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

Sam Steddy
University College London

Vieri Samek-Lodovici
University College London

1. Introduction

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

(1) a. Dem - Num - A - N
b. Dem - Num - N – A
c. Dem - N - Num - A
d. N - Dem - Num - A

*e. Num - Dem - A - N
*f. Num - Dem - N - A
*g. Num - N - Dem - A
*h. N - Num - Dem - A

*i. A - Dem - Num - N
*j. A - Dem - N - Num
k. A - N - Dem - Num
l. N - A - Dem - Num

*m. Dem - A - Num - N
n. Dem - A - N - Num
o. Dem - N - A - Num
p. N - Dem - A - Num

*q. Num - A - Dem - N
r. Num - A - N - Dem
s. Num - N - A - Dem
t. N - Num - A - Dem

*u. A - Num - Dem - N
*v. A - Num - N - Dem
w. A - N - Num - Dem
x. N - A - Num - Dem

Cinque (2005) also argues for the universal base-generated structure in (2), where DemP, NumP, and AP, are generated in a universally fixed order to the left of N, each in the specifier of a functional projection selected by an agreement projection. For reasons of space, the phrasal projections DemP, NumP, AP, and NP are henceforth represented in our examples and structures as Dem, Num, A, and N. The landing positions in specAgr$_W$, specAgr$_X$, specAgr$_Y$ are represented as '_' when empty, and the heads Agr$_W$, Agr$_X$, and Agr$_Y$ are omitted except where necessary. Overt phrasal labels subscripts are provided only where disambiguation is necessary, and we omit all but one final bracket.

(2) [$_{AgrWP}$ _ Agr$_W$ [$_{WP}$ **Dem** W [$_{AgrXP}$ _ Agr$_X$ [$_{XP}$ **Num** X [$_{AgrYP}$ _ Agr$_Y$ [$_{YP}$ **A** Y **N**]

What interests us here is Cinque's important insight that the attested orders are exclusively those that can be derived from this structure via successive movement operations that raise NP with or without pied-piping of the selected or selecting projections. Crucially, Cinque demonstrates that all unattested orders require remnant movement, i.e. moving a constituent from which NP has already been extracted. This result is further supported by Abels and Neeleman (2006) who, in the context of a more general argument against Kayne's (1994) Linear Correspondence Axiom, derive the above typology while weakening Cinque's structural assumptions to allow for base-generated rightward items. Despite this change, their analysis must disallow remnant movement too. An example of the kind of remnant movement at issue is provided in (3). Under Cinque's assumptions, deriving the unattested order *i* 'A Dem Num N' from the base generated order 'Dem Num A N' requires raising NP to specAgr_{Y}, followed by remnant movement of YP to specAgr_{W}. Note that YP contains a silent copy of NP which precedes the extracted NP.

(3) Dem Num $[_{\text{AgrYP}}$ _ Agr_{Y} $[_{\text{YP}}$ A Y N] → Dem Num $[_{\text{AgrYP}}$ N Agr_{Y} $[_{\text{YP}}$ A Y $t_{\text{NP}}]$ → $[_{\text{YP}}$ A Y $t_{\text{NP}}]_i$ Dem Num N t_i

This paper examines the factors that determine the ungrammaticality of remnant movement in Cinque's typology. As we will show, an outright ban on remnant movement fails to explain why and where remnant movement is ungrammatical, and is inconsistent with an exhaustive derivation of Cinque's typology, since, as we will show, remnant movement remains necessary for at least one attested order when closely following the assumptions in Cinque (2005). We will also show that Cinque's parametric analysis, though useful and informative, does not account for one of the attested orders, requires contradictory parametric values in at least one case (forcing further parametrization than originally assumed), and encodes a full description of the derivations associated with each order in the parametric values necessary to distinguish them.

We solve these problems by proposing a new analysis that derives and explains the ungrammaticality of remnant movement in unattested orders while preserving it where necessary. Our analysis exploits Grimshaw's (2001a) insights on the relation between movement economy and structural alignment within an optimality theoretic framework (see also Prince and Smolensky 1993, 2004, McCarthy and Prince 1993). Cinque's entire typology will be shown to follow from the interactions of four universal constraints requiring alignment of NP, AP, NumP, and DemP with the left edge of Cinque's base generated structure. Since simultaneous alignment is structurally impossible, the constraints conflict with each other. The attested word orders will be shown to correspond to the best possible left-alignment configurations that can be built by freely moving constituents containing NP or its traces starting from Cinque's universal base-generated structure. The unattested orders, in turn, will be shown to correspond to structures with sub-optimal alignments.

Crucially, the proposed analysis need not stipulate a ban on remnant movement nor encode derivational steps as language specific parameters. The ungrammaticality of the unattested orders follows directly from the interaction of the proposed constraints because the kind of remnant movement involved in these cases inevitably produces suboptimal alignment configurations. Under specific circumstances, however, even remnant movement may determine an optimal alignment configuration. As expected, precisely in these cases remnant movement is grammatical and the corresponding order attested.

The optimality analysis is discussed in section 2, whereas section 3 closely examines the aspects that we consider problematic in Cinque's (2005) original analysis.

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, whether attested or unattested. The analysis proper is given in sections 2.2-2.4 which explain how the proposed alignment constraints determine which structures are optimal – and hence grammatical – and which are invariably suboptimal, determining the ungrammatical status of the corresponding word orders. Finally, section 2.5 generalizes the analysis to additional conceivable structures of the examined word orders and considers a few empirical predictions distinguishing our analysis from Cinque (2005).

2.1 Conceivable Word Orders and Their Structural Representation

As in Cinque (2005), we only consider structures that can be built from Cinque's universal base-generated structure in (2) above by moving constituents containing either NP or silent copies of NP,[1] which for reason of space we represent as 't_{NP}' while still adopting Chomsky's (1995) copy theory of movement. Like Cinque (2005), we disallow structures with comp-to-spec movement within the same projection.

Together, these assumptions exclude structures where AP, NumP or DemP raise on their own, much as in Cinque (2005), but unlike Cinque's analysis they still allow for movement of remnant constituents containing silent NP copies. For example, the structure in (4), with NP raised to specAgr$_Y$ followed by remnant movement of '$[_{YP}$ AP $t_{NP}]$' to specAgr$_X$ and yielding the unattested order *m* 'Dem A Num N', remains a possible structure (moved constituents are shown in italics). Its ungrammatical status will follow from its alignment properties rather than from banning the combination of movement operations involved in its derivation.

(4) $[_{AgrWP}$ _ Agr$_W$ $[_{WP}$ **Dem** W $[_{AgrXP}$ *$[_{YP}$* ***A*** *$[_{YP}$ Y $t_{NP}]]$* Agr$_X$ $[_{XP}$ **Num** X $[_{AgrYP}$ ***N*** Agr$_Y$ t_{YP}]

We also make two temporary assumptions that will greatly facilitate the presentation of the analysis but that we will later show to be retractable with no effects on the analysis' overall validity.

First, we assume that whenever a constituent may reach a higher position through a single movement rather than a series of successive steps it will do so. For example, the structure for order *d* 'N Dem Num A' is assumed to be the one in (5), with no intermediate t_{NP} copies, rather than the structure in (6), where NP moves through the intermediate positions specAgr$_Y$ and specAgr$_X$. Later, in section 2.5, we will see that this is actually a property of the analysis, which always favors movement lacking intermediate copies.

(5) $[_{AgrWP}$ ***N*** Agr$_W$ $[_{WP}$ **Dem** W $[_{AgrXP}$ _ Agr$_X$ $[_{XP}$ **Num** X $[_{AgrYP}$ _ Agr$_Y$ $[_{YP}$ **A** Y $t_{NP}]$

(6) $[_{AgrWP}$ ***N*** Agr$_W$ $[_{WP}$ **Dem** W $[_{AgrXP}$ t_{NP} Agr$_X$ $[_{XP}$ **Num** X $[_{AgrYP}$ t_{NP} Agr$_Y$ $[_{YP}$ **A** Y $t_{NP}]$

Second, we assume that whenever a specific word order can be obtained by raising either AgrP or the immediately lower WP, XP, or YP projection, the raised phrase is the lower WP, XP, or YP projection. For example, the order *n* 'Dem A N Num' can be derived by raising either AgrYP or just YP to specAgr$_X$, because specAgr$_Y$ is empty and the overt phrases being reordered remain A and N in both derivations, compare (7) and (8) below. Our assumption let us choose the structure in (8), raising YP, as the canonical representation for this word order. Later, in section 2.5, we will show that both structures perform equally well relative to the proposed constraints and that the analysis cannot and need not distinguish between them.

(7) $[_{AgrWP}$ _ Agr$_W$ $[_{WP}$ **Dem** W $[_{AgrXP}$ *$[_{AgrYP}$ _ Agr$_Y$ $[_{YP}$* ***A*** *Y* ***N*****]]** Agr$_X$ $[_{XP}$ **Num** X t_{AgrYP}]

(8) $[_{AgrWP}$ _ Agr$_W$ $[_{WP}$ **Dem** W $[_{AgrXP}$ *$[_{YP}$* ***A*** *Y* ***N*****]]** Agr$_X$ $[_{XP}$ **Num** X $[_{AgrYP}$ _ Agr$_Y$ t_{YP}]

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[1] For a possible explanation of why movement need to be constrained to constituents containing N, see Georgi and Müller (to appear). Also, some analyses maintain that N might raise as a head, see Dehé and Samek-Lodovici (2009) for discussion and references therein. In this respect, we follow Cinque's assumptions on NP-raising to facilitate a comparison between the two analyses. The proposed analysis does not hinge on this assumption and remains valid even under N-raising.

We may now proceed and consider all the possible structures that can be built from Cinque's universal base-generated structure according to the assumptions just introduced. Their total number is constrained by the landing positions available to any moving phrase, which, following Cinque (2005), are limited to specAgr$_W$, specAgr$_X$, and specAgr$_Y$. This immediately excludes any structure involving more than three movement operations. All the logically possible structures are provided in (9) indexed according to the corresponding word order, followed by a short summary of the necessary derivational steps in parenthesis, where 'W', 'X', and 'Y' stand for specAgr$_W$, specAgr$_X$, and specAgr$_Y$ respectively.

(9) Word orders and corresponding structures:

a. [**Dem Num A N**] (No movement)
b. [**Dem Num N A** t$_{NP}$] (NP→Y)
c. [**Dem N Num A** t$_{NP}$] (NP→X)
d. [**N Dem Num A** t$_{NP}$] (NP→W)

*e. [[$_{XP}$ **Num** t$_{YP}$] **Dem** [$_{YP}$ **A N**] t$_{XP}$] (YP→X, XP→W)
*f. [[$_{XP}$ **Num** t$_{AgrYP}$] **Dem** [$_{AgrYP}$ **N A** t$_{NP}$] t$_{XP}$] (NP→Y, AgrYP→X, XP→W)
*g. [[$_{XP}$ **Num** [$_{AgrYP}$ **N** t$_{YP}$]] **Dem** [$_{AgrXP}$ [$_{YP}$ **A** t$_{NP}$] t$_{XP}$] (NP→Y, YP→X, XP→W)
*h. No structure possible for 'N Num Dem A'

*i. [[$_{YP}$ **A** t$_{NP}$] **Dem Num N** t$_{YP}$] (NP→Y, YP→W)
*j. [[$_{YP}$ **A** t$_{NP}$] **Dem N Num** t$_{YP}$] (NP→X, YP→W)
k. [[$_{YP}$ **A N**] **Dem Num** t$_{YP}$] (YP→W)
l. [[$_{AgrYP}$ **N A** t$_{NP}$] **Dem Num** t$_{AgrYP}$] (NP→Y, AgrYP→W)

*m. [**Dem** [$_{YP}$ **A** t$_{NP}$] **Num N** t$_{YP}$] (NP→Y, YP→X)
n. [**Dem** [$_{YP}$ **A N**] **Num** t$_{YP}$] (YP→X)
o. [**Dem** [$_{AgrYP}$ [**N A** t$_{NP}$] **Num** t$_{AgrYP}$] (NP→Y, AgrYP→X)
p. [**N Dem** [$_{YP}$ **A** t$_{NP}$] **Num** t$_{YP}$] (NP→W, YP→X)

*q. [[$_{XP}$ **Num A** t$_{NP}$] **Dem N** t$_{XP}$] (NP→X, XP→W)
r. [[$_{XP}$ **Num A N**] **Dem** t$_{XP}$] (XP→W)
s. [[$_{XP}$ **Num N A** t$_{NP}$] **Dem** t$_{XP}$] (NP→Y, XP→W)
t. [[$_{AgrXP}$ **N Num A** t$_{NP}$] **Dem** t$_{AgrXP}$] (NP→X, AgrXP→W)

*u. No structure possible for 'A Num Dem N'
*v. [[$_{AgrXP}$ [$_{YP}$ **A** t$_{NP}$] **Num** [$_{AgrYP}$ **N** t$_{YP}$]] **Dem** t$_{AgrXP}$] (NP→Y, YP→X, AgrXP→W)
w. [[$_{AgrXP}$ [$_{YP}$ **A N**] **Num** t$_{YP}$] **Dem** t$_{AgrXP}$] (YP→X, AgrXP→W)
x. [[$_{AgrXP}$ [$_{AgrYP}$ **N A** t$_{NP}$] **Num** t$_{AgrYP}$] **Dem** t$_{AgrXP}$] (NP→Y, AgrYP→X, AgrXP→W)

Consider, for example, how the structures for the first seven orders are obtained. Those for orders *a-d* are obtained by leaving NP in-situ or moving it to specAgr$_Y$, specAgr$_X$, or specAgr$_W$ respectively. As for the next three orders, order *e* is obtained when NP remains in-situ, YP moves to specAgr$_X$, and XP moves to specAgr$_W$. Order *f* is obtained when NP moves to specAgr$_Y$, AgrYP itself moves to specAgr$_X$, and the remnant XP moves to specAgr$_W$. Order *g* occurs when NP moves to specAgr$_Y$, the remnant YP to specAgr$_X$ to the right of DemP, and XP containing NumP and NP to specAgr$_W$ to the left of DemP. Note that the structure for *f* must raise AgrYP rather than YP, since the raising phrase carries with it the NP in specAgr$_Y$. Raising YP alone would determine the word order in *g*. In general, whenever a listed structure shows movement of one of the AgrP projections it is because its specifier is filled and has moved along with the raising AgrP.

As for orders *h* and *u*, they lack a representation because none is possible. For example, in the case of *h* the corresponding order 'N Num Dem A' requires raising NP to specAgr$_X$ to precede NumP, and then raising AgrXP, containing NP and NumP, to specAgr$_W$ so that they both precede DemP. This, however, makes it impossible to strand AP lower than DemP because there is no possible position for it since AgrXP must raise. Similar considerations apply to *u*.[2]

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

2.2 Deriving Cinque's Typology

What causes movement in the above structures and why do some movement operations yield grammatical structures –and hence attested word orders– and others do not?

Following studies on the relevance of alignment in Phonology and Syntax (e.g. McCarthy and Prince 1993, Legendre 1996, Grimshaw 2001a, 2001b, Choi 1996, 1999, Samek-Lodovici 1996, 1998, 2001, Costa 1998, Sells 2000, 2001, Gerlach 2002), we propose that movement in the above structures follows from the four constraints below which favour alignment of NP, AP, NumP, and DemP with the left edge of Cinque's base-generated structure, i.e. the left edge of AgrWP (possibly coinciding with the left edge of the extended projection of the noun; on extended projections see Grimshaw 1991, 2000). The definitions below exploit McCarthy's and Prince's (1993) format for alignment constraint within their theory for generalized alignment, followed by a brief informal definition.

(10) Alignment constraints:

N-Left – Align(NP, L, AgrWP, L). Align NP's left edge with AgrWP's left edge.

A-Left – Align(AP, L, AgrWP, L). Align AP's left edge with AgrWP's left edge.

Num-Left – Align(NumP, L, AgrWP, L). Align NumP's left edge with AgrWP's left edge.

Dem-Left – Align(DemP, L, AgrWP, L). Align DemP's left edge with AgrWP's left edge.

We also maintain that the constraints apply to the head of a chain and that they 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 (11) below for the unattested order *m*. The constraint N-left is assessed on the head of the NP-chain, hence on the overt NP, and it is violated four times due to the intervening DemP, AP, t_{NP}, and NumP

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[2] Cinque (2005:321-324) accounts for unattested orders by showing that none of them can be built from the universal base-generated structure (they all require the wrong merge order, to use his terminology). Allowing for remnant movement, as we do here, instead uncovers a fundamental difference between *h* and *u* – which are genuinely impossible to build – and the other unattested orders, which can be built but require remnant movement.

preceding NP. Likewise, Num-left is violated three times, A-left is violated once, and Dem-left is satisfied (the violations are represented as stars preceding the constraint names). As we will see later on, counting silent copies as alignment violations is crucial to derive the ungrammatical status of remnant movement. The proposed alignment constraints are thus syntactic in nature, since they are sensitive to the presence of intervening syntactic structure independently of its overt or silent phonological status.

(11) *m. [**Dem** $[_{YP}$ **A** t_{NP}] **Num N** t_{YP}] (NP→Y, YP→X) *A-L, ***Num-L, ****N-L

The table below generalizes the above reasoning to all the structures listed in (9) above. Each structure is assessed against the proposed constraints, with constraint violations represented as stars in the corresponding constraint column. For most structures, the constraint violations are easily determined by checking the alignment of the relevant items in the structures in the first column. The structures for *e-g* and *v-x*, however, involve raised constituents containing traces of YP or AgrYP. Being copies, the traces of YP and AgrYP are actually full syntactic trees containining the silent copies of AP and NP and hence causing two additional alignment violations whenever they precede overt instances of DemP, NumP, AP or NP. For example, in *e* the trace ‘t_{YP}’ causes two additional alignment violations, thus determining –together with the initial Num – three violations of Dem-left, four of A-left, and five of N-left.

(12) Tableau 1

			Dem-left	Num-left	A-left	N-left
	a.	[Dem Num A N]		*	**	***
	b.	[Dem Num N A t_{NP}]		*	***	**
	c.	[Dem N Num A t_{NP}]		**	***	*
	d.	[N Dem Num A t_{NP}]	*	**	***	
☠ by r	*e.	[[$_{XP}$ Num t_{YP}] Dem [$_{YP}$ A N] t_{XP}]	***		****	*****
☠ by r	*f.	[[$_{XP}$ Num t_{AgrYP}] Dem [$_{AgrYP}$ N A t_{NP}] t_{XP}]	****		******	*****
☠ by s	*g.	[[$_{XP}$ Num N t_{YP}] Dem [$_{YP}$ A t_{NP}] t_{XP}]	****		*****	*
☠ by k	*i.	[[$_{YP}$ A t_{NP}] Dem Num N t_{YP}]	**	***		****
☠ by k	*j.	[[$_{YP}$ A t_{NP}] Dem N Num t_{YP}]	**	****		***
	k.	[[$_{YP}$ A N] Dem Num t_{YP}]	**	***		*
	l.	[[$_{AgrYP}$ N A t_{NP}] Dem Num t_{AgrYP}]	***	****	*	
☠ by n	*m.	[Dem [$_{YP}$ A t_{NP}] Num N t_{YP}]		***	*	****
	n.	[Dem [$_{YP}$ A N] Num t_{YP}]		***	*	**
	o.	[Dem [$_{AgrYP}$ N A t_{NP}] Num t_{AgrYP}]		****	**	*
	p.	[N Dem [$_{YP}$ A t_{NP}] Num t_{YP}]	*	****	**	
☠ by r	*q.	[[$_{XP}$ Num A t_{NP}] Dem N t_{XP}]	***		*	****
	r.	[[$_{XP}$ Num A N] Dem t_{XP}]	***		*	**
	s.	[[$_{XP}$ Num N A t_{NP}] Dem t_{XP}]	****		**	*
	t.	[[$_{AgrXP}$ N Num A t_{NP}] Dem t_{AgrXP}]	****	*	**	
☠ by w	*v.	[[$_{AgrXP}$ [$_{YP}$ A t_{NP}] Num N t_{YP}] Dem t_{AgrXP}]	******	**		***
	w.	[[$_{AgrXP}$ [$_{YP}$ A N] Num t_{YP}] Dem t_{AgrXP}]	*****	**		*
	x.	[[$_{AgrXP}$ [$_{AgrYP}$ N A t_{NP}] Num t_{AgrYP}] Dem t_{AgrXP}]	*******	***	*	

The tableau reveals that some structures are inherently worse than other competing structures because they perform worse on some constraints while not performing better on the remaining ones.

Consider for example structure *m* again, repeated in (13), and compare it against structure *n*, shown in (14). Structure *n* is as effective as *m* at bringing AP closer to the left edge of Agr$_{WP}$, but unlike *m* it also improves the alignment of NP, while keeping the alignment of DemP and NumP invariant. This is reflected by the number of violations that *m* and *n* incur against the constraints. Structure *n* outperforms *m* alignment-wise because it incurs two violations on N-left against the four of *m* (namely for DemP, AP, t_{NP}, and NumP), while both structures incur the same number of violations on Dem-left, A-left, and Num-left. It follows that *m* provides an inherently worse alignment configuration than *n* and therefore it is suboptimal. Under Optimality Theory only optimal structures are grammatical hence the inherently suboptimal status of *m* determines its ungrammatical status and explains why the corresponding order is unattested in Cinque's typology.

(13) *m. [**Dem** [$_{YP}$ **A** t_{NP}] **Num** [**N** t_{YP}] (NP→Y, YP→X) *A-L, ***Num-L, ****N-L

(14) n. [**Dem** [$_{YP}$ **A N**] **Num** t_{YP}] (YP→X) *A-L, ***Num-L, **N-L

In tableau 1 above, all inherently suboptimal structures like *m* are marked with '☠', followed by the identifier of a structure that outperforms them in the same way as *n* outperforms *m* (or, to use OT terminology, a structure that harmonically bounds the suboptimal one). For example, *n* outperforms *m* on the N-L constraint, as we just saw. Likewise, *k* outperforms structure *i* on N-Left and structure *j* on both Num-Left and N-left, making *i* and *j* inherently suboptimal and the corresponding orders impossible.

The set of inherently suboptimal structures exactly matches the set of unattested orders identified by Cinque. The analysis thus provides us with a clear explanation for why these orders are ungrammatical (and hence unattested). They are ungrammatical because the corresponding structures instantiate inherently suboptimal alignment configurations. Or, put differently, given a choice between two structures where one shows inferior alignment properties, human grammars always opt for the superior alternative.

2.3 On the Ungrammaticality of Remnant Movement

The analysis also explains why remnant movement yields, in most cases, inherently suboptimal structures.

In general, movement to the left is good for the alignment of what is moved, but not for the alignment of what ends up following the moved item. For example, given the order ABCD, moving [CD] leftward, yielding A[CD]B, improves the alignment for C and D, but worsens the alignment of B, while the alignment of A remains invariant.

Remnant movement occurs when an item is extracted from a larger moving constituent before the latter moves. The extracted item might move closer to the left edge than the remnant. In this case, the extracted item ends up better aligned than if it had not extracted. For example, D could move in front of A prior to the movement of [C t_D], building the sequence DA[C t_D]B. The trace 't_D' adds an extra alignment violation to B, but there is a net gain for D, which is better aligned than if it had not been extracted and followed C. Since this 'positive' remnant movement can improve alignment for the extracted item and hence is favoured by the corresponding alignment constraint, it is predicted to be possible, and it is indeed attested in the derivation for order *p*, as we will discuss in detail in section 3.3.

If the extracted item instead follows the raised remnant, its alignment will be worse than if it had not been extracted. Compare, for example, the remnant-free structure where D raises with C, yielding A[CD]B, with the remnant-movement structure where D raises in front of B and then the remnant [C t_D] raises before D, yielding the sequence A[C t_D]DB. In the remnant structure, D and B incur an additional alignment violation caused by the trace 't_D'. The alignment loss suffered by D and B is not compensated by any alignment gain elsewhere, since the alignment of A and C remains invariant across the two sequences. For this reason, remnant movement of this kind always determines a worse overall alignment configuration than the corresponding remnant-free structure.[3]

This is shown again relative to a hypothetical NP in (15) and (16) below. A and B are arbitrary phrases whose alignment is assessed by the constraints A-Left and B-Left. Leftward movement of '[A N]' in the remnant-free structure (16a) improves the alignment of A and NP relative to the initial structure in (15) at the expense of B's alignment and is thus favoured by the constraints A-Left and N-left. If, instead, NP is extracted and eventually follows the remnant [A t_{NP}], as shown in (16b), NP and B incur one additional violation due to the copy 't_{NP}' preceding them, while the violations of A remain unchanged. Remnant movement of this kind thus creates alignment configurations that are inevitably worse than their remnant-free counterparts, and hence suboptimal.

(15) Initial structure: __ [B [A N]] *A-Left, **N-Left, B-Left

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[3] Thanks to Jane Grimshaw for particularly useful comments about this point.

(16) a. Remnant-free: [A N]$_i$ B t_i A-Left, *N-Left, **B-Left

b. Remnant movement: [A t_{NP}]$_i$ N B t_i A-Left, **N-Left, ***B-Left

This is exactly what makes remnant movement ungrammatical in all unattested structures of Cinque's typology. We have already seen in the discussion of (13) and (14) above how the structure for *n*, which raises YP while keeping NP unmoved, outperforms *m*, which raises a remnant YP saddled by a copy of NP before NP.

The same holds for *i* and *j*, whose raised NP in specAgr$_Y$ and specAgr$_X$ respectively follows the remnant YP raised specAgr$_W$. Both are outperformed by *k* where YP raises with NP still in situ, hence improving the NP's alignment. The same also holds for *q*, where the remnant XP in specAgr$_W$ precedes the extracted NP, determining a worse alignment configuration than *r*, where XP raises with NP still in situ. Likewise in *v*, the remnant YP in specAgr$_X$ precedes the extracted NP and is therefore outperformed by *w*, where YP with NP in situ. Finally, in *e* and *f*, the remnant XP in specAgr$_W$ precedes the extracted YP and AgrYP, which contain NP. Both are outperformed by *r*, where XP raises with its unmoved YP and AgrYP phrases, thus improving the alignment of both the AP and NP within it.

The only remaining unattested order, *g*, is slightly different because the phrase whose alignment is worsened via remnant-movement is AP rather than NP. As the structure for *g* in (17) shows, first the NP raises to specAgr$_Y$, then YP raises to specAgr$_X$ (remnant movement), and finally XP raises to specAgr$_W$, taking the NP with it. The silent copy that causes additional alignment violations is the copy of YP, shown struck-through in (17) to make visible the copies of AP and NP contained in it. These copies assign two alignment violations to the DemP and AP following them. Compare this with the corresponding remnant-free structure *s* in (18), where XP raises with YP in it. Consequently, AP is moved leftward too, resulting in an overall better alignment configuration with three less violations than *g* on A-L and the same number of violations on the other three constraints.

(17) *g. [[$_{XP}$ **Num** [$_{AgrYP}$ **N** ~~[$_{YP}$ **A N**~~]]] **Dem** [$_{AgrXP}$ [$_{YP}$ **A** t_{NP}] t_{XP}] Num-L, *N-L, ****Dem-L, *****A-L

(18) s. [[$_{XP}$ **Num** [$_{AgrYP}$ **N** [$_{YP}$ **A** ~~**N**~~]]] **Dem** t_{XP}] Num-L, *N-L, ****Dem-L, **A-L

Structures with remnant movement of the kind just examined thus always express a suboptimal alignment configuration because the copy/copies they carry increase the misalignment of any extracted item following them with no compensating benefits. Therefore, there is no need to introduce conditions blocking remnant movement. Rather, remnant movement is absent whenever it fails to deliver any benefit in the quest for optimal alignment.[4]

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[4] This result appears to be independent from the specific assumptions on Kayne's Linear Correspondence Axiom followed by Cinque (2005). For example, the analysis appears to remain valid even under the weaker assumptions made in Abels and Neeleman (2006), where DemP, NumP, and AP are allowed to be base-generated to the right of N even though movement is assumed to be strictly leftward. Even under these assumptions, remnant movement of a phrase containing 't_{NP}' to the left of some item X inevitably produces a worse alignment configuration than movement of the same phrase with NP in-situ, because in the latter case NP improves its alignment while keeping an invariant number of violations for X when compared against remnant movement. Even more interestingly, the proposed OT analysis appears to derive the ban on rightward movement, which Abels and Neeleman's (2006) analysis must stipulate. Any instance of rightward movement creates new silent copies to the left of the moved item, thus inevitably producing additional alignment violations with no possible alignment gains on any other item.

2.4 Optimal Word Orders

All attested structures 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 see this, we have to briefly introduce some formal aspects of Optimality Theory (Prince and Smolensky 1993, 2004). Under Optimality Theory, crosslinguistic variation follows from the distinct 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' favours alignment of DemP over NumP, NumP over AP, and AP over NP. Conversely, the ranking 'N-L>>A-L>> Num-L>>Dem-L' favours alignment of NP over AP, AP over NumP, and NumP over DemP.

Each individual ranking imposes its own preference order over the available structures. In particular, given a ranking R and two structures *s1* and *s2*, *s1* will beat *s2* relative to R whenever the highest ranked constraint on which *s1* and *s2* differ is violated more times by *s2* than by *s1*.

It becomes thus possible to identify the *optimal* structure for a specific ranking R as that structure that remains unbeaten in R. What is optimal in the winning structure is the alignment configuration relative to the alignment priorities specified in the ranking at issue, a property that is directly reflected by its optimal allocation of constraint violations. Any conceivable alternative structure with fewer violations on some constraint C will necessarily also incur more violations than the optimal structure on some higher ranked constraint C', or else the optimal structure would be beaten on C and would not be optimal.

Consider for example the movement-free structure for order *a*. This structure is optimal under the ranking Dem-L>>Num-L>>A-L>>N-L because no other structure beats it relative to this ranking. Some other structures do outperform *a* on specific constraints, but they also always incur more violations than *a* on other higher ranked constraints in this ranking. For example, structure *b* violates N-L once less time than *a*, but incurs one additional violation on the higher constraint A-L. The same holds for all remaining structures, making *a* the optimal structure for this ranking, i.e. 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 the table below together with the other results discussed so far. The column on the left recapitulates Cinque's typology, with each letter identifying one word order (repeated at its right) and the corresponding structure (not shown). The column on the right provides the set of rankings that select that particular structure as optimal, provided such a ranking exists. As we saw above, structures involving remnant movement are inherently suboptimal across all rankings, hence no ranking selects them as optimal and the corresponding order remains unattested. The other structures are instead all optimal under one or more rankings, hence they are grammatical and the associated order attested. The table exhausts all the 24 distinct rankings that can be built out of four constraints, hence no other optimal structure is possible, thus deriving Cinque's typology.

(19) Possible rankings and selected optima

Structure identifier and corresponding order		Rankings selecting the structure as optimal
a	Dem Num A N	Dem left >> Num left >> A left >> N left
b	Dem Num N A	Dem left >> Num left >> N left >> A left
c	Dem N Num A	Dem left >> N left >> Num left >> A left
d	N Dem Num A	N left >> Dem left >> Num left >> A left
*e	Num Dem A N	*None*
*f	Num Dem N A	*None*
*g	Num N Dem A	*None*
*h	N Num Dem A	*Structurally impossible*
*i	A Dem Num N	*None*
*j	A Dem N Num	*None*
k	A N Dem Num	A left >> N left >> Dem left >> Num left A left >> Dem left >> Num left >> N left A left >> Dem left >> N left >> Num left
l	N A Dem Num	N left >> A left >> Dem left >> Num left
*m	Dem A Num N	*None*
n	Dem A N Num	Dem left >> A left >> N left >> Num left Dem left >> A left >> Num left >> N left
o	Dem N A Num	Dem left >> N left >> A left >> Num left
p	N Dem A Num	N left >> Dem left >> A left >> Num left
*q	Num A Dem N	*None*
r	Num A N Dem	Num left >> A left >> N left >> Dem left Num left >> A left >> Dem left >> N left Num left >> Dem left >> A left >> Num left Num left >> Dem left >> N left >> A left
s	Num N A Dem	Num left >> N left >> A left >> Dem left Num left >> N left >> Dem left >> A left
t	N Num A Dem	N left >> Num left >> A left >> Dem left N left >> Num left >> Dem left >> A left
*u	A Num Dem N	*Structurally impossible*
*v	A Num N Dem	*None*
w	A N Num Dem	A left >> N left >> Num left >> Dem left A left >> Num left >> Dem left >> N left A left >> Num left >> N left >> Dem left
x	N A Num Dem	N left >> A left >> Num left >> Dem left

The set of rankings deriving each attested word order always includes a ranking matching the order itself. For example, the rankings selecting structure *w* with order ‘A N Num Dem’ as optimal includes the matching ranking ‘A-L>>N-L>>Num-L>>Dem-L’. This does not mean that the proposed grammar system simply describes the desired word order through the associated constraint ranking. 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, structure *q* should be optimal under the ranking ‘Num-L>>A-L>>Dem-L>>N-L’. But this is clearly not the case: unattested word orders are unattested precisely because the corresponding rankings cannot select the related structures 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 the following tableau shows, the ranking ‘Num-L>>A-L>>Dem-L>>N-L’ just mentioned selects structure *r* as optimal, rather than *q*, due to its fewer violations of N-left (The optimal structure is marked as ‘☞’ as per OT conventions).[5]

(20) Tableau 2

	Num left	A left	Dem left	N left
*q. [[$_{XP}$ Num A t_{NP}] Dem [$_{AgrXP}$ N t_{XP}]	*		*	****
☞ r. [[$_{XP}$ Num A N] Dem t_{XP}]	*		*	**

In conclusion, alignment constraints trigger raising of the relevant phrases to the appropriate positions much like overt agreement checking does in Cinque (2005) (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

To complete the analysis, we need to show that the temporary assumptions introduced in section 2.1 are, indeed, temporary.

The first assumption stated that phrases reach their final landing site in a single step, blocking movement through intermediate positions. This assumption is actually a consequence of the proposed analysis. Intermediate steps insert silent copies that worsen the alignment configuration for any item following them. Structures involving intermediate steps are therefore inevitably beaten by the corresponding single-movement alternative across all rankings. For example, compare structure *d*, where NP raises to specAgr$_W$ directly, to the alternative structure *d'*, involving intermediate stops in specAgr$_Y$ and specAgr$_X$. As tableau 3 shows, the silent copies left in the intermediate positions determine additional violations of Num-L and A-L, leaving *d'* harmonically bounded by *d*. The same would of course hold if the intermediate steps involved only specAgr$_Y$ or only specAgr$_X$.

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[5] As it stands, our analysis predicts that in some languages the order of NP relative to DemP, NumP, and AP might be sensitive to the number of items involved (Klaus Abels, p.c.). For example, the ranking A-L>>Dem-L>>Num-L>>N-L predicts the order ‘A N Dem Num’ – with NP preceding DemP – when all four items are present, but the switched order ‘Dem N’ when only DemP and NP are present. This prediction is rooted in the definitions of the alignment constraints, which currently target DemP, NumP, AP, and NP directly. As a result, all constraints are vacuously satisfied whenever the corresponding projection is absent, which in turn causes the order to switch as described. An analysis where the order remains invariant independently of the number of items involved is easily obtained by revising the alignment constraints so that they target the projections XP, YP, and WP that contain DemP, NumP, and AP. Since these projections are part of the main tree-spine and can be assumed to remain present even when DemP, NumP, and AP are absent, the corresponding constraints remain active, which in turn ensures that the order remains invariant. For example, the ranking A-L>>Dem-L>>Num-L>>N-L discussed above would place NP before DemP even when AP and NumP are absent, because the highest-ranked constraint XP-Left would still require movement of XP into specAgr$_W$, carrying the NP with it and placing it before DemP. Note that it would not be possible to extract the NP and leave it after DemP, as this would create an inherently suboptimal remnant movement configuration of the kind discussed in section 2.3. Specifically, raising NP with XP as in (1) incurs less N-left, WP-left, and YP-left violations than extracting the NP as in (2), while the violations for XP-left remain unchanged. Determining which analysis is correct requires further investigating Cinque’s typology to determine the attested sub-orders in each language for each possible subset of DemP, NumP, AP, and NP.

(1) [$_{XP}$ X NP]$_i$ [DemP W [Y t_i]

(2) [$_{XP}$ X t_{NP}]$_i$ [DemP W [Y [NP t_i]

(21) Tableau 3

			Dem left	Num left	A left	N left
☞	d.	[N Dem Num A t_{NP}]	*	**	***	
	d'.	[N Dem t_{NP} Num t_{NP} A t_{NP}]	*	***	*****	

The absence of intermediate steps is thus an empirical prediction of the analysis. It also distinguishes this analysis from Cinque's account, which predicts the presence of intermediate steps. The clearest contrast is predicted to occur in languages with the word order *d* just examined, which is found in languages such as Kikuyu and the other few languages listed in Cinque (2005:319, FN10). Since we are not in a position to test them at this moment, we leave testing of this prediction to further research.

Our second temporary assumption stated that whenever the same word order can be represented through two structures differing only in whether they raise an agreement projection AgrP or its selected complement (i.e. YP, XP, or WP), the structure chosen as representative is the one that raises the complement. The assumption was necessary to ensure that word orders were represented by a single structure, thus facilitating the following discussion. In reality, however, both structures are possible because they are not distinguished by the alignment constraints. Once we allow for both structures, both are selected as optimal or suboptimal depending on the presence of remnant movement.

This structural ambiguity is predicted to occur whenever the specifier of the relevant AgrP projection remains unoccupied and therefore raising 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 specAgr_W as in structure *k* in the tableau below. But the same word order can also be derived by raising AgrYP to specAgr_W, as shown in structure *k'*. The constraint violations, however, remain identical for both structures, ensuring an identical grammatical fate as optimal or suboptimal.

(22) Tableau 4

		Dem left	Num left	A left	N left
k.	[$[_{YP}$ A N] Dem Num $[_{AgrYP}$ _ t_{YP}]	**	***		*
k.	[$[_{AgrYP}$ _ $[_{YP}$ A N]] Dem Num t_{AgrYP}]	**	***		*

We may thus safely drop this assumption too, since the analysis retains its ability to derive the attested and unattested orders of Cinque's typology even when allowing for these additional structures. Incidentally, this provides a second potentially testable empirical difference with respect to Cinque (2005) where a similar structural ambiguity absent.

This concludes the presentation of the optimality analysis. Cinque's typology follows immediately from the interaction of the proposed alignment constraints. The attested orders constitute optimal alignment configurations relative to one or more rankings of the constraints. Unattested orders occur whenever the corresponding structures must resort to remnant movement of the sort discussed in section 2.3, which, as we showed, inevitably produces suboptimal alignment configurations across all rankings. Finally, the analysis extends to any conceivable structures 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 intermediate traces or raising agreement projections.

3. Problematic Aspects in Cinque (2005)

Cinque's analysis has many important merits. By collecting together the results of several individual languages it provides an empirically sound crosslinguistic typology for the linear ordering of DemP, NumP, AP, and NP. Furthermore, it uncovers the essential generalization characterizing this typology, namely the observation that the derivations of the attested orders involve movement of constituents containing NP and lack remnant movement. Without Cinque's analysis, alternative analyses of the same typology, such as ours or the analysis in Neeleman and Abels (2006), would not have been possible.

Our analysis capitalizes on these significant results, but it also offers an explanation for the ungrammatical status of remnant movement. Its theoretical advantages stand out more clearly, however, once we also closely 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 eliminates, hence providing – we believe – a stronger overall account.

3.1 Encoding Derivations into Parameters

The first part of Cinque (2005) shows that the attested and unattested orders can be derived from the proposed universal base-generated order, provided that movement is restricted to NP with additional optional pied-piping of the *whose picture* or *picture of who* type. It is this restriction that is responsible for blocking remnant movement of any lower constituent containing silent NP-copies but no NP.

Our analysis need not stipulate such a restriction. Constituents containing only NP-copies are free to move anywhere. Remnant movement will still be absent from most attested word orders because it produces suboptimal alignment configurations. This is a welcome property when considering – as discussed in Abels and Neeleman (2006) – that a ban on remnant movement appears empirically non-viable due to the many syntactic analyses that appear to require it. For example, Abels and Neeleman (2006) propose the sentence below as possible evidence for remnant movement of VP. Other analyses involving remnant movement cited by Abels and Neeleman (2006) include den Besten and Webelhuth (1987), Kayne (1998), Müller (1998), Koopman and Szabolcsi (2000), Nilsen (2003).

(23) [Painted t_k by Picasso]$_i$, [this painting]$_k$ does not seem to be t_i

The second part of Cinque's paper offers a more detailed analysis, deriving the impossibility of remnant movement from a slightly adapted condition on movement/attraction from Kayne (2005: sec. 5.6). Cinque assumes that DemP, NumP, and AP require licensing by a nominal feature that is supplied via agreement between NP and the agreement projection immediately above the WP, XP, and YP projections containing DemP, NumP, and AP. Agreement licensing is assumed to be possible both with or without movement of NP, or a constituent containing it, into the specifier of the relevant Agr$_\alpha$P projection and whether movement occurs or not depends on the specific language at issue.

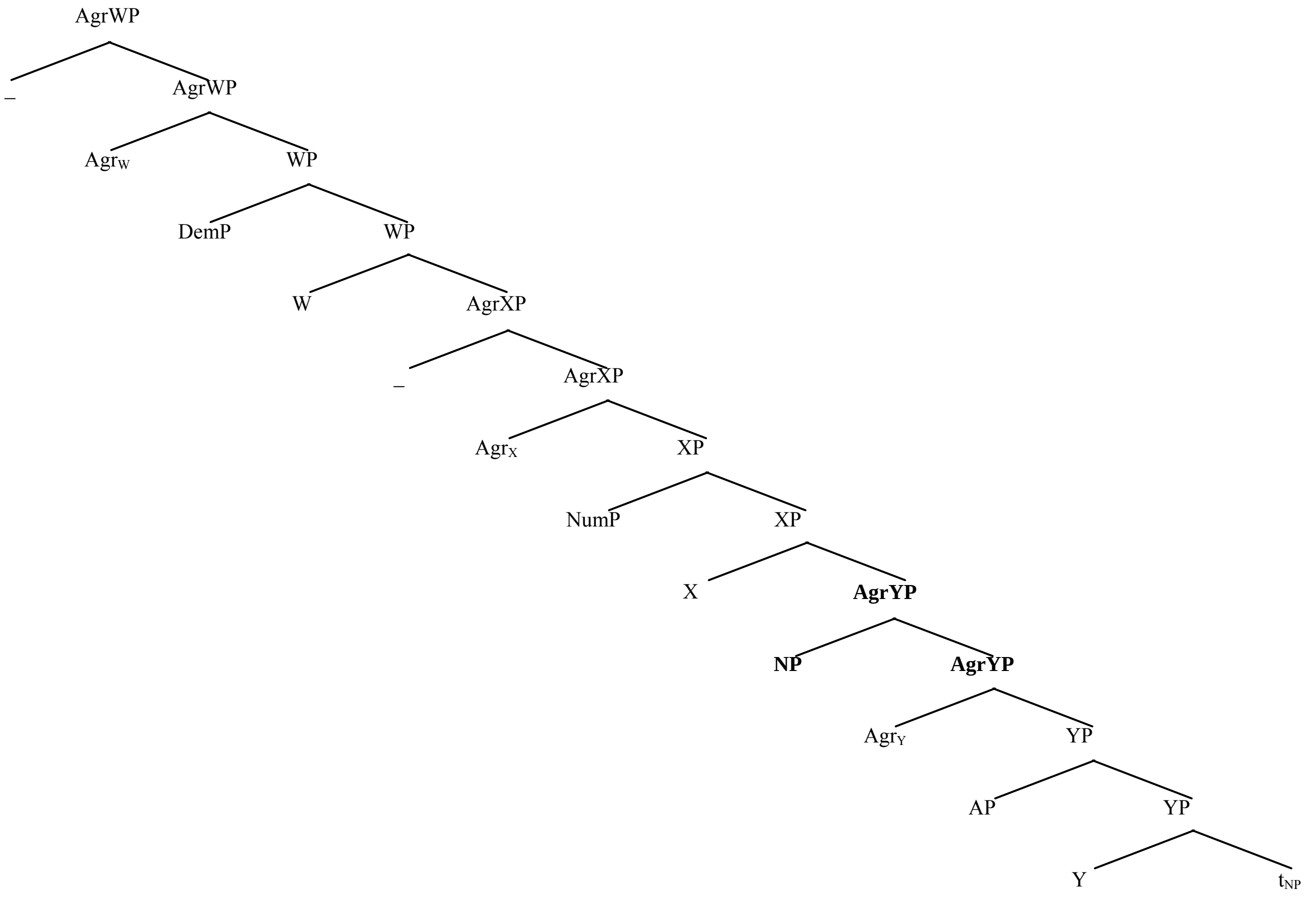
When movement is necessary, which phrase raises is determined by the condition in (24). The condition states that the phrasal category moving to specAgr$_\alpha$ is the category *closest* to Agr$_\alpha$ that is neither the complement nor the specifier of the complement of Agr$_\alpha$ – thus excluding WP, XP, and YP and their specifiers – and where 'closest' is defined as in (25) (Cinque 2005:326).

(24) *Selection of moving category* – For any functional head H, the category ZP moving to SpecHP must be (i) distinct from the complement and the specifier of the complement of H, and (ii) 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).

To see how these conditions derive the absence of remnant movement consider structure (26) below, where NP has raised to specAgr$_Y$, licensing YP, and hence AP too. Now consider NumP and XP and assume that they too require licensing by overt movement of a phrase carrying an N-feature into specAgr$_X$. Condition (24) blocks remnant movement of the lower AgrYP segment into specAgr$_X$ because both the NP in specAgr$_Y$ and the higher AgrYP segment count as closer categories.[6]

(26)



A closer examination reveals that this analysis requires a complex set of ancillary assumptions that raise undesirable theoretical issues as well as problematic empirical consequences.

A first issue concerns the excessive parametric complexity being implicitly assumed. Since some attested orders require NP to remain in-situ, Cinque's analysis assumes that licensing can

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[6] Since licensing requires a nominal feature, it is natural to wonder whether remnant movement of the lower AgrYP is already blocked by its potentially non-nominal nature. Cinque does not address this point but the answer is necessarily negative because some of the attested orders require pied-piping of the *picture of who* type, thus requiring nominal features to be accessible in the projections dominating NP, AgrYP included. For example, the attested order 'Num A N Dem' is derived by moving the entire AgrXP phrase into specAgr$_W$. It follows that the relevant nominal feature must be accessible at the root node AgrXP and hence also at the intermediate projection AgrYP. Without the conditions in (24) and (25) remnant movement of the lower AgrYP segment into specAgr$_W$ would thus remain legitimate.

occur via long-distance agreement à la Chomsky (1995). The attested order ‘Dem Num A N’, where nothing moves, would otherwise incorrectly be deemed ungrammatical. This assumption, however, introduces a highly articulated parametric system where individual languages must specify category by category whether licensing occurs by movement or long-distance agreement (Cinque 2005:326). For example, a language with the order ‘Dem Num N A t_{NP}’, where NP raises into specAgr$_Y$, will have to parametrically specify that licensing of WP and XP (and hence DemP and NumP) occur via long-distance agreement while licensing of YP (and hence AP) involves overt NP movement.

The complexity of the assumed parametric system is further increased by the optional availability of pied-piping. Its presence or absence too must be specified with respect to each category. For example, languages with the order ‘A N Num Dem’, derived via the two steps shown in (27) below, must parametrically specify that (i) YP and AP are licensed via long-distance agreement between AgrYP and NP (blocking NP movement into AgrYP, which would cause an incorrect N-A suborder); (ii) XP and Num are licensed via movement of NP into specAgr$_X$ with pied-piping of the *picture of who* type; and (iii) WP and Dem are licensed via movement into specAgr$_Y$ with pied-piping of the *whose picture* type.

(27) Dem [Num [A N]] → Dem [[A N] Num t_{AgrYP}] → [[A N] Num t_{AgrYP}] Dem t_{AgrXP}

As is apparent from the above description, the required parameters actually describe the derivational steps that are necessary to obtain the desired pattern. In other words, the parametric system mirrors, in its structure and content, the final typology and the syntactic derivations that determine it.

It follows that we gain no genuine understanding of why some derivations are legitimate and others are not, because the derivations themselves are already stipulated as theoretical primitives in the parametric values. In contrast, the proposed OT analysis provides a genuine explanation of why some orders are grammatical and others not. Its own theoretical primitives, i.e. the proposed constraints, do not need to state which movement types are legitimate and for which category they are so. Nor does the OT analysis pre-determine for each language whether licensing of a specific category will or will not involve movement. All these aspects emerge as properties of the structures that the constraints select as optimal alignment configurations. The only parametric property distinguishing one language from another is constraint ranking, i.e. a fully abstract property unrelated to the specific empirical domain at issue and only determining which constraints take precedence whenever two or more constraints cannot be all satisfied at once.

3.2 Contradictory Parametric Values

Cinque (2005:326) explains that in order to derive his typology his analysis must also parametrize the definition of ‘closest node’ in (25) above, distinguishing languages where closeness to a head H is calculated in terms of intervening *nodes* (i.e. counting each individual phrasal segment) from languages where what counts is 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 structure (28) (the same structure shown in tree format in (26) above).

(28) [$_{AgrWP}$ _ Agr$_W$ [$_{WP}$ **Dem** W [$_{AgrXP}$ _ Agr$_X$ [$_{XP}$ **Num** X [$_{AgrYP}$ **N** [$_{AgrYP}$ Agr$_Y$ [$_{YP}$ **A** Y t_{NP}]

The next step requires a different definition of closeness depending on which of the two orders is derived. Order ‘Dem N A Num’ requires movement of the entire AgrYP projection into specAgr$_X$, intuitively placing ‘N A’ between Dem and Num. This requires the definition of ‘closest node’ where segments count as intervening nodes, so that the top AgrYP segment in (28) is identified as the node closest to Agr$_{X}$ (remember that raising XP or NumP is already blocked by condition (24.i)).

The order ‘Dem N Num A’ must instead move NP alone from specAgr$_{Y}$ to specAgr$_{X}$, hence disallowing for pied-piping of AgrYP. To make this possible, NP must be selected as the closest phrase to Agr$_{X}$. This requires the alternative *category* definition of ‘closest node’. As Cinque points out, languages with this value may not select the top AgrYP node as ‘closest’ because this node is just a segment (specifiers are assumed to phrase-adjoin as in Kayne 1994). The closest category thus becomes the NP in specAgr$_{Y}$ as desired (see Cinque 2005:326 for discussion).

We find Cinque’s *segment/category* parameter highly problematic because some of the attested orders involve derivations containing steps where NP moves on its own, thus requiring the category definition of ‘closest node’, as well as steps where NP moves with pied-piping, hence requiring the segment definition of ‘closest node’. The corresponding languages would thus require contradictory parametric values.

Consider for example the attested order *t* ‘N Num A Dem’. Its derivation requires the steps detailed in (29) with the constituent moved at each step shown in italics. First NP moves into specAgr$_{Y}$, yielding the familiar structure in (29.ii) available in tree format in (26) above. Then NP raises to specAgr$_{X}$ as shown in (29.iii). This requires the *categorial* definition of ‘closest node’ or else the entire AgrYP would be pied-piped and incorrectly place AP before NumP. Finally, the entire AgrXP moves to specAgr$_{W}$ as shown in (29.iv), thus placing the suborder ‘N Num A’ before DemP as desired. But this latter operation involves pied-piping, thus requiring the *segment* definition of ‘closest node’, contradicting the value necessary for the previous step.

(29) i. $[_{\text{AgrWP}}\ \_\ \text{Agr}_{W}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_{X}\ \ [_{\text{XP}}\ \textbf{Num}\ \ X\ \ [_{\text{AgrYP}}\ \ \_\ \ \text{Agr}_{Y}\ \ [_{\text{YP}}\ \textbf{A}\ \ Y\ \textbf{N}]$

ii. $[_{\text{AgrWP}}\ \_\ \text{Agr}_{W}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_{X}\ \ [_{\text{XP}}\ \textbf{Num}\ \ X\ \ [_{\text{AgrYP}}\ \boldsymbol{N}\ \ \text{Agr}_{Y}\ \ [_{\text{YP}}\ \textbf{A}\ Y\ \ t_{\text{NP}}]$

iii. $[_{\text{AgrWP}}\ \_\ \text{Agr}_{W}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \boldsymbol{N}\ \text{Agr}_{X}\ \ [_{\text{XP}}\ \textbf{Num}\ X\ \ [_{\text{AgrYP}}\ t_{\text{NP}}\ \text{Agr}_{Y}\ \ [_{\text{YP}}\ \textbf{A}\ Y\ \ t_{\text{NP}}]$

iv. $[_{\text{AgrWP}}\ [_{\mathit{AgrXP}}\ \boldsymbol{N}\ \ \mathit{Agr}_{X}\ [_{\mathit{XP}}\ \boldsymbol{Num}\ \ X\ \ [_{\mathit{AgrYP}}\ \ t_{\mathit{NP}}\ \ \mathit{Agr}_{Y}\ [_{\mathit{YP}}\ \boldsymbol{A}\ Y\ t_{\mathit{NP}}]]]]\ \ \text{Agr}_{W}\ [_{\text{WP}}\ \textbf{Dem}\ \ W\ t_{\text{AgrXP}}\ ]$

Under Cinque’s analysis, the only conceivable solution for this problem appears to be further parametrization. Languages would have to specify the necessary definition of ‘closest node’ as category or segment for each agreement head, depending on the kind of movement needed to derive their respective word order. For example, the ‘N Num A Dem’ order just examined would require this parameter set for ‘category’ relative to Agr$_{X}$ and ‘segment’ relative to Agr$_{W}$. The problem, of course, is that once again we are transcribing derivational steps into parametric values, effectively using parameters as instructions for the derivations that we think should succeed.

The OT analysis is not affected by this problem. Movement is always free, thus dispensing with any selection 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 alignment constraints. No condition is language specific. 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 proposed constraints.

3.3 An Unaccounted Word Order

Despite their number and complexity, Cinque's parameters are unable to derive the entire typology. The attested order *p* 'N Dem A Num' remains unaccounted for.[7] According to Cinque this order can be derived in two ways. A first derivation raises AgrYP, containing '[A N]', to specAgr_X as in (30.ii), followed by extraction of NP to specAgr_W as in (30.iii). The second derivation raises NP to $\text{specAgr}_{Y,}$ as in (31.ii), then moves the entire AgrYP containing '[N A]' to specAgr_X, as in (31.iii), and finally raises NP to specAgr_W as in (31.iv) (Cinque 2005:323).

(30) i. $[_{\text{AgrWP}}\ \_\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ \ X\ \ [_{\text{AgrYP}}\ \_\ \ \text{Agr}_Y\ \ [_{\text{YP}}\ \mathbf{A}\ \ Y\ \mathbf{N}]$

ii. $[_{\text{AgrWP}}\ \_\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \mathit{[_{AgrYP}\ \_\ Agr_Y\ \ [_{YP}\ \mathbf{A}\ Y\ \ \mathbf{N}\ ]]}\ \ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ \ X\ \ t_{\text{AgrYP}}]$

iii. $[_{\text{AgrWP}}\ \boldsymbol{N}\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ [_{\text{AgrYP}}\ \_\ \text{Agr}_Y\ \ [_{\text{YP}}\ \mathbf{A}\ Y\ \ t_{\text{NP}}\ ]]\ \ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ \ X\ t_{\text{AgrYP}}\ ]$

(31) i. $[_{\text{AgrWP}}\ \_\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ \ X\ \ [_{\text{AgrYP}}\ \_\ \ \text{Agr}_Y\ \ [_{\text{YP}}\ \mathbf{A}\ \ Y\ \mathbf{N}]$

ii. $[_{\text{AgrWP}}\ \_\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ \ X\ \ [_{\text{AgrYP}}\ \boldsymbol{N}\ \ \text{Agr}_Y\ \ [_{\text{YP}}\ \mathbf{A}\ Y\ \ t_{\text{NP}}]$

iii. $[_{\text{AgrWP}}\ \_\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ \mathit{[_{AgrYP}\ \boldsymbol{N}\ \ Agr_Y\ \ [_{YP}\ \boldsymbol{A}\ Y\ \ t_{NP}]]}\ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ X\ \ \ t_{\text{AgrYP}}\ ]$

iv. $[_{\text{AgrWP}}\ \boldsymbol{N}\ \text{Agr}_W\ \ [_{\text{WP}}\ \mathbf{Dem}\ \ W\ \ [_{\text{AgrXP}}\ [_{\text{AgrYP}}\ t_{\text{NP}}\ \ \text{Agr}_Y\ \ [_{\text{YP}}\ \mathbf{A}\ Y\ \ t_{\text{NP}}]]\ \text{Agr}_X\ \ [_{\text{XP}}\ \mathbf{Num}\ X\ \ t_{\text{AgrYP}}\ ]$

The problematic step in both derivations is the final one, where NP is extracted from AgrYP, itself contained in specAgr_X. This extraction from within the specifier of AgrXP is not licensed under either of the two definitions of what counts as closest to the attracting head Agr_W. The category-based definition would select the constituent in the specifier of AgrXP, hence raising the entire AgrYP phrase containing '[A N]' or '[N A]' depending on which of the above two derivations is followed and yielding the incorrect orders 'A N Dem Num' or 'N A Dem Num' respectively. The segment-base definition would select the entire AgrXP projection containing 'A N Num' or 'N A Num' depending on the derivation being followed, yielding the incorrect orders 'A N Num Dem' or 'N A Num Dem' respectively. The analysis thus fails to derive a structure for this order, incorrectly predicting it to be ungrammatical.

Interestingly, 'N Dem A Num' becomes underivable because the conditions governing movement based on the two definitions of 'closest' exclude extraction from within a phrase located in a specifier position. Were it not for the problem just examined, this would be a desirable property, since extraction from a specifier is generally blocked (e.g. Cinque 1990, Abels and Neeleman 2006). The derivation for order *p* that avoids extraction from within a specifier phrase does exist, but it is unavailable in Cinque's analysis because it involves remnant movement. Under this derivation, N moves directly to AgrWP, followed by remnant movement of YP to specAgr_X as shown in (32).[8]

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[7] Cinque (2005) explains that this order is primary in Pitjantjatjara (Bowe, 1990:111) and it coexists with order 'N Dem Num A' in Noni (Rijkhoff 2002:273) and Nkore-Kiga (Dryer 2003:43, 2007; Lu 1998:162n59, 165). In addition, Abels and Neeleman (2006:5, fn1) mention that a word order requiring a similar derivation might be necessary for Greek.

[8] Abels and Neeleman (2006) exploit rightward generation of Num to the right of N to derive this order through simple N-raising to the highest left position as in (1) below. Their derivation avoids extraction from within a specifier as well as remnant movement. Their overall analysis, however, must still stipulate the impossibility of remnant movement in order to exclude unattested orders.

(1) **[Dem [[A N] Num]]** → **N [Dem [[A** t_{NP} **] Num]]**

(32) i. $[_{\text{AgrWP}}\ \_\ \text{Agr}_{\text{W}}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ \text{W}\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_{\text{X}}\ \ [_{\text{XP}}\ \textbf{Num}\ \ \text{X}\ \ [_{\text{AgrYP}}\ \ \_\ \ \text{Agr}_{\text{Y}}\ \ [_{\text{YP}}\ \textbf{A}\ \ \text{Y}\ \textbf{N}]$

ii. $[_{\text{AgrWP}}\ \boldsymbol{N}\ \text{Agr}_{\text{W}}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ \text{W}\ \ [_{\text{AgrXP}}\ \_\ \ \text{Agr}_{\text{X}}\ \ [_{\text{XP}}\ \textbf{Num}\ \ \text{X}\ \ [_{\text{AgrYP}}\ \ \_\ \ \text{Agr}_{\text{Y}}\ \ [_{\text{YP}}\ \textbf{A}\ \ \text{Y}\ \text{t}_{\text{NP}}\,]$

iii. $[_{\text{AgrWP}}\ \boldsymbol{N}\ \text{Agr}_{\text{W}}\ \ [_{\text{WP}}\ \textbf{Dem}\ \ \text{W}\ \ [_{\text{AgrXP}}\ \ \textit{[}_{\textit{YP}}\ \boldsymbol{A}\ \ Y\ t_{NP}\,\textit{]}\ \ \text{Agr}_{\text{X}}\ \ [_{\text{XP}}\ \textbf{Num}\ \ \text{X}\ \ [_{\text{AgrYP}}\ \ \_\ \ \text{Agr}_{\text{Y}}\ \text{t}_{\text{YP}}\,]$

Structure (32.iii) is one of the only two possible ways to derive the desired order without extracting NP from within a specifier; the other being the parallel structure raising AgrYP rather than YP discussed in section 2.5. It follows that under Cinque's structural assumptions remnant movement not only need not be stipulated against, since it can be derived by our analysis, but it cannot be stipulated against if extraction from within a specifier is to remain ungrammatical.

This problem too is absent from the proposed OT analysis, which successfully accounts for the entire typology. Order *p* is obtained through the derivation shown in (32) (or the alternative parallel derivation that raises AgrYP), thus exploiting remnant movement of YP and avoiding extraction from within a specifier. Remnant movement is here possible because the extracted NP moves to a position *preceding* the landing site of the remnant, as discussed in section 2.3. This ensures that the NP's alignment is not penalized by the silent copy 't_{NP}' in the remnant, while leftward-shift of the remnant improves the alignment of AP. The final structure in (32.iii) is the same structure listed in tableaux 1 in (12) above, and it is optimal under the ranking listed in table (19).

The derivation of order *p* also shows that remnant movement cannot be excluded by stipulation. When the extracted NP precedes the remnant, remnant movement determines one of the grammatical structures in Cinque's typology. Our analysis derives this property, properly predicting when remnant movement is grammatical or ungrammatical according to how it contributes to the overall alignment of the derived structure.

4. Conclusions

The attested and unattested orders of DemP, NumP, AP, and NP forming Cinque's typology follow straightforwardly from the interactions of four simple universal alignment constraints. The structures that provide an optimal alignment configuration – one that cannot be improved upon – are grammatical and the corresponding orders attested. All other structures are suboptimal and thus ungrammatical, and any word order instantiated only in suboptimal structures is unattested.

The most important property of this analysis, we believe, is its ability to explain why and when remnant movement is ungrammatical. Rather than being stipulated impossible, remnant movement is shown to be inherently ineffective at improving alignment. Structures where remnant movement does not improve alignment are suboptimal and hence ungrammatical. Yet, even remnant movement becomes grammatical in the few cases where it builds the best possible alignment configuration for a specific ranking, as we showed in the discussion of order *p* in section 3.3. By avoiding a ban on remnant movement, our analysis allows for its existence under any syntactic context that might require it, such as those discussed in Abels and Neeleman (2006) for other syntactic domains.

We also showed how an analysis à la Cinque (2005) is actually unsuccessful in deriving the entire typology and, furthermore, that such an analysis encodes the desired derivation in the parametric values associated with each specific language. In contrast, the analysis proposed here accounts for the entire typology and it does so on the basis of just four *universal* constraints which trigger movement operations but need neither state *what* should move, nor *where* it should move to. The only parametric aspect of the analysis concerns constraint ranking, i.e. a fully general property that Optimality Theory places at the core of the cognitive organization of human grammar.

Finally, insofar as the proposed analysis is correct, it joins other analyses in OT-syntax in showing that syntax and phonology share the same cognitive organization, with alignment constraints playing an important role in determining the internal architecture of linguistic representations.

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