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A dynamic perspective on left-right asymmetries

CLLD and *Clitic doubling* in Greek

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Various intepretational effects and structural restrictions can be observed in the phenomenon of the duplication of arguments *(doubling)* by clitics in languages like Modern Greek. The fact that some of these restrictions operate apparently differentially depending on whether the doubled argument occurs in the left or the right periphery have led to the postulation of two supposedly distinct phenomena: *CLLD* (Clitic Left Dislocation: left periphery, unbounded) vs. *Clitic Doubling* (ClD: right periphery, clause bound). We examine these left-right asymmetries from the perspective of *Dynamic Syntax* (DS), a grammar formalism which reflects directly the dynamics of incrementally mapping a string of words to a semantic representation. Because in DS no separate level of syntactic representation is assumed, many standard structural constraints emerge as epiphenomenal and rather attributable to the timing of the construction process and its interaction with the context of utterance. For example, the *Right Roof Constraint,* a phenomenon which appears to require proliferation of otherwise unmotivated functional projections with attendant leftward movement (Kayne 1994), emerges in DS as an immediate consequence of the fact that interpretational processes at early stages may assign underspecified structure/content with delayed construal while interpretational processes at the closing stages may not (as a result of the independently motivated *compositionality* requirement). In a similar vein, the current account of left-right asymmetries in the occurrence of clitics exploits the DS mechanisms to derive a non-ambiguity account of clitics in all their occurrences, with variation explicable from the availability of multiple strategies interacting in the construction of semantic structure: the range of effects results from the distinct stages during processing when the clitic or the doubled DP make their contribution to the resulting representation. Besides aiming at a reduction in explanatory levels of representation, the account also aims to demonstrate the benefits of including, as part of the grammar, the parsing dynamics of how context-dependent interpretations are built up incrementally.

Keywords: Clitic Left Dislocation; Clitic Doubling; Clitics; Dynamic Syntax; Greek; Left-periphery; Left-Right asymmetries; Right-periphery; Right Roof Constraint.

1. Introduction

1.1 The phenomena: Clitic Left Dislocation (CLLD) and Clitic Doubling (ClD)

Regarding the periphery of the Greek clause structure two phenomena related to the presence of clitics have been identified: *Clitic Left Dislocation* (CLLD) on the left periphery and *Clitic Doubling* (ClD) on the right periphery (see Alexiadou 2005, Anagnostopoulou 2005 for details):[1,2]

(1) **To Jani** **ton** agapas CLLD
the John-ACC him-ACC you-love
'You love John.'

(2) **Ton** agapas **to Jani** ClD
him-ACC you-love the John-ACC
'You love John.'

1.1.1 *Clitic Left Dislocation and Clitic Doubling: Structural similarities*

These two constructions share some structural similarities. Firstly, both CLLD and ClD require case matching between clitic and doubled DP:[3]

(3) **To Jani** **ton** agapas CLLD
the John-ACC him-ACC you-love
'You love John.'

(4) **Ton** agapas **to Jani** ClD
him-ACC you-love the John-ACC
'You love John.'

In addition, both the CLLDed and the ClDed DP can be reflexive pronouns which indicates that the doubled DP is, in some sense, local to the other arguments of the verb in terms of Binding Theory restrictions:

(5) **Ton eafto tu** **ton** prosechi **(o Janis)** CLLD
the himself-ACC him-ACC he-takes-care-of (the John-NOM)
'John takes care of himself.'

1. Abbreviations: ACC: accusative case; CLLD: Clitic Left Dislocation; ClD: Clitic Doubling; GEN: genitive case; NOM: nominative case; PAST: past tense; PRES: present tense; RRC: Right Roof Constraint.

2. Bold font will be used from now on to indicate intended coreference between terms; subscripts will also be used when needed.

3. For the related constructions *Hanging Topic Left Dislocation* and *Right Dislocation*, which do not require case-matching see Anagnostopoulou (1997) and Valiouli (1994) respectively.

(6) **Ton** prosechi **ton eafto tu** **(o Janis)** ClD
him-ACC he-takes-care-of the himself-ACC (the John-NOM)
'John takes care of himself.'

Moreover, in Greek, both constructions can appear in both root and subordinate contexts:

(7) Ipe oti **to Jani** **ton** prosechis CLLD
he-said that the-John-ACC him-ACC you-take-care-of
'He said that you take care of John.'

(8) Ipe oti **ton** prosechis **to Jani** ClD
he-said that him you-take-care-of the-John-ACC
'He said that you take care of John.'

Nevertheless, there are also structural differences between the two constructions. We will consider those next.

1.1.2 *CLLD: Structural properties*

The following is a *focus construction* in Greek which, like *wh*-constructions (see e.g. (11)) is "unbounded" in that the dependency between the left-dislocated DP and the argument position in which it must be construed can be across (a certain type of) clause boundaries (see e.g. Tsiplakou 1999). Focus constructions in Greek do not employ clitic doubling:[4]

(9) To JAni ipes [oti dagose i Maria]
the-John-ACC you-said that bit the-Maria
'It was John that you said Mary bit.'

CLLD, like *wh*- and *focus* left dislocation constructions, is unbounded in the sense that the dependency between the doubled DP and the pronoun can be across clause boundaries:

(10) **To Jani** ipes [oti **ton** dagose i Maria] CLLD
the-John-ACC you-said that him-ACC bit the-Maria
'You said that Mary bit John.'

Notice also that (unbounded) *wh*-phrase clitic-doubling is possible in Greek (see Androulakis 1998 for discussion):

4. Small caps in the examples indicate contrastive stress. Without contrastive stressing such constructions are similar in interpretation to the *Topicalisation* construction in English, see Alexopoulou (1999); Alexopoulou & Kolliakou (2002).

(11) **Pja** **gineka** ipes oti **(ti)** dagose o-Janis?
whom woman-ACC you-said that her-ACC bit the-John
'Which woman did you say that John bit?'

Like *wh-* and *focus* constructions, in Greek, the CLLD dependency obeys locality restrictions identified as *island constraints,* e.g. the dependency between the left dislocated DP and the argument position at which it must be construed cannot cross relative clause boundaries (the Complex-NP-Constraint, see Ross 1967):

(12) ***To Jani** xero ti gineka [pu **ton** agapai] CLLD
the-John-ACC I-know the woman who him-ACC she-loves
'I know the woman who loves John.'

Moreover, the dependency in CLLD can be established only between the doubled DP and a clitic, neither an epithet nor a strong pronoun (both of the latter have to be doubled by a clitic to be grammatical in CLLD constructions):

(13) **To Jani** **ton** agapas **to-vlaka**
the-John-ACC him you-love the-idiot-ACC
'John, you love the idiot.'

(14) ***To Jani** agapas **to-vlaka**
the-John-ACC you-love the-idiot-ACC
'John, you love the idiot.'

(15) **To Jani** **ton** agapas **afton**
the-John-ACC him you-love him-ACC
'John, you love him.'

(16) ***To Jani** agapas **afton**
the-John-ACC you-love him-ACC
'John, you love him.'

All this evidence indicates that there are structural locality restrictions in the dependencies between the clitics and the doubled DPs in CLLD.

1.1.3 *Clitic Doubling: Structural properties*

Ross (1967) identified an asymmetry between left- and right- periphery constructions: Whereas leftwards dependencies can be unbounded, rightward ones require strict intraclausal locality. This condition has been termed the *Right Roof Constraint* (RRC). For example, consider the following English sentences:

(17) **It** is possible **that I am wrong**
(18) *That **it** is possible is unfortunate **that I am wrong**

Speaking metaphorically, the ungrammaticality of (18) above has been attributed to the illegal "movement" of the highlighted clause away from its local domain *(it is possible ~~[that I am wrong]~~)* to the right periphery of its containing sentence *(That [it is possible ~~[that I am wrong]~~] is unfortunate that I am wrong).* This prevents the association between the pronominal *it* and the "moved" clause.

Given that, as we saw above, the association between the clitic and the CLLD-ed DP in the left periphery seems to be unbounded, the question arises whether ClD, which concerns the right periphery, is similar in properties. As can be seen below ClD is *not* unbounded; at least in Greek, ClD is restricted by the *RRC*. Consider the contrast between the two Greek sentences below:

(19) Ipa [oti **ton** enochlune to Jani] chthes
I-said-PAST that him-ACC they-bother-PRES the John-ACC yesterday
'I said that they bother John yesterday.'

(20) #Ipa [oti **ton** enochlune] chthes **to Jani**
I-said-PAST that him-ACC they-bother-PRES yesterday the John-ACC
Only possible reading: # 'I said that yesterday they bother John.'

(20) is anomalous because the adverb *chthes* (= yesterday) demarcates the continuation of the main clause. This is because *chthes* (= yesterday) can only be semantically associated with the main clause verb marked with past tense *(ipa* (= I-said)), and not the verb in the subordinate clause *(enochlune* = they-bother), which is in the present. But the indicated coreference relation between the clitic *ton* (=him) and *to Jani* (= the John) only allows for an interpretation where the adverb *chthes* itself belongs to the subordinate clause yielding the semantically anomalous:

(21) #**Ton** enochlune chthes
him-ACC they-bother yesterday
'They bother John yesterday.'

Consider also the contrast below:[5]

5. The reason that the following examples are characterised as anomalous rather than ungrammatical tout court is because, to my ear, the "flavour" of the anomaly is one of processing difficulty rather than outright ungrammaticality. This is because, in the context of a Dynamic Syntax analysis where the grammar characterises possible parses, there is a much less natural, but still possible, alternative parse of such structures which can moderate the anomaly when such structures are presented in written text with a lack of intonational/prosodic indications: in such cases, interference can be caused by the independent phenomenon of afterthought *Right Dislocation* (see Cann et al. 2005: 187–192 for an analysis of this in English); this can be controlled for by avoiding a sharp pause before the right-peripheral DP. Such parses can make the sentences acceptable to speakers if one explicitly suggests to them a possible reading like: *I said to you only that they bother him, John I mean*.

(22) Ipa [oti **ton** enochlune **to Jani**] s'esena mono.
I-said that him-ACC they-bother the John-ACC to you only
'I said to you only that they bother John.'

(23) #Ipa [oti **ton** enochlune] s'esena mono **to Jani.**
I-said that him-ACC they-bother to you only the John-ACC
'I said to you only that they bother John.'

The PP *s'esena mono* (= to you only) is an argument of the main clause verb *ipa* (= I said). When this PP intervenes between the boundary of the embedded clause *(oti ton enochlune* = that they bother him) and the doubled DP *to Jani* (= the John), an anomaly results. Similarly, the anomaly of (24) can be attributed to the fact that *tis Marias* (= to Mary) belongs to the main clause and this prevents the association of *to Jani* (= John) with the clitic *ton* (= him) in the subordinate clause:[6]

(24) #**Tis**$_j$ ipa [oti **ton**$_i$ apelisa] **tis Marias**$_j$ **to Jani**$_i$.
her-ACC I-said [that him-ACC dismissed] the Mary-GEN the John-ACC
Intended but impossible: 'I told Mary that I dismissed John.'

(25) **Tis**$_j$ ipa [oti **ton**$_i$ apelisa **to Jani**$_i$] **tis Marias**$_j$.
her-GEN I-said [that him-ACC I-dismissed the John] the Mary-GEN
'I told Mary that I dismissed John.'

We now turn to look at what kind of interpretational effects are achieved by the use of such constructions in Greek.

1.1.4 *Clitic Left Dislocation and Clitic Doubling: Interpretational effects*

It is reported in the literature that both constructions are associated with "familiar", "definite" or "topical" information as far as the status of the referent of the doubled DP and the pronominal goes (see a.o. Suñer 1988, Anagnostopoulou & Giannakidou 1995, Gutièrrez-Rexach 1999, Alexiadou 2005). In many cases, this has provided the motivation for analysing pronominal clitics as something other than regular pronouns. Thus we find analyses taking them as agreement morphemes, operators, variables, or regular verbal arguments with no explanatory account of the intepretational effects associated with such constructions except by the stipulation of syntactic encoding of such semantic features (see Leonetti 2007 for discussion). However, the syntactic encoding of such features does not seem to prevent any type of quantificational expression from being felicitous in both CLLD and ClD constructions:

– CLLD with (bare) indefinites, universals, and negative quantifiers

6. In Greek the genitive case indicates the indirect object as the dative morphology has been lost.

(26) **Zaketa me kubia** den tha **tin** xanaforeso.
sweater with buttons not will it-ACC I-wear-again
'I will never again wear a sweater with buttons.'

(27) **Ena fititi su ton** ida n'agorazi tsigara chthes.
a student-ACC yours him-ACC I-saw buying cigarettes yesterday
'I saw a student of yours buying cigarettes yesterday.'

(28) **Kathe fititi su ton** ida n'agorazi tsigara chthes.
every student-ACC yours him-ACC I-saw buying cigarettes yesterday
'I saw every student of yours buying cigarettes yesterday.'

(29) **Kanenan** (tus) den tha **ton** peraso.
any (of them) not will him-ACC pass
'I will not pass any (of them).'

(30) **Kathe digma** prepi na **to** exetazis prosechtika.
every specimen-ACC must to it-ACC examine-you carefully
'You must examine each specimen carefully.'

– ClD with (bare) indefinites, universals, and negative quantifiers:

(31) Den tha **tin** xanaforeso **zaketa me kubia.**
not will it-ACC I-wear-again sweater with buttons
'I will never again wear a sweater with buttons.'

(32) I Tzeni **ton** malose **ena fititi mu.**
the Jane-NOM him-ACC she-scolded a student of mine-ACC
'Jane scolded a student of mine.' (adapted from Schneider-Zioga 1994)

(33) I Tzeni **to** malose **to kathe pedi.**
the Jane-NOM it-ACC she-scolded the every child-ACC
'Jane scolded every child.' (from Schneider-Zioga 1994)

(34) Den tha **ton** peraso **kanenan** (tus).
not will him-ACC pass any (of them)
'I will not pass any (of them).'

(35) Prepi na **to** exetazis prosechtika **kathe digma.**
must to it-ACC examine-you carefully every specimen-ACC
'You must examine each specimen carefully.'

It is reported that the interpretation of quantifiers in these contexts appears to differ in that they are associated with *specificity, referentiality, partitivity, D-linking, presuppositionality,* etc. i.e. context-dependent interpretations, which, nevertheless, syntactic accounts encode as features on representations. However, the fact that these quantificational expressions are associated with such encoded features does not result in their possible escape of scope interactions, i.e. widest scope, as would be expected if they were truly *referential*. For example, it is well-known that universal quantifiers, unlike indefinites, cannot escape their local clause in terms of scope constraints. This explains the contrast in possible scope alternations shown below:

(36) Mia gineka ide kathe fititi.
a woman saw every student
'A woman saw every student.' (∃∀, ∀∃)

(37) Mia gineka ipe [oti **kathe fititi** **ton** ide n'agorazi tsigara].
a woman she-said that every student him she-saw buying cigarettes
'A woman said that she saw every student buying cigarettes.' (∃∀,* ∀∃)

(38) Mia gineka ipe [oti **ton** ide **kathe fititi** n'agorazi tsigara].
a woman she-said that him she-saw every student buying cigarettes
'A woman said that she saw every student buying cigarettes.' (∃∀,* ∀∃)

The fact that the universal quantifier in (37) appears in a CLLD construction associated with a clitic (ClD in (38)) does not allow it to escape its local domain and scope over the indefinite. But this should be possible if such DPs were either "referential" or "specific" in any standard semantic sense (cf. Farkas 1994, 1997). Moreover, in a similar vein, analogous examples to those presented in Farkas (1981) and elsewhere can be constructed with clitic doubling structures showing that doubled indefinites can acquire intermediate scope readings. In the following, the doubled indefinite can scope above the universal modified by the relative but below the universal subject, i.e. the books can vary with the lecturers but not with the students:

(39) Kathe kathigitis penese kathe fititi pu **to** ixe diavasi
Every lecturer praised every student who it-ACC read
ena vivlio pu ixe sistisi.
a book that he-had recommended.
'Every lecturer praised every student who had read some book he had recommended.' (∀∃∀, ∀∀∃, ∃∀∀)

This would be unexpected behaviour if such DPs were truly referential (but cf. Anagnostopoulou & Giannakidou 1995 for somewhat distinct views).

Moreover, experimental evidence presented in Garoufi (2006) seems to show that no necessary association with *specificity* can be maintained for doubled sentences, at least for indefinites. For definites, in contrast to what is reported in the literature, non-specific definites can be doubled in Greek:

(40) Oli tha **to** xirocrotisun **to agori** pu tha fthasi proto.
all will him-ACC cheer the boy that will arrive first
'Everyone will cheer the boy who arrives first.' (∀THE, THE∀)

Even though doubling structures are characterised as presupposed, old information supposedly disallowing stressing as a result, in fact, strings where the doubled DP is associated with focus indicators, like *only*, are perfectly grammatical. Their interpretation is analogous to that seen in the case of focus dislocation structures above in (9):

(41) Mono **to JAni** den **ton** xeretisan.
only the-John not him they-greeted
'It was only John that they didn't greet.'

(42) Den **ton** xeretisan **to JAni** mono,
not him they-greeted the-John only
'It was only John that they didn't greet.'

As this evidence shows, encoding of notions like referentiality and specificity in the syntax creates structures without clearcut semantic import. Moreover, as Leonnetti (2007) points out such "specificity effects" only arise in languages and structures where the doubling of the DP is optional. Once such doubling becomes obligatory these interpretive effects disappear. This points to the conclusion that the existence of alternative strategies in a language for conveying a single truth-conditional content can be exploited by the speakers for various pragmatic effects. But the existence of alternative strategies does not mean that there are encoded syntactic restrictions on the choice of such strategies. It rather seems to involve calculation of effort/effect balance, as advocated in pragmatic frameworks like *Relevance Theory* (Sperber and Wilson 1986/1995). In our case, a structure that includes a (syntactically) optional doubling argument must be motivated by some pragmatic considerations. However, these considerations cannot be taken as "grammaticalised" since they can vary from use to use and can be explained by an independent pragmatic theory without requiring the postulation of some otherwise unmotivated features or ambiguities in the expressions and structures involved.

In fact, when one takes into account the dynamics of left-to-right processing of linguistic strings, it seems that some interpretational effects can arise because of the timing of the introduction of a pronoun and a potential antecedent. As argued for Italian in Brunetti (2006), CLLD structures in Greek can be used for contrast/comparison purposes, an option which doesn't seem available for ClD:

(43) Context question:
Ti edoses st'aderfia su gia ta Chistugenna;
'What did you give your siblings for Christmas?'

(44) **Tu Jani**$_i$ **tu**$_i$ edosa ena CD,
the-John him-ACC I-gave a CD

ke **tis Marias**$_j$ **tis**$_j$ edosa ena vivlio.
and the-Mary-GEN her-GEN I-gave a book
'I gave John a CD and Mary a book.'

(45) #Tu$_i$ edosa **tu Jani**$_i$ ena CD,
him-ACC I-gave the-John a CD
ke **tis**$_j$ edosa **tis Marias**$_j$ ena vivlio.
and her-GEN I-gave the-Mary-GEN a book
'I gave John a CD and Mary a book.'

(45) is anomalous as an answer to the question in (43). In time-linear terms this can be explained as follows: Elements introduced initially in a processing cycle (as the DP in CLLD) can provide the context for the interpretation of the following string, for example, they can introduce (the representation of) an entity which can serve as the element that resolves the reference of a pronoun. On the other hand, elements introduced at the end of processing (ClD) cannot provide such context as any such pronominals[7] will have already been resolved referentially from the discourse/sentential context. Thus such elements in the right periphery can only confirm or emphasise an already made choice of referent for the pronoun.

The formal implementation of this intuitive explanation within the *Dynamic Syntax* framework will be presented in the following sections.This account will allow us to maintain that clitics are neither operators nor variables, determiners, agreement morphemes etc., but just ordinary pronominals, i.e. elements underspecified in terms of content which crucially rely on context for their full interpretation (see Section 2.3.). This context can be either the general discourse and cognitive context or be provided by linguistic input while the sentence string is being processed. Even though clitics are regular pronominals in essence, in particular languages, pronouns might develop diachronically so that they can allow uses as *expletives* or function in the same way as *gaps/traces* etc. (see Cann et al. 2005, Cann & Kempson 2008). The initial grammatical contribution assigned to pronouns in general must be such that it allows and explains such natural progressions observed cross-linguistically. The analysis of particular pronominal elements within a single language must also be weak enough to allow for all their uses in particular structures without postulating ambiguities for no good reason (see also Leonetti 2007 for similar general ideas).

Under these assumptions, it is desirable to provide an account of the Greek pronominal clitics that appear in the CLLD and ClD constructions as not distinct from clitics in isolation functioning as the sole argument of the verb. All the left-right asymmetries that arise in these constructions, structural and interpretational, can be attributed to the timing of the introduction of the pronoun and the

7. Unless they are genuine expletives.

doubled DP in interaction with the general architecture of the grammar formalism which models the parser. We attempt to show here that the dynamics of how context-dependent interpretations are built up by processing words in a sequential manner are adequate to solve the puzzles associated with CLLD and ClD without a separate, independent level of syntactic representation.

2. Sketching a Dynamic Syntax model for Greek

Dynamic Syntax (DS) is a parsing-based framework, involving a strictly sequential interpretation of linguistic strings. DS models "syntax" as just the dynamics of building representations of STRUCTURED INTERPRETATIONS from the input provided by sequences of words relative to a particular context. So no separate "syntactic" level of representation is assumed: only the incremental processing of strings of words relative to the context and the resulting representation of content. Therefore phenomena attributed to syntactic representations or rules in other frameworks are handled through the processing dynamics in DS.

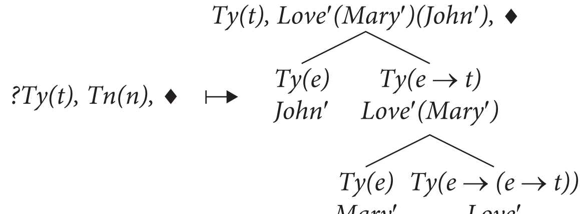
2.1 Background

The parsing process usually starts with a GOAL (indicated always with a ?) to derive a structure of type "proposition" indicated as: *Ty(t)*.[8] If the parse is successful, we end up with a completed propositional structure in tree format. So, for example, a complete parse of the sentence string below

(46) O Janis agapai ti Maria.
the-John-NOM he-loves the Mary-ACC
'John loves Mary.'

will start with the one-node tree on the left of (47), called the AXIOM, and through the parsing actions specified by the DS formalism will gradually yield the tree on the right-hand side:

(47)



8. This is a simplification for expository purposes here: goals can be structures of any type, see e.g. Gregoromichelaki et al. (2009).

The semantic representation language adopted by DS is the LAMBDA CALCULUS[9] with a restricted set of types for semantic combination: *Ty(e)*- individual entity, *Ty(e → t)*-predicate, etc.[10] Note that the content annotations on the tree do not stand for words but rather for representations of semantic values potentially enriched in combination with contextual information (see, e.g., Carston 2002). Moreover, DS trees do not encode any notion of WORD ORDER. By convention, predicates appear on the right branch and arguments on the left. Word order is handled by means of the POINTER, ♦. The pointer always appears at a unique node showing that that particular node is currently under development. All nodes are also assigned unique addresses by means of the predicate *Tn,* seen above in (47).[11]

The parsing process is driven by goals to be fulfilled at each stage in the parse. These are encoded in the form of REQUIREMENTS, indicated by ? in front of any type of annotation. For example, as we saw above, *?Ty(t)* imposes the goal of building a proposition, ?*Ty(e)* requires that the node where it appears host a representation of type *individual* etc. Such requirements, once introduced, must be fulfilled, otherwise the parsing process will be unsuccessful (it will ABORT).

Words are processed sequentially left-to-right and contribute, not only semantic content, but also ACTIONS that build semantic structure (LEXICAL ACTIONS). There are also general COMPUTATIONAL ACTIONS (rules) that perform tasks at certain points. Thus the parser in DS is modelled as operating in a partially top-down manner through (predictive) computational actions and according to the time-linear sequence of the words.[12] Words and rules are defined as macros of the following form:

(48) FORMAT OF LEXICAL AND PARSING ACTIONS

IF	*some condition holds*	Trigger
THEN	*build tree structure, move up or down,*	
	insert content X, …	Actions
ELSE …		Elsewhere Statement

The first part (IF) always contains a set of conditions that must be satisfied on the node where the pointer ♦ currently resides so that the actions specified in the

9. Augmented with the epsilon calculus, as we will see later.

10. In the graphics we have simplified the representations by omitting details: *Love'* stands for $\lambda x.\ \lambda y.Love'(x)(y)$; *Love'*(*Mary'*) stands for $\lambda y.Love'(Mary')(y)$ etc. Brackets are omitted freely to improve readibility.

11. These addresses will be generally omitted from the graphics for reasons of space unless necessary for the point illustrated.

12. In this respect the model shares similarities with the one presented in Chesi (this volume). However, in DS, there is no separate level of syntactic representation.

THEN part can apply. If the conditions do not hold, then the ELSE part specifies what is to be done (usually the parse is Aborted).

2.2 A language to talk about trees: LOFT

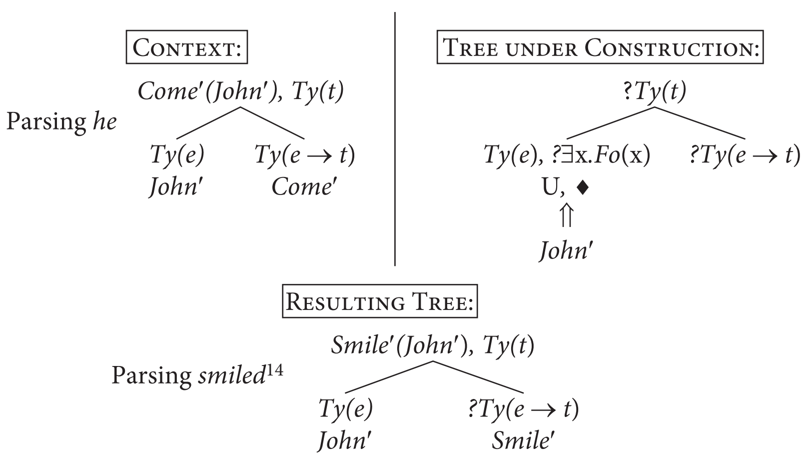
Parsing in DS is specified by means of actions which map partial trees to partial trees until a complete one has been reached. In order to achieve this, we need a language to talk about trees and the annotations on their nodes. For this reason, DS utilises the modal logic LOFT (Blackburn & Meyer-Viol 1994). By means of the operators this language provides one can describe nodes on the tree from the perspective of any other node. For example, the specification $\langle\downarrow_0\rangle X$ on a node means that X holds at the argument daughter of this node, conventionally assigned a position indicated by 0; $\langle\downarrow_1\rangle X$ means X holds at the functor (predicate) daughter of this node, which we indicate with 1. Moreover, we can talk about yet not completely specified dominance relations among nodes. For example, $\langle\downarrow^*\rangle X$ means that the current node dominates X, i.e. X occurs either at the current node or at a node somewhere below the node we are currently considering; but there is no information as to exactly how many dominance steps separate the two nodes (the *Kleene star* (*) indicates zero or more dominance steps). Analogously $\langle\uparrow^*\rangle$ indicates that X holds either at the current node or at a node arbitrarily higher in the local propositional tree. These underspecified relations usually come with requirements for their eventual resolution to fully specified ones.

This language for talking about nodes on the tree, in combination with the device of requirements, allows us to impose various constraints on the tree's future development. For example, case ACCUSATIVE will impose the requirement $?\langle\uparrow\rangle Ty(e \rightarrow t)$ on the argument node, meaning that the predicate node must (eventually) be its mother. In addition we can annotate a node as $?\langle\uparrow^*\rangle Tn(a)$ meaning 'somewhere above me is treenode a' if we do not yet know the exact position of such a node in the tree. As we will shall see, this allows us to specify temporarily underspecified relations among nodes.

2.3 Anaphora in DS

UNDERSPECIFICATION is a crucial notion in DS. We've already seen how the parsing process is driven by underspecified annotations on the trees in the form of requirements which weakly specify (constrain) how the parse should unfold in order to be successful. Another form of underspecification, in this case in terms of content, is provided by lexical items which rely essentially on their context of occurrence for acquiring fully specified semantic values. PRONOUNS (but also ellipsis indicators) are the elements par excellence that exploit this flexibility of interpretation. They are modelled in DS as invariably providing as their lexical content underspecified place-holders, called METAVARIABLES which are annotated as U, V, W etc. These elements must be substituted by the representation of some referent supplied by the linguistic or extra-linguistic context. This is indicated on the node on which they occur by the annotation $?\exists x.Fo(x)$, which is a requirement that will only be satisfied once a proper semantic value (a referent) is provided for the metavariable.[13] CONTEXT in DS involves storage of parse states, i.e. storing of the partial tree, the word sequence processed, plus the actions used in building up the partial tree. In this respect, whenever a referent is available in the context store, it can be retrieved by use of a pronoun in the linguistic string. So consider the processing of the second sentence below in the context of having processed the first one:

(49) **John** came in. **He** smiled.



The representation of a referent, *John'*, is available in the tree structure stored in the context representation. Use of the pronoun *he* subsequently will provide a metavariable U on the newly constructed tree. A process of SUBSTITUTION, illustrated above as ⇑, will then copy the value *John'* from the context on the node where the metavariable U resides so that the requirement $?\exists x.Fo(x)$ becomes satisfied and is subsequently removed.

13. *Fo* (standing for *formula*) is a predicate whose arguments are members of the set D_{Fo}, the set containing only appropriate contentful semantic values, i.e. lambda terms and their arguments as specified in the semantic representation language employed by DS.

14. We will not offer here any analysis regarding the contribution of tense/aspect etc., but give only very simplified representations.

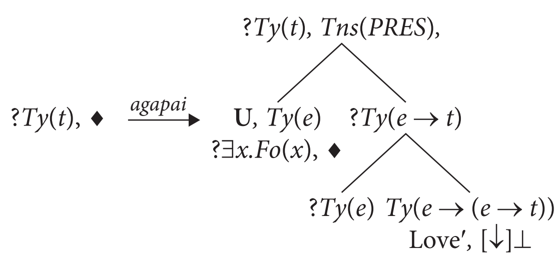
2.3.1 *Pro-drop*

The same mechanism allows for the handling of *pro-drop* phenomena. Verbs in languages like Greek induce the propositional structure for a predicate and its expected arguments with a metavariable as the subject. This is because in such languages the agreement morphology on the verb imposes constraints on the selection of the subject which sometimes in context are sufficient for the hearer to identify the individual intended, i.e. such agreement morphemes function in the same way as pronominals. In such cases, therefore, the semantic value for the subject can be provided by the context of utterance and therefore a lexical specification can be omitted. In (50) below we present the lexical entry for the verb *agapai* in Greek and in (51) the effect that processing of this word has on the development of the initial partial tree:[15]

(50) *agapai*= he-loves

IF	$?Ty(t)$	
THEN	$put(Tns(PRES));$	Tense
	make(($\langle\downarrow_1\rangle$); go($\langle\downarrow_1\rangle$); put($?Ty(e \rightarrow t)$);	Predicate Node
	make($\langle\downarrow_1\rangle$); go($\langle\downarrow_1\rangle$);	
	put (Love', $Ty(e \rightarrow (e \rightarrow t))$, $[\downarrow]\bot$;)	Main Functor
	go($\langle\downarrow_1\rangle$); make($\langle\downarrow_0\rangle$); go($\langle\downarrow_1\rangle$);put(?Ty(**e**));	Internal Argument
	go($\langle\downarrow_1\rangle\langle\downarrow_1\rangle$);make(($\langle\downarrow_1\rangle$);go($\langle\downarrow_1\rangle$);	
	put($Ty(e), V, ?\exists x.Fo(x)$)	Subject
ELSE	Abort	

(51)



The lexical entry results in a partially specified predicate-argument structure with the pointer on the subject node awaiting either some semantic value provided by the context or further linguistic input to fill in the content of the subject. It is a property of metavariables that they can be provided with content in either of these two ways. In the tree above, a subject can now be processed in a string like *Agapai i Maria to Jani* (= Loves Mary-NOM John-ACC, Mary loves John) or the context can provide the missing annotation for the subject in a string like *Agapai to Jani* (= Loves

15. make(...), go(...) and put(...) are (atomic) actions out of which the DS lexical and computational macros are composed, see Section 2.1. and, in particular, example (48) above.

John-ACC, She loves John). The BOTTOM RESTRICTION, [↓]⊥, on a node that can be seen in the lexical entry and the predicate node above indicates that the node cannot be developed further downwards thus ensuring that most words contribute their encoded content to terminal nodes.[16] Metavariables appearing as verb-induced temporary arguments in pro-drop languages are not associated with such restrictions so they can be provided with a value through the processing of a DP.

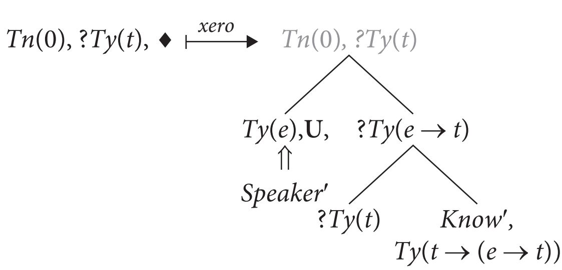
2.4 The parsing process

We will now illustrate how the parsing mechanism works by displaying briefly the processing of a string like *Xero oti agapas to Jani* (= I-know that you-love the-John):

(52) Xero oti agapas to Jani
I-know that you-love the John-ACC
'I know that you love John.'

We start with the one-node partial tree, which we saw is called the *Axiom*. We process the verb *xero* which requires a proposition (of *Ty(t))* as its object and indicates that its subject must be the individual in the context designated as the speaker, whoever that is *(Speaker')*. As there is no further argument specifying the subject, a representation of the speaker is inserted at the subject node and we go on to develop the propositional object. Notice that the grammatical word *oti* (= that) receives no representation on the semantic tree as its role is purely procedural, in the sense that it only contributes word order and tense constraints on the representation (omitted here for reasons of space), and no semantic content:[17]

(53)

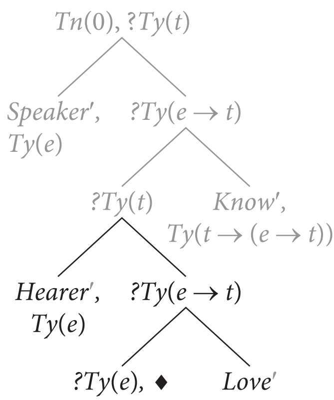


16. We will see that clitics can be exceptions to this regularity.

17. From now on information that has not changed from one parse step to the next will appear in gray font. Some irrelevant annotations will also be omitted for readibility purposes, e.g. the bottom restriction.

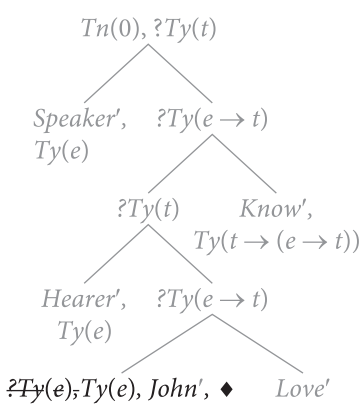
We continue processing the verb *agapas* (= you-love), which again indicates that the subject is the individual designated in the context as the hearer *(Hearer')* and its object some individual *(Ty(e))* to be provided. The pointer is then left on the object node of the embedded proposition. As Greek is not object pro-drop, necessarily some word has to provide the expected argument to satisfy the requirement ?Ty(**e**) on this node:

(54)



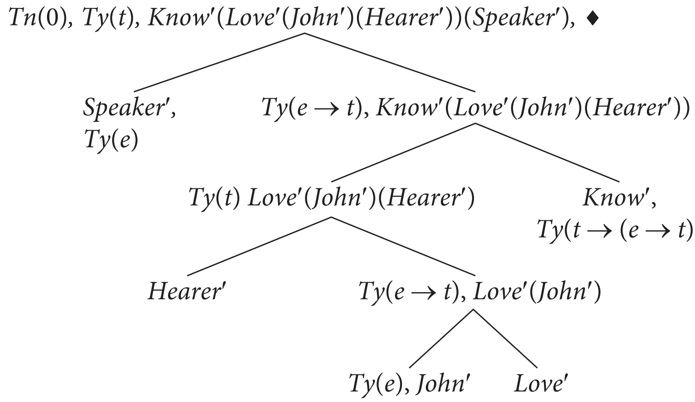
We now process the DP *to Jani* (: the John-ACC), which provides the expected argument and satisfies the requirement *?Ty(e):*

(55)



Now computational actions take over, compiling the interpretation on the non-terminal nodes of the tree and eventually resulting in the complete tree shown below, which indicates a successful parse of the string as no requirements remain unsatisfied and no words are left to process:

(56)



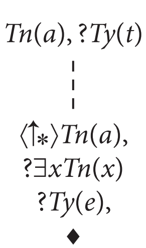
2.5 Parsing bounded and unbounded dependencies

Displacement constructions are treated in DS as involving semantic content that is presented as initially structurally underspecified. Such constructions initiate the building of temporarily UNFIXED NODES, i.e. nodes that will be attached on the tree at a fixed position later in the parse. These nodes are indicated with dotted lines in the graphics below and always carry a requirement that they must be fixed in the propositional tree at some point (?∃x.Tn(x): there must be a fixed treenode *(Tn)* address for this node). The LOFT modal operators which employ the *Kleene star* (*) do the job of specifying the local domain where the node must be fixed. There are two kinds of such structures: local and long-distance ones.

2.5.1 *Long-distance dependencies*

Long-distance dependencies occur when the unfixed node can belong in any subordinate clause which functions as an argument in the current predicate-argument structure.[18] A DS computational rule, the rule of *-Adjunction, is used to build an unfixed node as the following shows, initially in the parse, before any processing of linguistic input has started:

(57)



18. *Local dependencies*, on the other hand, as in e.g. *scrambling* phenomena, require that the unfixed node belong necessarily to the current predicate-argument structure under development, see below.

The above says that the node joined by the dotted line to the root *?Ty(t)* node (conventionally indicated by the address *Tn(a))* must eventually be of type *e* (: *?Ty(e)),* it must have a fixed address (: $?\exists x.Tn(x)$) and it must be dominated by the root node *Tn(a)* (: $\langle\uparrow^*\rangle Tn(a)$). Notice that this reflects the STRONG ISLAND constraints associated with such structures as the node cannot be fixed in any adjunct tree (the Kleene * indicates zero or more *dominance* steps and adjuncts in DS do not belong to the same dominance domain as arguments).[19] Let's now see briefly how this rule is applied in the processing of a long-distance dependency, e.g. *Focus Left Dislocation,* in Greek with the parsing of the following string:[20]

(58) To JAni xero oti agapas,
the John-ACC I-know that you-love
'It is John I know you love.'

As usual, we start with the Axiom. We then apply the *-Adjunction rule to give us a structure like the one above in (57), which prepares the way for the processing of the dislocated *to Jani* (= the John-ACC). This can now be processed to satisfy the requirement $?Ty(e)$ on the unfixed node; the satisfied requirement is removed and the pointer returns to the root node in anticipation of the verb:[21]

(59)

$$Tn(0), ?Ty(t), \blacklozenge \quad \xrightarrow{*Adjunction} \dots \dots \xrightarrow{Jani}$$

$Tn(0), ?Ty(t), \blacklozenge$
¦
$\sout{?Ty(e)}, Ty(e), John'$
$?\exists x Tn(x)$

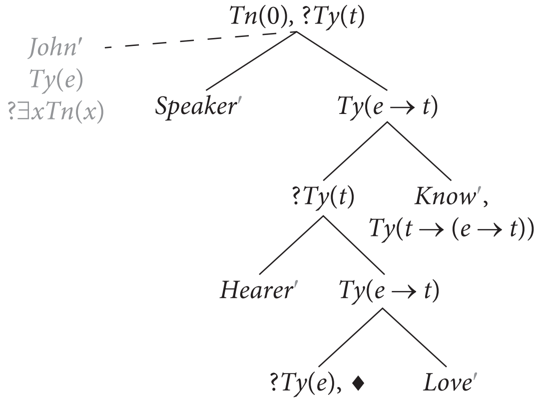
We are now ready to process the rest of the string *xero oti agapas* (= I-know that you-love) in the same way as it was illustrated above. This results in the following partial tree:

19. The DS account of island constraints relies on the analysis of adjunct structures, e.g. relative clauses, as building trees LINKed to the main propositional tree. LINK is a relation between two independent trees whose nodes are therefore not related by dominance relations. Any type of island violations will have to be attributed to the existence of such a relation between the relevant nodes. We omit discussion of such structures for reasons of space (see Cann et al. 2005).

20. For an analysis of such constructions in an earlier version of Dynamic Syntax, LDS_{NL}, see Tsiplakou (1999).

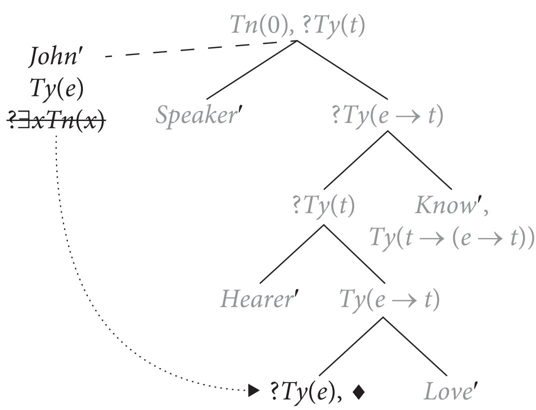
21. Note that REQUIREMENTS are constraints in the future development of the structure so they must be eventually satisfied for a parse to be declared successful. When they are satisfied, such requirements are removed (indicated on the graphics by crossing them out). There is no restriction that they must be satisfied at all stages of the parse. So the requirement $?\langle\uparrow\rangle Ty(e \rightarrow t)$ that we saw above in Section 2.2. (omitted for readibility here) contributed by the accusative morphology on to *Jani* will be eventually satisfied when the node is fixed at its appropriate position as a daughter of the predicate node.

(60)



We now have the pointer at a node which requires something of type *e* and an unfixed node which requires a fixed position anywhere inside the tree. The DS rule of Unification can be applied at this point to unify the two nodes: the unfixed and the fixed one. Application of *Unification* results in the following partial tree:

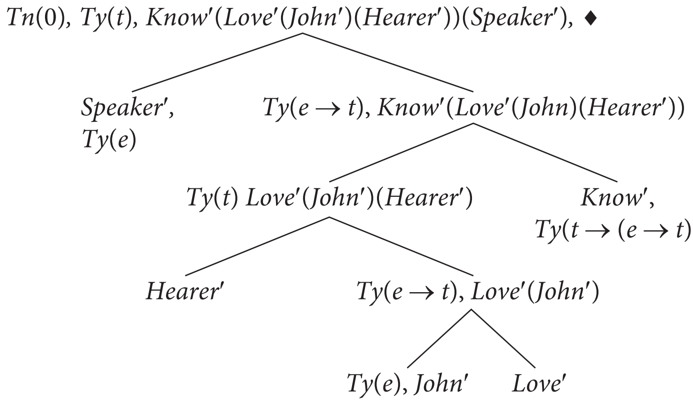
(61)



Since, by this merge, the requirements on both nodes are now satisfied, the set of computational rules that build up the interpretation and complete the tree can take over to result in the following completed structure (notice that there is no longer a record of the fact that there was a dislocation construction since the tree below indicates truth-conditional content only):[22]

22. However, the set of actions which were used to build this tree are also stored in the context and there is a record there of the dislocation used by the speaker (see Cann et al. 2005, Ch 9; Cann et al. 2009, Ch 7.)

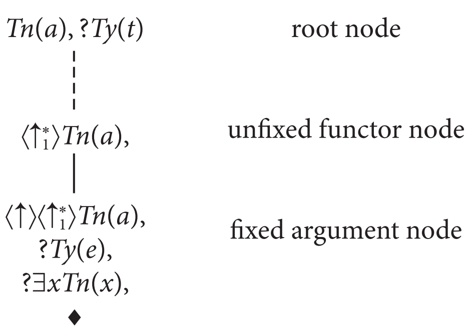
(62)



2.5.2 *Local dependencies*

Local dependencies require that the unfixed node belong necessarily to the current predicate-argument structure under development. The rule defined to deal with such dependencies is the rule of Local *-Adjunction and within DS it is used, e.g. in the analysis of scrambling constructions in verb-final languages (see Cann & Kempson 2008). The rule applies to a ?*Ty*(*t*) node and it introduces an unfixed functor node along with its (fixed) argument daughter. The annotation $\langle\uparrow*_1\rangle$ associating the unfixed functor node with the root node (via the mention of *Tn(a))* indicates that the functor node must be fixed inside the current predicate argument structure, i.e. it cannot cross any propositional boundaries:

(63)



In scrambling structures, it is the use of case on the argument processed next which fixes such locally unfixed nodes in their appropriate positions (constructive use of case). Cann & Kempson (2008) also assume that the same mechanism accounts for Romance proclitic constructions: the lexical entry for such clitics introduces and subsequently fixes such unfixed nodes according to the case features included before the processing of the verb has taken place (this is taken to encode the clitics' historical development from frozen scrambling structures). Here we are going to extend the same analysis to the Greek clitics.

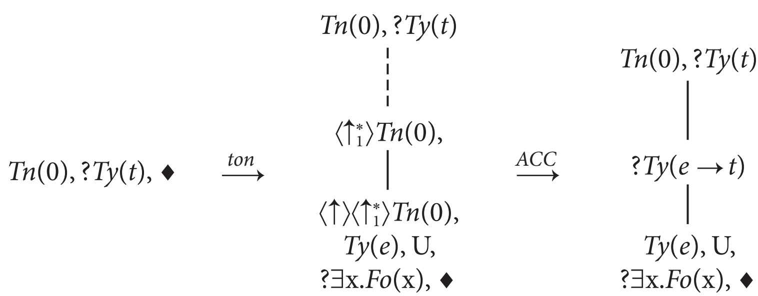
2.6 Parsing clitics in DS

We assume that clitics in Greek introduce *locally unfixed nodes* which are fixed immediately because of the case marking. As an illustration we will consider the processing of the following string:

(64) Ton agapas.
him-ACC-clitic you-love
You love him.

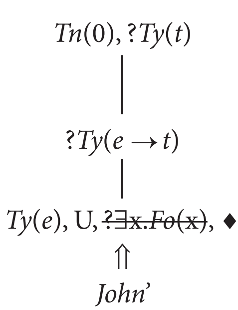
Consider (65) below. As always, the starting point is the Axiom. As a second step the lexical entry for the clitic *ton* is invoked. Firstly, it induces a locally unfixed functor node and its argument daughter, which is annotated as *Ty(e),* and carries a metavariable **U** as its underspecified semantic content, reflecting the fact that the clitic is essentially a pronominal. Subsequently, the processing of the accusative case on *ton* allows the fixing of the functor node since the node occupied by the content contributed by the clitic is expected to be a direct object:

(65)



Now the pointer resides at a node annotated with a metavariable as its semantic value and requires provision of a value for a successful parse. Let's assume that a value is readily available in the context, e.g. the value *John*'. As can be seen in (66) below, this value can be copied and substituted on the current node:

(66)



From here on the parse can proceed with the parse of the verb as normal. However, in clitic-doubling languages like Greek there are two further options for annotating this node and hence eliminating the metavariable: a value for the metavariable can be provided either by an unfixed node already introduced (CLLD), or by the subsequent processing of an argument (ClD). In order to see how this works we need to examine first the DS analysis of *expletive* pronouns and *extraposition* in English, as the same mechanisms will be exploited in the analysis of CLLD and ClD in Greek.

2.7 Expletives and Extraposition

2.7.1 *Expletive pronouns*

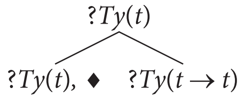
As we saw above, the *bottom restriction* [↓]⊥ ensures that words contribute content to terminal nodes that cannot be extended further downwards. The rule of *Unification* cannot normally be applied to a node carrying a *bottom restriction* because such unification will end up providing a branching structure, which is incompatible with the *bottom restriction* indication. However, specialised items, like EXPLETIVE pronouns, seem to be elements which allow just that, i.e. they allow the argument position they annotate to be provided by content through the processing of further linguistic input. The EXTRAPOSITION construction in English employs such an expletive element, the pronominal *it:*

(67) **It** is possible **that I am wrong.**

As argued in Cann et al. (2005), expletive pronouns are mostly used in languages as delaying mechanisms for an appropriate referent to be provided later on or function in the same way as agreement morphemes. *It* here is just a dummy element delaying the provision of the actual argument of the predicate *Possible*', which is the proposition *Wrong'(Speaker').* We saw a similar phenomenon earlier in the processing of the verb in a subject pro-drop language like Greek (see Section 2.3.1.): the metavariable provided as the subject by the lexical entry of the verb, through the agreement morphology, can either (a) receive a value from the context of utterance or (b) be annotated by processing a DP provided explicitly. For this to work, it is essential that such metavariables are not accompanied by a *bottom restriction,* otherwise the first option will not be available. We can assume a similar account for the potential of some pronominals to historically develop into expletives: they can be assumed to result from weakened lexical entries as they have lost their *bottom restriction,* which means the nodes they furnish with content will be allowed to be extended downwards with additional tree branches through *Unification.* Let's see now how we process such structures in DS.

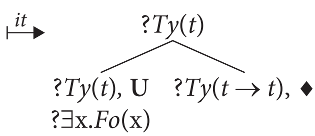
We start with the Axiom as usual and then computational rules introduce the anticipation of a predicate-argument structure where a proposition functions as the subject of a predicate. The pointer is placed on this subject node:

(68)



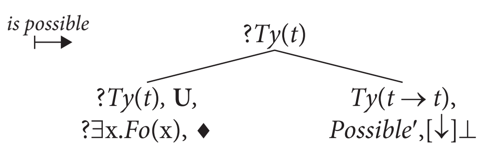
At this point, a proposition can be provided by the linguistic string as in, e.g. the string *That I am wrong is possible.* Alternatively though, there can be a delay in the provision of such propositional content, perhaps for reasons of emphasis or other pragmatic purposes. This function is performed by the expletive element *it,* a pronoun analysed in DS as introducing no *bottom restriction* on the node it annotates. However, like all pronominals, it introduces a metavariable U, a requirement for a proper semantic value to be provided, $?\exists x.Fo(x)$, and, crucially, it shifts the pointer to the predicate node awaiting the processing of the verb:

(69)



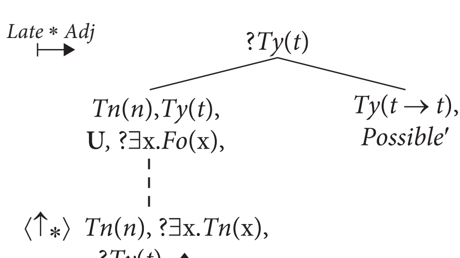
Parsing the predicate *is possible* subsequently annotates the node with the content *Possible*' and the pointer returns to the subject node, where there is a requirement still to be fulfilled (for the role of *be* see Cann 2007):

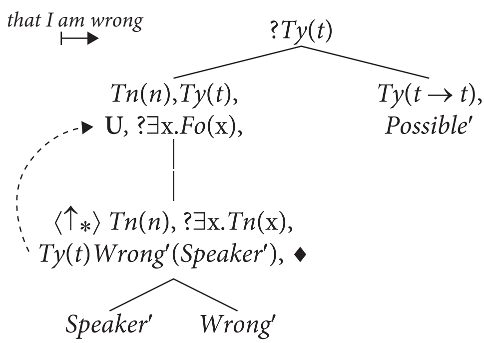
(70)



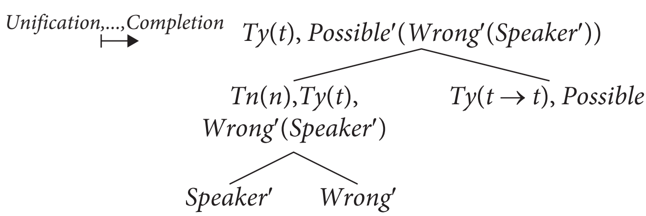
Now a DS rule called Late* Adjunction can apply, which builds an unfixed node below a fixed one, provided they share type annotations so that they can be unified. Notice that it is crucial here that an expletive expression (like *it)* does not contribute the *bottom restriction* ($[\downarrow]\bot$), otherwise Late*Adjunction and the processing of the upcoming subordinate sentence could not apply. This rule will build a node of *?Ty(t)* below the subject, which allows the string *that I am wrong* to be parsed at that point:

(71)



(72) 

Unification of the two nodes can then apply and subsequently the usual computational rules will compile the interpretation on the non-terminal nodes yielding a complete tree and a successful parse:

(73) 

Notice that there is no trace on the eventual tree of the fact that an expletive pronoun was involved in this particular semantic representation. This is identical to the one derived through the parse of a string like *That I am wrong is possible* since the truth conditions are identical and the contribution of *it,* like any pronoun, is a temporary place-holder (a metavariable) until a proper value is provided (in this case a proposition).

This account of expletives and the way they contribute to the parsing dynamics captures the intuition that there is a continuum of properties that pronominals can exhibit, from strong pronouns which are regular lexical items with their own lexical entries and which occupy regular argument positions to displaced clitics or agreement morphemes, the former on the way to becoming similar to the latter, i.e., even though clitics still retain their independence as words they have begun to lose the properties that characterise distinct lexical items. One aspect of the characterisation of this continuum is captured in DS via the device of the *bottom restriction:* strong pronominals, as the English *she* or *he,* but also anaphors like *himself* etc., usually retain this property and hence cannot share the argument position they occupy; on the other hand, expletives like *it,* doubling clitics and agreement morphemes may have lost this property, while retaining their basic pronominal nature (i.e. the provision of a metavariable in the representation) and hence will allow doubling. In the following table we see a typology of properties, from a DS point of view, that anaphoric elements can be classified under:

(74)

	(strong) pronouns	It_{expl}	clitics (Greek)	agreement (Greek)
independent lexical entry	+	+	+	–
bottom restriction	+	–	–	–
pointer shift	–	+	–	–

As this classification shows, the pointer-shifting property is another distinguishing feature of some expletive pronouns like *it* (or *there)* which characterises their behaviour as devices which delay the provision of a value for the node they annotate. We will discuss this property further in the following sections.

2.7.2 *The Compositionality Constraint*

These extraposition structures, as we saw earlier in (17)–(18) (repeated below), obey the Right Roof Constraint-RRC:

(17) **It** is possible **that I am wrong**
(18) *That **it** is possible is unfortunate **that I am wrong.**

As we said, the RRC means that unbounded dependencies are possible at the left periphery but not at the right. We can see now why this is so, emerging as a consequence of the general architecture of DS.

As we have indicated a few times, DS trees do not encode word order as these are semantic structures employing a logical vocabulary independent of natural language. However, such trees are built incrementally following the DS parsing protocols and assuming a word-by-word input in a time-linear fashion. Application of the protocols relies on the presence of the pointer, ♦, at an appropriate place on the tree and appropriate annotations having already been provided or being expected (e.g. examine the IF-THEN-ELSE articulation of the macros in (48) and (50), which illustrate the general format of rules and lexical entries in DS). Hence the position of the pointer in appropriate places and in appropriate parsing contexts takes care of the word order restrictions in each natural language. However the general architecture of the parser as implemented in the DS model also has consequences for the possible parsing strategies universally available.[23]

23. It is assumed that it is these general properties of the parser that are either indicated by (in parsing) or dictate (in production) the intonational and prosodic structure of the sentence, not the other way round (cf. Hartmann this volume; Goebbel this volume), i.e., it is not arbitrary, language-particular prosodic principles that account for e.g. word order but rather these principles follow from the architectural properties of the parsing mechanism and the need for phonology to indicate those.

Left-right asymmetries in the sentence structure of all languages are then assumed to follow from (a) what it means for an element of the tree-structure (tree nodes or annotations) to be *temporarily* underspecified as to its contribution within a monotonic and incremental parsing regime, and (b) admissible pointer movements within local domains.

For elements at the left periphery of the sentence, the device of unfixed nodes allows them to be introduced and await resolution *(Unification)* before the structure has been completed as long as the language allows that the pointer appears at an appropriate node at some point in the parse. As we have seen, the parsing algorithm operates in a partially top-down fashion by initially predicting structure to be inhabited by the content provided by the processing of words or indeed elements awaiting resolution such as unfixed nodes or metavariables. When this has been achieved, the parser compiles the information on non-terminal nodes in an incremental and monotonic manner. As a consequence, at the later stages of processing, when the whole structure has been introduced, the possibilities for residual underspecification are minimized. This is because partial trees reflecting local predicate-argument domains cannot be completed unless all their requirements (indicated by ?) are satisfied and eliminated. And given the strict monotonicity of the parsing regime once some mother node is fully annotated, there can be no return to any of its daughter nodes: modifications on the daughters would make them inconsistent with the content of the mother node, in violation of the soundness of the semantic compilation. Underspecified elements therefore, like the metavariable **U** on the subject node in (69)–(72), must be provided with a value before the root node *?Ty(t)* is annotated and the pointer is able to escape this local domain. And if a value is not provided at the latest at the parsing stage illustrated in (70), the remaining requirement $?\exists x.Fo(x)$ on the node will prevent a legitimate parse of the string because the pointer can neither move away from a local domain nor return to it once completion has been achieved. So application of Late* Adjunction is indirectly enforced at this point and no later, as there will be no chance for the pointer to return to this node.[24]

This then, according to DS, is what causes the ungrammaticality in (18) as the intended value *(Wrong'(Speaker'))* for the metavariable contributed by *it* is provided too late in the parse. The only alternative for such a structure is to be initially

24. In this respect, we are in agreement with Geraci & Cecchetto (this volume) in that there is nothing in the architecture of the grammar that prevents "rightward movement" as long as locality, as defined by the compositionality constraint, is respected. The only apparent violation of this constraint that appears in Geraci & Cecchetto (ibid) relies on the finite/non-finite distinction of the complement and the function of non-manual signs so that the data as presented are not currently adequate for us to evaluate as providing counterexamples to this locality requirement or not.

parsed with some anaphoric reading for *it (That it is possible is unfortunate)* which is then contradicted by the provision of the *that I am wrong* clause which cannot be accommodated anymore. This consequence of the time-linear architecture of DS is referred to as the *Compositionality Constraint* (see Cann et al. 2005). Notice that this is *not* an independent stipulation imposed on top of the general DS architecture but rather follows from it as a consequence (hence we do not define it as a separate principle/rule). In this model, this is what explains both the locality of right periphery "extractions" (the *RRC)* and the locality of scope constraints for non-indefinite quantifiers as we will see below.[25,26]

Now we can put these DS assumptions together, namely, the notion that some items lack the contribution of a *bottom restriction* (Section 2.7.1.) and the explanation of the RRC (Section 2.7.2.) to model the structural differences between CLLD and ClD in Greek.

2.8 Clitic Left Dislocation

We saw earlier in Section 2.6. how clitics are processed in DS. We will now make the additional assumption that these clitics, like expletive *it* in English, do not introduce a *bottom restriction* on the node which they annotate. What this means is that this particular node will allow unification with some other unfixed node, as it seems to be the case in DOUBLING constructions. So consider the processing of the following Clitic Left Dislocation (CLLD) construction under these assumptions:

(75) **To Jani** xero oti **ton** agapas.
the John-ACC I-know that him-ACC you-love
'John I know you love (him).'

Given the evidence provided by the island and the other locality restrictions obeyed in CLLD constructions, in parallel with *wh*-/focus-constructions, in Greek (see Sections 1.1.1.–1.1.2.), we will assume that the left dislocated DP is introduced

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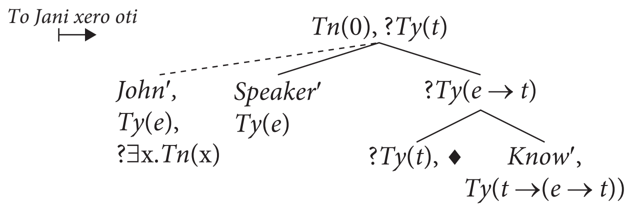
25. For processing explanations of the *RRC*, but under distinct assumptions, see Neeleman & Ackema (2002); Hawkins (2004). These explanations are compatible, in certain respects, with the present account, but notice that here the explanation is integrated in the architecture of the grammar formalism and assumes no separate level of syntactic representation.

26. Apparent cases of "rightward movement" as in languages like Uyghur, see Öztürk (this volume), need to be examined as, at first glance, they might appear as counterexamples to the *Compositionality Constraint*. However, as such languages are characterised as radically pro-drop, there are alternative explanations within DS: if the RRC is respected these can be analysed as cases of resumption in the same way as ClD is analysed here; if the RRC is violated, then an analysis similar to the *Right Dislocation* phenomenon in English (*Recapitulation*, see Cann et al. 2005: 187–192) would be more suitable.

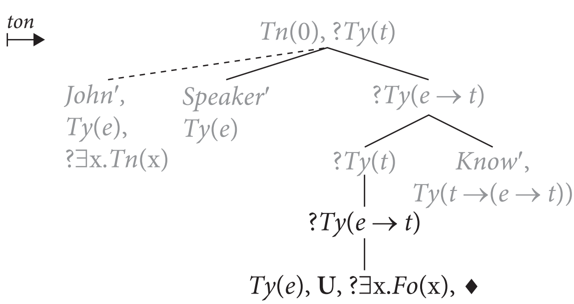
in the semantic structure initially as an unfixed node. So processing *To Jani-ACC xero oti* (=the John-ACC I-know that) according to the mechanisms we have seen already will produce the following partial tree where the pointer resides on the subordinated *Ty(t)* node ready for the clitic *ton* (=him-ACC) to be processed:

(76)



As we saw in Section 2.6. the clitic will now introduce an initially locally unfixed node, which will be immediately fixed because of its case morpheme. A metavariable **U** will also be inserted as well as a requirement (?∃x.*Fo*(x)) for its substitution by the representation of a referent:

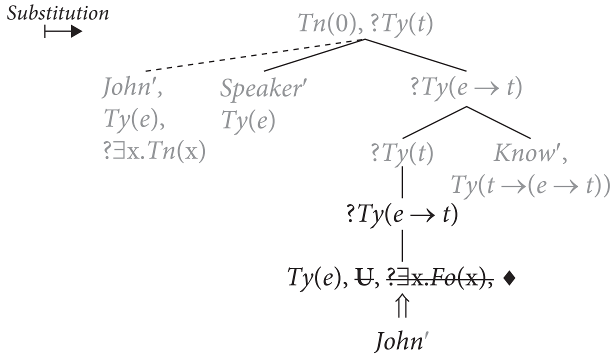
(77)



As we said, the clitic itself does not introduce a *bottom restriction,* like the expletive *it* in English (see Section 2.7.1.). Nevertheless, such clitics are not expletives in the same sense as they do not induce pointer movement away from the node they annotate (as *it* does). Therefore, they are not delaying devices (see (74)). Hence, a referent representation will be provided for this node from the context store at this point. This means that the referent of the doubled DP, here *to Jani* (= the John-ACC) must be already available in the context.[27] The context, however, also stores whatever has been contributed by the doubled DP by means of left-dislocation. This explains the sense in which such dislocated elements are "topics", whether newly introduced or contrastive (see Brunetti 2006, 2009). So the clitic, as any regular pronoun, will acquire its reference from appealing to the context store, i.e., in DS terms, by means of *Substitution:*

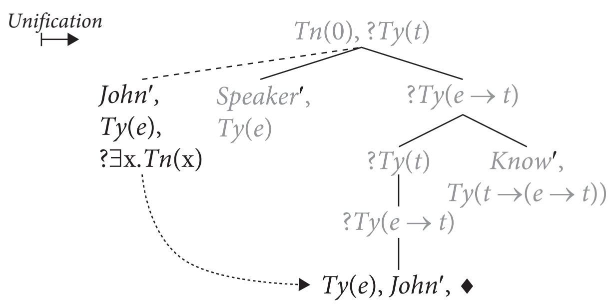
27. Or inferrable from the context given regular processes of *bridging inferences*.

(78) *Substitution*



However, because of the lack of *bottom restriction,* the nodes annotated by such clitics also allow *Unification* with the unfixed node that has been introduced by the left-dislocated DP. Hence, in this sense they function as "resumptive" pronominals as well. Such unification will only be possible in case the semantic values of the two nodes are compatible, i.e. identical. So below we see Unification attempted between the two nodes:

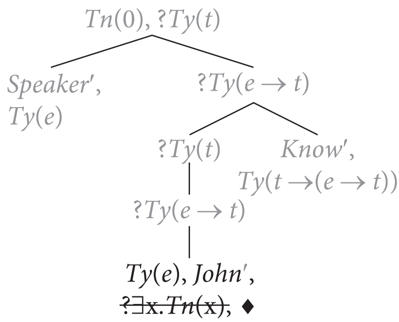
(79) *Unification*



Unification succeeds here because the fixed node carries no *bottom restriction*[28] and the semantic values on the two nodes are identical:

28. In the case of other coreferential terms, e.g. *strong pronouns* or *epithets* such unification will not succeed as these maintain the contribution of a *bottom restriction* on the terminal nodes they induce. This is not evident in the graphics in that the actual structure assumed by DS for the *Ty*(*e*) nodes has been omitted for readibility and space purposes: names as well as quantifiers contribute subtrees representing structured terms of the *epsilon calculus*, see below in Section 2.10.

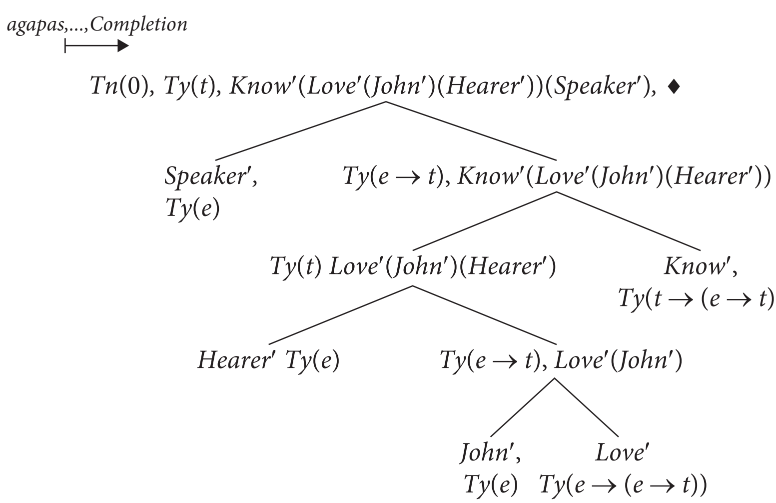
(80)



So, even though exactly the same unfixed node-unification mechanisms apply in such CLLD and (clitic-less) *wh-*, *focus-* and *Topicalisation-constructions*, the difference lies in the fact that the unfixed node in CLLD is unified with a node which already carries a semantic value. So this unification is solely for the purpose of satisfying the requirement of the unfixed node itself and no requirements of the fixed one as in the other cases. The extra processing effort that CLLD structures induce (as they involve both Substitution and Unification) must therefore be justified by extra effects. Contrastive interpretations or topic-shifts (see Brunetti 2006, 2009) can be attributed to this.

Now, going back to processing the string in (75), the upcoming verb *agapas* (= you-love) can now be parsed and the regular computational actions will complete the tree:

(81)



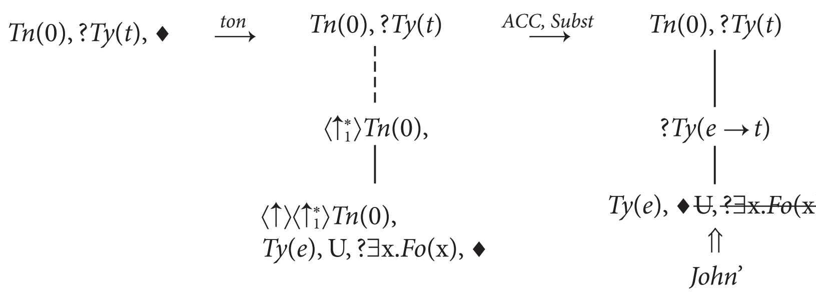
2.9 Clitic doubling

In Clitic doubling constructions (ClD) there is no unfixed node awaiting resolution when the clitic is parsed. So consider the processing of the following ClD string:

(82) **Ton** agapas **to** **Jani.**
him-ACC you-love the John-ACC
'You love John.'

As we saw above, we start with the Axiom. Processing of the clitic induces the following structural updates:

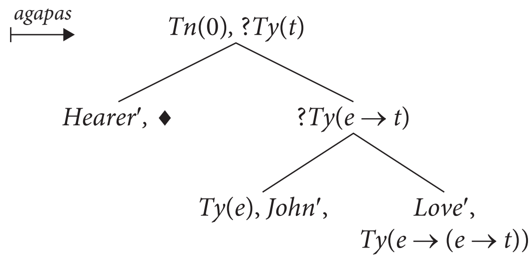
(83)



A referent representation, *John'*, is provided from the context for the metavariable **U** contributed by the clitic which satisfies the requirement introduced, $?\exists x.Fo(x)$. So, unlike what happens in CLLD, where the referent is introduced by the doubled DP, the referent associated with the pronominal in ClD must be prominent or salient enough in the context so that its successful recovery at this point would be secured. This is what explains the distinct discourse properties of the two constructions illustrated in (43)–(45). In ClD, under this analysis, the doubled DP can only come later as a confirmation of a referent already selected. Unlike what happens in CLLD, the doubled DP in ClD cannot be solely responsible for introducing the referent in the context, as such a referent has already been utilised for the earlier resolution of the clitic. Moreover, the pointer will now move away from the object node and it will require additional processing effort for it to return there later. But the fact that the clitic does not contribute any *bottom restriction* like it usually would will allow further expansion of this node.

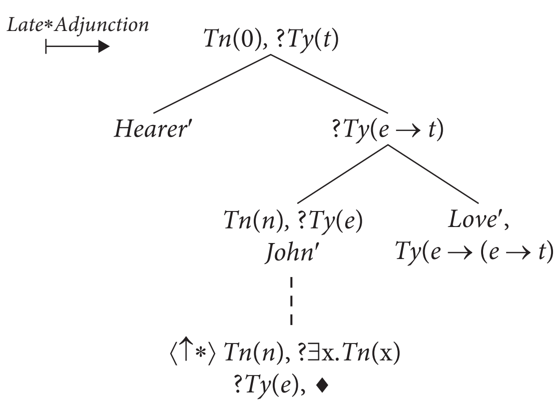
Back to the parse, with the pointer now at the *?Ty(t)* node, we can process the verb *agapas* (=you-love). This will result in the following partial tree which would be ready for completion if there wasn't further linguistic input, namely the doubled DP, to be processed:

(84)



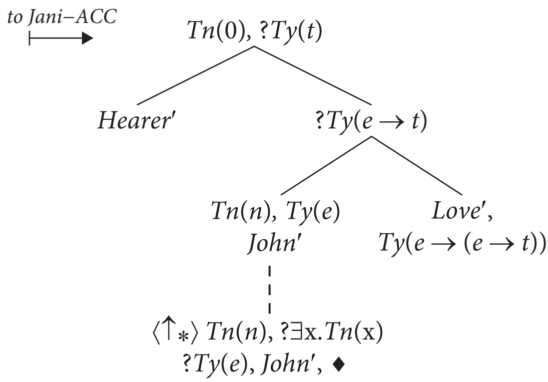
This representation is well-formed as it stands and ready for final completion. However, as there is further linguistic input to be accommodated, this is not a viable parsing route. Given that Greek, as a free word order language, by definition allows flexible pointer movement within the local predicate-argument structure, the only available parsing strategy is for the pointer to return to the object node already annotated by the clitic.[29] Now in order to process the doubled DP, the mechanisms that can be utilised are exactly those described in Gargett et al. (2008) and Gregoromichelaki et al. (2009) for the processing of APPOSITIONS and EXTENSIONS/CONTINUATIONS in dialogue, hence the similar interpretive effects that such constructions share. Here, for reasons of space, we will only illustrate with a simplified version employing *Late-*Adjunction,* the same rule already used in the processing of *extraposition* in Section 2.7. above. As we saw there, *Late- *Adjunction* introduces an unfixed node below one with which they share type specifications and moves the pointer there. Like all unfixed nodes, this also carries the requirement for a fixed position, ?∃x.*Tn*(x):

(85)

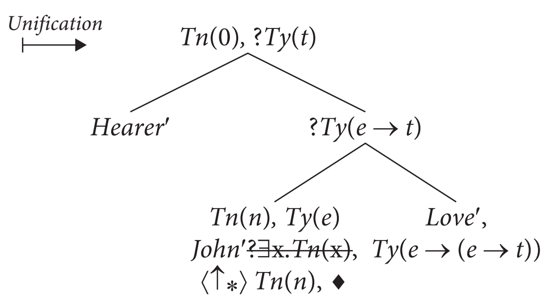


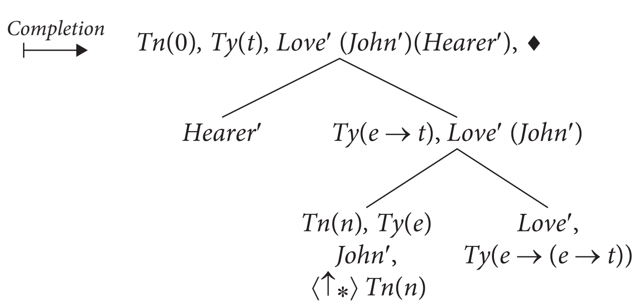
29. DS is a constraint-based framework; multiple parsing strategies might be pursued simultaneously as long as they satisfy the constraints specified; as more and more constraints are added, the parsing paths diminish.

Now the processing of *to Jani* (= the John-ACC) will annotate the unfixed node with a semantic value that can only be identical to the one already occupying the node above so that *Unification* will be possible. Hence the obligatory coreference/dependence between the two elements, the clitic and the DP:

(86) 

Successful *Unification* can now take place to satisfy the requirement on the unfixed node for a fixed position. The tree can then be completed as usual:

(87) 

(88) 

This analysis solves in a natural way the general puzzle mentioned by Cecchetto (1999: 42) for standard accounts of clitic-doubling constructions, which is usually ignored in the literature. Why does ClD not induce a *Principle C* (or *B)* violation even though the pronominal precedes a coreferential DP?

(89) **Ton** ida **to Jani.**
him-ACC saw-I the-John-ACC
'I saw John.'

The puzzle is solved here as a result of the timing of the application of the Binding Theory restrictions and the resolution of the pronominal's reference.[30] First remember that DS tree nodes are not annotated with words but rather semantic values. Binding Theory restrictions in DS are then formulated in terms of either obligatory copying of some term in the local predicate-argument structure to substitute a metavariable contributed by an *anaphor* or prohibition of the copying of terms already appearing in local domains (co-arguments). These constraints are imposed in a dynamic manner, i.e. at the stage when the particular linguistic items (anaphors, pronouns etc.) are processed, not holistically on the final semantic representations which do *not* include words but only terms in the semantic representation logical language.

Now, returning to the puzzle in (89) above, remember that, as we saw above in (83), the antecedent that provides the substitution for the metavariable contributed by the clitic in ClD is provided before the doubled DP has been processed, as this referent is retrieved from the context store. Hence no violation occurs at that point. When the doubled DP is processed *(to Jani* in (89)), it is processed on an unfixed node, just below the node it will eventually unify with, never a coreferential co-argument node. At this location it will never be licensed to unify with any of the other co-arguments of the predicate. Instead, it will only be allowed to eventually unify with the fixed node carrying the coreferential term.[31] So a co-argument violation is never incurred.

Moreover, we also have a procedural explanation of the puzzle raised by Cecchetto (ibid) regarding the Binding Theory violations with CLLD. Consider the following:

(90) (adapted from Cecchetto (1999))
#To proto vivlio **enos singrafea**$_i$ to grafi$_i$ panda me efxaristisi.
the first book of an author$_i$ it-ACC writes-he$_i$ always with pleasure
'His first work, a writer always writes with pleasure.'

From the DS dynamic point of view, when the referent for the metavariable at the subject node is being sought, contributed by the *pro-drop* character of the verb as

30. For the reformulation of Binding Theory in DS, see Cann et al. 2005, Gregoromichelaki 2006.

31. This is ensured by the tree architecture and LOFT annotations.

we saw above in (50), the clitic *to* and the doubled DP *to proto vivlio enos singrafea* have already been processed and have annotated a co-argument, namely the object node. For the purposes of this dynamic version of *Binding Theory,* the referent at the node annotated by the clitic is now in the same domain as that of the subject node, hence the anomaly of (90) above. This is in contrast to the ClD structure above in (89), where there is no such locality violation when the doubled DP or the clitic are processed, as there are never any co-argument relations between the two nodes.

We can now also see why the *RRC* holds in the ClD structures discussed in Section 1.1.3. A relevant example is repeated below:

(24) #***tis***$_j$ ipa [oti **ton**$_i$ apelisa] **tis Marias**$_j$ **to Jani**$_i$.
her-ACC I-said [that him-ACC dismissed] the Mary-GEN the John-ACC
Intended but impossible: 'I told Mary that I dismissed John.'

After the processing of a single propositional tree has been completed, the pointer will never be able to return back to any of the nodes inside this particular tree. So the only chance for further developing any such nodes is just before the final completive computational rules apply, i.e. just before the accumulation of content on the nonterminal nodes has been achieved (this is the *Compositionality Constraint* mentioned earlier in 2.7.). Once this chance passes and the pointer moves higher to the containing structure, there is never again any license to further develop this particular embedded proposition, even in a free word-order language like Greek. So in the above, when the processing of the embedded clause *oti ton apelisa* (= that him-ACC I-dismissed) has been finalised as it is perfectly possible to do since all the required arguments for the predicate have been provided, either by the clitic or by the subject-pro-drop nature of the Greek verb, the pointer will have to finalise the predicate-argument structure so that it can move on to process the DP *tis Marias* (= to Mary) which belongs to the higher proposition. But at that point, the content of the DP *to Jani* (=the John) cannot be accommodated in the tree structure any more, hence the anomaly ensues.[32]

In order to see how clitics interact with quantification we turn now to the presentation of the analysis of quantification in DS.

32. For the processing of right dislocations, which involve purely anaphoric relations between pronouns and their antecedents, not a unification of nodes, see Cann et al. 2005: 187–193. Notice that right dislocations in English do not seem to be even island-restricted as the following from Ward & Birner (1996) shows:

(i) One thing he'll never be is motivated, that guy.

2.10 Quantification in DS and clitic doubling

In DS, all DPs (both "referential" and "quantificational") contribute structured terms of type *e (: Ty(e))*. More specifically, quantified noun phrases are taken to contribute *arbitrary names* to the semantic representation similar to those used in *natural-deduction* proofs. These names are taken to denote the *arbitrary witness* of the truth of their containing proposition. The logic within which these names are defined is the EPSILON CALCULUS (see Meyer-Viol 1995).[33] Here, the defined names (so-called *epsilon terms)* are used to replace quantifiers in proofs so that reasoning can be performed in a more intuitive way. As we shall see, as a side-effect, the formulae constructed out of these replacements follow the structure of natural language sentences more faithfully than standard predicate logic. Another advantage of these terms is that they carry an explicit record of the propositional formula within which they occur. Consider the following equivalence between a plain predicate logic formula and its equivalent in the epsilon calculus:

(91) $\exists x.F(x) \equiv F(\underbrace{\varepsilon, x, F(x)})$

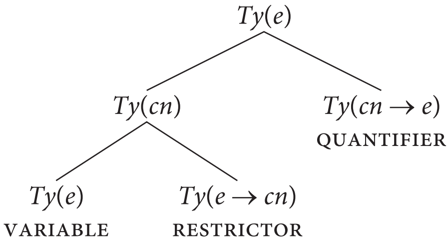
The schematic formula on the right-hand side of the equivalence sign, an epsilon calculus formula, is an ordinary predicate-argument expression, like e.g. *F(a)*. However, within the argument of this expression,[34] there is a required second token of the predicate *F* as the *restrictor* for that argument term (ε is the variable-binding term operator that is the analogue of the existential quantifier, here binding the variable *x)*. The effect is that the term (ε, *x*, *F(x)*), replicates inside it the content of the overall formula that is predicated of it (notice the replication of *F* both as a predicate, and as a restrictor in (91)). As it turns out, this internal complexity to the epsilon terms corresponds directly to what is required as the antecedents of E-TYPE PRONOUNS (see e.g. Evans 1980), for the puzzle of the interpretation of such pronouns is precisely that they appear to require some computation of the whole content of the sentence containing their antecedent; this is the property by definition of epsilon terms: they contain as their restrictor the whole formula in which they appear as arguments.

Through employing the epsilon calculus, in DS, the terms derived from the processing of quantificational expressions contribute *Ty(e)* subtrees in the overall representation. These subtrees are structured so that the contribution of each component of the DP can be captured. The following structure is required:

33. This calculus is a conservative extension of predicate logic, which means that exactly the same theorems are provable, though, in making explicit the properties of these names that are only implicit in predicate logic, the epsilon calculus is more expressive.

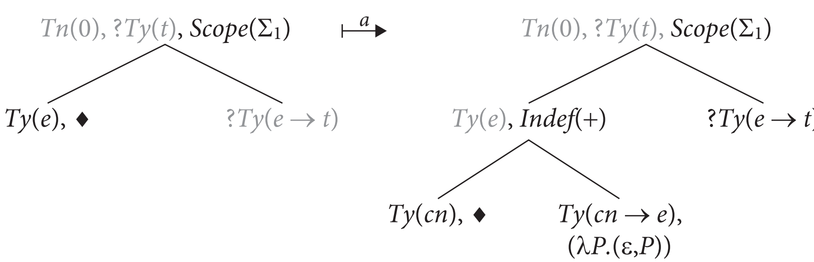
34. The argument is underbraced solely for display purposes to avoid multiple brackets.

(92)



The whole subtree is of type *e*. But there is also a second type *e* node which is a variable contributed by the noun (this is because further specifications can be added for this variable as in the case of restrictive relative clauses). Let's see now the processing of a string with an indefinite, like *A man cried,* to illustrate the function of those terms. We start by processing the determiner *a* after the initial processes for the parsing of an English sentence have been completed:

(93)



In terms of representation, INDEFINITES like *a man* contribute terms in the propositional structure of the form: (ε, *x, Man'x),* i.e. EPSILON TERMS. UNIVERSAL QUANTIFIERS, e.g. *every man,* contribute terms of the form (τ, *x, Man'x),* TAU TERMS. Hence, in the second tree in (93) above, the processing of the determiner *a* has contributed a functor (λP.(ε, *P))* introducing the ε binder, the equivalent of an existential quantifier in predicate logic. This functor will take the contribution of the common noun, here *man,* as its argument.

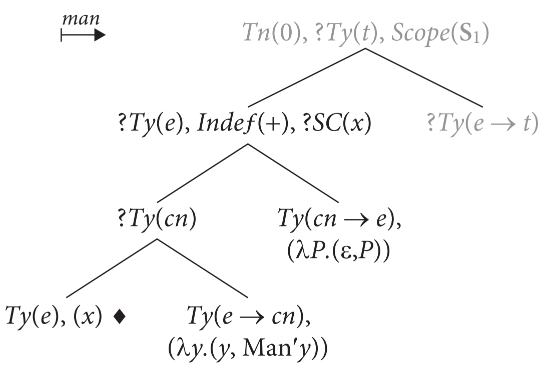
The initial tree now also contains the annotation *Scope* at its root node. SCOPE in DS is not determined according to the respective tree position but by means of gradual accumulation of constraints contributed by the processing of quantificational expressions. As a final step in every local derivation, the terms are evaluated in terms of scope. The predicate *Scope,* the *scope statement,* collects all such scope constraints as they are contributed by DPs. The annotation S_1 represents the index of evaluation (a *situation/event)*[35] with respect to which the proposition that is

35. This is a simplification of the actual representation of the contribution of tense and other indexicals in DS as we are not concerned with these complications now, see Cann (2011); Gregoromichelaki (2011) for discussion.

being constructed will be evaluated. This index is standardly introduced as part of the Axiom *(?Ty(t), Scope* (S_1)*)* starting the parsing of any sentence. The determiner *a* contributes a feature *Indef(+)* as indefinites are considered special in terms of their scope properties: non-indefinite quantifiers, e.g. *universals,* take scope according to their order of appearance in the string whereas indefinites scope freely with respect to other terms.

Continuing with the parse, the pointer now is at a position at which the common noun *man* can be processed. This contributes a variable of type *e,* here *x,* and a predicate *λy.(y,Man'y)* which is of a form appropriate to serve as the argument of the quantificational functor (λP.(ε, P)) contributed by the determiner:[36]

(94)

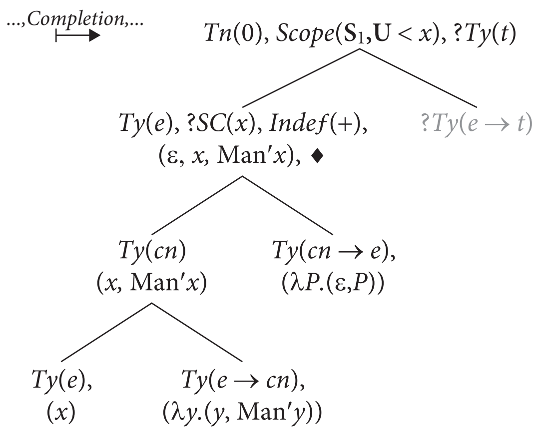


There is also the requirement *?SC(x),* which means that the variable *x* must be involved in a scope dependency with the other terms in the semantic structure, i.e. here the index of evaluation, S_1 and any other terms that might appear subsequently. Unlike universals, indefinites are assumed to introduce an element of UNDERSPECIFICATION in terms of scope. They contribute to the tree an annotation which dictates that they must depend on another term inside the overall structure; which term this will be eventually is not determined by linguistic means but by free pragmatic choice.

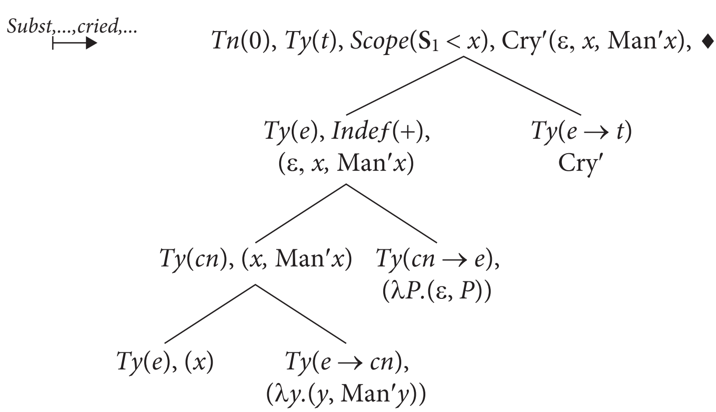
This annotation is shown below in (95) as $\mathbf{U} < x$. This indicates that the variable *x* representing the indefinite depends on some other term, but since the choice is free, a metavariable **U** temporarily appears until a choice of dependency is made. The result of this assumption is that, unlike other quantifiers, indefinites are *not* scopally restricted in their local predicate-argument domains, as they can depend on other terms earlier introduced higher on the tree or indeed the index of evaluation for the whole proposition.

36. Brackets are omitted freely to improve readibility.

Now turning back to the parse of *A man cried,* the usual computational rules can apply and compile the interpretation on the non-terminal nodes of the subject subtree, as can be seen below:

(95)


An epsilon term of type *e,* (ε, *x,* Man'*x*) has now been derived at the top node of the subject subtree by the processing of the indefinite *a man.* As the requirement *?SC(x)* remains unsatisfied and the only other available element is the index of evaluation S_1, this is chosen, by *Substitution,* as the first member of the dependency involving the variable *x,* shown below as *Scope*($S_1 < x$). What remains to be done now is the processing of the verb *cried* and the usual compilation of information on the nonterminal nodes of the tree:

(96)


The last step in the parse is the evaluation of the epsilon term, as the way it appears on the tree now is incomplete. As we said earlier, terms in the epsilon calculus function as witnesses of the sets constructed by the content of the proposition they are contained within. This is why such terms, once completed, provide antecedents for E-TYPE ANAPHORA (see e.g. Evans 1980) without further ado:

(97) **A man** cried.
He sat down. (= (The man who cried) sat down)

The Scope Evaluation Rule defined in Kempson et al. (2001), Cann et al. (2005) transforms the proposition at the root node of the tree in (96) to a new truth-conditionally equivalent proposition which incorporates the scope declarations collected under the predicate *Scope*. This is shown in (98) below:

(98) $Ty(t), S_1 < x, Cry'(\varepsilon, x, Man'x) \rightarrow$
$Ty(t), S_1: Cry'(a)$ where $a = \varepsilon, x, (Man'x \wedge (S_1: Cry'x))$

Notice how the epsilon term contains inside its restrictor, $(Man'x \wedge (S_1: Cry'x))$, the whole proposition in which it serves as an argument. In this sense, denotationally, this epsilon term serves as the witness of that proposition.

This analysis of quantification in DS solves a puzzle raised by Diesing (1999) regarding the assumptions Cardinaletti & Starke (1999) make regarding clitics: even though clitics seem to essentially require a discourse antecedent, they can also function as bound variables in structures like the following:

(99) **Kathe mathitis** pistevi oti tha **ton** perasis.
every student-NOM believes that will him-ACC pass-you
'Every student believes that you will pass him.'

According to the modelling of quantification and anaphora in DS, the anaphoric relation involved in cases like these is no different than cases of regular discourse anaphora. The incomplete, unevaluated *tau-term* contributed by the universal quantifier, $(\tau, x, Student'x)$, becomes temporarily available in the context store when the clitic *ton* comes to be processed. Hence, it can serve as a regular antecedent for the substitution of the metavariable contributed by the clitic. However, when the Scope Evaluation Rule applies, the effect is one of quantifier binding, as the rule replaces all occurrences of such incomplete terms with variables bound inside the term's restrictor (see Cann et al. 2005). The simplified representation derived from (99) above will then initially be as follows (underbraces indicate the two arguments of *Believe'*):

(100) $Ty(t), Believe'(\underbrace{(Pass'(\tau, x, Student'x)(Hearer'))}\ \underbrace{(\tau, x, Student'x)})$

But after application of the Scope Evaluation Rule, which for τ-terms introduces implication, →, as the main connective in the restrictor of the term, this is transformed to:[37]

37. Note that in this notation two-place predicates first combine with objects with the result then combining with the subject.

(101) $Ty(t), Believe'(\ \underbrace{(Pass'(a)(Hearer'))}\ \underbrace{(a)}\ )$
where $a = (\ \tau, x, Student'x \rightarrow Believe'\ (\ \underbrace{Pass'(x)(Hearer')}\ \underbrace{(x)}\ )\ )$

(102) $= \forall x[Student'x \rightarrow (Believe'\ [Pass'(x)(Hearer')]\ (x))]$

This derives exactly the same interpretational effect as Delfitto (2002), who postulates that clitics are indicators of unsaturated arguments. Here, though, this is achieved without assuming that clitics themselves are anything other than anaphoric pronouns providing arguments for the predicate introduced by the verb (and they are not distinct elements whether they occur in a doubling structure or not). The metavariable contributed by the clitic will always be provided with a value from the context: either the general discourse context, in which case we get the indexical interpretation, or the sentential context, here including (τ, *x*, *Student'x)* derived from *kathe mathitis* (= every student), which induces the bound variable interpretation. So it is the combination of the dynamic, time-linear perspective on syntax as well as the employment of the epsilon calculus representational language that derives the desired effects from general principles.

Now consider a case where an indefinite seems to acquire non-local scope outside its containing clause:

(103) Kathe gineka ipe [oti **(ton)** ide **kapjon fititi** n'agorazi
Every woman she-said that (him) she-saw some student buying
tsigara].
cigarettes
'Every woman said that she saw some student buying cigarettes.' (∃∀, ∀∃)

This, in the ∃∀ reading, seems to violate the locality presumed to constrain scope evaluation. However, in DS, this behaviour is attributed to the context-dependent nature of indefinites as opposed to other quantificational expressions. As we said previously, indefinites contribute a metavariable (e.g. **U** < *x)* in the scope statement *(Scope(...))* of their containing local predicate-argument structure (see e.g. (95)). This can be resolved by replacing this metavariable with any term that has already been processed or the index of evaluation for the whole proposition which is given as part of the *Axiom* (see (93)). This models the idiosyncratic behaviour of indefinites in terms of the potential for extra-wide scope, which is characterised in the literature as SPECIFICITY effects (see e.g. Sportiche 1996, Anagnostopoulou 1994). In the ∃∀ reading of the above sentence, the indefinite *kapjon fititi* (= some student) can outscope the τ-term derived from the universal *kathe gineka* (= every woman) by selecting as its dependency the index of evaluation of the whole proposition which has already been introduced in the representation. This accounts for the fact that even though indefinites cannot be characterised as "referential" tout court in the sense that they necessarily acquire widest scope they, nevertheless, can outscope any other term as a matter of free pragmatic choice (by selecting the index of evaluation as their sole dependency). This is crucial because, as has been pointed out by Farkas (1981), there are intermediate readings for indefinites as we showed in (39), repeated below, which falsifies any strict dichotomy between "referential"/"specific"/*D-linked* etc. vs "quantificational" readings:

(39) Kathe kathigitis penese kathe fititi pu **to** ixe diavasi
Every lecturer praised every student who it-ACC read
ena vivlio pu ixe sistisi.
a book that he-had recommended.
'Every lecturer praised every student who had read some book he had recommended.' (∀∃∀, ∀∀∃, ∃∀∀)

And the extra-wide scope potential of indefinites does not threaten the general locality constraints, e.g. the *Compositionality Constraint* we saw above in 2.7.2. This is because the indefinite itself never escapes its local predicate-argument structure: it is only its choice of scope dependency, which contains an anaphoric element in the form of a metavariable, that allows it to behave more freely than other quantifiers. However, this is not an option for other quantifiers like universals, which explains the missing readings we saw in Section 1.1.4 as regards the restricted scope domain of even doubled universal quantifiers (repeated below):

(104) Mia gineka ipe [oti **ton** ide **kathe fititi** n'agorazi tsigara].
A woman she-said that him she-saw every student buying cigarettes
'A woman said that she saw every student buying cigarettes.' (∃∀,* ∀∃)

Now this analysis seems to provide a way to understand what is going on in structures with ClDed quantifiers, like the one in (38) above: the way quantification is handled in DS, in combination with the dynamics of parsing which define the syntax, provides the means for processing such structures and deriving the intuitive interpretational effects associated with them. Such sentences will be processed in exactly the same way as any regular ClD structure as we saw in Section 2.9. above. The only complication that arises is how a referent is provided for the metavariable contributed by the clitic, since, in such structures, the quantifier has not yet been processed when the clitic is encountered. But remember that, as we explained earlier, terms in the epsilon calculus stand for the witnesses of the sets denoted by their restrictors.[38] So, as long as we can assume that a set is salient enough in the context of utterance, a witness term for this set will be available at

38. Epsilon and tau terms are *duals*, see Meyer-Viol (1995) and Egli & Von Heusinger (1995) for the exact specification of their semantics in terms of choice functions.

the point when the referent for the clitic is being sought. Later unification with the linguistically provided term will confirm this choice of referent. This is exactly the intuitive intepretational effect that such structures are associated with: the quantification has a context-dependent, presuppositional flavour (termed variously as *partitivity, specificity, D-linking* etc.) as far as the denotation of the common noun goes. Nevertheless, as we saw, this does not change the scope behaviour of such quantifiers, they are still locally restricted in the predicate-argument structure in which they serve as arguments (except the principled exceptional behaviour of indefinites we saw earlier). So, the way to interpret this partitivity/specificity intuition is that the set denoted by the common noun in the doubled DP is salient enough in the discourse context, therefore a witness for this set is available when the clitic is parsed. This then provides the equivalent of an incomplete epsilon term in the representation, exactly as we saw above in the processing of (99). At the point of scope evaluation this incomplete term will derive the effect of a bound variable interpretation as we saw above in (101). Hence this perspective seems to capture the intuitive intepretational effects associated with such structures without any need to encode syntactico-semantic features or special structural stipulations which will derive rigidly some particular interpretation but lack the flexibility and variability of the effects.

3. Conclusion: clitics and left/right asymmetries in Dynamic Syntax

The analysis of clitics presented here assumes that they are neither operators nor variables, determiners, agreement morphemes etc., just ordinary pronominals. Like ordinary pronouns, they always provide underspecified, context-dependent content and require a referent which can be provided either by linguistic input or by information in the context. However, in particular languages, pronouns might develop diachronically so that they can become *expletives* or function in similar ways as *gaps/traces,* resumptives etc. The analysis assigned to these pronouns must be weak enough to allow for all these uses without postulating ambiguities for no good reason.

When such development occurs, constructions like CLLD and ClD in Greek, as modelled in DS, emerge naturally as providing alternative strategies to speakers for achieving various pragmatic effects. However, such effects are not encoded in the grammar, and the behaviour of the clitic pronouns in such structures is not distinct from clitics functioning as arguments in isolation. Nevertheless, there are both structural and intepretational asymmetries that arise in these constructions. The aim here was to show that these are epiphenomenal and can be attributed to the timing of the introduction of the pronoun and the doubling DP. Thus there is no need either for arbitrary syntactic-representational restrictions, like the *Right Roof Constraint* or for encoding notions like *specificity, definiteness, referentiality* etc. in the syntax, on the featural characterisation of DPs or the clitics. The dynamics of how context-dependent interpretations are built up in a sequential manner provide a means of solving the puzzles associated with CLLD and ClD without recourse to a separate, independent level of syntactic representation.

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