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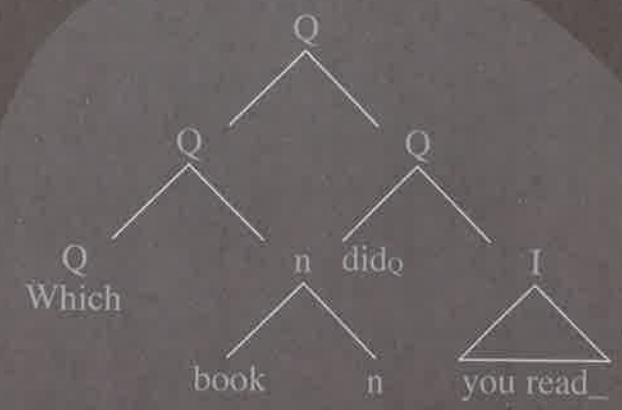
STUDIES ON SYNTACTIC CARTOGRAPHY

句法制图研究

Fuzhen SI
司富珍 ◎主编



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Background

This volume presents the papers containing the most updated ideas and results of cartographic research in the past two years, contributed by the two keynote speakers, five invited speakers and some other participants of the first International Workshop on Syntactic Cartography (IWSC), which was held in 2015 at the Beijing Language and Culture University (BLCU), China. As the very first international conference on syntactic cartography in China (perhaps also the first one taking the name of "syntactic cartography" in the world), its initial motivation was to promote the study of syntactic cartography in China and to provide a platform for international linguists who are interested in exploring the "structural maps that could do justice to the complexity of syntactic structures" (Rizzi, 2004). The articles presented in the workshop covered a wide scope of cartographic studies, from theory-oriented studies such as "The Left Periphery: Cartography, Freezing, Labeling" by Luigi Rizzi, and "Hierarchies of Features vs. Hierarchies of Projections" by Richard Larson, to empirical studies on the syntax of Chinese, Japanese, Persian and some other languages. The discussions among the speakers sparked many young scholars' interests in the cartographic approach. The publication of the current volume is to make the discussions and results of the IWSC accessible to more readers and researchers.

The Contributions

To some extent, the history of generative grammar is a history of ongoing efforts to seek out a careful balance between simplicity at the deep level and the

The Left Periphery: Cartography, Freezing, Labeling*

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Abstract: After a brief illustration of core ideas and results of cartographic research, this paper focuses on the cartography of the left periphery of the clause. After illustrating the criterial approach to scope-discourse semantics and certain properties of the functional sequence in the left periphery, I focus on the freezing effects which characterize criterial configurations. Freezing effects are illustrated through criterial positions in the left periphery, and also in the high and low structure of the IP. In the last part, the question of the "further explanation" of criterial freezing is addressed. Freezing effects are traced back to the interaction of the labeling algorithm introduced in Chomsky (2013) with a maximality principle which constrains movement to apply to maximal object with a given label.

Keywords: left periphery, cartography, freezing, labeling

1. Aspects of the cartography of syntactic structures

Cartographic analysis has roots in generative grammar as well as in other traditions of linguistic inquiry. One fundamental root is the traditional distinction between functional and contentive categories in the lexicon. The syntactic implications of the distinction started being fully exploited through the hypothesis that functional elements are full-fledged syntactic heads. Early versions of GB

* I would like to thank Fuzhen Si, Dylan Tsai, Richard Larson and the participants in the International Workshop on Syntactic Cartography, Beijing Language and Culture University, Beijing, for useful feedback on my talk. This research was supported by the ERC Advanced Grant 340297 SynCart.

theory had already focused on the inflectional and complementizer nodes as crucial components of the clausal structure, the locus of much syntactic action. By the mid 1980's the syntactic role of functional elements was fully acknowledged through the hypothesis that they give rise to X-bar projections, much as contentive elements do (Chomsky 1986b). This led to the assumption of a clausal structure like the following:

(1) $[_{CP}$ ...C...$[_{IP}$...I ...$[_{VP}$...V...]]] (Chomsky 1986b)

If the fundamental geometry of functional configurations was established by these hypotheses, the nature of the functional labels and the actual richness of functional representations remained to be determined. Cartographic studies took off from there. Pollock's (1989) seminal paper on the clausal structure showed that splitting the inflectional node into finer components, both projecting full X-bar structures, permitted an insightful analysis of verbal morphosyntax, while at the same time offering a new perspective to capture the syntactic properties of adverbial elements. The success of the split-Infl approach also suggested that it could be advantageous to replace syntactic labels such as Infl and Comp with less arbitrary labels more transparently indicating the interface role of the element, such as T, Asp, Voice, Force, etc. These lines of research were fully systematized in Cinque's (1999) analysis of clause structure.

In this paper, I will focus on the cartography of the complementizer system. Configuration (2) expresses the map of the C-layer of (1), according to a recent assessment of the issue:

(2) [Force [Top* [Int [Top* [Foc [Top* [Mod [Top* [Q_{emb} [Fin $[_{IP}$ ...]]]]]]]]]]

(Rizzi & Bocci 2015)

The global picture emerging from about two decades of cartographic studies highlights the following points:

-each layer in (1) is an abbreviation for a much richer structural zone; e. g., the C layer is split into finer components Force, Int, Fin, etc., as in (2);

-complex functional sequences emerge for each zone (most notably in Cinque 1999, and in Nanosyntax, Starke 2009: see Rizzi and Cinque 2016 for a recent assessment);

-such richer syntactic representations permit a more transparent mapping with the interface systems.

The latter point is sometimes referred to as the syntacticization of argumental and scope-discourse semantics: thematic roles, scope and discourse-related properties are read off simple and uniform Spec-Head-Complement representations provided by syntax.

If cartography is not an independent syntactic theory, it is clear that certain theoretical hypotheses turned out to be particularly congenial to the cartographic enterprise. For instance, the antisymmetric hypothesis (Kayne 1994) which bans multiple specifiers and adjunctions, favouring simple and uniform atomic representations; or the criterial approach to scope-discourse semantics, which we will dwell on later in this paper. All in all, the fundamental computational devices assumed in cartographic analysis are fully consistent with basic tenets and tools assumed by minimalism: syntax is a matter of binary merge, both internal and external, giving rise to labeled hierarchical representations. But the hallmark of the perspective is that computations are hosted and triggered in much more detailed structural representations than in standard minimalist analyses.

Several important indications of clear theoretical relevance emerge from cartographic studies. One is that the set of functional elements is much richer than previous assumed (Cinque & Rizzi 2010, Rizzi & Cinque 2016), and the co-occurrence of more functional elements forming complex functional sequences is the norm in syntactic configurations. At a more abstract level, cartographic results suggest that natural languages favour local simplicity, adopting organizational principles which enforce a distributed representation of complex properties: syntactic structures thus consist of complex functional sequences of simple, but numerous, structural atoms.

In this paper I will focus on the study of the initial periphery of the clause, starting from the cross-linguistic scope of this line of cartographic research. I will then illustrate the criterial approach to constructions expressing scope-discourse

properties, and aspects of the methodology used to establish aspects of the left peripheral sequence. In the second part, I will address one important property which is associated with criterial configurations: the freezing effects, which will be illustrated in connection with criterial positions in the C-system and in the high and low IP structure. In the third part, I will address the issue of the "further explanation" of cartographic properties: can the properties uncovered in cartographic research be deductively connected to basic ingredients of syntactic computations? I will address the issue in relation to freezing effects, which I will connect to basic properties of the labelling algorithm.

2. Cross-linguistic scope with special reference to the left periphery

The initial empirical core for the analysis of the left periphery came from the study of Italian, a language which offers rich positional evidence for a well-developed C-zone. The analysis initially involved limited comparative extensions to other Romance and Germanic languages, but this line of research quickly proved of general relevance, and was extended to other language families. On Romance see Rizzi (1997, 2000, 2004a-b), Belletti, (2004a-b, 2009), Poletto (2000), Laenzlinger (1997), Cinque (2002), Benincà and Munaro (2010), and on Germanic Grewendorf (2002), Haegeman (2004, 2013), among many other references. See Roberts (2004) on Celtic, Krapova & Cinque (2008), Garzonio (2005) on Slavic, Puskás (2000) (and also earlier work such as Brody 1990, Kiss 1998), on Finno-Ugric, Shlonsky (1997), (2014) on Semitic, Frascarelli and Puglielli (2008) on Cushitic, Aboh (2004), Biloa (2013), Bassong (2010), Torrence (2013), Hager M'boua (2014) on African languages, Durrleman (2008) on Creole, Jayaseelan (2008) on Dravidian, Tsai (2008), Tsai (2015), Paul (2005), (2014), Badan (2007), Badan and Del Gobbo (2011) on Chinese (but the body of cartographic research on Chinese will be greatly enhanced by the IWSC Beijing workshop), Endo (2007), Endo (2014), Saito (2010) on Japanese, Pearce (1999) on Austronesian, Speas & Tenny (2003) on American Indian, Legate (2001) on Australian aboriginal. In addition, much research was produced in

Romance and Germanic dialectology (e. g. Ledgeway 2004, Paoli 2007, Cruschina 2012, Grewendorf and Poletto 2009), and on Classical languages and diachrony (Salvi 2005, Danckaert 2012, Benincà 2006, Franco 2009), etc. Volumes 1, 2, 3, 5, 7, 8, 9, 10, 11 of the subseries "The Cartography of Syntactic Structures" of the Oxford Studies in Comparative Syntax are devoted in part, or entirely, to the cartography of the left periphery. See Cinque & Rizzi 2010, Shlonsky 2010, Rizzi 2013, Rizzi & Bocci 2015, Rizzi & Cinque 2016 for general overviews.

3. A structural approach to scope-discourse semantics: The Criteria

An important ingredient of the cartographic analysis of the left periphery (LP) is the criterial approach to scope discourse semantics, according to which the LP is populated by a sequence of functional heads (Top, Foc, Q, Rel, Excl, ...) which have a dual function:

1. In syntax, they trigger movement.

2. At the interfaces with sound and meaning, they trigger interpretive routines for the proper assignment of

   a. scope-discourse properties at LF, and

   b. the appropriate intonational contour at PF.

For instance, different kinds of A'-constructions would have representations like the following, with the criterial head expressed in bold.

(3)	a. Which book	Q	should you read<which book> ?
	b. This book	TOP	you should read <this book> tomorrow
	c. THIS BOOK	FOC	you should read <this book>, not Bill's book
	d. The book	REL	that you should read <the book> is this one
	e. What a nice book	EXCL	I read <what a nice book> !

In English the system of criterial heads is typically not expressed, but other languages immediately support the plausibility of this structural approach, as they spell out criterial heads through dedicated morphemes expressing Q, Top,

Foc, etc. :

(4) a Ik weet niet [wie of [Jan _ gezien heeft]] (Dutch varieties, Haegeman 1994)
'I know not who Q Jan seen has'
b Un sè [do [dan lo yà [Kofi hu ì]]] (Gungbe, Aboh 2004)
'I heard that snake the TOP Kofi killed it'
c Un sè [do [dan lo wè [Kofi hu _]]] (Gungbe, Aboh 2004)
'I heard that snake the FOC Kofi killed'
d Der Mantl [den wo [dea Hons _ gfundn hot]] (Bavarian, Bayer 1984)
'The coat which REL the Hans found has'
e Che bel libro che [ho letto _]! (Italian)
'What a nice book EXCL I read'

Criterial heads also guide interpretive routines at the interfaces with sound and meaning. At the internal interface with meaning, they express how their specifier and complement must be interpreted. E. g., a Top head would trigger the instruction "interpret my specifier as the topic, and my complement as the comment", thus determining conditions for felicitous use in discourse.

For instance, after a certain referent (e. g., my book) is introduced by speaker A in a dialogue like (6), it can be taken up as a topic by speaker B (most naturally if other referents are prominent and there is an element of choice between possible topics, e. g. between "my book" and "Gianni's book"; otherwise, a null topic would be the most natural choice in this context); speaker B then makes a comment about the topic (the topic-comment structure is expressed by the clitic Left Dislocation construction in Italian, where the object topic is resumed by the clitic *lo*):

(6) A: Non hai ancora letto il mio libro, vero? (E quello di Gianni?)
'You haven't yet read my book, right? (And Gianni's book?)'
B: Il tuo libro, lo sto per leggere (e quello di Gianni lo leggerò più avanti)
'Your book, I am about to read (and Gianni's book I will read later)'

Italian and other Romance languages also use a left peripheral position for focus, but only for special interpretations. One major case is corrective focus: speaker A makes a statement involving a certain referent, and speaker B may correct him by using left peripheral focus (whereas the rest of utterance is presupposed, and the focal element is not resumed by a clitic):

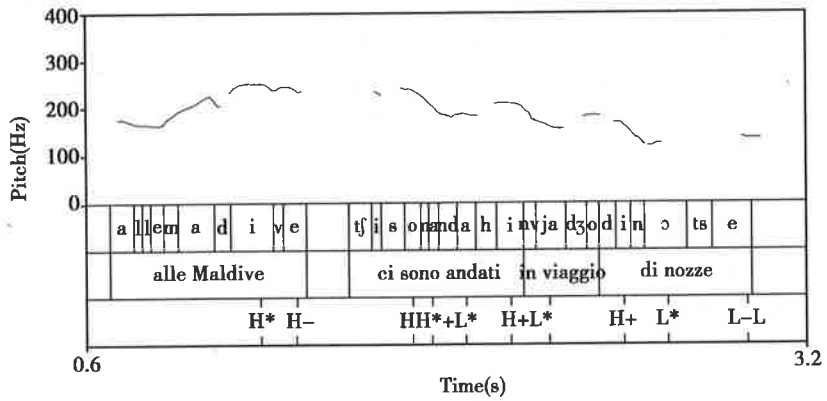
(7) A: So che stai per leggere il libro di Gianni.
'I know that you are about to read Gianni's book.'
B: Ti sbagli, IL TUO LIBRO sto per leggere (quello di Gianni lo leggerò più avanti)
'You are wrong, YOUR BOOK I am about to read (Gianni's book I will read later)'

The conditions for felicitous use are quite strict, i. e., neither (6) B nor (7) B would be felicitous if the contexts were inverted; and neither construction could be used to express simple new information focus, e. g., as an answer to a question like "What are you going to read?".

At the interface with sound, the system determines the assignment of the intonational contour, through contour-assignment rules which are in part language specific and based on the criterial configurations (I am assuming here the system proposed in Bocci 2013 for Italian, building on much related literature). Figure (9) illustrates the specific contour assigned to clitic left dislocation, in sentences like (8) B, felicitous in context (8) A, in Sienese Italian, according to the experimental analysis proposed in Bianchi, Bocci & Cruschina (2014):

(8) A: Secondo me non avranno mai il coraggio di partire da soli per le Maldive...
'According to me, they will never have the courage of traveling alone to the Maldives.'
B: Beh, alle Maldive, ci sono andati in viaggio di nozze.
'Well, to the Maldives, they went (there) on honeymoon.'

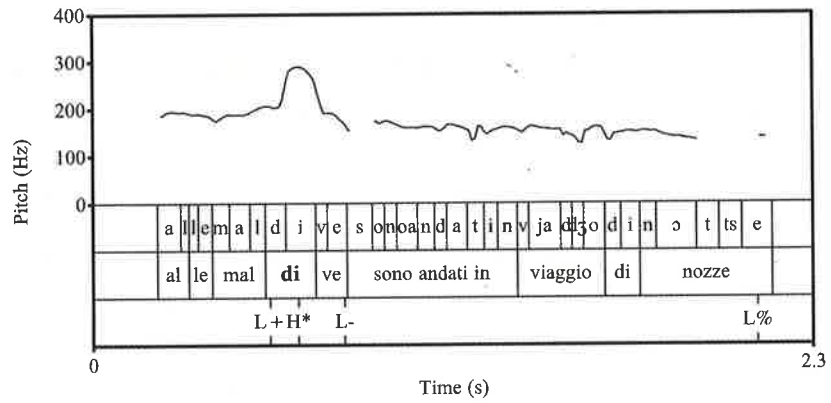
(9) Topic-Comment



As for Focus-Presupposition, a corrective focal structure like (10) B, felicitous in context (10) A, receives the contour illustrated in (11), again according to the analysis in Bianchi, Bocci & Cruschina (2014):

(10) A: Se ho capito bene, sono andati alle isole Vergini.
'If I understood correctly, they went to the Virgin Islands.'
B: Ti sbagli! ALLE MALDIVE sono andati in viaggio di nozze!
'You are wrong! TO THE MALDIVES they went on honeymoon!'

(11) (Corrective) Focus-Presupposition



(from Bianchi, Bocci & Cruschina 2014)

So, left peripheral topic and focus receive clearly distinct kinds of prosodic prominence in Italian, and the contour of comment and presupposition is sharply different. These distinct contours are clearly rule-governed and depend on the particular criterial configuration involved (Bocci 2013).

In this approach, the special interface properties of such left-peripheral constructions are fully determined by the syntactic representation, and more specifically by the criterial heads and features: no additional device connecting PF and LF is needed, apart from a syntax endowed with criterial heads and the familiar syntactic computational devices (merge and movement).

4. Elements of the left-peripheral sequence

Simple positional evidence provides critical information on functional sequences. In many cases, certain elements cannot co-occur because of their inherent properties, but their respective ordering to a third element may indirectly support certain ordering conclusions. I.e., if A precedes B and B precedes C, then A precedes C in the sequence, even though A and C never co-occur. This kind of consideration led to the conclusion that the finite and infinitival complementizers in Italian (*che* and *di* respectively) occupy distinct position, as they are, respectively, followed and preceded by topics:

(12) Penso che, a Gianni, gli dovrei parlare
'I think that, to Gianni, I should speak to him'
(13) Penso, a Gianni, di dovergli parlare
'I think, to Gianni, 'of' to have to speak to him'

The interrogative complementizer *se* (if) can be preceded and followed by a topic, and in fact it can be surrounded by topics:

(14) a. Non so, a Gianni, se gli potremo parlare
'I don't know, to Gianni, if we could speak to him
b. Non so se, a Gianni, gli potremo parlare

'I don't know if, to Gianni, we could speak'

c. Non so, a Gianni, se, queste cose, gliele potremo dire

'I don't know, to Gianni, if, these things we could say'

These facts are hard to accommodate in a single C approach, as the C-element sometimes precedes Top (*che*) sometimes follows it (*di*), and sometimes can both precede and follow Top (*se*).The facts are immediately captured by a cartographic analysis of the type.

(15) ...che ... (TopP) ...se... (TopP) ...di ...

that	if	Fin
Force	Int	Fin

The ordering *che* > *se* is supported indirectly in Italian, through transitivity considerations, as the two elements never co-occur. If we broaden the comparative perspective, though, the ordering is immediately supported by the so-called "reported question" construction in Spanish (Plann 1982, Suner 1994, McCloskey 1992) where the corresponding elements *que* and *si* co-occur in this order, with the possibility of a topic intervening between them:

(16) María preguntó que el lunes si había periódicos

'Maria asked that the Monday if there were newspapers'

The construction is felicitous in the following context. Mary asked the question "Are there newspapers on Monday?", and I can report this speech event by uttering (16). *Si* marks the status of the embedded clause as a yes/no question, and *que* marks the reported character of it. Verbs taking indirect questions which are not also verbs of saying (*forget*, *remember*, etc.) do not enter into this construction.

Saito (2012) discussed reported questions in Japanese like (17), with triple *no ka to* complementizer sequences:

(17) Taroo-wa [$_{CP}$ kare-no imooto-ga soko-ni ita (no) ka (to)] minna-ni tazuneta

T. -TOP he-GEN sister-NOM there-in was *no ka to* all-DAT inquired

'Taroo asked everyone *if* his sister was there' (Saito 2012)

Saito analyzes the sequence *ka to* (if that) as the mirror image of the *que si* sequence in Spanish, and *no* as a lower expression of Fin, a sort of finite analogue of Italian *di*. So, by comparing Japanese and Italian (and Romance, more generally), we have:

(18) Japanese [... [... [... [...[$_{TP}$ ...] Fin] Int] Force/Report]

no ka to

(adapted from Saito 2012)

(19) Italian [Force/Report [Int [Fin [$_{TP}$ ...] ...] ...] ...]

che se di

The hierarchical order is the same in the two languages, whereas the linear orders of the complementizer particles are the mirror image of each other, as a consequence of the headedness properties of the two languages, whatever approach one adopts to headedness (either a primitive syntactic head-complement parameter, or a movement induced effect, as in the antisymmetric approach of Kayne 1994, or a parameter on the linearization of a purely hierarchical structure, as in Berwick & Chomsky 2011).

It is often observed that languages, alongside the order *that*>*if*, also have structure with the two elements co-occurring in the opposite order *if*>*that*, as in the Dutch *of dat* sequences. If ordering paradoxes arise, can one maintain the validity of transitivity arguments of the kind illustrated in this section (van Kraenenbroek 2006, 2009)? In fact, certain functional elements like *that* and the equivalent in other languages are typically versatile, in that they can appear in distinct positions in the left periphery; in some languages this is straightforwardly shown by the fact that two occurrences of *that*-like elements can co-occur in the same clause, e. g., in the Turinese dialect, before and after a topic (*that Top that*: Paoli 2005; see also Radford 2013). Once the versatility of such elements is

recognized, transitivity paradoxes disappear: a *that*-like element can lexicalize Force, as in Spanish or Japanese reported questions, and a lower head, possibly Fin, in the Dutch varieties admitting *of dat*, without giving rise to any ordering paradox.

5. Freezing effects in criterial positions

Cartographic research has uncovered numerous properties of functional sequences. In addition to properties of ordering, mutual incompatibilities and other distributional constraints, freezing effects in criterial positions have triggered much current research. We turn to such effects now.

Freezing in criterial position is straightforwardly illustrated by the fact that a wh-phrase moved to the C-system of an indirect question cannot be moved further:

(20) a. Bill wonders [[which book] Q [John published__this year]]

b. * Which book does Bill wonder [____Q John published__this year]]

(Lasnik & Saito 1992)

Hence something like the following appears to hold, as a descriptive generalization:

(21) Criterial freezing: An element satisfying a criterion is frozen in place

(Rizzi 2006, 2010)

Should (21) be stated in some form as an independent principle? Cases like (20) b could be plausibly ruled out as not properly interpretable (what would the corresponding LF look like?), or could be amenable to an inactivation approach, as in Bošković(2008): the wh-phrase carries an uninterpretable Q feature which is checked in the criterial position in (20) a, thus making the phrase inactive for further movement, an approach based on an extension to the A-bar system of Chomsky's (1995) inactivation approach to A-chains.

Nevertheless, there are more complex cases in which no (obvious) interpretive problem, or problems of inactivation, would arise (Rizzi 2006, 2010). These are cases in which the same complex phrase contains two criterial features F1 and F2, e. g., a Q feature on the wh-specifier and a corrective focus feature on the lexical restriction of the wh-phrase:

(22) [quanti$_{Q}$ ARTICOLI$_{Foc}$]

How many ARTICLES

In such cases one could expect that the complex phrase would move to a criterial position, thus satisfying one criterion, and then to a higher criterial position to satisfy the other criterion, but this never happens: once the phrase has reached the first criterial position, it is frozen there and can't move further. For instance once phrase (22) has moved to the C-system of the embedded question, as in (23) a, it cannot further move to the corrective focus position in the main clause:

(23) a. Non so[quanti$_{Q}$ ARTICOLI$_{Foc}$] Q abbiano pubblicato__, non quanti libri

'I don't know how many ARTICLES they have published, not how many books'

b. * [Quanti ARTICOLI] Foc non so __ Q abbiano pubblicato __, non quanti libri

'How many ARTICLES I don't know they have published, not how many books'

whereas a direct object with a focalized lexical restriction can undergo such focus movement to the main clause from the non criterial object position:

(24) [Molti ARTICOLI$_{Foc}$] Foc mi hanno detto che hanno pubblicato__, non molti libri

'Many ARTICLES they told me that they have published, non many books'

No obvious interpretive problem would arise in (23) b: under the copy theory of traces, the trace in the embedded C-system would contain an occurrence of the Q-operator *quanti*, which could be interpreted there (and an inactivation approach would not suffice, because there would still be an active Foc feature to check in the phrase):

(25) Quanti ARTICOLI$_{Foc}$ non so[<quanti ARTICOLI>Q abbiano pubblicato__], non quanti libri
'How many ARTICLES I don't know[<how many ARTICLES>they have published], not how many books

While a whole phrase satisfying a criterion cannot move further, an element can be subextracted from a criterial configuration if there are no other violations, e. g., an adnominal PP can be subextracted and clefted:

(26) E' [di questo autore] Foc che non so[quanto libri__] Q siano stati pubblicati nel 1967
'It is by this author that I don't know how many book have been published in 1967'

The subextraction option shows that (21) should be revised by making reference not to the whole criterial phrase, but to the "criterial goal" , the element carrying the criterial feature:

(21) In a criterial configuration, the criterial goal is frozen in place

An entire criterial configuration can be moved as a whole, for instance, an indirect question can be clefted or topicalized, as in (27), but the criterial configuration cannot be "undone" :

(27) a. E' [[quanti$_Q$ libri di questo autore] Q[siano stati pubblicati nel 1967]] che non è chiaro__

'It is how many books by this author have been published in 1967 that it isn't clear'

b. [[Quanti libri di questo autore] Q [siano stati pubblicati nel 1967]] non lo so davvero__
'How many books by this author have been published in 1967, I really don't know

So, an empirically adequate description of the freezing effects is that a criterial configuration cannot be "undone" by movement, while the criterial configuration can be moved as a whole, or an element can be subextracted from the criterial phrase if no other constraint is violated.

In this section I have illustrated freezing effects arising in the C-system through the functioning of indirect questions. Such effects have been found in other areas of the clausal structure. Before turning to a theoretical analysis of the effect, let me illustrate, in the next two sections, freezing effects arising, respectively, in the high and low part of the clausal structure.

6. That-trace effects as freezing in subject position

The subject position is a typical site where phrasal movement stops. Is it a criterial position? And do we find freezing effects? If there is a subject criterion, one would expect scope-discourse interpretive properties of the kind that are typically found in criterial positions. An interpretive property associated to the subject position is that it singles out the argument "about which" the event is reported, a property that subjects have in common with topics (Reinhart 1981; on some differences see Rizzi 2005 and much work stemming from Li and Thompson 1976).This is clear in active-passive pairs. An all-new event, e. g. in an answer to a "what happened?" question like (28) can be an active or a passive sentence, as in (29), in which the same event is reported as being about the agent or the patient, respectively:

(28) Cos' è tutta questa confusione?Che cosaèsuccesso?

'What is all this confusion? What happened?'

(29) a. Un ragazzo ha buttato a terra un vecchio
'A boy knocked an old man to the ground'

b. Un vecchio è stato buttato a terra da un ragazzo
'An old man was knocked to the ground by a boy'

The choice of the aboutness subject has consequences for discourse organization and anaphora resolution: for instance, as Calabrese (1986) observed, in a null subject language like Italian the *pro* subject of the following sentence, in case of ambiguity, selects the subject of the previous utterance as its antecedent. So, if (30) is uttered immediately after (29) a, the interpretation is that the boy shouted, whereas if (30) is uttered after (29) b, the old man shouted:

(30) . . . e immediatamente *pro* ha cominciato a gridare
'. . . and immediately __started shouting'
(after (29) a: the boy shouted;
after (29) b: the old man shouted)
(Calabrese 1986)

In the spirit of the criterial approach, it makes sense to hypothesize a subject criterion, associated to a particular functional head in the high IP structure, attracting movement of the closest nominal to its Spec and triggering the aboutness interpretation at the interface. Rizzi (2006), Rizzi & Shlonsky (2007), building on Cardinaletti (2004) implement the subject criterion through the postulation of a Subj head as an obligatory component of the clausal spine in the higher zone of the IP, higher than T and other obligatory heads of the clausal structure. The obligatoriness of Subj is a way to express the EPP generalization of the classical GB approach, the fact that the subject position is obligatory in clauses. A plausible candidate for the overt realization of the Subj head is the system of subject clitics in Northern Italian Dialects (Poletto 2000, Manzini & Savoia 2005), elements expressed in between the subject DP and the predicate introduced by the inflected verb.

If there is a subject criterion, we expect freezing effects in subject position, under criterial freezing. This set of assumptions thus naturally captures *that*-trace effects:

(31) a. * Who do you think [that [____Subj will come]] ?
b. Who do you think [that [Mary Subj will meet____]] ?

Such effects are not just a language-specific, construction-specific quirk of English declaratives, as it is sometimes assumed. They are manifested in cases of extraction from indirect questions (object extraction is marginal in (32) b, but subject extraction is detectably more deviant, as in (32) a), and such contrasts are typically found across languages:

(32) a. * Which mechanic do you wonder whether __Subj could fix the car?
b. ? Which car do you wonder whether the mechanic Subj could fix __?

The thematic subject is attracted to Subj as an intermediate step in the derivation of (31) a, (32) a:

(31) a' … you think [that [who Subj __will come]]
(32) a' … you wonder [whether [which mechanic Subj __could fix the car

At this point, the subject is frozen under criterial freezing, and further movement is thus barred.

Subject extraction is typically harder than object extraction, but possible in special structural configurations. Different languages use different strategies to make subject extraction possible, thus circumventing the freezing effect. In (Standard) English, extraction is made possible by complementizer deletion. Presumably here the whole CP+SubjP complex is truncated (where CP abbreviates the whole left peripheral structure), so that there is no freezing position and the subject can be extracted from a lower position (say, Spec T):

(33) Who do you think [$_{CP}$… [$_{SubjP}$… [$_{TP}$ __ will come]]]

The truncation option is accessible in declaratives (as the declarative interpretation is the default interpretation, presumably assignable also in the absence of a position marking declarative force, as in exceptional case marking declaratives), but not in interrogatives, where the C-system is needed to express interrogative force and (in wh-movement languages) to host the wh-operator, so that (32) a. contrary to (31) a, is irredeemable.

A familiar typological generalization is that Null Subject Languages typically do not manifest *that*-trace effects. So, there must be a strategy systematically available in Null Subject Languages to avoid the freezing effect. Straightforwardly extending the approach in Rizzi (1982, ch. 4) to the current framework, I will assume that expletive *pro*, always available in Null subject Languages, fills the Spec Subj position, thus formally satisfying the Subject Criterion and permitting extraction of the thematic subject from a lower position:

(34) Chi credi[che [*pro* Subj __ verrà]] ?
'Who do you think that will come?'

Other languages may use different strategies to make subject extraction possible: special complementizer-changing rules, clausal pied-piping, use of resumptive pronouns, perhaps deeper truncations in so-called "anti-agreement" configurations, etc.. See Rizzi & Shlonsky (2007), Shlonsky (2014) for discussion.

In conclusion, the conjoined effect of the subject criterion and criterial freezing offers an alternative to the classical ECP analysis of subject object asymmetries, capturing the basic properties of the classical approach and avoiding the theoretical difficulties of an ECP account in a framework based on minimalist guidelines (Rizzi 2016).

7. Freezing in the low focus position

What makes freezing effects in the C-system of embedded questions easily

detectable is that these positions are obligatory: subject positions are always obligatory in clauses, and C-systems marked with the Q feature are obligatory when embedded under verbs like *wonder*. Checking criterial freezing in other criterial positions, e. g., Foc, is more difficult because such positions appear to be present on demand, if the particular scope-discourse property must be expressed. So, in order to test a freezing effect, e. g., with Foc, we need a construction where Foc is obligatorily selected.

We will now discuss a construction which makes a low focus position obligatory. Belletti (2004a) argued that there is a low periphery surrounding the predicative nucleus which contains a focus position. This low focus position is generally optional, but it becomes obligatory in certain constructions, such as inverse copular constructions (Moro 1997). The postcopular DP *Gianni* is necessarily focal in (35) b:

(35) a. Gianni è il direttore
'Gianni is the director'
Subj Pred
b. Il direttore è Gianni
'The director is Gianni'
Pred Subj

One salient property of the inverse copular construction is that the clause-final subject DP is necessarily focal. Different kinds of evidence can be given in different languages to support this conclusion.

For instance (Rizzi 2015b), backward pronominalisation in Italian is possible with the direct copular construction, but not with the inverse construction, and the impossibility of backward anaphora is a familiar testing property of focus, ever since Chomsky (1975):

(36) a. Nella foto della sua$_i$ classe, Gianni$_i$ è il più bello
'In the picture of his class, Gianni is the most handsome'
b. * Nella foto della sua$_i$ classe, il più bello è Gianni$_i$

'In the picture of his class, the most handsome is Gianni'

Heycock (2012) observes that the contrast between direct and inverse construction can be immediately highlighted by inserting the two constructions in mini-discourses enforcing the focal interpretation of one particular DP. In the direct construction in English, both the referential DP (precopular) and the predicative DP (postcopular) can be focal:

Direct construction:

(36) a. Who is the culprit? John or Bill?
b. John is the culprit

(37) a. Tell me about John: is he the culprit, or the victim?
b. John is the culprit

On the contrary, in the inverse construction only the referential DP (postcopular) is focal:

Inverse construction:

(38) a. Who is the culprit? John or Bill?
b. The culprit is John

(39) a. Tell me about John: is he the culprit or the victim?
b. # The culprit is John

The argument is reproduced for Hebrew in Shlonsky & Rizzi (2016).

Why is focalization of the postcopular DP obligatory in the inverse construction? In Rizzi (2015b) I have proposed that this property can be derived by the theory of locality. It is not necessary to develop this argumentation here. The empirical fact that the postcopular DP is obligatorily focal suffices to

allow us to test freezing effects in this position.

In fact, Longobardi (1985) observed that the referential DP is unmovable in the inverse construction, while it is movable in the direct construction. The contrast is shown in interrogatives, relatives and clefts in the following examples:

(40) a. Chi credi che sia il colpevole?
'Who do you think that is the culprit?'
b. * Chi credi che il colpevole sia?
'Who do you think that the culprit is?

(41) a. Ecco Gianni, che credo che sia il direttore
'Here is Gianni, who I believe that is the director'
b. * Ecco Gianni, che credo che il direttore sia __
'Here is Gianni who I believe that the director is'

(42) a. E' Gianni che è il direttore
'It is Gianni that is the director'
b. * E' Gianni che il direttore è __
'It is Gianni that the director is'

This can now be understood as a freezing effect in the obligatory low focus position of inverse copular sentences. So, we have tested freezing effects in the CP system, and in the high and low parts of cartographic representations of the IP system.

8. "Further explanation" of freezing effects: The labeling algorithm

Why do freezing effects exists? Can phenomenological principles like Criterial Freezing be deducible from fundamental ingredients of linguistic Computations? Here as in many other cases emperical discoveries triggered by Cartographic studies raise the issue of "further explanation" (see Rizzi 2013 for discussion).

In recent work, it has been hypothesized that source of the freezing effect may be found in the labeling algorithm proposed in Chomsky (2013). A node created by merge must be assighed a label, and labeing is a matter of loclity in this system:

(43) Labeling algorithm: A node created by Merge receives the label of the closest head (Chomsky 2013)

In recent work (Rizzi 2015a-b, 2016b), I have formalized the algorithm by expressing the notion "closest head" in terms of Relativized Minimality. A head is the closest head to a given dominating node when there is no other head which intervenes hierarchically. More formally,

(44) α receives the label of H_1 such that: I. α contains H_1, and
II. there is no H_2 such that
i. α contains H_2, and
ii. H_2 c-commands H_1.
(Rizzi 2015a)

It is also assumed in Chomsky's system that the interface systems require complete labeling: perhaps, an unlabeled node cannot receive an interpretation, and the structure is ruled out by some version of Full Interpretation (Chomsky 1986a).

(45) Complete labeling: Labeling must be complete at the interfaces (Chomsky 2013)

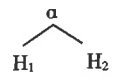
In this system, labeling is not a prerequisite for further applications of merge, so if a node is unlabeled a merge-based derivation can continue and operate on it. But labeling cannot be delayed beyond the point in which the structure is transferred to the interfaces because of the complete labeling requirement.

This system of definition interacts with the typology of applications of

merge. There are three cases to consider:

I. Head-Head Merge (X, Y):

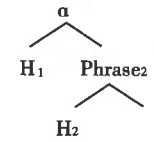
(46)



Here two items are taken from the lexicon and merged together. This is the necessary initial step of a merge-based computation. This seems to be already problematic for labeling, as the two heads are in a mutual c-command configuration. See Chomsky (2013), Rizzi (2016b) for possible solutions of this problem, which is not of immediate relevance for our concerns in this paper.

II. Head-Phrase Merge (X, YP):

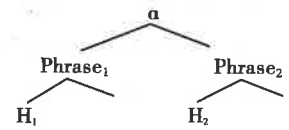
(47)



Here an item is taken from the lexicon, and merged with a phrase already computed through merge and stored in a temporary memory buffer. Here H_1 unquestionably is the closest head to α, so it determines α's label. E. g., if a Voice head is merged with a vP, the resulting phrase is labeled by the Voice head, hence, in traditional X-bar notation, it becomes a VoiceP. Head-phrase merge is the fundamental recursive step in merge-based derivations.

III. Phrase-Phrase Merge (XP, YP):

(48)



In case of Phrase-Phrase Merge, the situation is ambiguous, as both H_1 and H_2

qualify as the closest head to the new node created by Merge, so the algorithm gives inconsistent indications in (48), and α remains unlabeled. But this can only be a temporary state of affairs: under Complete Labeling, α must receive a label before being passed on to the interpretive systems. So, something must happen here to make labeling possible. Chomsky considers two possible ways of making (48) accessible to labeling:

1. Movement

$Phrase_1$ moves further from $[_\alpha\ Phrase_1\ Phrase_2]$ (compare with Moro 2000, an approach in which movement also resolves conflicting configurations for dynamic antisymmetry). At that point we get the following (49), where the head which remains internal to α, H_2, labels the structure:

(49) $Phrase_1 \ldots [_\alpha <Phrase_1> Phrase_2]$

So, for instance, in (50) the subject must vacate the position in which it has been externally merged with the vP, its thematic position, and must raise, in order to allow proper labeling of the structure α as vP:

(50) $[_\alpha$ DP vP]

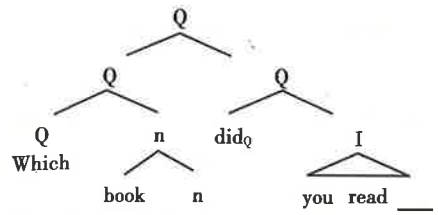
2. The creation of a criterial configuration

Moved phrases cannot "run away" indefinitely to escape labeling problems: at some point movement must stop. This happens when the moved phrase reaches a criterial position, e. g., in a main interrogative clause:

(51) $[_\alpha$[which $_Q$ book] [did_Q you read]]

A criterial configuration permits labeling of the whole structure: Both heads in XP-YP share the most prominent feature relevant for labeling (by assumption, criterial features are also categorial features, names of functional heads), Q in this case, so search of both XP and YP provides a non-ambiguous indication, Q, which can label the whole structure:

(52)



In general, what characterizes a criterial configuration is that it receives the label of the criterial feature and we get, in traditional X-bar notation, QP, or a Question Phrase, an interrogative clause, and also TopP, FocP, RelP, etc. . The complete map of an indirect question is more complex, as we have seen before, but the additional specifications (such as the distinction between the Force position and the criterial position) do not affect the conclusion.

9. Deriving Criterial Freezing from Labeling and Maximality

Wh-movement is successive cyclic because of locality (Chomsky 1973). In some positions movement must continue, whereas in others it must stop, depending on the selectional properties of the main verb. This is what is sometimes called "the halting problem" for wh-movement. If the main verb takes a declarative (e. g., a verb like *think*), movement must continue, and (53) b, while being a necessary intermediate step in the derivation of (53) c, cannot surface as such:

(53) a. John thinks $[C_{decl}$[Bill read [$which_Q$ book]]]

b. * John thinks $[_\alpha$[$which_Q$ book] $[C_{decl}$[Bill read__]]]

c. $[_\beta$[$which_Q$ book] [Q does [John think[$_\alpha$__ C_{decl}[Bill read]]]

If the main verb takes an indirect question (e. g., a verb like *wonder*), the pattern is reversed: the wh-element can and must stop in the embedded C-system, so that we observe a freezing effect:

(54) a. John wonders [Q [Bill read [$which_Q$ book]]]

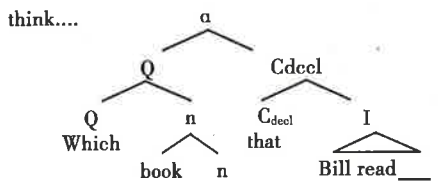
b. John wonders [$_{\alpha}$ [which$_{Q}$ book] [Q[Bill read__]]]

c. * [$_{\beta}$[which$_{Q}$ book] [Q does [John wonder [$_{\alpha}$__ Q [Bill read]]]

In a nutshell, further movement is obligatory from a non-criterial position, and forbidden from a criterial position (I will not discuss here the case of "partial movement" admitted in some languages, in which the equivalent of (53) b is possible, provided that an explicit wh-scope marker appears in the main complementizer).

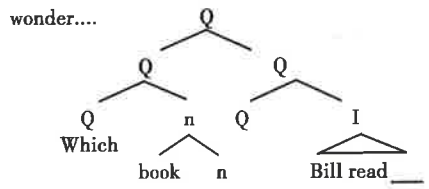
Chomsky (2013) observes that obligatory movement from a non-criterial position follows from labeling. In (53) b labeling of α is impossible because of the inconsistent properties of XP and YP, so *which book* must continue to move from partial representation (55), permitting labeling of α as C_{decl}: (again, the full cartographic representation of the C-system is more complex here, but this does not affect the conclusion):

(55)



As the algorithm accounts in a natural manner for the cases in which movement must continue, the possibility is worth exploring that labeling may also capture the cases in which movement must stop, thus providing a comprehensive solution for the "halting problem" of wh-movement (Rizzi 2015a). In the case of (54) b, the representation is:

(56)



Here we have a criterial configuration, hence the embedded clause can be correctly labeled as Q, an embedded question, hence the wh-element is allowed to halt here, as far as labeling is concerned. But the effect is stronger: it MUST halt here, and we get the freezing effect, as in (54) c. Why is it so?

I have proposed elsewhere (Rizzi 2015a) that the freezing effect follows from labeling and an independently plausible principle of maximality. It is a general fact that phrasal movement can only involve maximal projections: i. e. given the traditional X-bar schema, XP can be moved, but the non-maximal projection X' is inert for movement: there is DP movement, VP movement, CP movement, but no D', V', C' movement. For instance, the A' constituent cannot be extracted from the AP, stranding the specifier, and similar effects are found for all categories:

(57) a. He certainly is [very [proud of this result]]

b. * [proud of this result] he certainly is [very__]

c. [Very [proud of this result]] he certainly is__

The impossibility of moving non-maximal projections may be generalized in the form of a principle:

(58) Maximality: only maximal objects with a given label can be moved.

So, movement of intermediate projections is systematically banned under Maximality (on the possibility of moving heads alone through head movement see Rizzi 2016b).

Under bare phrase structure, being a "maximal projection" is not a rigid inherent property of a node, as the XP label in standard X-bar notation, but is a dynamic notion in the obvious sense that α is a maximal projection if the node immediately dominating it does not have the same label.

Then in the criterial configuration [XP YP], as in (56), neither node is maximal, in the sense just defined: only the whole category [XP YP] is maximal; so, further movement of either XP or YP alone is excluded by the ban on

movement of a non-maximal projection (58). Notice that *which book* will also be characterized by other categorial features not shared by *Bill read*, e. g., it is a DP. So, we must interpret (58) in the sense that, for a phrase to be movable, the phrase must be maximal with respect to all the categorial features defining its label; in (56) *which book* is not maximal w. r. t. the Q feature, and this makes it unmovable, no matter if the phrase is maximal w. r. t. some other features, e. g., D.

In conclusion, both the necessary continuation of movement in intermediate C-systems (55), and the halting in the criterial configuration (56) can be made to follow from labeling, under natural auxiliary assumptions.

The system also captures more complex cases of freezing like (23), repeated here for convenience with a more articulated structure:

(23) a. Non so $[_{\alpha}$ [quanti$_{Q}$ ARTICOLI$_{Foc}$] Q abbiano pubblicato __], non quanti libri
'I don't know how many ARTICLES they have published, not how many books'

b. * [Quanti ARTICOLI] Foc non so $[_{\alpha}$ __ Q abbiano pubblicato __], non quanti libri
'How many ARTICLES I don't know they have published, not how many books'

Once α is labeled as Q in (23) a, *quanti ARTICOLI* ceases to be maximal w. r. t. the Q feature, hence it becomes unmovable under the strong interpretation of (58) as requiring maximality w. r. t. all the categorial features defining the label of the phrase.

Similar explanations can be given for freezing effects in subject and low focus positions. As for the subject position, the critical derivational step will be

(31) a' ...you think [that [who$_{+F}$ Subj$_{+F}$ __ will come]]

where +F is whatever feature attracts the subject to Spec of Subj (plausibly the

person feature: Shlonsky 2015). Then, *who* would not be maximal with respect to +F, and it would be unmovable from this environment. Similarly, in the inverse copular construction, under the analysis of Rizzi (2015b), the referential DP would be moved to Belletti's (2004a) low focus position, yielding the following:

(59) Il direttoreè [Gianni$_{Foc}$ Foc __]

from where *Gianni* would be unmovable, being non-maximal w. r. t. the Foc feature. So, all the major cases of freezing we have reviewed can be derived from the conjoined action of labeling and maximality.

Conclusion

The defining feature of cartographic research is the attempt to draw maps as precise and detailed as possible of syntactic configurations. The trend toward rich cartographic representations was not prompted by a high level theoretical hypothesis, it simply emerged as an empirical discovery based on much detailed work focusing on syntactic structures. The descriptive and explanatory success of analyses based on rich structural representations progressively consolidated a line of research focusing on the fine details of syntactic representations as a primary object of inquiry.

In this paper I have illustrated aspects of cartographic research by focusing on work on the complementizer system. The detailed study focusing on structures has uncovered rich functional sequences corresponding to the traditional zones of the syntactic tree. The study has highlighted important properties of the sequences, properties of ordering, of mutual incompatibility, and other distributional properties; it has also underscored the freezing effects which are systematically triggered in criterial positions. The rich set of properties brought to light by cartographic research interacts with core syntactic theory in many ways, entering into explanatory analyses and offering alternatives to classical approaches, such as ECP based accounts. Moreover, the uncovered properties raise questions of "further explanation" : can they be traced back to fundamental

ingredients of syntactic computations through deductive paths? From this perspective, cartographic research can be seen as a generator of empirical issues which can nourish core theoretical research. The role of labeling in an analysis capturing freezing effects offers, in my opinion, an effective illustration of the potential for fruitful interactions between the large empirical dimension of cartographic research and the theoretical study of fundamental syntactic computations.

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Hierarchies of Features vs. Hierarchies of Projections

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Abstract: Grammatical theory countenances two apparently distinct notions of hierarchy:

Hierarchies of syntactic features, as proposed in many theories

Ex: 1st pers>2nd pers>3rd pers (Zwicky 1977)

nom/abs>dat>acc>gen>erg (Silverstein 1976)

$\theta_{AGENT} > \theta_{THEME} > \theta_{GOAL} > \ldots$ (Jackendoff 1972, Carrier-Duncan 1985, a. m. o.)

Hierarchies of syntactic projections, as proposed in syntactic cartography

Ex: [FORCE [TOP [FOC [TOP [FIN [TENSE […]]]]]] (Rizzi 1997)

[HABITUAL [REPETITIVE [FREQ [VOLITION [CELERATIVE [ANTERIOR […]]]]]] (Cinque 2000)

[SIZE [LENGTH [HEIGHT [SPEED [DEPTH [WIDTH […]]]]]] (Scott 2002)

Are both notions required? If not, how might reduction be made and in what direction? Here I explore these questions in the domain of θ-roles. I begin by reviewing Li's (2014) theory of argument realization for the Mandarin verb phrase based on a cartographic-style "hierarchy of θ-projections" :

[ag *v* [VP time Lv_{temp}[VP loc Lv_{loc}[VP instr Lv_{inst}[VP theme V]]]]

In considering Li's account, I note two important problems arising for it: (i) the problem of non-canonical argument orders in Mandarin and (ii) the problem of non-consistent argument orders in other languages (e. g., English).I then develop an alternative based on Larson (2014), which recasts θ-roles as syntactic θ-