and a few other languages listed in Cinque 2005:319n10. Since we are not in a position to test these languages at the moment, we leave this prediction open.

The structures in tableau 1 also presupposed that whenever the same word order could be represented through two structures differing only in whether they raised an agreement projection AgrP or its complement YP, XP, or WP, the chosen structure was the one raising the complement. This ensured that all word orders were represented by a single structure. Yet both structures can be allowed to compete because they incur the same constraint violations. Once we allow for both structures, both are selected as optimal or suboptimal depending on the presence or absence of remnant movement.

This provides a second empirical difference with respect to Cinque 2005, where this structural ambiguity is absent. In our analysis, this structural ambiguity occurs whenever the specifier of the relevant AgrP projection is empty and therefore raising of AgrP or its complement has identical effects on the overall alignment configuration. Consider, for example, the order 'A N Dem Num'. We assumed that the representing structure raises YP to Spec,Agr<sub>W</sub> as in structure *k* in tableau 4. However, the same word order can also be derived by raising AgrYP to Spec,Agr<sub>W</sub>, as shown in structure *k'*. The constraint violations remain the same for both structures, ensuring the same grammatical fate as optimal or suboptimal.<sup>8</sup>

(21) *Tableau 4*

	DEM-L	NUM-L	A-L	N-L
<i>k</i> . [ <sub>AgrWP</sub> [ <sub>YP</sub> <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ] [ <sub>WP</sub> <b>Dem<sub>P</sub></b> [[ <sub>XP</sub> <b>Num<sub>P</sub></b> [ <sub>AgrYP</sub> <i>t</i> <sub>YP</sub> ]]]	**	***		*
<i>k'</i> . [ <sub>AgrWP</sub> [ <sub>AgrYP</sub> – [ <sub>YP</sub> <b>A<sub>P</sub></b> <b>N<sub>P</sub></b> ]] [ <sub>WP</sub> <b>Dem<sub>P</sub></b> [[ <sub>XP</sub> <b>Num<sub>P</sub></b> <i>t</i> <sub>AgrYP</sub> ]]]	**	***		*

Our assumptions also excluded any structure involving Comp-to-Spec movement within the same projection. While this exclusion simplified our discussion, it can be safely removed because these structures can never provide a better alignment configuration than the examined structures. Since the structural space between complement and specifier does not contain instances of Dem, Num, A, and N in any projection, Comp-to-Spec movement may neither improve nor worsen the alignment of any item preceding or contained within the moving complement: these items remain as distant from the left edge of AgrWP as they were to begin with. Comp-to-Spec movement,

<sup>7</sup> As an anonymous reviewer points out, the presence of higher-ranked constraints favoring intermediate steps—such as the constraint OBLIGATORY SPECIFIER (ObSPEC) violated by unrealized specifier positions (Grimshaw 2001a, 2002)—might force movement through intermediate specifier positions and blur the difference between the proposed analysis and Cinque's. The prediction would still remain valid for any grammar that ranks these constraints lower than the alignment constraints.

<sup>8</sup> An anonymous reviewer points out that whenever there is a choice between two adjacent projections (e.g., AgrYP and YP), locality of movement would ensure that only the higher one moves. What we intend to show is that our analysis derives the correct outcomes in both cases and is thus independent from assumptions about locality.

however, does worsen the alignment of any item *following* the moving complement, because it creates a new copy of the complement, hence duplicating the instances of DemP, NumP, AP, and NP contained in the complement. The resulting structure is thus inevitably h-bounded by the structure lacking Comp-to-Spec movement.

We also facilitated our exposition by excluding multiple specifiers. We believe this assumption to be unnecessary as well. While a complete demonstration goes beyond the aims and space limits of this article, note that the presence of additional specifiers, and hence additional landing positions for moving phrases, does not affect the misalignment configuration inevitably built by cyclic remnant movement. Given ABCD, the derived structure [C t<sub>D</sub>]ADB is h-bounded by [CD]AB, which achieves better alignment of D and B. The presence of additional specifiers above A and B does not affect this fundamental relation. Which specifiers D or [C t<sub>D</sub>] lands on is inconsequential to alignment, while moving through more than one specifier only worsens it, as it creates additional intermediate traces. The presence of additional specifiers provides a representation for the unrepresented orders *h* and *u*, but the corresponding structures are respectively h-bounded by structures *t* and *w*; see tableau 5. Multiple specifiers could thus be allowed without jeopardizing the proposed analysis.

(22) *Tableau 5*

	DEM-L	NUM-L	A-L	N-L
☞ t. *h. [Agr <sub>WP</sub> <b>NP</b> [Agr <sub>WP</sub> [XP <b>NumP</b> [Agr <sub>YP</sub> t <sub>YP</sub> ]]] [ <sub>WP</sub> <b>DemP</b> [Agr <sub>XP</sub> [YP <b>AP</b> t <sub>NP</sub> ] t <sub>XP</sub> ]]	****	*	*****	
t. [[Agr <sub>XP</sub> <b>NP</b> [XP <b>NumP</b> [[YP <b>AP</b> t <sub>NP</sub> ]]]] [ <sub>WP</sub> <b>DemP</b> t <sub>AgrXP</sub> ]]	****	*	**	
☞ w. *u. [Agr <sub>WP</sub> [YP <b>AP</b> t <sub>NP</sub> ] [Agr <sub>WP</sub> [XP <b>NumP</b> [Agr <sub>YP</sub> t <sub>YP</sub> ]] [ <sub>WP</sub> <b>DemP</b> [Agr <sub>XP</sub> <b>NP</b> t <sub>XP</sub> ]]	*****	**		*****
w. [[Agr <sub>XP</sub> [YP <b>AP</b> <b>NP</b> ] [XP <b>NumP</b> [t <sub>YP</sub> ]]] [ <sub>WP</sub> <b>DemP</b> t <sub>AgrXP</sub> ]]	*****	**		*

Finally, the analysis predicts that the relative order of Dem, Num, A, and N is not necessarily preserved when one or more of DemP, NumP, and AP are missing (Klaus Abels, pers. comm.). In this case, the associated constraints DEM-L, NUM-L, and A-L would be vacuously satisfied. In rankings where they are sufficiently high-ranked, their vacuous satisfaction may let lower-ranked constraints impose a new order among the remaining items. Consider, for example, the ranking A-L >>> DEM-L >>> NUM-L >>> N-L, which selects order *k*, ‘A N Dem Num’, where NP precedes DemP and NumP. When AP is present, YP raises to Spec, Agr<sub>WP</sub>, carrying AP and NP with it in order to satisfy the highest-ranked constraint A-L, even if this adds violations to the lower-ranked DEM-L and NUM-L. When AP is absent, A-L is vacuously satisfied independently from the position of YP. Since no constraint requires NP to move, NP can remain in situ, thus following DemP and NumP, and thereby violating DEM-L and NUM-L fewer times. The order of NP relative to DemP and NumP thus depends on whether AP is present or absent. Changes in relative order of this kind are expected whenever the optimal order for the four-item case does not match the



corresponding ranking, as is the case with the additional rankings for orders *k*, *n*, *r*, *s*, *t*, and *w* listed in (18).

Whether such changes in relative order occur or not is an empirical issue that requires an accurate investigation of the corresponding languages. The analysis of remnant movement proposed here is orthogonal to this issue and remains valid even if relative orders turn out to be rigid. Rigid orders are easily accounted for by ensuring that the structures discussed so far remain optimal under the corresponding rankings even when some items are missing—that is, by making sure that the associated constraint violations are insensitive to the presence or absence of specific items. This is easily accomplished by redefining the constraints as requiring left-alignment of WP, XP, YP, and NP, and by making alignment sensitive to the intervening heads W, X, Y, and N rather than DemP, NumP, AP, and NP. The violations incurred by each four-item structure under the new definitions are identical to those in tableau 1 in (11), showing that the analysis of remnant movement is independent from the rigid or flexible nature of relative orders. The corresponding tableau is given in the appendix.

This concludes the presentation of the analysis. Cinque's typology follows immediately from the interaction of the proposed constraints. The attested orders constitute optimal alignment configurations relative to one or more constraint rankings. Unattested orders occur whenever the corresponding structures must resort to cyclic remnant movement, which inevitably produces suboptimal alignment configurations across all rankings. The analysis extends to any conceivable structure that can be built from Cinque's universal base-generated structure via repeated leftward movement of constituents containing NP or copies of NP, including structures with multiple specifiers, Comp-to-Spec movement, intermediate copies, or raised agreement projections.<sup>9</sup>

### 3 A Comparison with Cinque 2005

Cinque's (2005) analysis has important merits. By painstakingly assembling and organizing data from different languages, it provides an empirically sound typology for the order of DemP, NumP, AP, and NP. It also discovers that attested orders involve movement of constituents containing NP and lacking (cyclic) remnant movement. Without Cinque's analysis, new analyses of the same typology, such as ours or that of Abels and Neeleman (2006), would not have been possible. Our

<sup>9</sup> Cinque's analysis also addresses the relative frequency for each attested order. It does so by associating distinct markedness costs to different movement operations. For example, movement of NP plus pied-piping of the *whose picture* type is considered unmarked, whereas movement of NP without pied-piping is marked, and movement of NP plus pied-piping of the *picture of whom* type is even more marked. Those orders whose structure involves more—or more marked—operations are claimed to be less frequent than those involving fewer, or less marked, operations. Notwithstanding its valuable insight into the potential causes of markedness, this analysis dissociates the issue of frequency from the issue of grammaticality. The most marked grammatical structures, yielding the least frequent orders, are still chosen as grammatical by the speakers of the corresponding languages, who favor them above all less marked alternatives. The unattested orders, on the other hand, are ungrammatical, not just extremely high-marked. This dissociation makes it possible to apply Cinque's markedness analysis to any analysis of the DP typology involving similar movement operations, including our analysis. First the OT analysis determines which structures are grammatical and ungrammatical. Then the grammatical structures are evaluated for markedness along Cinque's metrics, with the structures involving marked operations expected to be less frequently attested than their less-marked alternatives. What remains to be explained, in both Cinque's analysis and ours, is why certain operations are marked and others are not, and exactly how markedness affects frequency but not—or at least not as much as we might expect—grammaticality.

analysis capitalizes on Cinque's results and accounts for the distribution of remnant movement. Its theoretical advantages stand out more clearly once we examine the fine-grained assumptions on which Cinque's analysis ultimately rests. It is this set of assumptions and their problematic consequences that our analysis dispenses with, hence providing—we believe—a stronger overall account.<sup>10</sup>

### 3.1 *The Analysis of Remnant Movement*

The first part of Cinque 2005 shows that the attested and unattested orders can be derived from Cinque's universal base-generated structure, provided that movement is restricted to NP with additional optional pied-piping of projections containing NP in their complement (the *picture of whom* pied-piping type) or containing NP as their specifier (the *whose picture* type). This restriction blocks remnant movement of any lower constituent containing silent NP copies but no NP. Our analysis need not stipulate such a restriction. Remnant constituents containing NP copies are free to move anywhere. Remnant movement is ungrammatical, and determining unattested orders, whenever it produces suboptimal alignment configurations across all constraint rankings. This freedom of movement is a welcome property because a ban on remnant movement appears empirically nonviable, considering the many syntactic analyses that require it. For example, Abels and Neeleman (2006) propose sentence (23) as possible evidence for remnant movement of VP. Other analyses involving remnant movement include Den Besten and Webelhuth 1987, Kayne 1998, Müller 1998a,b, 2002, Koopman and Szabolcsi 2000, Nilsen 2003.

(23) [Painted  $t_k$  by Picasso]<sub>i</sub>, [this painting]<sub>k</sub> does not seem to be  $t_i$ .

The second part of Cinque 2005 provides a formal analysis of the conditions blocking remnant movement based on the analysis of movement/attraction in Kayne 2005. Cinque assumes that DemP, NumP, and AP require licensing by a nominal feature supplied via agreement between NP and the agreement projections AgrWP, AgrXP, and AgrYP. Agreement licensing may occur either with or without movement of NP, or a constituent containing it, into the specifier of the relevant AgrP projection, and whether movement occurs or not depends on the particular language in question.

When movement is necessary, which phrase raises is determined by the condition in (24), slightly adapted from Kayne 2005:sec. 5.6 and ultimately responsible for blocking remnant movement. It states that the phrasal category moving to the specifier of an agreement projection AgrP is the category closest to its head Agr, where *closest* is defined as in (25). The complement of Agr and the specifier of the complement cannot be selected, thus excluding WP, XP, and YP and their specifiers (Cinque 2005:326).

<sup>10</sup> An anonymous reviewer asked us to compare our approach with other analyses governing the distribution of remnant movement (e.g., Takano 1994, Müller 1998a,b, 2002, Abels 2007), but examining all instances of grammatical and ungrammatical remnant movement in detail would require another article. Since Cinque (2005) provides a formal, detailed, and fully general account of how remnant movement is governed in his DP typology, we consider it important and sufficiently informative to engage with this specific account and its theoretical consequences.

(24) *Selection of moving category*

For any functional head H, the category ZP moving to Spec,HP must be (a) distinct from the complement and the specifier of the complement of H, and (b) *closest* to H.

(25) *Definition of closest*

The category closest to H is the category c-commanded by H that is dominated by the fewest number of nodes (where ‘‘node’’ includes every node, whether ‘‘category’’ or ‘‘segment’’ in Kayne’s (1994) sense).

Remnant movement is blocked because remnant phrases are not sufficiently close to the head Agr to be selected for movement to Spec,Agr. Consider structure (26), for example, where NP has raised to Spec,Agr<sub>Y</sub>, thus licensing YP and AP. Now consider XP and NumP and assume that they too require licensing by overt movement of a phrase carrying an N-feature into Spec, Agr<sub>X</sub>. Condition (24) blocks remnant movement of YP, or even the lower AgrYP segment, into Spec,Agr<sub>X</sub> because both the NP in Spec,Agr<sub>Y</sub> and the higher AgrYP segment count as closer categories.<sup>11</sup>

$$(26) \left[ \begin{array}{c} \text{AgrWP} - \text{AGR}_W \left[ \text{WP} \text{ DemP } W \left[ \text{AgrXP} - \text{AGR}_X \left[ \text{XP} \text{ NumP } X \left[ \text{AgrYP} \text{ NP} \right. \right. \right. \right. \\ \left. \left. \left. \left. \left[ \text{AgrYP} \text{ AGR}_Y \left[ \text{YP} \text{ AP } Y \text{ t}_{\text{NP}} \right] \right] \right] \right] \right] \right] \right] \end{array} \right]$$

3.2 *Parameters That Describe Derivations*

As mentioned, Cinque’s analysis assumes that licensing of DemP, NumP, and AP can occur via movement of NP (or a constituent containing NP) or long-distance agreement (Cinque 2005: 326). However, this assumption forces a highly articulated parametric system where individual languages must specify category by category whether licensing occurs by movement or by long-distance agreement. For example, a language with the order ‘Dem Num N A’, where NP raises to Spec,Agr<sub>Y</sub>, must parametrically specify that licensing of WP and XP (and hence DemP and NumP) occurs via long-distance agreement, but licensing of YP (and hence AP) involves overt NP-movement.

For every category requiring licensing by overt movement, the parameters must also state whether pied-piping is involved, and if it is, of which kind (*picture of whom* vs. *whose picture* type). For example, a language with the order ‘A N Num Dem’ derived as in (27) must specify first that YP and AP are licensed via long-distance agreement between AgrYP and NP (this blocks NP-movement into AgrYP, which would cause the incorrect N-A order); second, that XP and Num are licensed via overt movement of NP into Spec,Agr<sub>X</sub>, with pied-piping of the *picture of whom* type (this moves AgrYP to Spec,Agr<sub>X</sub>); and third, that WP and DemP are licensed via overt movement of NP into Spec,Agr<sub>W</sub>, with pied-piping of the *whose picture* type (this moves AgrXP to Spec,Agr<sub>W</sub>).

<sup>11</sup> Since licensing requires a nominal feature, we may ask whether movement of YP and the lower AgrYP is already blocked by the absence of a suitable feature. Cinque (2005) does not address this point, but the answer is necessarily negative because some attested orders require pied-piping of the *picture of whom* type, where NP is in the complement of the moved projection, showing that nominal features are accessible in the projections dominating NP.

- (27) 1. [DemP [NumP [AP NP]]  
 2. [DemP [AP NP] NumP  $t_{AgrYP}$ ]  
 3. [[[AP NP] NumP  $t_{AgrYP}$ ] DemP  $t_{AgrXP}$ ]

The parameter values associated with each language describe the derivational steps that obtain the desired order, specifying exactly which movements are required and even which movements are avoided (by specifying where long-distance agreement is possible). The parametric system thus mirrors in its structure and content the typology that we wish to explain. Consequently, we gain no genuine understanding of why some derivations are grammatical and others not, because the derivations themselves are already stipulated in the parametric values. Put differently, the properties of the attested structures do not emerge from the interaction of deeper, simpler primitives; they are directly encoded as parametric values, and as such remain unexplained.

The proposed OT analysis provides a more explanatory account. Information about which category moves and whether it requires pied-piping of a certain type is absent from the theoretical primitives of the analysis, namely, the alignment constraints. What moves, where it moves, and how it moves all follow from—hence are explained by—the effects of optimization relative to the possible rankings of the constraints. The attested orders are optimal solutions to conflicting alignment requests, and the process of determining such optimal solutions determines the structural properties of the final structure. There is no need to directly stipulate them as parametric values.

### 3.3 Contradictory Parametric Values and Descriptive Solutions

Cinque's analysis (2005:326) must also parameterize the definition of *closest node* in (25), distinguishing languages where closeness is calculated in terms of intervening *nodes* (i.e., counting individual phrasal segments) from languages sensitive to intervening *categories* (i.e., counting adjacent identical segments as a single node). Consider, for example, the derivations for the attested orders 'Dem N A Num' and 'Dem N Num A'. The first step, identical for both, raises NP into AgrYP, yielding (28).

- (28) [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** <sub>W</sub> [<sub>AgrXP</sub> – AGR<sub>X</sub> [<sub>XP</sub> **NumP** <sub>X</sub> [<sub>AgrYP</sub> **NP**  
 [<sub>AgrYP</sub> AGR<sub>Y</sub> [<sub>YP</sub> **AP** <sub>Y</sub>  $t_{NP}$ ]]]]]]

The next step requires a different definition of closeness depending on which order is derived. The order 'Dem N A Num' requires movement of the entire AgrYP projection into Spec,Agr<sub>X</sub>, intuitively placing [N A] between Dem and Num. This requires the definition of *closest node* targeting segments, so that the top AgrYP segment is identified as the node closest to Agr<sub>X</sub> rather than NP.

The order 'Dem N Num A' must instead move NP alone from Spec,Agr<sub>Y</sub> to Spec,Agr<sub>X</sub>, avoiding pied-piping of the entire AgrYP. To make this possible, NP must be selected as the phrase closest to Agr<sub>X</sub>, hence requiring the "category" definition of *closest node* (Cinque 2005: 326). The top AgrYP node no longer counts as closest because it is just a segment (specifiers are assumed to phrase-adjoin as in Kayne 1994).

Cinque's segment/category parameter requires further refining, however, because some orders require the "category" definition of *closest node* for some movements and the "segment" definition for others. Without further refining, the corresponding languages would require contra-

dictory parametric values. Consider, for example, the attested order *t*, ‘N Num A Dem’. Its derivation requires the steps in (29). First, the NP moves to Spec,Agr<sub>Y</sub>, yielding the structure in step 2 of (29). Next, the NP raises to Spec,Agr<sub>X</sub>, as in step 3 of (29). This requires the “category” definition of *closest node*; otherwise, the entire AgrYP would be pied-piped, incorrectly placing AP before NumP. Finally, the entire AgrXP moves to Spec,Agr<sub>W</sub>, as in step 4 of (29), thus placing [N Num A] before DemP as desired. This final operation, however, involves pied-piping, thus requiring the “segment” definition of *closest node*, contradicting the parametric value necessary for the previous step.

- (29) 1. [AgrWP – AGR<sub>W</sub> [WP **DemP** w [AgrXP – AGR<sub>X</sub> [XP **NumP** x [AgrYP – AGR<sub>Y</sub> [Y<sub>P</sub> **AP** y **NP**]]]]
2. [AgrWP – AGR<sub>W</sub> [WP **DemP** w [AgrXP – AGR<sub>X</sub> [XP **NumP** x [AgrYP **NP** AGR<sub>Y</sub> [Y<sub>P</sub> **AP** y t<sub>NP</sub>]]]]
3. [AgrWP – AGR<sub>W</sub> [WP **DemP** w [AgrXP **NP** AGR<sub>X</sub> [XP **NumP** x [AgrYP t<sub>NP</sub> AGR<sub>Y</sub> [Y<sub>P</sub> **AP** y t<sub>NP</sub>]]]]
4. [AgrWP [AgrXP **NP** AGR<sub>X</sub> [XP **NumP** x [AgrYP t<sub>NP</sub> AGR<sub>Y</sub> [Y<sub>P</sub> **AP** y t<sub>NP</sub>]]]] AGR<sub>W</sub> [WP **DemP** w t<sub>AgrXP</sub>]]

The only solution for this contradiction appears to be further parameterization. Languages would have to specify what definition of *closest node* applies to each distinct agreement head. For example, the order ‘N Num A Dem’ just examined would set this parameter for “category” relative to Agr<sub>X</sub> and “segment” relative to Agr<sub>W</sub>. The problem is that once again the details of derivational steps are described via equally detailed parametric values, using parameters as instructions for the desired derivations.

The OT analysis is not affected by this problem. Movement is free, thus dispensing with any description of derivational steps via apposite parametric values. Whether NP moves on its own, pied-pipes, or partly moves on its own and partly pied-pipes, is entirely determined by how well the final structure performs with respect to the ranked constraints. There are no language-specific conditions. The constraints are universal and so is the process that determines which structure is optimal. Only the ranking identifying each language is language-specific. But even this is not stipulated, since the typology emerges from considering *all* possible rankings of the constraints.

### 3.4 Underived Word Orders

Despite their descriptive power, the parameters in Cinque 2005 do not derive the entire typology. Consider (30), where AgrYP counts as closest to Spec,Agr<sub>X</sub> in terms of segments, whereas the NP in Spec,Agr<sub>Y</sub> is deemed closer in terms of categories. As Cinque points out, mere category counting actually only makes NP and AgrYP equidistant. To select NP as closest, the analysis needs to assume that in the category-counting process, specifiers count as closer to their target than the projections they are specifiers of (Cinque 2005:326n33). Let us call this the *specifier precedence* assumption.

- (30) . . . [AgrXP – AGR<sub>X</sub> [XP **NumP** x [AgrYP **NP** [AgrYP AGR<sub>Y</sub> [Y<sub>P</sub> **AP** y t<sub>NP</sub>]]]]

The specifier precedence assumption is both necessary and excessively strong. Without it, some attested orders cannot be derived; with it, other attested orders become underivable. Orders *p* and *l* illustrate these claims. Consider first *p*. The corresponding word order ‘N Dem A Num’ is obtained as in (31) by first moving NP to Spec,Agr<sub>Y</sub>, then the entire AgrYP containing NP and AP to Spec,Agr<sub>X</sub>, and finally NP to Spec,Agr<sub>W</sub>.

- (31) 1. [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> – AGR<sub>X</sub> [<sub>XP</sub> **NumP** x [<sub>AgrYP</sub> **NP** AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]]]]  
 2. [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>AgrYP</sub> **NP** AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** x t<sub>AgrYP</sub>]]]  
 3. [<sub>AgrWP</sub> **NP** AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>AgrYP</sub> t<sub>NP</sub> AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** x t<sub>AgrYP</sub>]]]

Without specifier precedence, order *p* is underivable because prior to the final step the three categories AgrXP, AgrYP (located in Spec,AgrXP), and NP (in Spec,AgrYP) are equally distant from Spec,Agr<sub>W</sub>. If nothing moves, order *p* is not obtained. If they all move, *p* is obtained but it incorrectly occurs in free variation with the orders ‘N A Num Dem’ and ‘N A Dem Num’ determined by the other two movement options. Specifier precedence is thus essential to the derivation of *p*. Furthermore, it may select NP as the category closest to Spec,Agr<sub>W</sub> only if it is allowed to apply recursively, first selecting AgrYP as closer than AgrXP, then NP as closer than AgrYP.

The recursive application of specifier precedence is fatal to other derivations, though. Consider order *l*, ‘N A Dem Num’. The first two steps of its derivation coincide with those for order *p*, moving NP to Spec,Agr<sub>Y</sub>, then AgrYP to Spec,Agr<sub>X</sub>. Only the final, third step differs, raising AgrYP rather than NP; see (32). Note that the second step is obligatory; were it not, AgrYP would remain too low to be selected for movement to Spec,Agr<sub>W</sub> in the third step.

- (32) 1. [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> – AGR<sub>X</sub> [<sub>XP</sub> **NumP** x [<sub>AgrYP</sub> **NP** AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]]]]  
 2. [<sub>AgrWP</sub> – AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> [<sub>AgrYP</sub> **NP** AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** x t<sub>AgrYP</sub>]]]  
 3. [<sub>AgrWP</sub> [<sub>AgrYP</sub> **NP** AGR<sub>Y</sub> [<sub>YP</sub> **AP** y t<sub>NP</sub>]]] AGR<sub>W</sub> [<sub>WP</sub> **DemP** w [<sub>AgrXP</sub> t<sub>AgrYP</sub>]] AGR<sub>X</sub> [<sub>XP</sub> **NumP** x t<sub>AgrYP</sub>]]]

The third step, however, is not possible because AgrYP is never selected as the category closest to Spec,Agr<sub>W</sub>. If specifier precedence does not apply, NP, AgrYP, and AgrXP are deemed equidistant relative to Spec,Agr<sub>W</sub> and will incorrectly all be selected for movement, yielding free variation. If specifier precedence applies recursively, then the NP in the innermost specifier is selected, incorrectly yielding order *p*. Languages with order *l* alone are thus underivable.

There is no simple solution to this problem because it requires selecting a different specifier as ‘closest’ to Spec,Agr<sub>W</sub> depending on whether we are deriving *p* or *l*. The only solution consistent with Cinque’s analysis appears to require an additional parameter specifying for each order whether specifier precedence applies recursively or only to the top agreement category. This would correctly select AgrYP for movement in (32).

Like the parameters discussed in the previous sections, this new parameter merely provides a way to introduce descriptive knowledge into the formal analysis. What moves where would no longer follow from universal principles of grammar measuring closeness. Rather, it would be read off the parameter that encodes our observations about which orders require movement of the innermost specifier and which require movement of the higher one.

The OT analysis does not suffer from this problem. Rather than viewing the word order typology as an outcome of parametric conditions governing movement, with the problems just discussed, the OT analysis models it as the outcome of alignment optimization. This leaves movement genuinely free, deriving orders  $p$  and  $l$  with no need to measure structural distance or govern movement precedence.

#### 4 Conclusions

The attested and unattested orders of DemP, NumP, AP, and NP in Cinque's typology follow straightforwardly from the interactions of the four proposed universal alignment constraints. The structures that provide optimal alignment configurations under some ranking of the constraints (i.e., configurations that cannot be improved upon via further movement) are grammatical and the corresponding orders attested. All other structures are suboptimal across all constraint rankings and universally ungrammatical. Any word order instantiated only through these suboptimal structures is unattested.

The most important property of this analysis is its ability to explain when and why remnant movement is ungrammatical. Rather than being stipulated impossible, remnant movement is shown to be ineffective at improving alignment. Structures where remnant movement does not improve alignment are suboptimal across all rankings and therefore ungrammatical. Yet even remnant movement becomes grammatical when it builds the best possible alignment configuration for a specific ranking, as we showed in the discussion of order  $p$  in section 2.3.

The analysis shows that remnant movement in Cinque's typology is governed by harmonic bounding, a formal relation holding between competing structures and entailed by the definition of *optimal* in OT. The analysis thus governs remnant movement while dispensing with any condition explicitly referring to it or to its distinctive properties. This raises the interesting question whether a similar alignment perspective might also apply to the distribution of remnant movement in other syntactic domains, such as those discussed by Abels and Neeleman (2006) and Müller (1998a,b, 2002).

We also showed that an analysis modeled in terms of constraints on movement, such as Cinque's (2005), cannot derive the entire typology without exhaustively describing the derivational steps necessary for each order in the parameter values of the corresponding language. In contrast, the OT analysis needs to state neither *what* should move, nor *where* it should move to, and accounts for the entire typology on the basis of universal constraints. The only parametric aspect concerns constraint ranking—a fully general property that OT places at the core of the cognitive organization of human grammar. Insofar as the analysis is correct, it joins other OT-syntax analyses in showing that syntax and phonology share the same cognitive architecture, with alignment playing an important role in determining the internal articulation of linguistic representations.

**Appendix: Tableau with alignment constraints sensitive to the heads W, X, Y, and N**

The structures in tableau 6 in (33) are those of tableau 1 in (11), but show the W, X, and Y heads. The constraints require left-alignment of WP, XP, YP, and NP, or respective chain heads, and are violated once for each head W, X, Y, N, or their copies, intervening between the overt WP, XP, YP, and NP and the left edge of AgrWP. The assessed violations are identical to those of tableau 1.

(33) *Tableau 6*

	WP-L	XP-L	YP-L	NP-L
a. [ [wp <b>Demp</b> w [ [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y <b>Np</b> ]]]]		*	**	***
b. [ [wp <b>Demp</b> w [ [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y <b>t<sub>NP</sub>]]]]</b>		*	***	**
c. [ [wp <b>Demp</b> w [ [yp <b>Num<sub>p</sub></b> x [ [xp <b>Ap</b> y <b>t<sub>NP</sub>]]]]</b>		**	***	*
d. [ [yp <b>Num<sub>p</sub></b> x [ [wp <b>Demp</b> w [ [xp <b>Ap</b> y <b>t<sub>NP</sub>]]]]</b>	*	**	***	
<hr/>				
*e. [[xp <b>Num<sub>p</sub></b> x [ t <sub>YP</sub> ]] [wp <b>Demp</b> w [ [yp <b>Ap</b> y <b>Np</b> ] t <sub>XP</sub> ]]	***		***	***
*f. [[xp <b>Num<sub>p</sub></b> x t <sub>Ag<sub>YP</sub></sub> ] [wp <b>Demp</b> w [[Ag <sub>YP</sub> <b>Np</b> ] [yp <b>Ap</b> y t <sub>NP</sub> ]] t <sub>XP</sub> ]]	***		***	***
*g. [[xp <b>Num<sub>p</sub></b> x [Np t <sub>YP</sub> ]] [wp <b>Demp</b> w [ [yp <b>Ap</b> y t <sub>NP</sub> ] t <sub>XP</sub> ]]	***		***	*
<hr/>				
*i. [ [yp <b>Ap</b> y t <sub>NP</sub> ] [wp <b>Demp</b> w [ [xp <b>Num<sub>p</sub></b> x [ [yp t <sub>YP</sub> ]]]]	**	***		***
*j. [ [yp <b>Ap</b> y t <sub>NP</sub> ] [wp <b>Demp</b> w [ [yp <b>Num<sub>p</sub></b> x [ [xp t <sub>YP</sub> ]]]]	**	***		***
k. [ [yp <b>Ap</b> y <b>Np</b> ] [wp <b>Demp</b> w [ [xp <b>Num<sub>p</sub></b> x [ [yp t <sub>YP</sub> ]]]]	**	**		*
l. [[Ag <sub>YP</sub> <b>Np</b> ] [yp <b>Ap</b> y t <sub>NP</sub> ]] [wp <b>Demp</b> w [ [xp <b>Num<sub>p</sub></b> x t <sub>Ag<sub>YP</sub></sub> ]]]	***	***	*	
<hr/>				
*m. [ [wp <b>Demp</b> w [ [yp <b>Ap</b> y t <sub>NP</sub> ]] [xp <b>Num<sub>p</sub></b> x [ [yp t <sub>YP</sub> ]]]		***	*	***
n. [ [wp <b>Demp</b> w [ [yp <b>Ap</b> y <b>Np</b> ] [xp <b>Num<sub>p</sub></b> x [ [yp t <sub>YP</sub> ]]]]		***	*	**
o. [ [wp <b>Demp</b> w [[Ag <sub>YP</sub> <b>Np</b> ] [yp <b>Ap</b> y t <sub>NP</sub> ]] [xp <b>Num<sub>p</sub></b> x t <sub>Ag<sub>YP</sub></sub> ]]]		***	**	*
p. [ [yp <b>Num<sub>p</sub></b> x [ [wp <b>Demp</b> w [ [xp <b>Ap</b> y t <sub>NP</sub> ] [yp t <sub>YP</sub> ]]]]]	*	***	**	
<hr/>				
*q. [ [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y t <sub>NP</sub> ]] [wp <b>Demp</b> w [ [yp t <sub>YP</sub> ]]]	***		*	***
r. [ [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y <b>Np</b> ]] [wp <b>Demp</b> w [ [xp t <sub>XP</sub> ]]]	***		*	**
s. [ [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y t <sub>NP</sub> ]] [wp <b>Demp</b> w [ [xp t <sub>XP</sub> ]]]	***		**	*
t. [[Ag <sub>XP</sub> <b>Np</b> ] [xp <b>Num<sub>p</sub></b> x [ [yp <b>Ap</b> y t <sub>NP</sub> ]]] [wp <b>Demp</b> w t <sub>Ag<sub>XP</sub></sub> ]]]	***	*	**	
<hr/>				
*v. [[Ag <sub>XP</sub> [yp <b>Ap</b> y t <sub>NP</sub> ] [xp <b>Num<sub>p</sub></b> x [Np t <sub>YP</sub> ]]] [wp <b>Demp</b> w t <sub>Ag<sub>XP</sub></sub> ]]]	***	**		***
w. [[Ag <sub>XP</sub> [yp <b>Ap</b> y <b>Np</b> ] [xp <b>Num<sub>p</sub></b> x [ [yp t <sub>YP</sub> ]]] [wp <b>Demp</b> w t <sub>Ag<sub>XP</sub></sub> ]]]	***	**		*
x. [[Ag <sub>XP</sub> [Ag <sub>YP</sub> <b>Np</b> ] [yp <b>Ap</b> y t <sub>NP</sub> ]] [xp <b>Num<sub>p</sub></b> x t <sub>Ag<sub>YP</sub></sub> ]] [wp <b>Demp</b> w t <sub>Ag<sub>XP</sub></sub> ]]]	***	***	*	



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