

On Anaphoric Associations*

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Abstract

The paper presents a model for the interpretation of pronominal anaphors based on the notion of 'anaphoric association', that is the association between a hierarchical structure regarding the discourse already processed and a hierarchical structure regarding the pronouns in input units. In the model a central role is played by various notions derived from Sidner's Focus Theory, as well as concepts borrowed from non-linear phonology and non-concatenative morphology. The model, incremental in nature, is capable of tackling facts generally overlooked by the literature on anaphora interpretation, such as the anaphoric possibilities offered by complex NPs and nominalizations, or the co-presence of distinct but interrelated discourse regions, as in discourses containing quoted speech.

1 Introduction

It is quite well known and acknowledged that in discourse there is a strong correlation between the use of anaphoric expressions and the 'activation' or 'prominence' of a previously introduced discourse entity. This correlation appears most obvious in situations where two pronominal anaphors, with identical agreement features, co-occur in utterances such as the second or the third in example (1) (from Beaver 2004), where *she* is most naturally mapped onto *Jane*, and *her* onto *Mary*.

- (1) a. Jane likes Mary.
- b. She often brings her flowers.
- c. She chats with her for ages.

The awareness of the existence of such a correlation has given rise to many different attempts devoted to handling anaphoric preferences analogous to that exhibited by the above small discourse. Among these attempts, one of the most viable is linked to concepts like 'center' or 'focus' of attention, which shares some

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of the same notions of topicality (see Hajičová 1987 and Kruijff-Korbayová & Hajičová 1997 for a basic comparison), but handles them in a very concrete and operational way.

The theories developed within this attention-centered approach to anaphora grew out of Natural Language Processing, and were initially developed in order to pair an anaphoric expression to an entity already present in the so-called ‘discourse model’ —i.e., “the set of entities ‘naturally evoked’ [...] by a discourse, linked together by the relation they participate in” (Webber 1983:335)— on the basis of operations that could be implemented in a computer program.

Among these theories, the most widely-accepted and influential ones are the so-called ‘Focus Theory’ (Sidner 1979, 1981, 1983) and the ‘Centering Theory’ (Grosz et al. 1995; Walker et al. 1998; Joshi et al. 2006). Albeit very different in their ultimate goals, these two theories share some basic assumptions and mechanisms. For instance, both theories model the attentional state as dynamic. In other words, they enable the updating of the attentional state after each processing unit, thus providing a partial but verifiable hypothesis of the possible mechanisms involved in anaphora interpretation in the course of an ongoing discourse.

However, these two theories also share a non-negligible set of limitations, lacunae and inadequacies. Here follows a partial list.

i. *Yes/no criteria.* Both Sidner’s theory and Centering Theory identify salient discourse entities on the basis of yes/no absolute criteria, thus stating that a discourse entity is either a focus, or a center of attention, or not. On the basis of this yes/no approach these theories claim that in a ‘processing unit’ (U) exactly a limited number of foci or centers of attention exist. This approach is therefore open to criticism from a theoretical standpoint (see, among others, Asher & Wada 1988), but also has repercussions on the concrete process of anaphora interpretation. Sidner’s theory, for example, in hypothesizing the co-presence of two distinct foci, is able to supply rules for the interpretation of two pronouns for each U. However, the theory does not manage to explain how to interpret the three pronouns contained in (2), i.e., *lui* ‘he’, and the clitics *gli-* and *-la* within the clitic cluster *gliela*.¹

¹ In interlinear glosses, I employ the following abbreviations: CL = clitic, ACC = accusative, DAT = dative, F = feminine, M = masculine, 3 = 3rd person singular, SPST = simple past, CPST = compound past, IMPF = imperfect. The examples contained in the article are mostly in Italian. Note that Italian has both null and overt pronouns, and that their use is not always equivalent (see (i) and (ii), from Di Eugenio 1990).

- (i) Quando Carlo_i ha incontrato Mario_j, Ø_{i/*j} non gli_{i/*j} ha nemmeno detto “ciao”.
When Carlo_i has met Mario_j, he_{i/*j} not to-him_{i/*j} has even said “hi”.
- (ii) Quando Carlo_i ha incontrato Mario_j, lui_{i/*j} non gli_{i/*j} ha nemmeno detto “ciao”.
When Carlo_i has met Mario_j, he_{i/*j} not to-him_{i/*j} has even said “hi”.

For the characteristics of the Italian pronominal system and for the problems it involves regarding the processing of anaphors see, among others, Calabrese 1986; Di Eugenio 1990, 1998; Not & Zancanaro 1995; Samek-Lodovici 1996; Grimshaw & Samek-Lodovici 1998; Carminati 2002; Buchwald et al. 2002 and Trecci 2003.

- (2) Carlo_i chiese a Gianni_j la moto_k. Lui_j
Carlo_i asked to Gianni_j the motorbike-F_k. He_j
gli_iela_k diede.
CL-DAT_i CL-ACC-F_k give-SPST-3.
‘Carlo_i asked Gianni_j for the motorbike_k. He_j gave it_k to him_i.’

ii. *Us and boundaries.* The boundaries of the Us are not made clearly explicit either in the work of Sidner (where the U is identified theoretically in the sentence, but where in some examples it is broken up into clauses) or by Centering (where the U assumed by the theory, the ‘utterance’, is left substantially devoid of definition; cf. Poesio et al. 2004). Various authors who have taken their cue from these two theories have hypothesized that the U is syntactically definable (by equating it, for example, to a tensed clause), while others identify the U as the result of a ‘[verbal] saturated relation’ (Cormack 1992) or define it in terms of ‘événements élémentaires’ evoked by the presence of a verb (Azam 1995). However it should be noted that none of these formulations can lead to the possibility of processing the pronoun *la* in (3), where the pronoun is linked to a discourse entity included in a NP.

- (3) L’invasione della Russia da parte della Francia
The invasion of-the Russia-F on part of-the France-F
la mise in ginocchio.
CL-ACC-F put-SPST-3 in knee.
‘The invasion of Russia by France had her on her knees.’

Again, both theories, at least in their original formulations, do not provide for the incremental processing of (however defined) incoming Us. Leaving aside the results of various psycholinguistic studies stating the addressee’s quite immediate tendency to interpret a pronominal anaphora, it should be stressed that this non-incremental approach may lead to incorrect predictions (Cormack 1992; Kehler 1997).

iii. *Incapacity to process salience in a multi-dimensional way.* Sidner’s theory assumes the presence of marked syntactic constructions and thematic roles as one of the basis for the identification of the focus of attention. Centering approaches, on the other hand, essentially assume a grammatical obliqueness scale as one of the basis for the identification of the center of attention. But there are other factors capable of producing salience (e.g., empathy, stress, intonation). In some variants of Centering (see Turan 1996 and Miltakaki 2002, among others) all the phenomena considered pertinent are channelled into the ‘center forward list’, that is the list that in Centering Theory assembles the potential centers of attention evoked in the U under examination. However, neither of the two theories offers a possibility of processing attentional salience in a multi-dimensional way, a fact that is quite usual in so-called ‘cumulative’ approaches to anaphora resolution.

iv. *Incapacity to process discourse entities belonging to distinct but interrelated discourse regions.* Both Focus Theory and Centering Theory are characterized as ‘local’ attentional focus theories. Sidner (1979:174) acknowledges that the application of her algorithms may depend on the articulation of the ‘global’ focus of attention (Grosz 1977), that is —roughly speaking— the attentional focus triggered by the global discourse articulation

and its high level ‘conceptual discontinuities’ (Van Hoek 1995, 1997). In its turn, Centering Theory assumes the existence of ‘discourse segments’ (Grosz & Sidner 1986) as the maximum domain within which to operate. In their original formulations, at any rate, the two theories do not deal with how to interpret pronouns within discourses with multiple interwoven threads, or again in discourses containing, for instance, quoted speech, that is in situations where there is a co-presence of distinct but inter-related discourse regions.

In this paper I propose a model for the interpretation of pronominal anaphora aimed at removing, at least partially, the lacunae and inadequacies mentioned above. The model, incremental in nature, is based on the notion of ‘anaphoric association’, that is the association between a hierarchical structure regarding the discourse already processed and a hierarchical structure regarding the pronouns in input units. In the model a central role is played by various notions derived from Sidner’s Focus Theory, as well as concepts borrowed from non-linear phonology and non-concatenative morphology. The model is capable of tackling facts generally overlooked by the literature on anaphora interpretation such as the anaphoric possibilities offered by complex NPs and nominalizations, or the co-presence of distinct but interrelated discourse regions, as in discourses containing quoted speech.

The structure of the paper is as follows. Section 2 contains details of the two anaphoric theories I make use of. Section 3 has a partial reformulation of Sidner’s theory. Section 4 contains a proposal for three domains relevant to the identification of pronominal anaphoric relations. Section 5 offers two extensions of the mechanism of association that underpins the model. Section 6 contains some remarks about discourse structure and its impact on pronominal anaphora interpretation. Finally, Section 7 presents a summary of the characteristics of the proposed model.

2 Background

2.1 Anaphors and discourse pegs

In this paper I assume the theory elaborated in LuperFoy (1991, 1997) as the primary frame of reference for the representation of discourse entities. LuperFoy’s theory provides three levels of representation of information, each one with its own mechanism of data acquisition, processing and updating:

- i. *Discourse model tier.* This tier is populated with ‘discourse pegs’ —a concept introduced by Landman (1986) and only partially modified by LuperFoy— which LuperFoy describes as loci for aggregation and organization of information available to a discourse agent at run-time.
- ii. *Linguistic tier.* This tier contains the ‘linguistic objects’ (LOs) introduced in the representation by the mechanisms that handle input strings.
- iii. *Belief system tier.* This is the tier that interprets the beliefs of a discourse agent; the belief system is implemented by LuperFoy through a standard knowledge base, i.e., an ontology-based domain model.

LuperFoy uses the three tiers constituting her model basically with a view to resolving problems such as information correction and interpreter’s tolerance with respect to contradictions between his own belief system and what is stated in the discourse. However, the model is also useful for defining a categorization of at least some of the possible anaphoric relations. In particular, LuperFoy set up her categorization by means of two parameters:

- a) the typology of the ‘sponsor’ (which in LuperFoy’s terminology means roughly what is commonly said to be the ‘antecedent’) of a dependent expression (DE);
- b) the coincidence, in interpretative terms, between a DE and its sponsor.

With reference to the first parameter, the theory assumes that a DE can have a LO or a peg as sponsor: in the first case, the sponsor imposes on the DE some linguistic constraints (e.g., constraints concerning number or gender agreement), while in the second case the DE directly relates to a peg as sponsor. With reference to the second parameter, LuperFoy distinguishes ‘total anaphors’ and ‘partial anaphors’. In the former, DE interpretation fully coincides with that of the sponsor. In the latter, the interpretation does not coincide with any LO or peg already found in the model. As a consequence, the sponsorship relation requires appropriate treatment of the objects that already inhabit the model.

By crossing the two parameters, LuperFoy defines the following basic quadripartition of anaphoric relations:

- i. The DE is a total anaphor and is linguistically sponsored; e.g., ‘I stopped *the bus* because *it* began smoking’. Only one peg is introduced in the discourse tier, and the LOs derived from the input strings *the bus* and *it* are linked to the same peg.
- ii. The DE is a partial anaphor and is linguistically sponsored; e.g., ‘Nancy hates *racoons* because *they* ate her corn last year’ (from Carlson 1977). Two pegs are introduced in the discourse tier: the first, perceived as generic, corresponding to a kind ‘racoons’, and the second corresponding to the specific racoons which ate Nancy’s corn. The LO derived from the string *they* is linguistically sponsored by the LO derived from the string *racoons*. The two pegs in the discourse tier are related by a ‘conversion operation’ (see later) of the type *specimen-of-kind*.
- iii. The DE is a total anaphor and is ‘discourse sponsored’ (that is, sponsored by a peg of the discourse model tier); e.g., ‘Create *a text file* in the folder. Copy *the document* to a new folder’. Only one peg is introduced in the discourse tier, and the LOs derived from *a text file* and *the document* are linked to the same peg.
- iv. The DE is a partial anaphor and is discourse sponsored; e.g., ‘I stopped *the car* and when I opened *the hood* [...]’ (from Karttunen 1968). Two pegs are introduced for the LOs derived from *the car* and *the hood*, and the peg-to-peg relation can be interpreted as a *part-of* relation.

Leaving out the interface between pegs and the constructs of the knowledge base, the relations between DES and respective

sponsors can be graphically represented through the scheme in Figure 1.

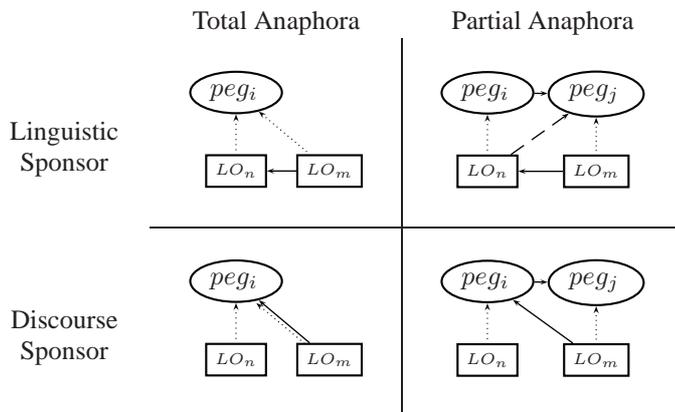


Figure 1: LOs and pegs: four basic discourse configurations after anaphora resolution (adapted from LuperFoy 1991:107)

In Figure 1, the continuous lines that link two LOs or a LO and a peg indicate the sponsorship relation. The dotted lines indicate the ‘specification’ relation which connect a LO and a peg.² The dashed line in the upper right hand quadrant indicates the flow of information from the head noun of sponsor LO_n to the newly created peg_j ; that is the flow required in cases traditionally described as ‘descriptive anaphora’, ‘identity of sense anaphora’, etc. Finally, the horizontal lines between two pegs represent four types of relationships: a) relations taken from the belief system; b) relations concerning the access of two pegs to the same construct of the knowledge base; c) i-part and i-sum relations (Link 1983); and d) relations deriving from a conversion operation. In particular, LuperFoy hypothesizes that these latter operations are limited in number and are universal. Among them, LuperFoy includes various types of operations resulting in peg-to-peg relations like *kind-of*, *specimen-of-kind*, etc.

With reference to the categorization of the anaphoric relations proposed by LuperFoy, it should also be said that she briefly describes how the discourse model tier can be employed for the representation of what (following Hellman & Dahl 1994 terminology) here I shall call ‘situational anaphora’ — a kind of phenomenon variously labeled in the literature as ‘clausal reference’ (Di Eugenio 1989), ‘discourse deixis’ (Webber 1988, 1991), ‘reference to abstract objects’ (Asher 1993), etc. However, LuperFoy’s treatment of situational anaphora does not seem completely convincing. In fact, she does not allow for the possible grouping of the situational pegs into complex, organized structures which can be viewed as the analogue of a theoretically infinite stretch of discourse evoked by a dependent expression (cf. Webber 1988, 1991; Dahl & Hellman 1995; Conte 1996). On the contrary, she

²I adopt here the terminology introduced by Sidner (1979) and successively utilized by various scholars. In Sidner’s view, a speaker ‘refers’ to something by utterances that ‘specify’ its corresponding discourse entity. In other words, “referring is what people do with words” (Sidner 1983:269), and “specifying” is what discourses do (Sidner 1979:260–264). In Sidner’s computational framework, the objects specified are database items which bear well-structured correspondence to objects in the word.

lets the situational pegs remain alone within the tier of the discourse model, with no peg-to-peg connections.

2.2 An overview of Sidner’s Focus Theory

2.2.1 Main components

In Sidner’s theory a central assumption concerns the intimate relationship between the focus of attention and definite anaphors³:

Definite anaphora are signals which the speakers uses to tell the hearer what element in the discourse is the current discourse focus: at the same time, the element in focus constrains which anaphoric expressions can be used to signal the focus. (Sidner 1979:3)

From this assumption derives the possibility, suggested by Sidner, to use a focused peg for two related purposes.⁴ The first is the use of a focused peg in order to track the so-called ‘aboutness’ of a discourse. The second is the definition —effected on the basis of the detection of the persistence and the shifts in the focus of attention— of a model able to explicit, at least in part, the mechanism which underlies the use and the comprehension of definite anaphors.

Besides a standard knowledge base and a parser, which has as output constructs analogous to LuperFoy’s LOs, the core of Sidner’s theory assumes the following main components.

i. *Registers*. During the course of a coherent discourse, the status of the local focus of attention is represented by Sidner by the content of six focus registers. The pegs inside the focus registers, as well as the focus registers themselves, are ordered on the basis of the focal salience exhibited and on the basis of the dependent expressions under examination. More specifically, Sidner distinguishes between two co-occurring series of registers: the Discourse Focus (DF) series and the Actor Focus (AF) series. These series have an analogous articulation. They comprise:

- a) two registers related to single pegs, i.e., the ‘Current Discourse Focus’ (CDF) and the ‘Current Actor Focus’ (CAF); CDF and CAF are a subset of the pegs accessible by the interpretation algorithms provided by the theory (see later);
- b) four registers containing pegs’ lists; Sidner distinguishes:
 1. The ‘Potential Discourse Focus List’ (PDFL) and the ‘Potential Actor Focus List’ (PAFL), that is, the registers which contain the pegs mentioned in a processing unit U_i , except for those already assigned to CDF and CAF; therefore, all the pegs mentioned by U_i are considered accessible for a dependent expression contained in U_{i+1} .

³Sidner uses the term ‘definite anaphors’ to group personal and possessive pronouns, “certain uses of definite noun phrases, and noun phrases containing *this* and *that*” (Sidner 1983:267).

⁴In this paper, instead of Sidner’s original term ‘NP-bundle’, I adopt the more general term ‘discourse peg’ introduced by LuperFoy. Note that the correspondence between the two terms is only partial (LuperFoy 1991:67–69). Despite this, the correspondence is enough for the aims of the current paper.

	DF series	AF series
CF (Current Focus)	CDF (Current Discourse Focus)	CAF (Current Actor Focus)
ALFL (Alternate Focus List)	PDFL (Potential Discourse Focus List)	PAFL (Potential Actor Focus List)
Stack	DFS (Discourse Focus Stack)	AFS (Actor Focus Stack)

Table 1: Sidner (1979, 1981, 1983): focus registers

2. Two stack registers⁵; those registers store, in a temporally ordered fashion, the various CDFs and CAFs as they are individuated by the interpretation algorithms during the processing of the relevant stretch of the discourse.

The set of registers posited by the theory is shown in Table 1. In the table the labels ‘Current Focus’ (CF) and ‘Alternate Focus List’ (ALFL) act as placeholders respectively for CDF or CAF, and PDFL or PAFL.

ii. *Registers’ ordering.* Sidner proposes a basic preferential scale concerning the use, by the interpretation algorithms, of the elements contained in the six focus registers.⁶ As for pronouns, the scale varies according to the thematic status of the pronoun to resolve. When the pronoun is in non agent ($\neg A$) position, the scale first gives, in an ordered fashion, the sequence of pegs in the DF registers (CDF, PDFL, DFS) and then that of the AF registers (CAF, PAFL, AFS). When the pronoun is in an agent (A) position, the scale first gives, in an ordered fashion, the sequence of pegs in the AF registers (CAF, PAFL, AFS), and then that of the DF registers (CDF, PDFL, DFS).

iii. *Ratification procedure.* What is suggested, on the basis of registers’ contents, by the various interpretation algorithms triggered by the type of the dependent expression to be interpreted (e.g., personal pronouns in $\neg A$ position, personal pronouns in A position, plural pronouns where no single sponsoring element exists, possessive pronouns, etc.) is submitted to what Cormack (1992) subsumes under the term ‘ratification procedure’. The ratification procedure does or does not license the anaphoric relation between the two elements of a dotted pair ‘(potential-sponsor.anaphora)’ on the basis of:

- a) morphological agreement, and syntactic and semantic standard constraints (see, *inter alia*, Bosch 1983, Carter 1987 and Di Sciullo 2005, 2006);

⁵The stack used by Sidner is a data structure also known as ‘first-in last-out list’. The operations available in such a kind of structure are a) PUSH: add a new element x to the top of the stack; b) POP: remove and return an element off the stack; if a specific item x on the stack is ‘popped’, then all elements above x are deleted from the stack and x is deleted and returned. In linguistics, probably the best known (implicit) use of such a dynamic data structure is that given in Jakobson 1941 (see especially Chapter 2).

⁶In various works Sidner suggests slightly different orders in regard to the preferential scale (see an analysis of the various types in Cormack 1992). I am assuming here the scale proposed in Sidner (1979) and modified by Cormack. Cormack assumes that a pronoun, irrespective of the position in which it occurs, can find its sponsor in both stacks put forward by Sidner (Cormack 1992:51-53; 70).

- b) general inferencing based on the knowledge base assumed by the theory.

When the ratification procedure does not detect contradictions related to the sponsor suggested (on the basis of the features of the anaphora under examination) by the various interpretation algorithms, then the suggested sponsor is accepted. This holds despite the fact that other possible sponsors, available from the various focus registers, can obtain no vetoes by the ratification procedure.

iv. *Interpretation algorithms.* The algorithms for anaphora interpretation given by the theory are too long and intricate to be reproduced in full here; in fact, their expression in abbreviated form covers twelve pages in Sidner (1979). As for the concern of the present paper, I limit myself to say that the pronominal anaphora interpretation algorithms assume the form of a discrimination net which relies on the focus registers and the kind of anaphora to be interpreted. When the proposed sponsor suggested by one algorithm is rejected by the ratification procedure, the theory gives two possibilities: a) the suggested sponsor can be used to generate a peg, as happens for partial anaphors of the kind ‘Nancy hates *racoons* because *they* ate her corn last year’; b) the search is repeated on the basis of the other potential sponsors stored in the registers.

v. *Expectations, interpretation and updating.* In Sidner’s theory, a basic focusing process consists of three sub-processes:

1. SUB-PROCESS A: the choice of the expected foci effected on the basis of what the speaker initially says in the first U of the discourse.

As for the DF series, this choice is delegated to the ‘expected focus algorithm’ (Sidner 1979:68-69). The first logical step of this mechanism is the construction of a ‘default expected focus list’ computed from the thematic relations of the verb, with VP at the end:

- (4) DEFAULT EXPECTED FOCUS LIST
theme \succ all the remaining thematic roles —
excluding the agent one— according to the linear
order of occurrence \succ agent \succ VP⁷

⁷Sidner borrows the notion of ‘theme’ from Gruber, who defines it as “the entity which is conceived as moving or undergoing transitions” (Gruber 1976:38). Note, however, that Sidner claims that for the purposes of her theory “the theme can best be generalized as the verb relation that indicates the property of being affected by the action of the verb” (Sidner 1979:64). Further interesting remarks about Sidner’s concrete use of such a notion can be found in Cormack (1992:31ff.).

1.	1.1	Application of the initialization mechanisms to (5.U ₁)		
	1.2	Focus registers after step 1.1:		
			DF series	AF series
			CDF my dog	CAF I
			PDFL the vet yesterday I VP of (5.U ₁)	PAFL my dog the vet
			DFS NIL	AFS NIL
2.	2.1	Interpretation of <i>he</i> in (5.U ₂)		
	2.1.1	Proposed pair: (CAF. <i>he</i>), i.e., (<i>I.he</i>)		
	2.1.2	(<i>I.he</i>): rejected by the ratification procedure		
	2.1.3	Proposed pair: (<i>first-element-of-PAFL.he</i>), i.e., (<i>dog.he</i>)		
	2.1.4	(<i>dog.he</i>): accepted by the ratification procedure		
	2.2	Interpretation of <i>him</i> in (5.U ₂)		
	2.2.1	Proposed pair: (CDF. <i>him</i>), i.e., (<i>dog.him</i>)		
	2.2.2	(<i>dog.him</i>): rejected by the ratification procedure		
	2.2.3	Proposed pair: (<i>first-element-of-PDFL.him</i>), i.e., (<i>vet.him</i>)		
	2.2.4	(<i>vet.him</i>): accepted by the ratification procedure		
3.	3.1	Focus registers: updating		
	3.2	Focus registers after step 3.1:		
			DF series	AF series
			CDF him [the vet]	CAF he [my dog]
			PDFL hand he [my dog] VP of (5.U ₂)	PAFL him [the vet]
			DFS my dog	AFS I

Table 2: Interpreting *he* and *him* in (5.U₂): main steps

If the first U of the discourse is a ‘*there*-insertion’, an ‘is-a’-type, a cleft or a pseudo-cleft sentence, the CDF is set by the DF-related expected focus mechanism to the grammatical subject of the first U of the discourse (on these syntax-driven choices see Sidner 1979:60ff.); else, the CDF is set to the most highly ranked element of the default expected focus list. As for the initialization of PDFL, this is done copying, in the same order, the elements of the default expected focus list, except for the element already assigned to CDF.

As for the AF series, an analogous mechanism initializes CAF with the agent of the first U (if one exists), and PAFL with all the animate entities (this is roughly the meaning of Sidner’s term ‘actor’) evoked in the first U of the discourse. PAFL is ordered according to the linear order of occurrence of these entities. It does not contain the element already assigned to CAF.

Since at the beginning of a discourse all the registers are empty, the initialization mechanisms filling the CDFs and the ALFLs of the two series are conceived by Sidner as a kind of bootstrapping device used for guessing—in a principled way (Sidner 1979:59–70; 152–156)—the registers content from the first U. The CDF and the CAF proposed by the initialization mechanisms may be confirmed or rejected, after the first U, on the basis of the ratification procedure.

2. SUB-PROCESS B: the interpretation of the anaphors contained in the processing unit under examination. This is effected on the basis of the interpretation algorithms.
3. SUB-PROCESS C: the updating of the focus registers effected on the basis of the results of the interpretation algorithms invoked by sub-process B.

Sub-process A is applied exclusively to the initial U of the discourse. The remaining sub-processes instead constitute the focusing cycle for the Us which, in the discourse stretch under examination, follow the initial one.

2.2.2 An example

After this highly partial description of the core of Sidner’s theory, an example may be useful in order to give a less abstract view of the interactions of the various components posited by the theory.

Consider example (5), from Sidner (1979), where *he* is the co-specifier of *dog*, *him* is the co-specifier of *vet*, and the symbol U is assigned by myself to the two processing units defined by Sidner.

- (5) (U₁) I took my dog to the vet yesterday.
- (U₂) He bit him in the hand.

The main logical steps which Sidner’s Focus Theory assumes for interpreting *he* and *him* in (5.U₂) are sketched in Table 2.

For the first U of (5), the DF-related expected focus mechanism initializes CDF with the theme of (5.U₁), and orders the remaining elements on the basis of the default expected focus list shown here in (4), while as for the AF registers the related mechanism initializes CAF with the agent, ordering PAFL members on the basis of their linear appearance in (5.U₁). The two stacks, DFS and AFS, are empty because no CDFs or CAFs exist before (5.U₁) processing (see Table 2, step 1.2).

The pronoun *he* of (5.U₂) appears in A position; therefore its co-specification with the CAF provided by step 1.1 is checked (step 2.1.1). Since the pair (*I.he*) is rejected by the ratification procedure because it does not satisfy agreement constraints (step 2.1.2), the co-specification of *he* with the first element of PAFL is

checked, and the ratification procedure does not detect contradictions (step 2.1.4).

The pronoun *him* of (5.U₂) appears in \neg A position, therefore the CDF provided by step 1.1 is assumed to be its co-specifier (step 2.2.1). The inferential component of the ratification procedure, however, does not approve the (*dog.him*) pair; in fact, “[t]his choice must be rejected by the inference mechanism on the basis of information which states that dogs can not be bitten in the hand because they do not have hands” (Sidner 1979:150). Because of the unratifiable status of the (CDF.*him*) pair, the first member of PDFL is checked, and no contradiction is detected (step 2.2.4).

Therefore, after (5.U₂) processing (see Table 2, step 3.2), the focusing process leads to the following situation:

- i. The expected foci obtained from the initialization mechanism (step 1) are replaced by *dog* and *vet*, i.e., the pegs co-specified by the two pronouns in step 2. Notice that — although expected and not ‘confirmed’ foci are involved as starting points — here anyway appears what Sidner calls a ‘focus movement’. In fact, the centers of attention suggested by step 1 shift from the foci hypothesized by the initialization mechanism with regard to (5.U₁) to the foci signalled by the anaphors in (5.U₂). Moreover, notice that, after the first U in a discourse, in Sidner’s machinery a focus movement recognition follows patterns similar to those used in order to recognize, in (5), *my dog* and *the vet* as CAF and CDF. Therefore, it should be stressed that, after the registers’ initialization, in Sidner’s theory the focus of attention is not to be considered a matter of prediction. Rather, it is as a matter of recognition based on the anaphoric expressions that follow in the discourse.
- ii. The ALFL members not co-specified in (5.U₂) are deleted from the registers, and replaced by the new pegs derived from the processing of (5.U₂). The ordering for the new PDFL and PAFL is the same assumed respectively by a) the default expected focus list shown here in (4), and b) the PAFL initialization mechanism used for the first U in the discourse. The two elements already identified by the interpretation step as CAF and CDF —i.e., *he* and *him*— are excluded from the lists. In a hypothetical unit (5.U₃), the speaker may maintain the same foci signalled by the linguistic choices he makes in (5.U₂), that is his use of *he* and *him* to point out the focal attentional status of *my dog* and *the vet*. Conversely, he may use the potential foci arising from (5.U₂), e.g. *hand*, to shift attention through the use of a subsequent dependent expression.
- iii. The CAF and CDF given by step 1 are pushed respectively onto the AF and DF stacks. If the dependent expressions of a hypothetical unit (5.U₃) can not find their sponsors in the CF and ALFL registers obtained from the processing of (5.U₂), the stacked pegs can be evaluated as potential sponsors, assuming in this way that a ‘backward focus movement’ takes place.⁸

⁸ Following is an example, taken from Sidner (1983), regarding the main steps related to the visiting of a stack. For the sake of space many details about AF and DF series interrelationships are omitted.

3 Pronouns, preferential trees and associations

3.1 Working tools

In many anaphora interpretation models, as in Sidner’s one, the available sponsors of a pronoun do not assume a fixed preferential value, but the preference is considered as inherently relational (e.g., for a dependent expression DE, a potential candidate *x* is ‘more preferred’ or ‘less preferred’, for the sponsorship relation, than a potential candidate *y*). This relational view, adopted in order to control and minimize the search space in a principled way, shows a strong family resemblance with some phonological lines of reasoning concerning the treatment of stress. In fact, given a textual string containing two or more syllables, in some phonological frameworks the degree of stress related to a syllable σ_i is computed exclusively in a relational way; e.g., a syllable

(U₁) Wilbur is a fine scientist and a thoughtful guy. (U₂) He gave me a book a while back which I really liked. (U₃) It was on relativity theory, (U₄) and talks mostly about quarks. (U₅) They are hard to imagine, (U₆) because they indicate the need for elementary field theories of a complex nature. (U₇) These theories are absolutely essential to all relativity research. (U₈) Anyway, I got it while I was working on the initial part of my research. (U₉) He’s really a helpful colleague to have thought of giving it to me.

The initialization mechanism related to the DF registers identifies *Wilbur* as the CDF of (U₁). In fact, *Wilbur* is the grammatical subject of an ‘is-a’-type sentence (Sidner 1979:67–68), that is a marked syntactic construction overriding the ordering given here in (4). At the time that (U₂) is processed, the pronoun *he* is evaluated as the co-specifier of the CDF *Wilbur*. The ratification procedure does not detect contradictions. Hence, without looking for alternate potential sponsors in the PDFL built after (U₁) processing, the peg *Wilbur* is confirmed as the CDF of (U₂). However, at the time that (U₃) is processed, *Wilbur* can not be licensed by the ratification procedure as the co-specifier of *it*. Therefore, as the sponsor of *it*, Sidner’s machinery proposes, in an ordered way, the pegs of the PDFL obtained from (U₂) processing. Since the pair (*book.it*) raises no contradictions, *book* is accepted, and a focus movement takes place: *book* becomes the new CDF, and *Wilbur* —the previous CDF— is pushed onto the DF stack. *Book* is confirmed as CDF by (U₄), which has in its PDFL *quarks*, that is the new CDF co-specified by *they* in (U₅); therefore, the discourse focus moves again, and the previous CDF, *book*, is pushed onto the DF stack. At the time that (U₈) is processed, the CDF is *elementary field theories* (evoked in (U₆) and co-specified by the NP *these theories* in (U₇); on focus and full definite NPs see Sidner 1979:97–141), and the available stack is the following:

quarks	(U _{5,6})
book	(U _{3,4})
Wilbur	(U _{1,2})

At the time that (U₈) is processed, as the sponsor of *it* the ratification procedure rejects: a) *elementary field theories*, i.e., the CDF; b) all the members of the PDFL obtained from (U₇) processing. Therefore, the focusing process is allowed to search in the DF stack, beginning from the top. The pair (*quarks.it*) is rejected by the ratification procedure; so, the peg *quarks* is ‘popped’, and the stack has now *book* as its top element. This peg is accepted as CDF by the ratification procedure; therefore, a backward focus movement takes place. At the time that (U₉) is processed, the pronoun *he* can not co-specify —because of the ratification procedure veto— with the CDF, i.e. *book*, or with a member of the PDFL arising out of (U₈) processing. At this point, a search in the stack can only propose, as the co-specifier of *he*, *Wilbur*, that is a peg for which the ratification procedure does not detect contradictions. *Wilbur*, evoked by (U₁), is therefore the new CDF of (U₉). For some relevant notes related to the use of the stacked foci see Sidner (1979:89-90), Cormack (1992: §5.8) and Hitzeman & Poesio (1998).

σ_i is simply ‘more stressed’ or ‘less stressed’ than a syllable σ_j . And the same applies to higher constituents in the phonological hierarchy; for example, a phonological word ω_i is globally ‘more stressed’ or ‘less stressed’ than a phonological word ω_j .

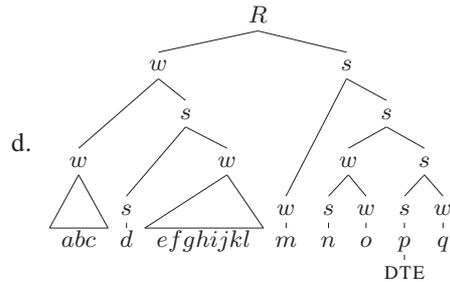
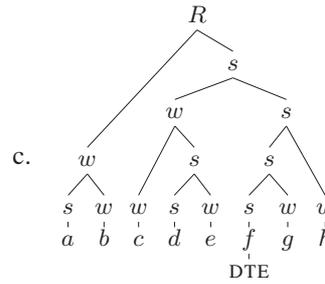
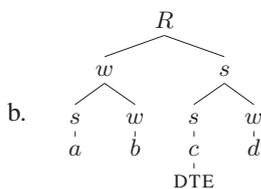
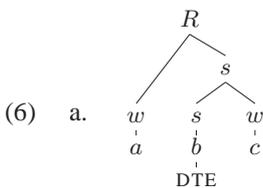
On the basis of this strong family resemblance, in this paper I adopt, for the purpose of sketching a focus-based model aimed at pronominal anaphora interpretation, the same basic framework developed by Liberman (1975) in order to formulate his theory on stress and intonation.

In §§3.1.1–3.1.4 I briefly describe the main working tools developed by Liberman in order to handle the association between a textual string and an intonational contour. The reader who is already familiar with Liberman’s theory can skip to §3.2. However, before proceeding any further, a caveat to the reader is in order. Although anaphora interpretation may be at least partially dependent from prosody (see, among many others, Oherle 1981, Kameyama 1999 and De Hoop 2004), the use in this paper of Liberman’s tools does not entail anything with respect to the possible interrelationships between prosody and pronominal anaphora interpretation, nor necessarily entails hypotheses about the activation of a common cognitive mechanism.

3.1.1 Trees

Liberman represents linguistic stress through binary branching ‘metrical’ trees of arbitrary complexity. In a metrical tree, each non-terminal element is labeled by one of the following symbols: R (root), w (weak), and s (strong). R denotes the root of a tree, and therefore an undetermined node with respect to stress specification. The labels s and w indicate the relative stress prominence of two sister constituents (two syllables, two phonological words, etc.).

To read and interpret metrical trees such as those represented in (6), the concept of ‘Designated Terminal Element’ (DTE) is of basic importance. Given a metrical tree, the DTE is the terminal element dominated by no nodes labeled w . Therefore, for (6a) the DTE is b , for (6b) the DTE is c , for (6c) the DTE is f , and for (6d) the DTE is p .



3.1.2 (Main) association rule

For any textual string and for any intonational contour, an intonational theory needs to define some mechanisms able to predict the points of the string that carry the meaningful height changes of the contour. In Liberman’s theory, this task is accomplished by a system that includes:

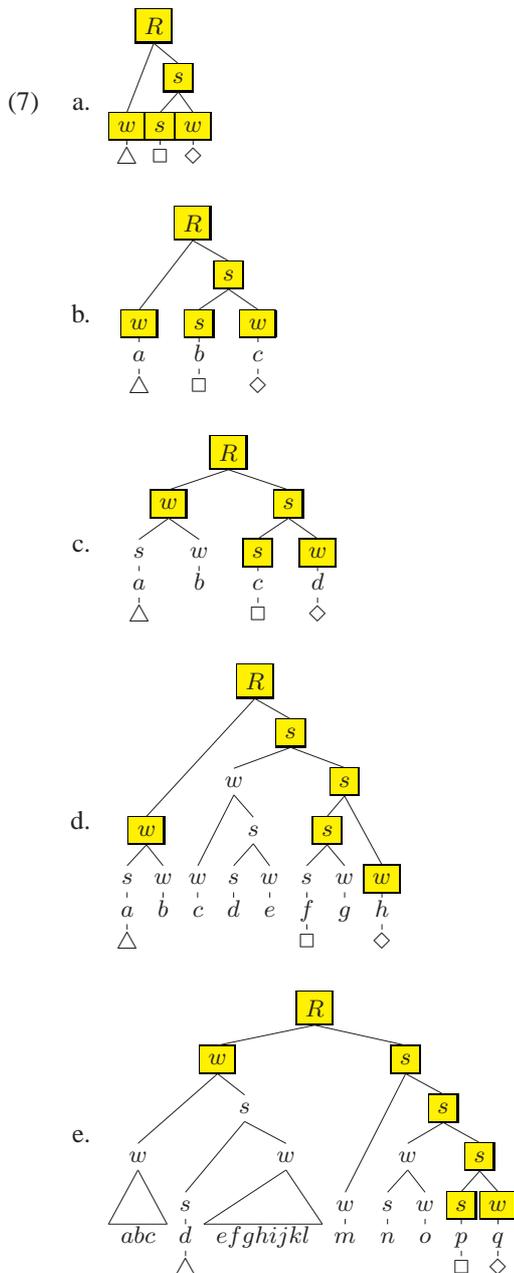
- i. A set of level tones; in fact, Liberman analyzes an intonational contour as a sequence of level tones of different height unified by default by transitions from a low(er) tone to a high(er) one and *vice-versa*.
- ii. The linking of a sequence of level tones $LT_1 \dots LT_n$ with metrical trees analogous to those shown in (6).
- iii. The following definition of ‘congruence’ between two metrical trees:
 - a) if T_1 and T_2 are metrical trees, then their roots ‘correspond’;⁹
 - b) if the nodes $n_i \in T_1$ and $n_j \in T_2$ correspond, and both nodes immediately dominate nodes with the same labels (i.e., $[ws]$ or $[sw]$), then the left daughter of n_i corresponds to the left daughter of n_j and the right daughter of n_i corresponds to the right daughter of n_j ; else if the nodes immediately dominated by n_i have a $[ws]$ pattern, whereas those immediately dominated by n_j have a $[sw]$ pattern, then n_j corresponds to the right daughter of n_i (i.e., a node labeled s);
 - c) if each T_1 node corresponds to some T_2 node, then T_1 and T_2 are ‘congruent’.
- iv. A (main) association rule between the tree of the textual string and the tree of the tone sequence that represents the information related to a given intonational contour. This

⁹By the term ‘correspondence’ Liberman means, roughly, the ability of a node $n_i \in T_1$ to superimpose without conflicts with a node $n_j \in T_2$. For instance: a node labeled w corresponds to a node labeled w and does not correspond to a node labeled s .

rule —which basically interprets the superimposition of two given trees— can be stated as follows (cf. Liberman 1975:44):

(MAIN) ASSOCIATION RULE. If two trees T_1 and T_2 are congruent and if a node $n_1 \in T_1$ that immediately dominates a terminal element Δ corresponds to a node $n_2 \in T_2$, then Δ is associated to the DTE of n_2 .

With reference to the (main) association rule, in (7) I show some associations between a tree that interprets the abstract tone sequence ‘ $\triangle \square \diamond$ ’ (see (7a)) and the trees presented in (6). The correspondences between the nodes of the tree (7a) and those of the trees (7b-e) are shown in the examples by the boxes.



3.1.3 Grids

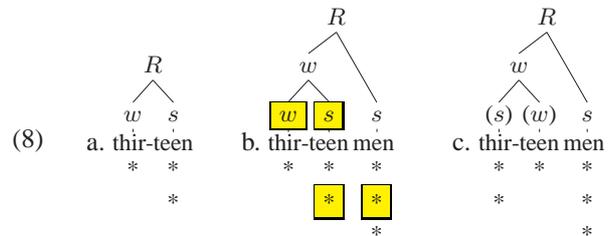
Liberman substitutes the classical number-based representation of stress (e.g., Chomsky & Halle 1968) with a ‘metrical

grid’. A grid is constructed accordingly with the following assumptions:

- i. The elements of the terminal sequential set of a grid have to dominate every syllable of an utterance.
- ii. The higher sets are constructed according to the ‘Relative Prominence Projection Rule’ (RPPR):

RPPR. In any constituent on which the strong-weak relation is defined, the designated terminal element of its strong subconstituent is metrically stronger than the designated terminal elements of its weak subconstituent. (Liberman & Prince 1977:316)

A grid for the word *thirteen* is given in (8a). The first level is created according to the first assumption. The second level derives from RPPR. In grids, the degree of stress of a given syllable is thus represented by the height of the column that stands below it.¹⁰



3.1.4 Reversal Rule (RR)

In a textual string consisting of two or more words, sub-optimal rhythmic patterns can arise. An example is shown in (8b), where the two boxed elements of the grid appear contiguous on a level higher than the terminal one.

According to Liberman’s theory, similar patterns may prompt to the application of a tree of the following ‘Reversal Rule’ (RR): $[_x [ws]] \Rightarrow [_x [sw]]$, where x stands for R , s or w . The application of such a RR to the utterance *thirteen mén* is shown in (8b). Here the boxed nodes of the tree are the domain of the RR. The outcome of the application of the RR is shown in (8c), where the stress on *-teen* is retracted (i.e., *thirteen mén*), and the parentheses indicate the nodes processed by the RR.

3.2 Pronouns, focus of attention and preferential trees

Sidner gives, at least in part explicitly, a hierarchical and relational view of the registers and their contents. Given such characteristics, a transposition of the mechanism that rules the registers and the focusing algorithms defined by her theory in terms of

¹⁰ Various authors have questioned the presence of both trees and grids in the phonological theory because of possible redundancies. However, it should be remembered that a) although trees and grids are both hierarchical representations, the tree analyzes linguistic material in terms of constituents, whereas the grid is a series of ‘beats’ representing only temporal segments; b) the linguistic stress (expressed by the trees) and the rhythmic stress (expressed by the grids) belong to different domains, insofar as the first is a grammatical object, while the second is the linguistic manifestation of rhythm (Liberman 1975, 174ff.). The reason for this digression will become clearer in §5.1.

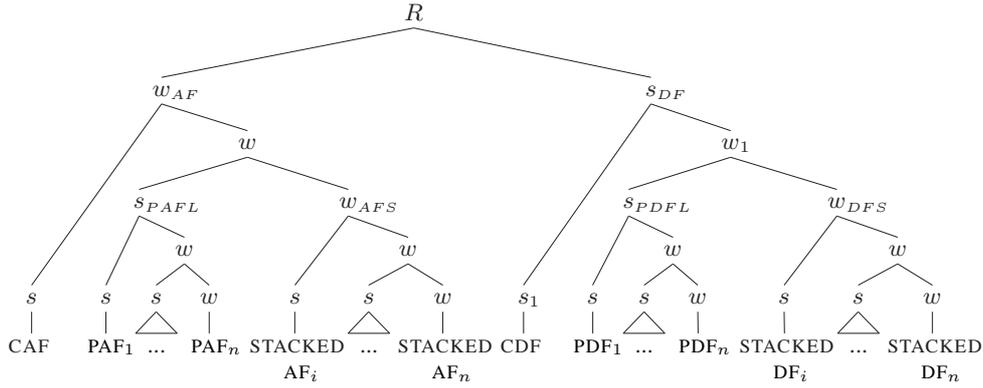


Figure 2: Preferential tree related to Sidner's registers and their contents.

s/w trees can be easily made. With reference to the registers, a tree representation of the latter and of the preference ordering for a pronoun in $\neg A$ position is given in Figure 2. In Figure 2, the labels s and w should be read as relational preference values regarding sister nodes — i.e., as for sponsorship relations, the material dominated by a s node is preferred to what is dominated by its w sister node. Moreover, it is assumed, for completeness, that all the six registers hypothesized by Sidner contain some elements.

With reference to the registers' visit mechanisms and the elements contained in them, for the tree in Figure 2 —where the path from R including no w nodes individuates the CDF peg as the DTE of the tree— we can assume the generalized adoption of RRs similar to those presented in the last section.

Suppose that for the tree in Figure 2 the peg in CDF position can not be licensed by the ratification procedure. In this case, a RR $[s_{DF} [s_1 w_1]] \Rightarrow [s_{DF} [w_1 s_1]]$ will have the DTE role played by PDF₁, and analogue RRs will allow a visit of all the remaining pegs dominated by the node s_{DF} .¹¹

If none of these pegs can be licensed by the ratification procedure, a RR $[R [w_{AF} s_{DF}]] \Rightarrow [R [s_{AF} w_{DF}]]$ will allow access to the pegs dominated by the left node immediately dominated by R (i.e., $|w \Rightarrow s|_{AF}$), hence giving place to what Cormack (1992) calls 'contra-focus'.

Moreover, ex-abrupto application of the last mentioned RR to the tree in Figure 2 causes the correct visiting order of the registers relative to an A position pronoun.

3.3 Associations and concurrent processes

This transposition of the original Sidner's machinery interprets both the preferential scale for pronouns in $\neg A$ position and that for pronouns in A position. Moreover it makes the representation of focus and some mechanisms involved in its processing

¹¹The visiting order can be stated as follows: if the node n_i which immediately dominates the current DTE is a node already visited by a RR, in order to visit all the registers the RR has to be applied to: a) the node that immediately dominates the node n_i and b) its sister node. Given the tree in Figure 2, for example, if subsequent applications of RRs come to identify PDF_n as the DTE, and PDF_n can not be approved by the ratification procedure, the next RR has to be applied to the sister nodes s_{PDF_L} and w_{DFS} .

clearer and simpler. Nonetheless, it does not alter Sidner's original approach. Therefore, why use a representation like the tree in Figure 2?

The reasons for adopting such a kind of representation depend on the need to simplify the treatment of phenomena which lie outside that which Sidner's model handles. I am alluding to the treatment of intra-sentential pronominal anaphors, to incremental processing, or to pronominal anaphora interpretation in discourses containing, for instance, quoted speech (see here §§4–6). However, Sidner herself suggests a possible answer to the above question by analyzing example (5), repeated here for convenience as (9).

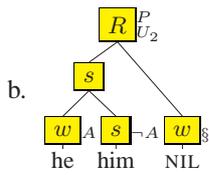
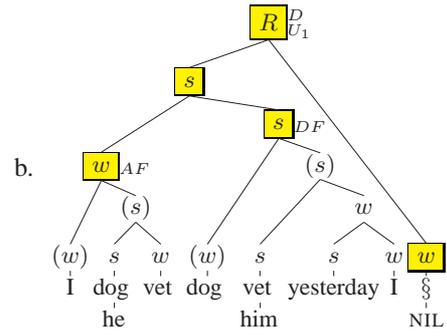
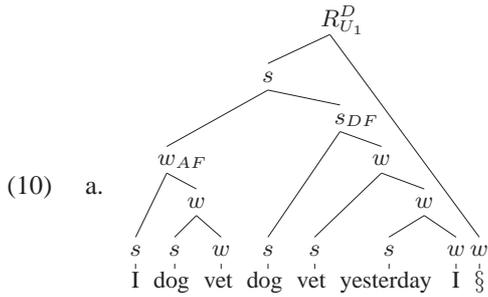
- (9) (U₁) I took my dog to the vet yesterday.
(U₂) He bit him in the hand.

Here follows what Sidner writes about this example:

[(9)] assumes a sequential processing in which one pronoun is resolved and then the next. Suppose, however, that focussing rules are implemented as concurrent processes with one process for anaphora in agent position and one for anaphora in other positions. Then the inference rejection of *my dog* as discourse focus could be unnecessary if the pronoun co-specification of *he* had already been established as *my dog* by the use of focussing rules. (Sidner 1979:161-162)

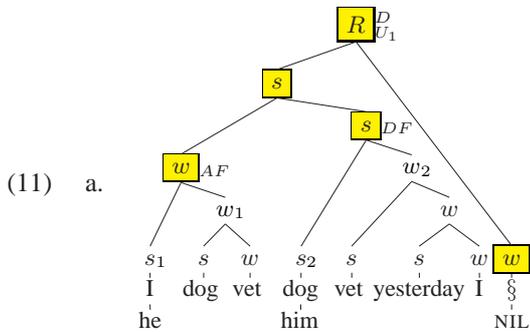
In terms of preferential s/w trees, this hypothesis regarding the simultaneous presence of different processes, one relative to A position pronouns, and the other to $\neg A$ position pronouns, can be expressed very easily. Within the domain of pronominal anaphora interpretation, in fact, in operative terms it allows the exact restatement of the (main) association rule used by Liberman to handle the association between a text and an intonational contour.

Consider the tree derived from the application of Sidner's initialization procedures to (9.U₁) —i.e. (10a). Here $R_{U_1}^D$ indicates that R is the root of the representation of the discourse D already processed by the initialization mechanisms (cf. Table 2, step 1.2), and the element labeled ' \S ' is inserted to represent the situational peg of $R_{U_1}^D$.



Given in this way, for $(9.U_1)$, a sponsorship preferential hierarchy¹², the pronouns in $(9.U_2)$ can be represented according to the structure (10b), where the index P of R indicates that the tree is relative to the pronouns P of $(9.U_2)$, and where two pronouns —*he* and *him*— ask for a sponsor in the domain of $R_{U_1}^D$.

The application of the association rule expressed in §3.1.2 to the trees rooted at $R_{U_2}^P$ and $R_{U_1}^D$ now causes two associations: $(I.he)$ and $(dog.him)$. The result of the two processes (or three processes, if we count also the NIL situational element) is shown in (11a).



¹² Note how the hierarchization of the preferences expressed in (10a) partially differs from the order imposed by Sidner on the content of her focus registers. To process the so-called ‘sentential’ or other cases of situational anaphors, Sidner in fact introduces VP into the DF registers. On the contrary, I am assuming here that the situational component of a clausal or nominal element pertains neither to AF or DF , being basically equivalent to the R that dominates these two nodes. Therefore, for (10a), the situational peg expressed by § is just a simple pointer to $R_{U_1}^D$. The fact that in preferential trees like (10a) the element § is in a less prominent position compared both to AF and DF nodes reflects the behavior of an Italian pronoun that, given sponsors § and NP equally licensable by the ratification procedure, selects NP rather than § (Di Eugenio 1989). Moreover, notice that labels like AF , DF , etc. are inserted in the trees, here and in the remainder of the paper, exclusively with a view to helping readers to orientate themselves in the reading of the trees, and have no determinant role to play other than this.

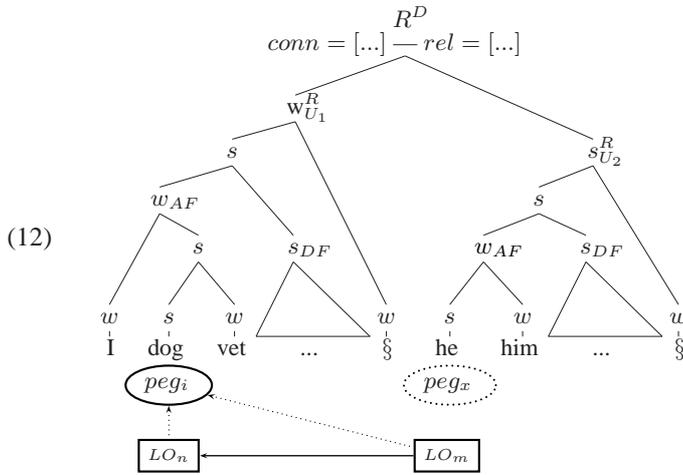
Assuming an orthodox replica of Sidner’s sequential algorithm implementation, for the associations given by (11a) both $(I.he)$ and $(dog.him)$ must be approved by the ratification procedure (cf. Table 2, step 2). However, given the co-occurrence of *he* and *him* in the structure (10b), we can treat the operations regarding the approval of $(I.he)$ and $(dog.him)$ as concurrent processes, thus enabling —as hypothesized by Sidner with regard to her framework— the removal of at least some of the inferencing required by the ratification procedure.

Consider, for instance, the association $(I.he)$ in (11a). Then suppose that a RR $[w_{AF} [s_1 w_1]] \Rightarrow [w_{AF} [w_1 s_1]]$ is applied because of the veto given by the ratification procedure. The DTE of the node w_{AF} , instead of *I*, becomes *dog*, i.e., a peg for which the ratification procedure does not detect contradictions. As a consequence, since in $(9.U_2)$ the pronouns *he* and *him* can not co-specify with the same peg, in (11a) a RR $[s_{DF} [s_2 w_2]] \Rightarrow [s_{DF} [w_2 s_2]]$ —i.e., a RR not triggered by the inferential component of the ratification procedure, but only by linguistic constraints— makes *vet* the DTE of the node s_{DF} . Since *vet* can be approved by the ratification procedure as the sponsor of *him*, the association can at this point be made without any contra-indication (see (11b), where the parentheses indicate the nodes processed by the RRs).

The derivations $(dog.he)$ and $(vet.him)$ shown in (11) realize Sidner’s suggestions about concurrent implementation of her focusing mechanism. However, with reference to $(9.U_2)$, we encounter a difficulty. An orthodox replica of Sidner’s theory in terms of preferential trees should define, in fact, the modification of (11b) in correspondence with the processing of $(9.U_2)$ — i.e., the zeroing of the elements contained in the Alternate Actor/Discourse Focus Lists that are not co-specified in $(9.U_2)$, and the creation of the Actor/Discourse Focus Stacks (cf. Table 2, step 3). There is, however, at least one other way to express the movement of the focus and the constitution of the stacks. Once the processing of $(9.U_1)$ is completed, the existence of a structure relative to $(9.U_2)$, and similar to that created for $(9.U_1)$, can be hypothesized, and the two resulting structures can be linked, inter alia:

- by relations between respective LOs and pegs (cf. Figure 1);
- by connectives (CONN; see, among others, Warner 1985) and ‘discourse relations’ (REL) similar to those used by Grosz & Sidner (1986) and various other scholars;
- by s/w relations determinant for an ‘anaphoric association’ of the pronouns of a successive, hypothetical unit $(9.U_3)$.

For (9), a partial and hypothetical representation of these links is given by (12).



Here the tree rooted at R^D stands for the discourse comprising both $(9.U_1)$ and $(9.U_2)$, and peg_x indicates the peg of *he* before being unified to peg_i by the interpretation of a total, linguistically sponsored anaphora of the type shown in Figure 1.¹³

Such a reinterpretation of Sidner's model—where focus movement and the stacks are expressed both by the DTES of various nodes present in the tree, and by the unification mechanism applied to the pegs—could somehow avoid the traditional and sometimes problematic distinction between 'global' and 'local' focus of attention (Hitzeman & Poesio 1998). On the other hand, it would allow a conditioned access to the not immediate Potential (Actor/Discourse) Foci that Suri (1992) and Suri & McCoy (1994) consider necessary in order to resolve ellipsis and pronominal anaphors. Moreover, a structure like (12) could take good advantage of discourse tree construction mechanisms similar to those proposed by, among many others, Polanyi (1988), Gardent (1997) and Webber & Cristea (1997).

Nonetheless, such a reinterpretation (besides various traditional problems like the definition of a plausible set of 'discourse relations', or the definition of the so-called 'right frontier' of a discourse tree) for a structure such as (12) would also pose the problem of the attribution of s and w values to the nodes U_1^R and U_2^R . In fact, in (12) this attribution is made exclusively accord-

¹³ It is important to note that, in LuperFoy's model, pegs are unique at the discourse tier, regardless of how many LOs co-specify with them. LuperFoy, moreover, interprets the focus of attention as a strict peg-related property. Here is what she writes about this topic:

The discourse model containing pegs provides the foundation for representing higher-order discourse structuring. For example, relative attentional focus [...] is a relation between pegs, not LO's or knowledge base elements. Facts about the LO (prosodics, linear recency, complement clause structure, negation contexts, etc.) can, however, influence the strength of focus, e.g., syntactic topicalization constructions increase attentional focus of the peg corresponding to the topicalized LO. The relative prominence of pegs in the discourse model affects their availability as sponsors and anchors to anaphoric LO's, and repeated mention increases the attentional focus value of a peg. (LuperFoy 1991:54-55)

ing to the linear ordering of the two U s of the discourse, with s assigned to the last U .

Before saying anything more about these problems, it is necessary to deal with a point that appears to be of basic importance for a correct settlement of a rule of anaphoric association, i.e., the definition of the domains involved by the process.

4 Domains

Sidner—and most of the authors who refer to concepts like focus or center of attention—assume the existence of a single domain relative to focus individuation and tracking. On the contrary, I hypothesize here that these operations depend on three distinct domains:

- i. 'Input units' (U_{in}), i.e., units responsible for:
 - a) the incremental construction of structures like (10a);
 - b) the construction of R^P -type structures like (10b).
- ii. 'Processing units' (U), i.e., units like (10a) which can function as association domains for R^P -type structures.
- iii. 'Insertion units' (U_I), i.e., units comprising one or more processing units and responsible for the insertion of one or more processing units as a block in a R^D -type structure, i.e., the structure which stands for the discourse already processed.

The definition of these domains is given in §§4.1-4.3.

4.1 Input units (U_{in})

The phonological phrases identified in phonology have proved to be credible 'performance structures' (cf. Abney 1991b, 1992).¹⁴ Phonological phrases, in fact, a) in phonology are normally considered the domain of various phenomena (see, among many others, Nespor & Vogel 1986 and Heseloot 1995); b) in psycholinguistic models regarding the localization and quantification of pauses in reading have been identified as a critical element in making predictions about the segmentation of utterances (Gee & Grosjean 1983); c) in some text-to-speech systems constitute the basic parameter for the assignment of variously defined boundaries (Bachenko & Fitzpatrick 1990; Atterer 2002); and d) in the

¹⁴One of the best known definitions of the phonological phrase (ϕ) is the following, from Nespor & Vogel (1986:168; 173):

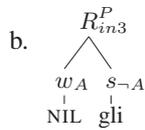
- i) ϕ -domain. The domain of ϕ consists of a C ['clitic group'; RG] which contains a lexical head (X) and all C's on its nonrecursive side up to the C that contains another head outside of the maximal projection of X.
- ii) ϕ -construction. Join into an n-ary branching ϕ all C's included in a string delimited by the definition of the domain of ϕ .
- iii) ϕ -restructuring (optional). A nonbranching ϕ which is the first complement of X on its recursive side is joined into the ϕ that contain X.

For more recent works related to phonological phrasing see, inter alia, Klein (2000), Revithiadou & Spyropoulos (2003), Kahnemuyipour (2004) and Selkirk & Kratzer (2005).

theory of parsing are, essentially, the same concept as Abney's (1991a) 'chunks'.¹⁵

In assuming, with Abney, that the construction of a complete syntactic interpretation is the prerogative of an attacher that assembles chunks, here I hypothesize that R^P -type structures like (10b) are built starting from the chunk they belong to. Chunks can therefore be considered the 'input units' (U_{in}) of the process of anaphoric association (cf. (13a), where the U_{in} s are within square brackets).

- (13) a. $[U_{in1}$ Il fratello] $[U_{in2}$ di Carlo] $[U_{in3}$ gli
 The brother of Carlo CL-DAT
 ha prestato] $[U_{in4}$ la moto.]
 lend-CPST-3 the motorbike.
 'Carlo's brother lent him the motorbike.'



Obviously, the construction of trees like (13b)—i.e., the R^P tree related to $[U_{in3}$ gli ha prestato]— must proceed on the basis of accessible elements, that is inferrable or fixed on the basis of default structures or strategies. I am alluding to information relative to the LOS present in the current U_{in} , information and inferences drawn from what has already been processed in the previous units in terms of LOS, pegs and constructs of the knowledge base, as well as decisions regarding the nature of the pronouns (Laenzlinger 1998; Cardinaletti & Starke 1999) or predications (Eckert & Strube 1999; Navarretta 2000) present in the current U_{in} .

4.2 Processing units (U)

In works rooted in Sidner's theory or in Centering Theory, the processing unit is usually the sentence or a tensed clause. On the contrary, I assume that the unit on which to proceed to the construction of structures such as (10a) is the Complete Functional Complex (CFC; Chomsky 1986). The CFC definition which I adopt comes from Giorgi & Longobardi (1991:54-55):

β is a Complete Functional Complex if it meets at least one of the following requirements: *a.* it is the domain in which all the θ -roles pertaining to a lexical head are assigned; *b.* it is the domain in which all the grammatical functions pertaining to the head are realized (where the R-relation counts as the structural subject of the NP).¹⁶

¹⁵In Abney's view a chunk (i.e., the unit usually utilized by partial parsing approaches to natural language) is a subgraph of the syntactic tree defined in terms of major heads or s-projections (see Abney 1987:39; for a similar notion cf. Grimshaw 1997).

¹⁶This definition presupposes the identification of two classes of nominals: a) the argumental class, where the nouns univocally define their arguments (for instance, *il giudizio di Carlo su Teresa* 'the judgment of Carlo about Teresa', where 'judgment' defines a judge and a person judged); and b) the non-argumental class, where the relation between the head and its argument is non univocally definable (for instance *la casa di Carlo* 'the house of Carlo'). See also on this topic Barker & Dowty (1992) and, for a strict computational approach, Dahl et al. (1987) and Not et al. (1999).

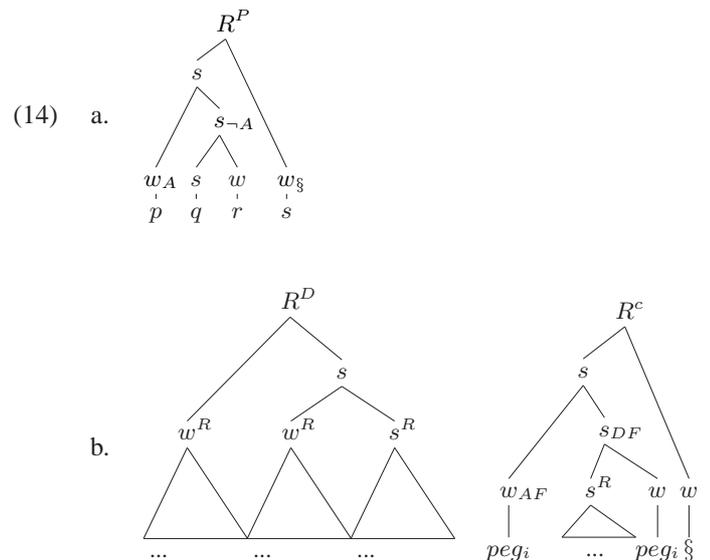
Basically, therefore the 'processing unit' (U) can be a NP with an external argument (Giorgi & Longobardi 1991, 28ff.), an inflectional phrase or a small clause.

4.3 Insertion Units (U_I)

The third unit I assume as a relevant domain for the analysis of pronominal anaphora, the 'insertion unit' (U_I), is the independent clause connected to its possible subordinates.

More for simplicity than necessity, the construction of the U_I s by means of U_{in} s and U s is effected by postulating the existence, during processing, of two distinct structures: one—let's call it R^c (c = 'current')—for the current U_{in} s and any current U s; the other—already identified as R^D —for the entire set of discourse material already processed, except for R^c .

An R^P -type structure, for each of the pronouns that constitute its terminal elements (see (14a)), may therefore find its own domain of association among the R s (which, as well as the roots of the trees, also mark the processing units dominated by them) present both in R^D and in R^c (see (14b)).



Upon the identification of a plausible completeness of a R^c -type structure, provided by the parser, this structure is promoted to the rank of U_I and inserted into the R^D structure through procedures analogous to those usually employed in discourse tree construction (see here §5.2.1).

Proof of the importance in processes of anaphoric interpretation of what here I call U_I —that is, the unit on the basis of which I proceed to the attribution of at least part of the s/w labels on a sentential level— has been provided by several authors (e.g., Suri 1992, Cormack 1992, Kameyama 1998, Miltakaki 2003, Poesio et al. 2004, Joshi et al. 2006). Still, in this regard, note also how Mattiessen & Thompson 1988 have treated the relations of syntactic subordination as the grammaticalization of discourse relations, i.e., relations no doubt important for the purposes of anaphora interpretation (see, among many others, Fox 1987, Berretta 1990, Cristea et al. 1998, Gómez Txurruka 2003, Polanyi et al. 2004). But it ought to be said that the hypothesis

that I assume here with regard to the constituency of U_{I_s} derives from the analytic framework developed by Labov and associates (Labov & Waletzky 1967; Labov et al. 1968), which is the framework employed to make a preliminary analysis of the corpus utilized to test the association model sketched in the current paper.¹⁷

4.4 Examples

In order to permit the reader a greater familiarity with the above definitions and procedures, for the remainder of this section I shall undertake a relatively detailed examination of some simple examples of anaphoric associations.

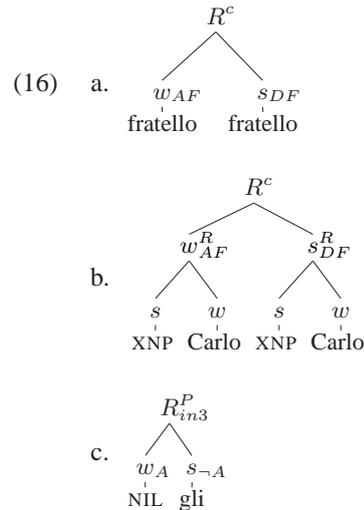
As for the first example (§4.4.1), some notes about its processing will be postponed to §4.4.2.

4.4.1 Example A

- (15) [U_{in1} Il fratello] [U_{in2} di Carlo] [U_{in3} gli ha chiesto]
 The brother of Carlo CL-DAT ask-CPST-3
 [U_{in4} la moto.] [U_{in5} Lui]
 the motorbike-F. He
 [U_{in6} gliela ha data.]
 CL-DAT CL-ACC-F give-CPST-3.

‘Carlo’s brother asked him for the motorbike. He gave him it.’

i. As a result of the absence of pronouns in U_{in1} , R_{in1}^P only exists virtually. The tree derived from the processing of U_{in1} is (16a); in fact *fratello* ‘brother’—insofar as it can not be defined at this stage as an agent of anything at all—designates an animate entity, and therefore must be present, as assumed by Sidner’s framework, in AF as well as in DF series.



ii. Like R_{in1}^P , R_{in2}^P only exists virtually. The pair $U_{in1} + U_{in2}$ constitutes a complex NP, *il fratello di Carlo*, in which *Carlo* is the external argument. However, Sidner’s theory does not contemplate the sponsorship possibilities offered by complex NPs. As a consequence, in order to assign in the derivation a preferential structure to $U_{in1} + U_{in2}$, a brief digression is in order.

Consider example (17).

- (17) [Il fratello di Carlo]_{*i*} apparve alla finestra;
 [The brother of Carlo]_{*i*} appear-SPST-3 at-the window;
 $\emptyset_{i/*j}/lui_{\#i/j}$ sorrise.
 (he_{*i/*j*})/he_{*\#i/j*} smile-SPST-3.
 ‘Carlo’s brother appeared at the window; he smiled.’

In (17), \emptyset and *lui* have, as potential sponsors, the NPs *il fratello di Carlo_i* and *Carlo_j*. However, using \emptyset instead of *lui* (cf. fn. 1), *Carlo* is not available as a proper sponsor, and \emptyset can co-specify only with the complex NP.

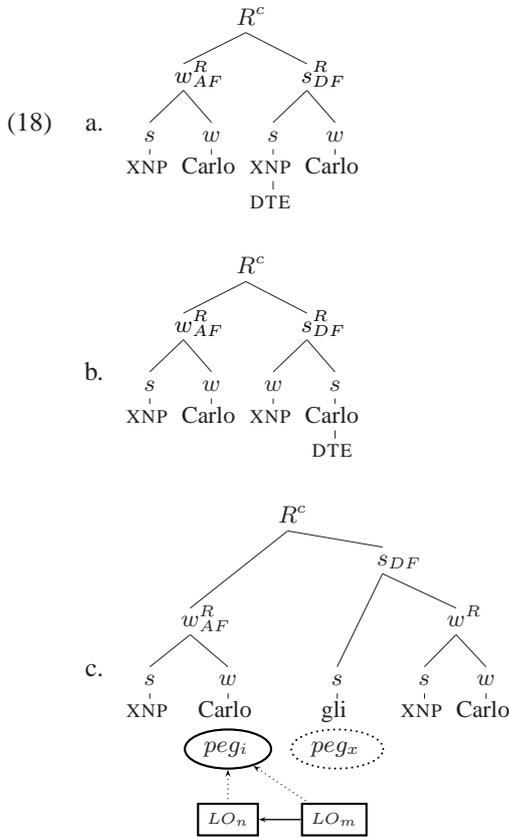
On the basis of examples like (17), the principle that in general terms seems to govern the attribution of *s/w* values to items included in complex NPs could be expressed as follows: if a complex NP can serve as overall sponsor, then that same NP is preferred to the different entities it contains.

In order to show the preferential relationship expressed by this general principle, in a preferential tree a node *n* relative to a complex NP terminal element (XNP) will be notated as [*n* [_{*s*} XNP]_{*w*} ...]]. In a XNP, the node labeled *s* constitutes a simple pointer to *n*. Moreover, that which is dominated by the node labeled *w* marshals, in an ordered fashion (cf. §4.4.4), all the pegs evoked in the NP except for that derived from the head. In fact, the head appears to be relevant exclusively in relation to anaphoric phenomena that—as far as complex NPs are concerned—will not be dealt with here (e.g., partial, linguistically sponsored anaphors like the so-called ‘one-anaphors’).

Let’s now go back to the processing of the complex NP composed, in (15), by $U_{in1} + U_{in2}$. By using the aforementioned notation to express the components of a XNP element within a tree, the representation of $U_{in1} + U_{in2}$ will be at this point (16b), where the *R*s assigned to w_{AF} and s_{DF} indicate that the material dominated by these two nodes is at this stage a CFC, i.e., a processing unit available for an anaphoric association.

¹⁷The corpus employed to make this preliminary analysis is composed of a very small subset of the oral texts available from AESS, the archive of the Regione Lombardia which collects Italian documents of ethnographic relevance (see <http://www.aess.regione.lombardia.it>). In particular, the texts composing the corpus may be ascribed to three categories, all accepting a basic Labov-style analysis: a) personal narratives; b) traditional narrative songs very similar to the ones usually named ‘ballads’ in Anglo-Saxon tradition and ‘romances’ in Hispanic tradition (cf. Mirrer-Singer 1980); and c) sales street-talk concerning goods at least partially unknown to the potential buyers, i.e., strange gadgets for cleaning, multi-purpose food processors, etc. (cf. Grazioli 1992). Unfortunately, for the specific aims of the present paper, this AESS-based corpus suffers two practical inadequacies. First, all the texts contained in the corpus are orally performed, and, at least in part, they heavily depend on speech/visual situation, gesture, prosody and paralinguistic features. Secondly, the corpus is mostly composed of discourses spoken in various Italian dialects characterized by a particularly complex clitic syntax (Poletto 1997). As a result, the use in the paper of examples borrowed from this AESS-based corpus would have required at least: a) the insertion of a lot of information related to prosody, gesture, perceptive context, etc. not really relevant for the specific aims of the present paper, but no doubt relevant in order to fully understand the examples; b) a lot of caveats—related for example to clitic doubling structures—relevant to explain even the basic operations required by the proposed model. Hence my choice to rule out from the paper, with the exception of one, examples taken from my AESS-based corpus, using instead constructed examples and real examples borrowed from a written novel (Simenon 1992). Notice that this solution is used in the paper exclusively for the sake of clarity, and that all the examples given in the paper have at least one counterpart example in my AESS-based corpus.

iii. R_{in3}^P is (16c), insofar as *gli* ‘to-him’ is unable to appear in A position. The association of R_{in3}^P with (16b) would identify XNP —*il fratello di Carlo* ‘the brother of C.’, i.e., the DTE of the DF nodes— as the sponsor of *gli* (see (18a)).

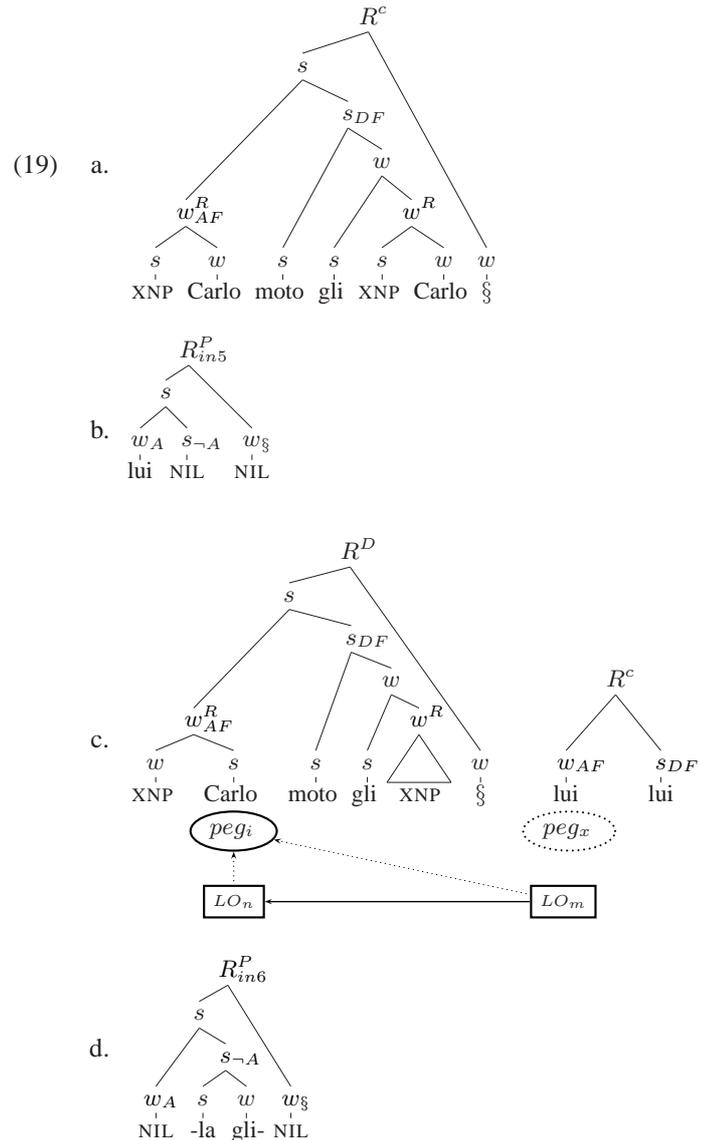


Having eliminated this candidate, since in the domain $U_{in1} \dots U_{in3}$ it can not be licensed by the ratification procedure (note that the processing of the U_{in} s can utilize the incremental algorithm developed by Merlo (1993) to identify the binding domains), the application of a RR to the relevant nodes identifies *Carlo* as the preferred candidate (see (18b)). This candidate is accepted by the ratification procedure as the sponsor of *gli*, and the insertion of U_{in3} in the structure that has already been processed gives rise to (18c), where

- in accordance with Sidner’s expected focus list shown here in (4), *gli* ‘to-him’ is inserted in the DTE position of s_{DF} , since the complex NP *il fratello di Carlo* is at this point identifiable as an agentive entity;
- the preferential pattern $[[w \text{ XNP}][s \text{ Carlo}]]$, whose lifespan is considered circumscribed to that of the interpretation of the pronoun that finds its own sponsor within XNP, is returned to the condition of initial default, that is $[[s \text{ XNP}][w \text{ Carlo}]]$.

In (18c) the anaphoric relation (*Carlo.gli*) is expressed in terms of pegs and LOs. peg_x indicates the original peg of *gli*. The association causes the unification of this peg with peg_i .

iv. U_{in4} has no pronouns. Its insertion into the structure (18c) gives rise to (19a).



Here the theme of the inflectional phrase —*moto* ‘motorbike’— is inserted in the tree as the DTE of s_{DF} on the basis of Sidner’s default expected focus list, and the ‘§’ node is inserted to represent the situational component of R^c .

v. R_{in5}^P is (19b). Its association with (19a) identifies the sponsor of *lui* ‘he’ in XNP (the DTE of w_{AF}^R), that is, an item accepted by the ratification procedure. However, given the conditions that govern the occurrence in subject position of null and overt pronouns in Italian (see fn. 1), a RR is in any case applied to the nodes dominated by w_{AF}^R . This indicates *Carlo* as the sponsor of the pronoun. The conflation of (19a) with what has been processed in U_{in5} leads to (19c), where

- the R^c of (19a), at the time that U_{in5} is processed, is promoted to R^D (cf. §4.3);
- R^c is inserted as the root of the material present in U_{in5} , i.e., the current unit that, before it can be connected to the current R^D , must be identifiable as U_I ;
- AF and DF labels are associated with the nodes dominated by R^c for the reasons given earlier (see (16a)) in regard to *fratello* ‘brother’.

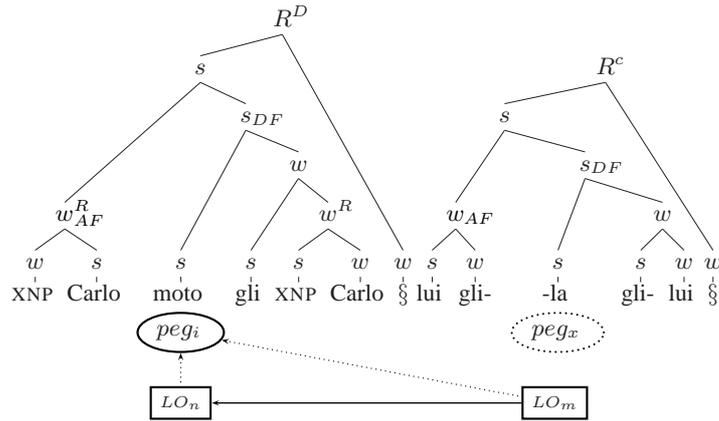


Figure 3: Example (15); preferential trees, LOs and pegs for one of the various interpreted anaphors

vi. U_{in6} is *gliela ha data*, and R_{in6}^P is (19d), where *-la* is a feminine accusative clitic, *gli-* is a dative clitic, and the *s/w* attribution to the terminal elements *-la* and *gli-* is obtained on the basis of Sidner’s default expected focus list shown here in (4).

The association of R_{in6}^P with the material in (19c) could have, as shown for the R^P -type structure in (14a), two top-level R s at its disposal, i.e. R^D and R^c . However, R^c is not a CFC, and it is therefore excluded from the set of the R s available for association because it is not, at this stage, a processing unit. The result of the association of R_{in6}^P with R^D is the selection of *moto* ‘motorbike’ for *-la* and, after a RR triggered by the ratification procedure, of XNP for *gli-*.

Example (15) can therefore be represented now in accordance with the two trees shown in Figure 3, where LOs and pegs are inserted for one of the various interpreted anaphors. The trees in Figure 3 could at this point be merged by means of a R^D that, as happens in (12), dominates both trees.

4.4.2 Intermezzo: example A revisited and a note about Sidner’s ‘actors’

In the last section, various issues related to example A processing were deliberately ignored. Some of these issues are briefly discussed in this section.

i. XNP nodes. The previously stated accessibility principle related to XNPs assumes that the visibility of the discourse entities under the *w* sister node of a XNP is constrained by the ratification procedure. In other words, the principle states that it is allowed to evaluate the material of a XNP sister node, only if this XNP can not be licensed as the sponsor of the pronoun under examination.

In general terms —at least judging by my AESS-based corpus (cf. fn. 17)— such a principle is tenable. However, it must be understood that there are exceptions to this principle, even though the result may occasionally seem odd.

Consider, for instance, (20), a real example supplied by Azzam et al. 1998.

- (20) In June, a few weeks before the crash of TWA Flight 800, leaders of several Middle Eastern terrorist organizations met in Teheran to plan terrorist acts. Among them was the PFL of Palestine, an organization that has been linked to airplane bombings in the past.

In (20), *them* co-specifies with *several ... organizations* rather than with the whole NP, and its co-specification is driven by our knowledge about *PFL* (or from the information given by the apposition) only *after* the appearance of *them*, i.e., a pronoun that, at the time when it appears, intuitively has as its optimal co-specifier *leaders of ... organizations*. For an analysis of at least a part of the anaphoric possibilities expressed by complex NPs see, inter alia, Chagnet (1995), Kister (1995), ter Haar et al. (1996) and Tsaklidou & Miltsakaki (2006).

ii. ‘Gli’ in (18c). Given the (*Carlo.gli*) interpretation provided for *gli* ‘to-him’, in principle *gli* must appear in (18c) as a terminal element of the sub-tree rooted at w_{AF} . For handling focus, however, this insertion appears redundant. In fact, it would have, as a result, the structure $[R[w_{AF}[s[s\ XNP][w\ Carlo]][w\ gli]][s_{DF}\ \dots]]$, that is, a structure where a) the sponsor of *gli* is already present and accessible, and b) it is in a more focused position than the sponsored pronoun. Therefore, given the peg-based view of attentional focus assumed by LuperFoy (see fn. 13), the absence of *gli* under the w_{AF} node in (18c) can be assumed as a simple notational shortcut.

In any case, note that LuperFoy (1991) —at least for the ‘processing units’ assumed by her framework— requires that a peg unification has to take place as soon as a ratifiable (*sponsor.pronoun*) relation is available. Assuming that this view can also be preserved under the incremental framework proposed here, as for the example A the pegs ‘Carlo’ and ‘gli’ would be already unified at the time that the processing stage $U_{in1} \dots U_{in3}$ is reached, hence giving as a result the preferential pattern shown in the sub-tree rooted, in (18c), at w_{AF} .

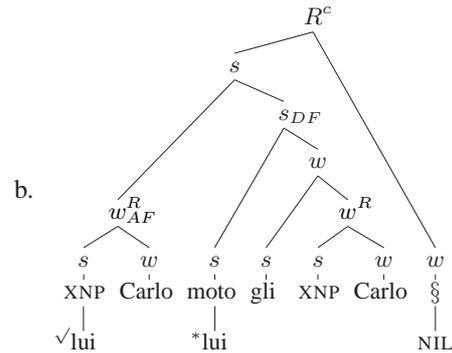
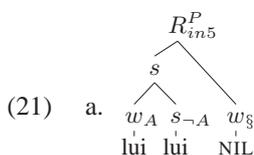
Moreover, notice that the ‘redundancy’ just evoked with regard to *gli* insertion under the w_{AF} node in (18c) is very different from that involved in Schlenker’s (2005b) ‘Non-Redundancy’ principle. In fact, Schlenker’s redundancy concerns ‘denotational configurations’. Therefore —exactly as happens for pegs in LuperFoy’s framework— no object can occur twice in his ‘memory register’. On the contrary, the redundancies spoken here are focus-based. This is the reason of the appearance, in (18c), of *gli* under the s_{DF} node. In fact, even though its sponsor already appears as embedded in XNP, *gli* (contrary to what happens in the sub-tree rooted, in (18c), at w_{AF}) must be inserted under s_{DF}

in order to express its preferential value with respect to the XNP node.

iii. *Preferential patterns lifespan and focus tracking.* In structure (18c), the preferential pattern $[[w \text{ XNP}][s \text{ Carlo}]]$ dominated by s_{DF} —i.e., the pattern derived from a RR applied in order to obtain the correct interpretation of *gli* (see (18b))— is returned to its initial default status. The reason for the circumscribed lifespan of preferential patterns like $[[w \text{ XNP}][s \text{ Carlo}]]$, contrarily to constraints related to pegs' lifespan (Karttunen 1976; Roberts 1989), is to be found in the anaphoric capabilities offered by complex NPs. In fact, after the interpretation of a pronoun which co-specifies with a peg embedded in a XNP, this XNP is potentially able to offer other sponsorship possibilities to a subsequent pronoun.

Notice that what is managed here by means of short-term, circumscribed lifespan of preferential patterns can result in two possible problems related to focus tracking, which in a sense are two sides of the same coin. On the one hand, in fact, the circumscribed lifespan of the s/w patterns, adopted for the interpretation of a pronoun which co-specifies with an entity embedded in a XNP, inhibits the overall consideration of this entity as an already focused peg. On the other hand, although the embedded peg, already focused, can assume the current focus status with respect to a subsequent stretch of discourse, usually it is its XNP node which, after its completion, attains a focused status. This, at least, is what appears by my AESS-based corpus. For the sake of space, in the present paper, these issues—which seem to ask for a possible 'focus percolation' within a XNP structure— will be ignored.

iv. *'Lui' in (19b).* The assumed status of *lui* 'he' in the (19b) structure is that of an A-type element, while the terminal node of the $\neg A$ branch of the same structure is assumed to be a NIL element. However, at the processing stage $U_{in1} \dots U_{in5}$, no principled assumptions can be made about $[U_{in5} \text{ Lui}]$ and the subsequent and still unknown event structure in which the resulting peg appears as a participant. Of course, in trying to hypothesize the optimal sponsor of *lui* at the processing stage $U_{in1} \dots U_{in5}$, one may resort to various strategies. In order to exemplify one of these possible strategies, let's assume, for instance, a 'minimize processing effort' approach. Given such an approach, one may hypothesize that the R^P structure related to $[U_{in5} \text{ Lui}]$ in example A is (21a), i.e., a R^P structure in which all the available nodes (that is, w_A and $s_{\neg A}$, since *lui* 'he' is unable to recruit a situational sponsorship domain) are fitted with the content of U_{in5} .



Given such a R^P structure, its association with the tree shown in (19a) —repeated here as (21b)— gives two possible (*sponsor.pronoun*) pairs: a) (XNP.*lui*), i.e., a ratifiable pair, and b) (*moto.lui*), i.e., an unratifiable one because it does not satisfy agreement constraints. Therefore, on a 'minimize processing effort' basis, at the processing stage $U_{in1} \dots U_{in5}$ one can assume that an association which leads to a ratifiable (*sponsor.pronoun*) pair is simply cheaper than an association leading to an unratifiable pair, i.e., that the least inference demanding R^P structure to adopt in order to assign an optimal status to $[U_{in5} \text{ Lui}]$ at the processing stage $U_{in1} \dots U_{in5}$ is that shown in (19b). The RR application triggered by the null/overt pronoun alternation in Italian then can lead to the (*Carlo.lui*) pair (see (19c)).

In any case, it is clear that whatever approach one may take in order to assign a tentative structure to the R^P related to $[U_{in5} \text{ Lui}]$ at the processing stage $U_{in1} \dots U_{in5}$, such an approach can only lead to a defeasible result. In fact, in example A the content of the input unit $[U_{in5} \text{ Lui}]$ can be, at $U_{in1} \dots U_{in5}$, the first element of an utterance which displays a textual 'asymmetry' (Schlenker 2005a:410ff.) with respect to the preceding context, or the first element of a non-active diathesis construction, or again the first element of an utterance which implies, with respect to the preceding context, the presence of a particular 'discourse relation' (cf. (12)), which may be relevant for the proper interpretation of the pronoun under examination.

In this regard, consider (22).

- (22) [Il fratello di Carlo]_j gli chiese la moto._k.
 [The brother of C_i]_j CL-DAT_i ask-SPST-3 the motorbike-F_k.
 Lui_j, infatti, non l_k'aveva.
 He_j, in fact, not CL-ACC-F_k have-IMP-3.
 'Carlo's brother asked him for the motorbike. He, in fact, did not have one'.

In (22), *lui* 'he' is the first element of an utterance which involves a textual 'asymmetry' (in the sense of Schlenker 2005a; see also Labov & Waletzky 1967 and Kehler 2002, among many others) with respect to the preceding context, i.e.,

- a) an asymmetry which can be detected, inter alia, on the basis of the aspect switch —resulting in a perspective shift— between the perfective form *chiese* and the imperfective one *aveva*;
- b) an asymmetry which, contrary to what happens for example A (at least assuming 'neutral' prosodics), permits the full

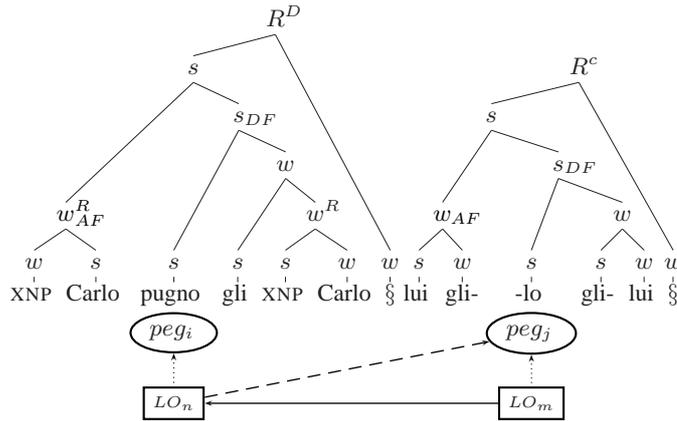


Figure 4: Example (23); preferential trees, LOs and pegs for one of the various interpreted anaphors

acceptable use of the overt pronoun *lui* ‘he’ co-specifying with *il fratello di Carlo* ‘the brother of C.’ (cf. also (17)).

[U_{in6} glielo ha ridato.]
CL-DAT CL-ACC-M give-CPST-3 back

‘Carlo’s brother gave him a punch. He gave him one back.’

Needless to say, such an asymmetry can not be assumed, just on the basis of the U_{in} constituted in (22) by *lui*, neither by incremental approaches nor by human beings.

This second example is substantially a replication of example A. The difference lies in the relation that connects *pugno* ‘punch’ and the clitic *-lo*. Evidently, in (23) we can only be speaking of two different punches, as happens for the pegs involved in some kind of one-anaphors or in so-called ‘paycheck sentences’ (Karttunen 1976; Conte 1988). The clitic *-lo*—insofar as it is sponsored by *pugno*, in its turn identified correctly by the process of association—therefore possesses its own peg (cf. Figure 4).

v. ‘Actors’. Sidner (1979, 1981, 1983) characterizes her ‘actors’ as animate entities. Despite that animacy has proven to be a critical factor in anaphora interpretation, this characterization seems too dependent from Sidner’s underlying practical purpose (see also Bullwinkle 1977a, 1977b), i.e., the implementation of a ‘Personal Assistant’ computer system designed to understand requests for arranging events such as meetings, a kind of activity where animate entities naturally assume a paramount role. Moreover, such an animacy-based definition may cause significant problems with regard to the treatment of what, in the literature on thematic roles and event structure, is sometimes called a ‘causer’ or a ‘doer’ (see, for example, Cuervo 2003). In the remainder of the paper, therefore, I shall use the term ‘actor’ in a broader sense than Sidner. More specifically, my use of this term will be in many senses conceptually similar to the definition of agent given in Arad (1996:221): “An ‘Agent’, in my model, is just a convenient label for the argument which is at spec, AspOR (an originator of an event)”. As for the possible cohabitation in the *AF* sub-trees of both animate and inanimate entities—which in its turn may result in various problems related to anaphoric associations—nothing will be said in this paper, apart from that, given the same embedding level, in a *s/w* sub-tree rooted at *AF* the entire subset of animate entities will be considered preferred (i.e., rooted at a *s* node) with respect to the entire subset of inanimate entities. In the remainder of the paper, moreover, the cohabitation of animate and inanimate entities under an *AF* node—because of its redundancy as for the specific examples proposed—in the *s/w* trees will not even be shown.

Notice that the interrelationships given in Figure 4 between preferential trees on one hand, and LOs and pegs on the other, hold also for other types of partial, linguistically sponsored anaphora like ‘Nancy hates *racoons* because *they* ate her corn last year’, ‘My neighbor has a *monster Harley 1200*; *they* are really huge but gas-efficient bikes’, etc. (cf. Figure 1). For the algorithms related to peg-to-peg linking, peg-to-peg operations like *kind-of*, *specimen-of-kind*, etc. see LuperFoy (1991:105ff.).¹⁸

4.4.4 Example C

(24) [U_{in1} L’invasione] [U_{in2} della Russia] [U_{in3} da parte
The invasion of-the Russia-F on part
della Francia] [U_{in4} la mise] [U_{in5} in
of-the France-F CL-ACC-F put-SPST-3 in
ginocchio.]
knee.

‘The invasion of Russia by France had her on her knees.’

i. U_{in1} includes, given the meaning with which I interpret the

¹⁸Notice that, during the interpretation of the so-called ‘strained anaphors’ like ‘John became a guitarist because he thought that it was a beautiful instrument’ (cf. Hirst 1981), the focus of attention is overridden by factors mostly determined by knowledge and inferring; conversely, the interpretation of the so-called ‘bridging’, ‘indirect’ or ‘associative anaphors’ (i.e., discourse sponsored, partial anaphors; see Figure 1) may heavily rely on focus (see, among others, Caselli & Prodanof 2005).

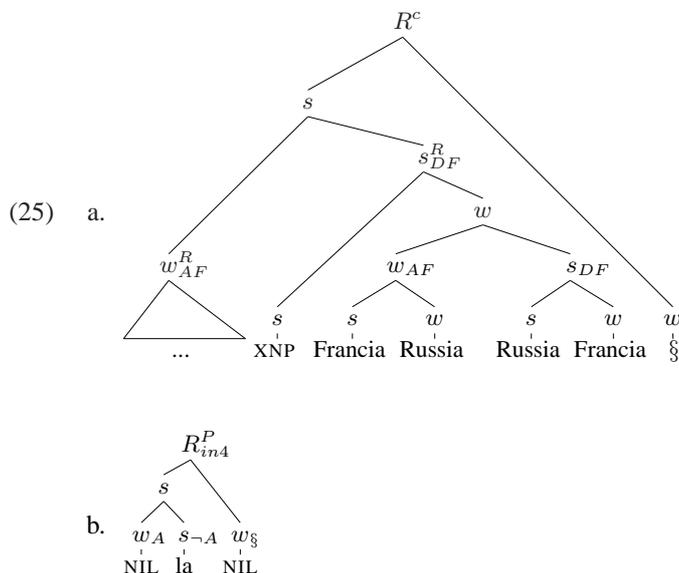
4.4.3 Example B

(23) [U_{in1} Il fratello] [U_{in2} di Carlo] [U_{in3} gli ha dato]
The brother of Carlo CL-DAT give-CPST-3
[U_{in4} un pugno.] [U_{in5} Lui]
a punch-M. He

notion of actor (see §4.4.2), a member of AF series. Its processing therefore brings about the construction of a tree analogous to the one in (16a).

ii. $U_{in1} + U_{in2}$ permits the identification of a processing unit. The complex NP *l'invasione della Russia* 'the invasion of Russia' can therefore be represented by a tree analogous to the one in (16b). The only difference lies in the presence of a § terminal element, expressing the situational component of the propositional complex NP $U_{in1} + U_{in2}$ (see, among others, Zucchi 1993). In fact, already at this point, a pronoun in a subsequent parenthetical may recruit an appropriate sponsorship situational domain.

iii. U_{in3} marks the insertion into the tree of an ulterior element of XNP, i.e., an element identifiable as an external argument with agent role. The representation is therefore (25a), where the node w_{AF}^R has the same configuration as the sister node w_{DF}^R , and where the R s indicate that the material dominated by w_{AF}^R and s_{DF}^R is a processing unit.



iv. R_{in4}^P is (25b), and its association with (25a) first causes the selection of XNP (which can not be licensed by the ratification procedure) and, after the application of a RR to the relevant nodes, the selection of *Russia*, i.e., the new DTE of the node s_{DF}^R .¹⁹

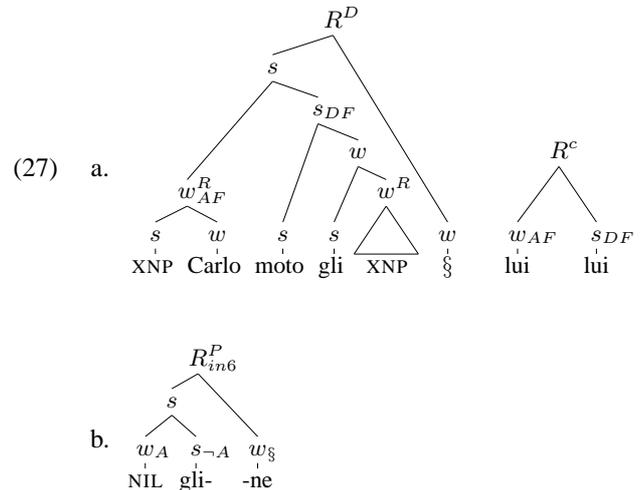
4.4.5 Example D

(26) [U_{in1} Il fratello] [U_{in2} di Carlo] [U_{in3} gli
 The brother of Carlo CL-DAT
 ha prestato] [U_{in4} la moto.] [U_{in5} Lui]
 lend-CPST-3 the motorbike-F He

¹⁹Needless to say, §4.4.4 expresses an extremely partial view of the problems connected to nominalizations. In nominalizations, in fact, a role is played by factors such as the presence of the aspectual 'nuances' mentioned in the literature at least starting from Bally (1932), the possible co-presence of a possessor and an agent, or the presence of adjectives capable of functioning as sponsors (e.g., 'The French invasion of Russia made them masters of eastern Europe for a few months'; cf. Grimshaw 1990: §3.5.2; §4.2). The processing of similar problems will not be dealt with here, nor will more general aspects such as the processes of deletion or movement that can be applied to a node in the course of derivations or the partial reshuffling of U 's preferential defaults.

[U_{in6} gliene è stato grato.]
 CL-DAT CL(='for-it'/'of-them'/etc.) be-CPST-3 grateful.
 'Carlo's brother lent him the motorbike. He was grateful to him for it.'

In (26)²⁰, by utilizing the same procedures illustrated in the preceding examples, the fragment $U_{in1} \dots U_{in5}$ produces the structures shown in (27a).



The R^P of U_{in6} is (27b), insofar as U_{in6} supplies a neighborhood sufficient to take the clitic *-ne* as a dependent expression evoking a situational sponsorship domain. The outcome of the association of R_{in6}^P with R^D is (§.-*ne*) and (*moto.gli-*). This last association can not be approved by the ratification procedure. The application of a RR to the relevant nodes causes another unratifiable association, i.e., (*gli.gli-*). A further RR application results in a ratifiable association, i.e., the pair (XNP.*gli-*).

5 Extensions

An approach to anaphora interpretation based on trees and associations limited to the one outlined in the previous sections has of course few chances to arrive at, *iuxta sua propria principia*, the correct (*sponsor.pronoun*) pair. It is therefore necessary to enrich the model. In this section I present two ways of fulfilling this task.

5.1 Preferential grids

The s/w trees I use for anaphoric associations interpret default preferences. In some cases, however, these can be overridden by factors untouched by those advocated in incremental s/w tree construction. This is the case of the stress contour of the utterances and several other factors normally assumed as relevant in the so-called cumulative approaches to anaphora resolution.

This difference between default preferences and other factors repeats, in a sense, the difference that, within phonology, gives place to the simultaneous presence of trees and grids (cf. fn. 10). Therefore, when taking into account factors that modify default

²⁰For the characteristics of the Italian *ne* see, among others, Calabrese & Cordin (1988:562ff.), Cordin (1988) and Di Eugenio (1989).

sponsorship preferences, it appears viable to introduce ‘preferential grids’ also aimed at pronominal anaphora interpretation. Such grids, as well as the metrical ones, represent the locus where default preferences (expressed by the trees) and preferences ruled by other factors are merged.

From a general point of view, the construction of a preferential grid is the same as a metrical grid. For each leaf of a *s/w* tree, a first level of elements is set in the grid, and the nodes labeled *s* that dominate the leaves determine the height of the columns. These therefore produce a hierarchical representation of the preference linked to the selection of a sponsor.

As for the use of preferential grids in pronominal anaphora interpretation, consider for instance Sidner’s ‘Potential Actor Ambiguity Condition’.²¹ In the spirit of the shallow processing approach advocated among others by Carter (1987), in such cases the creation of a possible underspecified representation can be postponed until the completion of the analysis of the stress and intonation characteristics of the unit where the competing sponsors appear.

Cantrall (1969), for instance, marked how the disambiguation of utterances in a sense similar to those for which Sidner’s theory invokes the Actor Ambiguity Condition can in some cases be appointed to the observation of the pitch concord between candidate and pronoun. Therefore, dividing arbitrarily the tonal space into eight levels (where 1 is the lowest and 8 the highest), Cantrall states that in (28) *his_i* co-specifies with *John*, *his_j* with *Bill* and *his_k* with *Harry*.

(28) 4 2 6 6 4 2
 John_i told Bill_j that Harry_k had broken his_k/his_i/his_j bike.

The analysis in terms of preference of an utterance like (28) could add to the grid levels, inherited from a *s/w* tree, additional values generated according to the pitch concord for *John*, *Bill* or *Harry*. This example, chosen exclusively for its absolute simplicity and its reasonable likelihood (at least assuming Cantrall’s data), clearly shows that many factors can act as grid modifiers. If the default preferences (given by the trees) and the additional preferences that can be reflected on the grid are kept distinct, this separation of information can contribute to a better understanding of the interrelation of other factors with the basic salience of the pegs.

5.2 Layers

The distinction made in §4 between input units (*U_{in}*) and processing units (*U*) offers, in general terms, some considerable advantages.

In the first place, by equating *U*s with CFCs, we can channel into a single domain the application of syntactic constraints and pragmatic preferences regarding the selection of the sponsors. In the second place, the equivalence between *U* and CFC permits to tackle, in a principled way, the processing of phenomena overlooked by the literature on discourse anaphora interpretation. Moreover, the chunks-based definition of input units makes it possible:

- a) to process input incrementally, on the basis of a cognitively plausible unit;
- b) to isolate a domain —i.e., *R^P*— in which several pronouns can be evaluated simultaneously and interconnectedly, a fact that supports the identification of their sponsors;
- c) to supply a natural explanation for the garden path phenomena observed by various authors within the non-incremental framework of Centering Theory.

The distinction between *U* and *U_{in}*, nonetheless, has its downside. In the first place there is a substantial increase in the possible interpretations of a pronoun owing to incremental processing of input (see on this topic Hahn & Strube 1996). In the second place there is a considerable multiplication of *R*s —be they comprised in *R^c*-type or in *R^D*-type structures— subject to association with *R^P*s. Therefore we find ourselves at odds, in the presence of a very high number of possibilities, with a default preference formulation problem analogous to the one that, restricted to compound or complex sentences, characterizes Focus Theory (Carter 1987; Suri 1992; Cormack 1992; Azzam 1995; Suri et al. 1999) and Centering Theory (Kameyama 1998; Strube 1996; Miltakaki 2003; Poesio et al. 2004; Joshi et al. 2006).

Now, I do not propose to tackle this last problem here, no matter how central and binding it may be for the purposes of discourse fragments that are less elementary than those presented in §4.4. This is partly because the treatment of this problem would require more space than this article permits, and partly because the hypotheses I use with a view to setting up a default ordering regarding the visit of the *R*s present in both *R^c* and in *R^D* structures —albeit with various modifications— appear substantially similar to those already given in Kameyama (1998) and partially adopted by Di Eugenio (1998), Strube & Hahn (1999) and various other scholars.

However, there is a fundamental difference between my way of processing the various *R*s subject to association and the choices made by Kameyama within Centering Theory. This difference concerns the processing of quoted speech, i.e., one of the least investigated aspects of anaphora interpretation and, at the same time, one of the aspects most dependent on ‘global’ focus factors such as the factoring of discourse into segments, the consideration of the locutive paths existing between the participants involved in the discourse, or again the aspects normally identified by labels such as ‘subjective language’, ‘sentience domain’ (Speas & Tenny 2003), textual ‘asymmetries’ (Schlenker 2005a:410ff.) or ‘point of view’.

With a view to making a brief presentation of Kameyama’s position regarding quoted speech, let us consider (29), a fragment extrapolated from a real example supplied in Kameyama (1998).

- (29) a. Hughes said Monday, “It is the apparent intention of the Republican Party [...]”
 b. Sunday he had added, “We can love Eisenhower [...]”

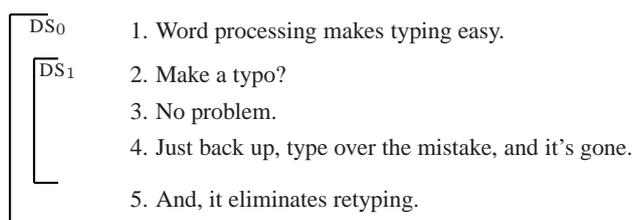
Commenting on this example, Kameyama assumes the anaphoric non-accessibility of the parts within quoted speech in comparison with the parts that she considers superordinate to these, that is the

²¹ “Whenever a pronoun may co-specify the actor focus and a single potential actor exists, expect a possible ambiguity” (Sidner 1979:155); for a full account see Sidner 1979, pp. 153-155.

parts that are the total property of the owner of the whole discourse.²² The quoted speech, in other terms, in Kameyama’s view would constitute what Grosz & Sidner (1986) (hereafter G&S) identify with the term ‘Discourse Segment’ (DS).²³ Given this discourse stack based interpretation to the processing of quoted speech—independently proposed moreover by Cornish (2002) and Miltsakaki (2003) (see also Arnold 1998:74ff.)—the pronoun *he* in (29b) could be resolved in a very simple and natural way. The quoted speech in (29a) would in fact be ‘popped’ from

²² I use here the term ‘owner’ to identify the individual who, in a sense, is intended to assume the responsibility for the utterances contained in a discourse. So, if John tells a personal narrative in which at some point appears Mark, who in his turn realizes a speech quoted in John’s narrative, Mark is the ‘owner’ of his own speech, and John is the ‘owner’ of the whole narrative, comprising Mark’s speech. Needless to say, I use here the term ‘owner’ simply to avoid the complexities of a proper treatment of quoted speech (see, among many others, Wierzbicka 1974).

²³ G&S claim that discourse structure is composed of three separate but interacting components: the linguistic structure, the intentional structure, and the attentional state. The linguistic structure is the structure of the sequence of utterances which make up the discourse. It is on this level that the discourse is divided into DSs (one or more utterances which “in a discourse are naturally aggregated”, p. 177). Evidence for a DS boundary, either at the start or the end of the DS, include linguistic expressions such as cue phrases, changes in aspect, tense and/or mood, particular forms of dependent expressions, prosody and other clues. In G&S’s theory, each DS is associated with a ‘Discourse Segment Purpose’ (DSP). The relationships between these DSPs make up the intentional level. There are two relationships discussed in G&S, ‘dominates’ and ‘satisfaction-precedes’; DSP_{*i*} dominates DSP_{*j*} (or, conversely, DSP_{*j*} ‘contributes to’ DSP_{*i*}) when satisfaction of DSP_{*j*} provides partial satisfaction of DSP_{*i*}; DSP_{*i*} satisfaction-precedes DSP_{*j*} if DSP_{*i*} must be satisfied before DSP_{*j*}. One DS can immediately precede another in a discourse without them being in a satisfaction-precedes relation; conversely, a satisfaction-precedes relation does not require one DS to immediately follow another. Attentional state, an abstraction of the participants’ ‘global’ focus of attention, is explicitly defined by G&S as “parasitic upon the intentional structure” (p. 180). It is modeled as a set of focus spaces containing all the pegs evoked within a DS. The collection of focus spaces is managed as a first-in last-out list, i.e. a stack (see here fn. 5). For each DS, a corresponding focus space is pushed onto the ‘global’ focus stack with all the pegs which are made available for co-specification in that segment. The dominance relations in the intentional structure determine which operations are performed on the stack when a DS is processed. If DSP_{*j*} is dominated by a DSP_{*i*}, the corresponding focus space *j* can be pushed on top of focus space *i* if *i* is on top of the stack when *j* is pushed. The stack of focus spaces is ‘popped’ prior to insertion when DSP_{*j*} contributes to DSP_{*i*}, where focus space *i* is higher in the dominance hierarchy. Here is an example, discussed in detail in Hirschberg & Pierrehumbert (1986) and Avesani & Vayra (1992), in which G&S’s model is utilized in order to verify the availability—in the ‘global’ focus of attention—of the potential sponsors of a dependent expression.



The boundaries of DS₁ are identified on the basis of prosodic cues such as pitch range and pause. During processing, the focus space corresponding to DS₀ is pushed onto the stack, followed—at the time that line 2 is processed—by the focus space corresponding to DS₁, which is con-

tinuously filled while DS₁ is processed. After line 4, the focus space corresponding to DS₁ is ‘popped’, hence leaving on the stack only the focus space related to DS₀. As a consequence, the dependent expression *it* in line 5 can not co-specify with *mistake*, since the focus space associated to DS₁ has already been ‘popped’ from the stack, and so all the pegs contained in DS₁ are considered unavailable for sponsorship. Therefore, in line 5, *it* has to find its sponsor in the domain of the focus space still on the stack—i.e., the LO *word processing* in DS₀ (line 1). A basic G&S analysis of a discourse is fully adjacent (no crossing), comprehensive, unique and recursive. Therefore it forms a tree. Webber (1991), in fact, points out that what G&S call attentional state is modeled equivalently as a stack or by constraining the current discourse segment to attach on the right-most frontier of a tree-shaped discourse representation, since

a) attaching a leaf node corresponds to pushing a new element on the stack, and b) adjoining a node *n_i* to a node *n_j* corresponds to popping all the stack elements through the one corresponding to *n_j*, and pushing *n_i* on the stack. Accordingly, the so-called ‘right frontier constraint’ related to tree discourse representations (see, among many others, Di Eugenio 1989, Asher 1993, Polanyi et al. 2003, Polanyi et al. 2004) might be thought as a different way to provide what G&S realize with focus spaces and the stack, that is: a) an attachment constraint in the incremental development of the tree structure (see also the structure-building principles proposed by Phillips 1996, 2003); b) a sponsorship constraint defining the regions of the discourse taken to be in the ‘global’ focus of attention. The fact that reference is made in the article to two types of stacks, one regarding pegs (Sidner) and another regarding focus spaces, i.e., the pegs pertaining to the set of utterances comprised in a DS (G&S), could be the cause of confusion. For this reason the ‘global’ focus stack proposed by G&S, if necessary, shall be clearly identified as a ‘discourse stack’.

This theme will be partially dealt with in the following paragraphs. In §5.2.1 I shall supply a re-interpretation of G&S’s stack in terms of preferential trees; in §5.2.2 I shall analyze some problems connected with the use of the discourse stack in relation to what G&S call ‘true interruptions’, and in §5.2.3 I shall supply a principle useful for the processing of at least part of the pronominal forms connected with the use of quoted speech.

5.2.1 A transposition

Given a fragment made up of several DSs like (30a), a representation in terms of *s/w* trees that expresses the modeling of the attentional state effected by G&S in terms of focus spaces and of operations regarding a stack of focus spaces is shown in (30b).

tinuously filled while DS₁ is processed. After line 4, the focus space corresponding to DS₁ is ‘popped’, hence leaving on the stack only the focus space related to DS₀. As a consequence, the dependent expression *it* in line 5 can not co-specify with *mistake*, since the focus space associated to DS₁ has already been ‘popped’ from the stack, and so all the pegs contained in DS₁ are considered unavailable for sponsorship. Therefore, in line 5, *it* has to find its sponsor in the domain of the focus space still on the stack—i.e., the LO *word processing* in DS₀ (line 1). A basic G&S analysis of a discourse is fully adjacent (no crossing), comprehensive, unique and recursive. Therefore it forms a tree. Webber (1991), in fact, points out that what G&S call attentional state is modeled equivalently as a stack or by constraining the current discourse segment to attach on the right-most frontier of a tree-shaped discourse representation, since

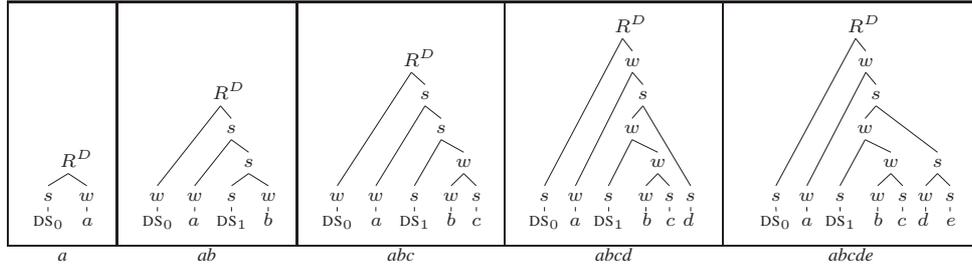
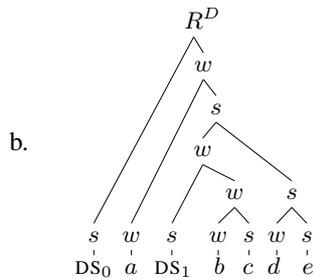
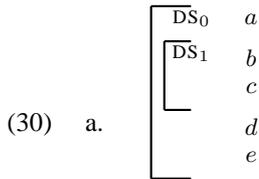


Figure 5: Tree derivation



With regard to (30b), here are some remarks regarding the nature and construction of the tree.

i. *U_I and terminal elements.* In (30b) the terminal nodes *a*, *b*, *c*, *d* and *e* are constituted by *U_I*s. Depending upon their linear assembly and the relations of subordination expressed, these units can exhibit preferential structures of arbitrary complexity (e.g., [_{*x*}[_{*s*} The ex-convict tied him][_{*w*} because he wasn't cooperating]]; cf. Suri & McCoy 1994).

ii. *DSs and terminal elements.* In (30b) the elements *DS₀* and *DS₁*—like the XNP and the situational elements already illustrated—are no more than simple pointers to the root of the tree that immediately dominates their *s* or *w* nodes. In a tree such as (30b), the embedding relations relative to the DSs are therefore expressed in terms of dominance of the nodes; e.g., in (30b) *DS₀* dominates *DS₁*.

At least adopting an orthodox replica of G&S's machinery, the content of the elements labeled DS—i.e., elements which also have a functional value for the purposes of the construction of trees and the operations of association—is substantially the 'Discourse Segment Purpose' (DSP; see here fn. 23) that for G&S must be a part of the corresponding focus space. Strictly speaking, such elements should therefore be labeled *DS_i/DSP_i*.

iii. *Insertion into the tree.* For trees like (30b), the insertion of the various *U_I*s into the tree requires the insertion of at least two nodes: a) a node which acts, in the tree rooted at *R^D*, as a combining site; b) the effective input structure. In this regard note how the input structure can be constituted:

- a) by a single insertion unit *U_I* if this *U_I* is dominated by a DS already present in the tree;
- b) by a pair of elements [_{*x*}[_{*s*} *DS_i*][_{*w*} *U_I*]] if *DS_i* is not already present in the tree.

For the hypothetical sequence *a...e* in (30a), the steps that lead to the construction of (30b) are therefore those shown in Figure 5, where the derivation follows the 'left-to-right', 'Merge Right' principles utilized by the structure-building procedure proposed by Phillips (1996, 2003).

iv. *Attribution of s/w.* In trees like (30b), the *s/w* values are assigned to the various nodes in such a way that the DTE of a tree is constantly represented by the last element inserted. Exceptions to this are the DS elements, which are labeled *s* on account of their own functional value and of the mechanisms that govern the association of *R^P*-type structures. However, when a *DS_i* is still open, a RR [_{*sw*}] ⇒ [_{*ws*}] applied to the preferential nodes of the DSs elements dominating *DS_i* establishes *DS_i* as the insertion domain for *U_I*s.

v. *Loci of association.* Within the terminal elements of a tree like (30b), the mechanism of association assumes, as the preferred element, the element that expresses the DTE of the tree. If the DTE is constituted by an element labeled *DS_i* (that is, an element that, on account of its own functional status, is by definition inaccessible to an association (but see fn. 24)), the possible application of a RR to the preference node related to *DS_i* and its sister node ensures that the role of DTE is taken on by the *U_I* that expresses the maximum prominence among those dominated by *DS_i*. If this *U_I* does not offer ratifiable sponsors for the current *R^P*-type structure, starting from this *U_I* further RRs can be applied. For example, given a *R^P*-type structure in search of a sponsor, the first thing the tree (30b) does is to offer as a locus of association the element *DS₀*, i.e., the DTE of the tree. Given the particular status of this element, the application of a RR [_{*R^D*} [_{*sw*}]] ⇒ [_{*R^D*} [_{*ws*}]] ensures that the DTE of the tree becomes *e*, therefore promoting this latter to the locus of maximum preference for association. Should *e* not offer one or more ratifiable sponsors for the *R^P*-type structure, the application of further RRs would guarantee, in a principled way, the explorability of the entire tree.

vi. *Association and accessibility.* According to the model proposed by G&S, the entities comprised in a definitively closed DS (e.g., *DS₁* in (30a), at the time that *d* is processed) are entities no longer available as sponsors to incoming dependent expressions. At least assuming an orthodox replica of G&S's model, for (30b)

the entire sub-tree that has as its DTE the element DS_1 ought as a consequence to be excluded from any processes of association. In terms of s/w trees, this constraint can be achieved by coupling the RRs to a simple restriction. This restriction can be stated as follows:

Avoid attributing the DTE to an element DS_i if its corresponding s or w node is immediately dominated by a node which is not on the ‘right frontier’ of the tree, i.e., the path from the root of the tree to its right-most node.

For (30b), therefore, the selections of a locus of association governed by the application of possible RRs are e , d , and a . Again, given the tree that interprets in Figure 5 the articulation of the fragment abc , the selections are constituted by c , b , and (should neither c nor b offer ratifiable sponsors for a hypothetical R^P -type structure) by the material dominated by the DS that dominates DS_1 , that is a .²⁴

5.2.2 G&S’s theory, interruptions, attentional state and discourse layers

In G&S’s theory, the basic structuring operation is ‘embed’. However, in order to treat discourse phenomena that can not be handled by this operation, G&S resort to the concept of ‘interruption’ (p. 192ff.). An example of what G&S call ‘true interruption’—characterized on the basis of one of the two meanings of interruption defined in the theory, that is the ‘strong’ meaning²⁵—is given in (31).

- (31) D1: John came by and left the groceries
 D2: *Stop that you kids*
 D1: and I put them away after he left

²⁴ Space unfortunately prevents a discussion of situational anaphors. In any case it should be noted that the difficulties which sometimes may be encountered in the delimitation of their recruitment domains are not to be underestimated. In fact, the recruiting of the sponsorship domain of a situational anaphora may result in a not so clear task. Consider, for instance, the following example (from Di Eugenio 1989):

[$C_{1.1}$ We left the city] [$C_{1.2}$ I was born in] [$C_{1.3}$ when I was 15.]
 [C_2 This was a deep shock for me.]

Advocating the possibility of a partial recruiting of the elements available in the so-called Right Frontier of a Webber-based discourse tree representation (see here fn. 23), Di Eugenio writes:

It is clear that *this* in C_2 refers to “leaving the city I was born in”: it seems to me that the temporal clause $C_{1.3}$ “when I was 15” is not included in the reference. (p. 132)

For similar situations related to the proper identification of a situational sponsorship domain (to some extent related to G&S’s DSPs, and strongly connected to the discourse stack that in G&S models the ‘global’ attentional state) see inter alia Fraurud (1992) and Maes (1996), where pronominal anaphora is discussed. For ‘encapsulating’, full definite NP anaphors—which, though sometimes hypothesized as strongly connected to the notion of focus (e.g., Hitzeman & Poesio 1998) seem to override whatever focus-related phenomenon on the basis of lexical selections and general knowledge—see, among others, D’Addio (1988), Conte (1996) and Consten & Knees (2005).

²⁵“An interruption is a discourse segment whose DSP is not dominated nor satisfaction-preceded by the DSP of any preceding segment”; p. 192.

In (31), D2 is analyzed by G&S as a ‘true interruption’ that breaks the flow of D1. As a consequence, “*them* in *and I put them away* can not refer to the children [...] but only to the groceries” (p. 194).

As for the processing of true interruptions for the purposes of defining the attentional structure, G&S model these occurrences using a stack in this case as well. Even according to G&S, however, for true interruptions the use of such a data structure is far from adequate. Here is what they write about this highly relevant problem pertaining to their stack-based model of the ‘global’ focus of attention:

The focusing structure for true interruptions is different from that for the normal embedding of segments, *because the focusing boundary between the interrupted discourse and the interruption is impenetrable.* (p. 193; my emphasis)

This boundary is clearly atypical of stacks. It suggests that ultimately the stack model is not quite what is needed. What structure should replace the stack remains unclear to us. (p. 204; fn. 12)

Now, discontinuous phenomena—structurally very similar to the discourse phenomena that G&S define as true interruptions—also occur in morphology, phonology and syntax, and on the basis of the classic non-linear approach to some linguistic structures they are often processed with the help of multi-dimensional representations.

In morphology, for example, a discontinuous phenomenon that in many respects resembles to G&S’s ‘interruptions’ is found in Semitic languages. Here—broadly speaking—the roots are expressed by consonants (e.g., the Arabic *k-t-b*, roughly ‘to write’) and the various words are formed by varying the vowels (e.g., *kataba* ‘he wrote’; *kutiba* ‘it was written’; *ka:tib* ‘writer’; *kitab* ‘book’; etc.). In the model developed by McCarthy (1981), in similar cases morphological articulation is analyzed by utilizing different planes of representation, each of which is equipped with its own principles and Well Formedness Conditions, as well as being bound one to the other by the same ‘skeleton’.²⁶ Again, phonological theories such as Autosegmental Phonology (Goldsmith 1976, 1990) base descriptions, constraints and rules on the presumed existence of different levels or planes, bound one to the other by a skeleton. Finally, as for syntax, this type of multi-dimensional framework is utilized in various domains. Yip et al. (1987), for example, resort to it in order to analyze case assignment. Bobaljik (1999), on the basis of solid arguments, suggests that Cinque’s (1999) analysis must be recast in terms of a multi-dimensional framework. And several authors treat at least part of the so-called ‘disjoint constituents’ as completely autonomous constituents, expressed in multi-dimensional syntactic structures and interpretable exclusively in terms of principles concerning the articulation of the discourse. Espinal (1991), for example,

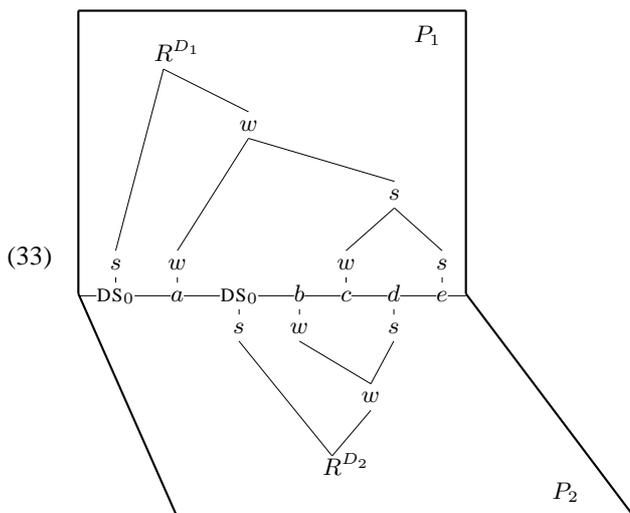
²⁶In a standard multi-dimensional representation, different characteristics can be represented on different planes that all converge on a common base; this base is what is called the ‘skeleton’. In other terms, each of the various planes can be imagined as being situated on the page of a book, where the skeleton is the spine and where each page is the basis of a representation.

supplies similar interpretations for discourse adverbials, vocatives, appositive relatives, etc.

Returning now to what G&S call true interruptions, a first hypothesis regarding their representation in terms of preferential trees could simply assume the multi-dimensional point of view that informs the morphological, phonological and syntactic representations I have just mentioned. Therefore, for an example like (31), we could assume the existence of a plane P_1 relative to D_1 , and of a plane P_2 relative to D_2 , and that P_1 and P_2 are connected exclusively on the basis of the skeleton, i.e., that the terminal elements of the two trees rooted at R^{D_1} and R^{D_2} are correlated exclusively in terms of precedence in their linear distribution. However, consider (32), where we find complex anaphoric relations that by virtue of the discontinuity of the sequence $a \dots e$ can not be interpreted on the basis of the ‘typical’ or ‘atypical’ discourse stack model proposed by G&S.

- (32) [The example is an idealization of a fragment of a street sales talk —concerning a strange gadget for cleaning— effectively included in a text of my AESS-based corpus (cf. fn. 17). *Context*: S = the seller; A = the audience; W = a member of the audience; XYZ = a widely known tool for cleaning.]
- (D_1) [S to A:] “blah blah_i”
 - (D_2) [S to W:] “Madam, do you have a XYZ_j at home? It_j’s good ... good stuff, hmm?”
 - (D_1) [S to A:] “blah blah_i”
 - (D_2) [S to W:] “Get it_j, madam. And shoo! Yes! Shoo! This [= the gadget for cleaning offered to the audience by the seller] is better! Wow!”
 - (D_1) [S to A:] “blah blah_i”

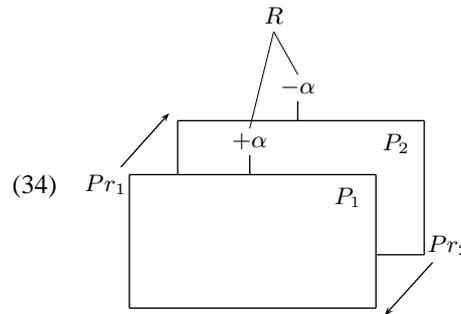
For (32), we could equally assume a representation in terms of preferential trees arranged on several planes like the one shown in (33), where for the sake of simplicity the utterances (32b) and (32d) are represented as single nodes in the tree rooted at R^{D_2} .



Conventional, static multi-dimensional representations like (33), however, avoid assigning degrees of preference to possible n ²⁴

planes involved in the discourse. In other words, they do not express the fact that in correspondence with (32d) —as a consequence of various reasons: prosodic, related to the locutive path expressed by the vocative or recoverable from perceptual clues, etc.— a switch occurs regarding the selection of the plane preferred (i.e., ‘foregrounded’) for the interpretation of the pronoun it_j present in the utterance. Hence the decision to adopt, in place of standard representations like (33), representations like (34), where

- the planes are arranged like layers in a drawing;
- the labels $\pm\alpha$ represent s or w according to the perspective (Pr) utilized to foreground P_1 or P_2 ; therefore, for a pronoun in P_1 we can assume P_1 as plane s for the purposes of selecting a sponsor, and P_2 as plane w ;
- the skeleton is constituted by the entire set of terminal elements of the trees present in P_1 and P_2 when P_1 and P_2 are superimposed one over the other, exactly like the layers in a drawing.



With regard to the proposal put forward by G&S to take account of their ‘true interruptions’, the solution shown in (34) appears far simpler and more natural. In fact, it does not make it necessary to resort to ‘atypical stacks’ with impenetrable frontiers (which in any case are not equipped to handle examples like (32)), but analyzes the interweaving of the DSS and the attentional states using layers that dynamically assume s/w values, while it expresses the effective development of the discourse by means of the skeleton.

5.2.3 Associations, quoted speech and a principle

Let’s go back to Kameyama’s hypothesis concerning the discourse status of quoted speech. In this regard consider (35), i.e., an example that illustrates the hypothetical situation outlined previously for (29).

- (35) [*Context*: Chief Superintendent Maigret and Judge Comélieu, speaking by telephone.]
- Maigret_i said to Comélieu: “I have captured the robber_j in Rue de Panama”.
 - Comélieu asked him_j: “Did you make him_j say where he has hidden the loot?”

This example illustrates a structure analogous to the one hypothesized by G&S for their ‘true interruptions’. Consequently, in following Kameyama’s line of reasoning suggesting that the

quoted speech must be treated as an inaccessible ‘discourse segment’, in order to explain how to *him_j* can co-specify with *robber* it would at least be necessary to postulate the employment of an ‘atypical stack’ with an impenetrable barrier. But such a move would be in any case inadequate to handle (35), and it seems far more natural to treat examples like (35) as the result of interacting, concurrent processes which display: a) their results on the basis of the skeleton, i.e., the effective sequence derived from the processes’ interaction; b) their different foregrounding degrees on the basis of the *s/w* values assumed by the layers on which the processes can be represented. On the basis of a representation like (34), for (35) it would therefore be possible to hypothesize:

- i. The presence of a layer for the locutive path that is introduced directly between the owner of the whole discourse and the recipient, that is a layer that acts as a support to ‘Maigret said to Comélieu’ and ‘Comélieu asked him’.
- ii. The presence of a layer —connected to the preceding one by the skeleton and by the tree that dynamically defines the *s/w* values of the layers— relative to the locutive path that is introduced between the two individuals who in (35) realize a speech.

As for the assignation to the layers of the *s/w* values — necessary in order to arrive at the correct (*sponsor, pronoun*) pair— this could be effected by making use of the following principle:

SAME LAYER PRINCIPLE (SLP). Should this be possible, identify the preferred layer for the selection of the sponsor as the same layer in which the pronoun appears.

This principle, which is substantially limited to highlight the centrality —for the purposes of pronominal anaphora interpretation— of the co-presence in the discourse of several locutive paths (Banfield 1973), and consequently of various points of situational anchoring (Fillmore 1975; Barwise & Perry 1983), defines the correct associations for (35), i.e., (*Maigret.him_i*) and (*robber.him_j*).

Despite its absolute simplicity, the SLP allows a reasonable way of tackling at least a subset of pronominal interpretation issues related to the presence of quoted speech in a discourse. Consider, for instance, example (36) (from Simenon 1992:72), where one of the layers does not always appears explicitly.

- (36) [*Context*: in Quai des Orfèvres, a journalist nicknamed ‘Vicomte’ (*V_i*) and Chief Superintendent Maigret (*M_j*).]
- a. [*V_i* to *M_j*:] “Non è stata ancora trovata la testa?” “*Hasn’t the head been found yet?*”
 - b. [*M_j* to *V_i*:] “No, che io sappia.” “*No, not as far as I know.*”
 - c. [*V_i* to *M_j*:] “Ho appena telefonato a Judel, che ha detto di no. Se sa qualcosa di nuovo, commissario, si ricordi di me.” “*I’ve just called Judel, who said no. If you hear anything new, Superintendent, remember me.*”

- d. $\emptyset_{i/*j}$ Andò a risedersi [...] (*He_{i/*j}*) went to retake his seat [...]

In order to be able to properly handle \emptyset in (36d), the first step ought to be constituted by the inferential reconstruction of the part explaining, in brackets, the locutive paths involved in the example.²⁷ In this way \emptyset could find its sponsor in the owner of the quoted speech in (36c) —i.e., the journalist nicknamed ‘Vicomte’— disregarding whatever potential sponsor evoked in the non-bracketed region. Moreover, in confirmation of the validity of the SLP, the removal of the utterance (36c), resulting in a discourse containing only (36a), (36b) and (36d), could only lead to the identification of Maigret as the sponsor of \emptyset .

But again, it is important to note that the SLP allows for the redefinition of some default preferences assumed for pronoun interpretation. In Italian, for instance (as already briefly mentioned in fn. 12), if a pronoun *a* can recruit one or more ξ -type nodes (acting in this way as a situational anaphora) and *b* can co-specify with a NP, then the preferred sponsor is the NP. This point is discussed by Di Eugenio (1989) on the basis of the following example (her ex. 15):

- (37) a. Marco è stato espulso da scuola.
Marco was expelled from school.
- b. i. \emptyset ha reso sua madre infelice.
He made his mother unhappy.
- ii. Questo ha reso sua madre infelice.
This made his mother unhappy.

Here follows the relevant part of Di Eugenio’s argumentation related to example (37):

In [(37)], \emptyset -anaphora is normally understood as referring to Marco, which is a centered entity, and not to the fact that “Marco was expelled from school”; to achieve this effect, we have to explicitly use *questo*, as in [(37b-ii)]. (Di Eugenio 1989:133-134)

Consider now the following example, from Simenon (1992:96).

- (38) [*Context*: in a bistrot, an employee (*E_i*) who works at the luggage check-room of the Gare de l’Est, Maigret, a young man (*Y_j*) and various other individuals. The young man is suspected of being the man who deposited a suitcase —containing important clues for Maigret’s current investigation— in the luggage check-room of the railway station. Maigret asks the employee for the young man’s identification.]
- a. [*E_i* to all:]: “Ecco... A vederlo_j così, direi [che è lui]_k.” “*Well... From what I can see of him_j, I’d say [it is he]_k.*”
 - b. [*Y_j* to all:]: “ $\emptyset_{*i/k}$ È falso” [...] “($\emptyset_{*i/k}$) is false” [...]

²⁷This reconstruction is possible thanks to the presence of the quotation marks, to the presence in the situation of only two individuals, and to the possibility of discovering —on the basis of the previous context— the identity of the one who gets the dialogue underway. For some notes related to participants’ tracking in quoted dialogues see Grazioli (1995).

In order to have a chance to fully interpret (38), the first step required, as happens in (36), is the reconstruction of the basic information regarding the speakers involved and their locutive paths. Given such a reconstruction, in (38b) the \emptyset -anaphora has as its possible co-specifiers:

- a) the owner of (38a), that is the employee; in this case the resulting interpretation can be paraphrased as ‘the employee E_i is a false man’;
- b) what the employee says in (all/a part of) his speech; in this case the resulting interpretation is, broadly speaking, ‘(all/a part of) what the employee E_i says in (38a) is false’.

Now, adopting the default preference advocated by Di Eugenio with regards to contexts with no quoted speeches, in (38b) the sponsor of the \emptyset -anaphora would be the owner of the quoted speech, that is the employee E_i . In fact, in order to instantiate a situational peg able to recruit its sponsorship domain starting from the quoted speech in (38a) (or better, from its bracketed indexed part), according to Di Eugenio *questo* must be used (i.e., ‘ \emptyset_i is false’ vs. ‘ this_k is false’). However, in (38) the sponsor suggested by Di Eugenio’s pattern of preference, despite its full availability, is the dispreferred one. In fact, an informal test submitted to a dozen native Italian speakers had shown that in (38), for all the people involved in the test, the sponsor of \emptyset must be found *inside* the quoted speech, and not elsewhere. And this is also my judgment about the correct interpretation, accounted for by the SLP, of this \emptyset -anaphora.

In any case, it should be stressed that, in general terms, the SLP application is not dependent from the quoted speech *per se*, but from the accessibility constraints exhibited by the available processes which set up the overall discourse, i.e., a fact which typically appears more evident in correspondence with the discourse asymmetries that may be caused by the insertion of quoted speech into the discourse.

In order to clarify this point, let’s return briefly to example (35), repeated here for convenience as (39).

- (39) [*Context*: Chief Superintendent Maigret and Judge Comélieu, speaking by telephone.]
- a. Maigret_i said to Comélieu: “I have captured the robber_j in Rue de Panama”.
 - b. Comélieu asked him_i: “Did you make him_j say where he has hidden the loot?”

(39) is an useful example to give, in a very economical way, a general view of the phenomena which the SLP aims to handle. However, (39) can not be considered a ‘simple’ example, because in (39b) the correct interpretation of the pronouns him_i and him_j relies on a kind of non-accessibility of the robber. In fact, if we look at the same constructed example assuming a different context —i.e., face-to-face dialogue, physical co-presence in the speaking situation, and the presence of the robber in the same place where Maigret and Comélieu are speaking— in a sense something similar to Sidner’s (1979:153–155) ‘Potential Actor Ambiguity Condition’ has to be invoked. The reason has to be found in Comélieu’s speech, which contains no vocatives helping

us to clarify the Comélieu-to-Maigret locutive path. As a consequence, if the three individuals evoked by the example share the same physical situation, the (*robber.him_j*) interpretation can be approved by the ratification procedure only on the basis of the co-occurring evaluation of the (*robber.him_i*) and (*Maigret.him_j*) alternatives.²⁸ In such cases, therefore, the interacting processes which set up the discourse are still distinct, and can be represented by means of layers (required, for example, to define the sponsorship recruitment domain of a hypothetical, subsequent situational anaphora). The searching order of the sponsors, however, can not be driven by the SLP. For instance, this order may be decided on the basis of some kind of mirroring principle, that is, a searching strategy which may give the same result provided by the SLP application, but for very different reasons.

6 Notes about discourse structure, associations and layers

Interpreting discourse structure as the result of a bundle of concurrent processes —which, in their turn, can be represented on layers dynamically marked by *s/w* values stating their foregrounding degree— seems an useful choice to supplement a focus model aimed at pronoun interpretation. The focus-based framework developed by Sidner, in fact, is not fully equipped to handle examples like (36) or (38). On the contrary, a layered view of discourse and the use of the SLP, when connected to the incremental processing proposed in §4, to stacked pegs evaluation (cf. fn. 8), and to the observation of the changes in setting, tense and aspect, enables the correct interpretation of almost all the pronominal anaphors present in the more formalized texts of my AESS-based corpus.²⁹

In this section I briefly discuss two further situations which seem to substantiate this ‘multi-dimensional’ nature of discourse structure and its consequent impact on pronominal anaphora interpretation. In §6.1 I discuss another aspect of the interaction be-

²⁸For example, an inferential line of reasoning about the (*robber.him_j*) ratification might be sketched as follows: in a prototypical situation, a Chief Superintendent of the French Police does not hide loot; so, in a prototypical situation, (*Maigret.him_j*) can not be licensed by the ratification procedure, and *him_j* has to take the robber as its sponsor. Nonetheless, note that the tuning of a context in which the prototypical situation is discarded —i.e., a context where the (*Maigret.him_j*) and the (*robber.him_i*) interpretations can be the right ones— is straightforward. For example, a context may present Maigret as an accessory in a crime. Given such a context, in (39b), since the locutive path Comélieu-to-robber is accessible as well as the path Comélieu-to-Maigret, the interpretation (*Maigret.him_j*) can not be ruled out by the ratification procedure.

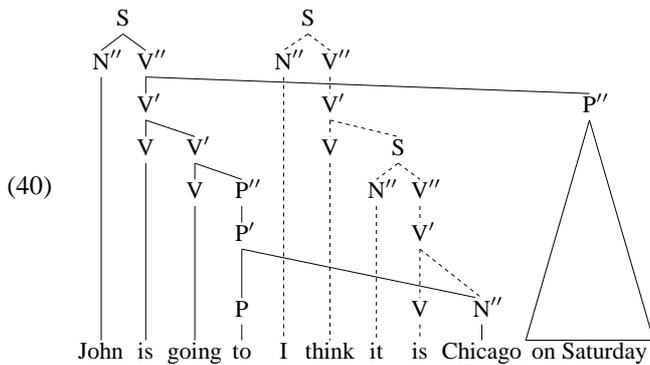
²⁹I am alluding here to the traditional narrative songs (see fn. 17), which have highly constrained linguistic and discourse structures. Notice that, in the texts of these songs, a lot of puzzling questions related to anaphora interpretation (e.g., discourse discontinuities, tense and aspect shifts, participants’ tracking issues, etc.) can find a lot of answers on the basis of a) the structuring of the songs in stanzas, which can be assumed as well-defined building blocks for the construction of the discourse; b) the absence of marked prosodic patterns, since the textual material is associated with a metrical structure (see, for similar narrative songs pertaining to the Anglo-Saxon tradition, Kiparsky 2005); and c) the traditional, modular and formulaic mode of oral composition. For some brief notes about an implemented computer system based on the model proposed in the current paper and capable of handling the pronouns present in the narrative songs of my AESS-based corpus see Grazioli (1997:112ff.).

tween pronoun interpretation and quoted speech. In §6.2 I give an example of a much more complex situation, taken directly from my AESS-based corpus.

6.1 Shared pegs

Despite SLP's usefulness in driving the quoted speech and pronoun interpretation interaction, it is pointless to emphasize that it can prove inadequate in a large number of situations. Nevertheless, it should also be noted that at least parts of such situations can be reduced to only two types of occurrences of what here I call a 'shared peg' — i.e., a peg co-specified by two or more LOS (see Figure 1) which belong to at least two different layers.

These two peg sharing situations, as well as being more complicated to handle, are very different from the anaphoric situations exemplified by (36) or (38), where no shared pegs exist. Moreover, they can not fail to bring to mind the 'syntactic amalgams' (Lakoff 1974) of the type represented in (40), where the straight and dashed branches show that the nodes belong to two different 'sentential layers', but where the 'Chicago' element of the skeleton is a shared resource.



And again, it should be stressed that if, in ordinary speech, such 'amalgams' are quite rare and exceptional as a syntactic phenomenon, their appearance seems much more common as a discourse phenomenon (i.e., with discourse pegs instead of syntactic entities as leaves), whether such 'discourse amalgams' are related or not to the insertion of quoted speech.

Without claiming to supply even a merely approximate typology of the shared resources which can be identified at the time that quoted speech appears, it is interesting to deal briefly with at least two peg sharing situations that are very diffuse in the personal narratives of my AESS-based corpus. In fact, despite being very different in their basic nature, these two situations can be handled by a single, G&S machinery-free principle that can not be disregarded in stating sponsors accessibility constraints related to discourse structure. As in the last section, these two sharing situations are presented on the basis of real examples borrowed from Simenon (1992), the written novel which I use here in order to present, in a simple way, some discourse phenomena which occur in my oral AESS-based corpus.

6.1.1 Type A

In my AESS-based corpus of oral personal narratives this first type of peg sharing is normally found in passages characterized, in their non-quoted speech part, by the imperfect tense, atelic eventualities, the lack of 'propulsive' verbal selections (i.e., what

advances the narrative; Bertinetto 2001:196ff.), and by orientational or evaluative discourse functions (Labov & Waletzky 1967; Labov et al. 1968). The owner of what follows the quoted speech may be fully explicit (i.e., the locutive path is simply 'performer-to-audience') or much more opaque, involving the so-called 'private states', etc.

Here follows an example taken from Simenon (1992:14); notice that the information provided by the passage opened by the \emptyset -anaphora is, for the owners of the quoted speeches, fully or at least in part given and shared; on the contrary, such information is not accessible to the recipient of the whole discourse, since the named entity 'Judel' is a first mention.

- (41) [*Context*: Chief Superintendent Maigret (M_i) and Inspector Lucas (L_j).]
- [M_i to L_j]: "Chi si sta occupando del caso?" "Who is on duty there?"
 - [L_j to M_i]: "Judel_k." "Judel_k."
 - \emptyset_k Era un ispettore del X arrondissement, un giovane un po' malinconico ma coscienzioso [...] (He_k) was an inspector of the 10th arrondissement, a young man a bit gloomy but conscientious [...]

Within the G&S's theory, this type of peg sharing situation can be analyzed as an instance of what, in the domain of interruptions, G&S call 'digressions', i.e., "a strong interruption that contains a reference entity that is salient in both the interruption and the interrupted segment" (p. 195). However, if applied to (41), a G&S-based analysis like 'interrupted segment + digression' raises many significant problems. Among these, the following may be mentioned:

- G&S's 'digressions' are defined as extemporaneous materials which do not involve a planned intention to deviate from the 'interrupted segment'. However, as already pointed out, in my AESS-based corpus of personal narratives G&S's 'digressions' are mostly instances of what Labov and associates call orientation and evaluation sections, that is discourse fragments which have a specific displacement window expressed in a formal way by means of displacement sets and temporal junctures (Labov & Waletzky 1967). Despite this, it should be stressed that G&S's theory pays no attention to the reasons for which 'digressions' may —or even must— be realized at a specific point of the 'interrupted segment'. And this may cause a lot of problems to the theory. In (41), for instance, the 'digression' after the quoted speech seems far from being a fortuitous, extemporaneous, unplanned insertion. In fact, it allocates relevant properties for the named entity 'Judel' (e.g., Judel is an inspector of the 10th arrondissement, he is male, he is young), that is a bit of situated knowledge not accessible to the intended recipient of the whole discourse. Of course, because of the overall situation in which Judel is evoked, some of the general properties which characterize Judel may be guessed. Nevertheless, for the recipient of the whole discourse, without the 'digression' the example results in a much less intelligible object. Moreover, without the 'digression', a more appropriate first mention of Judel may be realized by something like

‘Judel, the/a young, male inspector of the 10th arrondissement’. But such a detailed description makes sense only for the intended recipient of the whole discourse, and not for the two speakers, which are represented in (41) as individuals which share the common ground in which ‘Judel’ and all his relevant properties are already allocated. Therefore, for the two speakers, such a description would be infelicitous, that is redundant, awkward, not desired or even ambiguous (cf. Dale & Reiter 1995; Gardent 2002).³⁰

- ii. Assuming with G&S that discourse segments purposes can be adequately recognized, and that (41a) and (41b) accomplish purposes totally different from that of the ‘digression’ part, a conceptual/terminological problem may arise. Intuitively, in fact, (41c) —which in a sense ‘explains’ something related to the preceding discourse—in some way ‘contributes’ to (41a) and (41b). Moreover, (41b) —because of the (*Judel*. \emptyset) anaphoric relation— can only ‘precede’ (41c). But if we take, in their proper meaning, the ‘contributes to’ and ‘satisfaction-precedes’ relations posited by G&S (see here fn. 23, and, for a full account, G&S, §2.2), such an intuitive interpretation is far from being equal to that provided by G&S’s theory. Under G&S’s assumptions, in fact, (41c) does not ‘contribute to’ anything, no ‘satisfaction-precedes’ relation holds between (41b) and (41c), and our Hobson’s choice is to recognize a ‘digression’ opening. However, it is hard to agree with a picture presenting (41) as the result of an interrupted segment followed by a sort of deviation, as G&S’s definition of digressions explicitly assumes. On the contrary, much like Lakoff’s amalgams, (41) seems the result of a parallel, synchronized and multifaceted way to give a bundle of complex and different situated information, i.e., a situation determined by the presence of distinct, interacting, highly structured concurrent processes with a) clear-cut situated purposes; b) private data and working domains; and c) selective interfaces which allow for the proper use of the \emptyset -anaphora co-specifying Judel. At least in a very partial way, of course, the G&S’s definition of ‘digressions’ handles this very common kind of peg sharing situation. In fact, for G&S, ‘Speaking of *x* ...’ is a sort of discourse marker

commonly employed as a digression opener (cf. p. 195). Therefore, one may hypothesize that (41c) is a kind of grammaticalized or genre-related way to express something as ‘Speaking of Judel_{*i*}, you [=the recipient of the whole discourse] must know that he_{*i*} ...’, i.e., a ‘digression’ in which Judel is re-mentioned using a full definite NP. In no way, however, this kind of peg sharing situation can find its proper place in the G&S’s theory. In a sense it re-proposes, in an amplified fashion, the deficiencies which characterize the theory when it is faced with discourse situations like the ones treated here in §5.2. Moreover, it seems to add a lot of problems to the proper treatment of the ‘intentional structure’ upon which the entire G&S’s theory is built.

Leaving out these problems, which result from the application of a G&S’s digression-based analysis to this type of peg sharing, in any case it should be noted that G&S’s ‘digressions’ require the use of an ‘atypical stack’ equal to that hypothesized for the discourse situations exemplified here by (31), (32) and (35). This fact makes one think that G&S’s ‘true interruptions’ and ‘digressions’ are, in reality, particular aspects of a more general and pervasive phenomenon. I am alluding to the interweaving of the elements in different layers, i.e., a phenomenon that can also occur in correspondence with the insertion of quoted speech into the discourse.

6.1.2 Type B

In my AESS-based corpus of personal narratives, this second type of discourse peg sharing is normally found in passages characterized, in their non-quoted speech part, by the perfect tense (or by the so-called ‘historical present’), telic eventualities, the presence of propulsive verbal selections and by a ‘referential’ (Labov & Waletzky 1967) function. Quoted speech, moreover, not uncommonly raises expectations in the broad meaning indicated by Webber & Cristea (1997) (e.g., through suggestions), and in these cases the parts containing the pronoun(s) seem to supply satisfaction of expectation.

Here is an example taken from Simenon (1992:35).

- (42) [*Context*: Chief Superintendent Maigret (*M_i*) —who is inside the Brasserie Dauphine— and Judel (*J_j*); they are speaking by telephone.]

a. [*M_i* to *J_j*:] “Tra poco, col referto medico, spero di ricevere [nuovi particolari sul cadavere]_{*k*}.” “*Shortly, by means of the medical report, I hope to receive [new details about the corpse]_{*k*}.*”

b. \emptyset _{*i*} *Li_{*k*}* ricevette per telefono nel suo ufficio, verso le due e mezza. (*He_{*i*}*) received them_{*k*} by phone, in his office, round half past two o’clock.

If I properly understand the rather underspecified decisions assumed by G&S in order to split a discourse in ‘discourse segments’, the type of peg sharing situation exemplified by (42) may be analyzed in at least two ways. In the first case, one may consider (42a) and (42b) as members of the same ‘discourse segment’. In the second case, one may consider (42a) as pertaining to a ‘discourse segment’ different from the one containing (42b); in this case, we have a definitely closed segment which contains

³⁰With regard to the distinction between dependent expressions realized as pronouns or as full definite NPs, it is interesting to note that this kind of situation is not restricted to (*NP.pronoun*) and (\emptyset .*pronoun*) pairs, but holds for full definite (*NP.NP*) pairs too. Here is an example, taken from Simenon (1973:13), representative of a situation which is rather common in my AESS-based corpus of personal narratives; in the example, the canonical, reduced (*sponsor.anaphora*) pattern (e.g., ‘[Victor Cadet]_{*i*} ... Victor_{*i*} / Cadet_{*i*}’) is reversed, and ‘Victor’ is a first mention.

[*Context*: a ‘brigadier_{*i*}’ of the French Police, and Victor_{*j*}, a diver]

Le brigadier_{*i*}, qui avait demandé un autre numéro, attendait qu’on lui réponde.

— Allô! Victor_{*j*}? Je t’éveille? Tu étais déjà à déjeuner? Tant mieux. J’ai du boulot pour toi.

[Victor Cadet]_{*j*} n’habitait pas très loin de là, rue du Chemin-Vert, et un mois ne passait rarement sans qu’on fit appel à ses services au Canal Saint-Martin. C’était sans doute l’homme qui avait retiré le plus d’object hétéroclites, y compris de corps humains, de la Seine et des canaux de Paris.

the quoted speech, that is, a situation analogous to that advocated by Kameyama (1998) for the example given here as (29).

Now, in the first case the sponsors of \emptyset_i ‘he’ and li_k ‘them’ are still on the discourse focus stack. Therefore, no problem arises with respect to the sponsorship accessibility domain. But the procedures hypothesized by G&S in regard to the identification of what they call ‘discourse segment’ rely, among others, on various types of clues, and in example (42) one can find a lot of relevant clues which prevent considering (42a) and (42b) as members of the same ‘discourse segment’. I am alluding, for example, to the radical change of situation involved (from Brasserie Dauphine to Maigret’s office), to tense and aspect shifts, and to intended recipients.

In the second case, if the ‘discourse segment’ containing the quoted speech is definitively closed (as Kameyama proposes for (29)), and therefore considered inaccessible for the search of the sponsors of \emptyset and li , what is the procedure we have to follow in order to interpret these two dependent expressions? In Kameyama’s work nothing is said about situations like (42). And the same holds for Cornish (2002) and Miltsakaki (2003), where similar techniques are suggested.

In any case, it should be noted that sharing situations like (42) constitute a real challenge for G&S’s theory. In fact, if the ‘global’ coherence of a discourse is modeled by G&S through ‘discourse segments’ and focus spaces, the ‘local’ coherence and the treatment of pronouns are delegated by G&S to Centering Theory, which in its turn assumes a ‘discourse segment’ as its maximum working domain.

In order to see how these two theories can work hand-in-hand with respect to (42), let me suppose, on the basis of the lot of relevant cues mentioned above, that a ‘discourse segment’ boundary exists between (42a) and (42b). Under G&S’s assumptions, however, the presence of such a boundary—that is a well grounded boundary, at least from an intuitive point of view—gives a strange result, i.e., that (42) is in some way incoherent or intrinsically not analyzable. In fact, Centering has nothing to say about the two pronouns in (42b), since their sponsors belong to a different ‘discourse segment’. And G&S’s theory, strictly speaking, has nothing to say about pronoun interpretation, since it limits itself to handling ‘global’ focus spaces.

If we look at (42) with a cinematographic mind, however, this excerpt, like the type B sharing situations occurring in the oral personal narratives of my AESS-based corpus, seems the result of a perfect editing operation.³¹ The ellipsis and the consequent discontinuities between (42a) and (42b)—that is, what intuitively justifies the presence of a ‘discourse segment’ boundary—in fact do not cause incoherence. On the contrary, the absolute clarity of (42), despite the strong discontinuities that may be found in it, seems to rest precisely on the presence of the two pronouns in (42b), i.e., a glue-like presence which remains inexplicable under G&S’s and Centering assumptions, as well as under Kameyama’s ones.

On the basis of examples like (42), it is hard to consider G&S’s theory as a really useful means to track the ‘global’ focus of at-

³¹Note that here I adopt a movie-related terminology only for the sake of convenience. In fact the use of similar verbal techniques dates much earlier than film-making (see, *inter alia*, Hatcher 1942).

ention, i.e., a theory capable of acting as a proper shell for ‘local’ frameworks aimed at pronominal anaphora interpretation. In fact, when faced with examples like (42), G&S’s ‘discourse segments’ and the stack of corresponding focus spaces result in being too naive and rough-hewn both to properly model the discourse structure and to state the impact of discourse structure on sponsorship domains.³² Intuitively, the inadequacies of G&S’s theory in determining the ‘global’ focus of attention inhabited by the available sponsors rest on its poor consideration of the vari-

³²The restricted nature of the G&S’s theory and its strong assumptions about the structure of discourse are questioned—despite the fact that the model is still highly influential in the literature and in current implementations of computer systems aimed at natural language processing—in various works. Among them, however, the extensions developed in order to achieve, in the spirit of G&S, the flexibility required by the processing of distinct, interacting discourse processes are, to the best of my knowledge, only two. The first is that of Guinn (1990), developed in order to handle “parallel conversations” and discourses in which “a speaker introduces multiple arguments” (for more recent works related to these kinds of discourses see, *inter alia*, Sassen & Kühnlein 2005a, 2005b); Guinn, in order to analyze such discourses, hypothesizes a multi-stack data structure which is argued to be useful as “a representation of complex discourse interactions which can not be handled using a single stack scheme or an ATN grammar” (p. 41). The second is that of Rosé (1995) (see also Rosé et al. 1995). In her work, dealing with negotiation dialogues in which multiple suggestions are being negotiated at once (i.e., dialogues devoted to deliberating over which date and at which time to schedule a meeting), Rosé hypothesizes a graph structure stack model of attentional state in which “focus spaces for parallel intentions could both be pushed onto the stack as separate tops”, and where “the most recently modified top would be relatively more salient than the other tops”, but where “the entities in all the tops would be accessible” (p. 40). Notice, however, that neither Guinn nor Rosé establish a preferential principle like the SLP—i.e., a principle more similar to that assumed by Kameyama (1986) for handling Japanese and English pronouns within a ‘local’ framework. Moreover, neither Guinn nor Rosé pay attention to quoted speech. Quoted speech, in fact, in the natural language processing community is sometimes assumed as a relevant factor in ‘pure’ engineering models of anaphora resolution, but it is essentially disregarded even by focus-based, discourse structure oriented models which aim to work for whatever pronoun in whatever discourse. This peculiar lacuna maybe derives from poor understanding of the proper nature of quoted speech, or from its dependence on concepts like ‘perspective’ and ‘private state’, which are notoriously difficult arguments to deal with. In fact, the only focus-based work I know where quoted speech and its consequences on a pronoun interpretation model are at least mentioned as a core processing issue is Di Eugenio (1989). In this paper, analyzing various Italian texts on the basis of a variant of Webber’s tree discourse representation model (in which what I call ‘situational anaphora’ is called ‘discourse deixis’), Di Eugenio writes:

The only example that really violates the RF principle [=Right Frontier Constraint; see here fn. 23; RG] presents a shift in perspective in the narrative: the first part of discourse is ascribed to one character, the second to another one, then focus shifts to the former one: it is with respect to the portion of the tree that conveyed the first character’s perspective that a deictic has to be solved. (p. 130)

Di Eugenio, however, does not suggest a processing strategy able to resolve her example. In fact, she limits herself to put the processing of such ‘violations’ (which, if I properly understand her description, can be handled by a layered model similar to that proposed in the present paper) in the to-do agenda. For other strict discourse-based views of quoted speech see, among others, Redeker & Egg (2006) and Wolf & Gibson (2006).

ous dimensions exhibited by naturally-occurring discourses, that are not always so ‘Flatlandian’ as G&S’s theory seems to assume. Moreover, judging by the data contained in my AESS-based corpus, the role of these dimensions has to be parametrized at least on the basis of the genre or ‘mode’ (Smith 2003) of the (stretch of) discourse under examination, i.e. a critical element to select, at a given processing point, the foregrounding degrees of the layers available for an anaphoric association.³³

6.1.3 Type A and B shared pegs: a principle

By viewing discourse as a bundle of interacting concurrent processes, the type A and B sharing situations exemplified above can be explained by a very simple principle which does not exploit G&S’s machinery. This principle, which appears valid for all the personal narratives contained in my AESS-based corpus, can be stated as follows:

³³It is unclear to me if G&S’s theory can be amended in order to handle a multi-dimensional view of discourse structure. Some remarks on this topic, given on the basis of ‘discourse segments’ representations like (30b), but distributed on different layers similar in spirit to the functional categories used by some syntactic theories, are contained in Grazioli (1996). Here, in defining a kind of possible factoring of discourses in something faintly resembling to G&S’s ‘discourse segments’, a particular attention is given to the co-occurrence of different kinds of discontinuities available along various discourse dimensions of the personal narratives contained in my AESS-based corpus. Of course, the result —no matter how useful it may be, at least from a descriptive point of view— is very different from that produced by a standard G&S’s analysis, i.e. a single tree with sharp boundaries between not layerized ‘discourse segments’. By the way, in the same paper some remarks are given about the appearance —in the personal narratives of my corpus— of non-active diathesis constructions, i.e., a topic that, although relevant for handling anaphoric relations, both Sidner (1979, 1981, 1983) and G&S ignore. In this regard, consider for instance example (i), taken from Rizzi (2006) with minor notation changes.

- (i) [Context: a dialogue between A and B.]
 (a.) [A to B:] “Che cosa è successo?” “What happened?”
 (b.) [B to A:] “Un camion_i ha tamponato un autobus_j, poi \emptyset_i è ripartito.” “A truck_i bumped into a bus_j, then (it_i) left.”
 (b’) [B to A:] “Un autobus_i è stato tamponato da un camion_j, poi \emptyset_i è ripartito.” “A bus_i was bumped into by a truck_j, then (it_i) left.”

Whatever meaning we associate with canonical thematic roles such as ‘theme’, ‘affected object’, ‘causer’, ‘initiator’, ‘experiencer’, etc., Sidner’s theory is unable to handle in a transparent way the alternation appearing in (i.b) and (i.b’). Nonetheless, in trying to handle examples like (i), a ‘local’ framework as Sidner’s one can be successfully amended by rearranging, on the fly, the relevant R^P structure. For instance, it may be assumed, at the time that a canonical passive construction is detected, the pronominal associations related to the AF sub-tree of a processing unit are blocked, hence leaving the DF sub-tree as the only accessible association site for the R^P structure. However, if a ‘global’ perspective about the appearance of canonical passive, impersonal and so-called ‘SI/SE’ (cf. Frigeni 2004 and references cited herein) constructions is assumed, ‘local’ procedures related to R^P ’s rearranging seem quite *ad hoc* solutions, no matter of their success in handling examples like (i). In fact, such constructions, albeit their impact on pronoun interpretation is different in type, on a global account seem to act as differently situated processes analogous to those analyzed here by means of layers. This, at least, is what appears on the basis of the personal narratives of my AESS-based corpus. For some interesting remarks about this topic see, inter alia, Sansò (2006) and the works cited herein about the so-called ‘agent-defocusing strategies’.

A/B PRINCIPLE. If a) an individual i is the owner (cf. fn. 22) of a stretch of discourse, and b) if an individual j is in his turn the owner of a stretch of discourse quoted within i ’s discourse, then the discourse entities evoked by j ’s discourse are accessible —in terms of sponsorship and co-specification— for i ’s pronouns.

In other words, this G&S machinery-free principle states that a discourse process i can intervene in a discourse process j launched within i ’s ownership domain. This asks for the application of one or more RRs to the $\pm\alpha$ labels of the layers on which i and j can be represented (cf. (34)), i.e., the foregrounding of a layer which shares one or more resources (pegs, in this case) with the formerly foregrounded layer.

However, in order to support a flawless discourse, this simple principle has to work together with conditions not directly related to the focus of attention or the accessibility domain of the involved sponsors. I am alluding, for instance, to the relevance of what is inserted (cf. the above discussion about the ‘Judel’ peg) or to the specific genre, ‘mode’ or even the actual presentation modalities of the (stretch of) discourse in which a type A or B sharing situation appears.³⁴

6.2 Pronouns and associations in a complex interaction: an example

From the above discussion about pronouns, quoted speech and discourse structure, it seems quite obvious to me that discourse offers to language users a set of devices which allow to build up highly structured discourse models, i.e., repositories able to dynamically handle, as the discourse unfolds, the presence of entities which can be shared, differently situated, perspectivized, etc.

Intuitively, however, the fact that discourse is able to offer to a language user such a richness of devices just to allow his handling of the concurrent processes related to quoted speech or partly similar phenomena (e.g., unattached ‘orphans’ at syntactic structure; see, inter alia, Espinal 1991, Haegemann 1988, Huddleston & Pullum 2002; cf. also Sells 1985, Webber et al. 2003:552ff.) appears quite implausible. So, it turns out, in a natural way, to hypothesize that such a richness is, more simply, a general property of discourse.

In order to substantiate this view, let me close the paper saying

³⁴ For instance, if a speaker gives an exegesis of a text, the frequency of the type A shared pegs can be very high without making awkward the overall discourse. On the contrary, the same frequency may appear inappropriate in the course of a plain, ordinary personal narrative. Again, note that the genre or the ‘mode’ of a (stretch of) discourse is a critical element also for a correct application of the SLP. Without the definition of a proper working domain, in fact, the SLP may lead to over-generation (i.e., it allows, if plainly stated as in §5.2.3, for unappropriated possible applications). Some remarks about the domain of the SLP in the personal narratives contained in my AESS-based corpus are given in Grazioli (1996). Here, in overviewing the SLP domains and the processing issues involved by the SLP and the A/B principle applications (quite different in their results), a leading role is given to Labov’s ‘functions’ and to his analysis of the overall structure of a personal narrative. For a more general hypothesis related to problems to some extent similar to that involved with the SLP application see Rosé (1995:61-62), where it is hypothesized that such kind of problems can be properly treated on the basis of linear models (cf. Walker 2000).

a few words about the selling interactions contained in my AESS-based corpus.

These interactions are far from being equal to the selling negotiations analyzed by Mitchell (1957). In the situations analyzed by Mitchell, in fact, the seller and the potential buyer know exactly the nature of the object for which the negotiation is taking place. Moreover, both of them know exactly how to use the object and in what contexts it can be used. In the street talk of my corpus, on the contrary, the seller offers novelties, unfamiliar objects. As a consequence, the audience has some basic expectations (What is this object? What is its purpose? Why one has to buy it?) that the seller has to satisfy *before* to putting into practice the sale. For that reason, before the sale, the seller has to explain what kind of object he is proposing, what are the procedures to follow in order to assemble and use it, etc. In other words, he has to realize a kind of how-to-do-it, expert-apprentice task-oriented discourse (Grazioli 1992).

In my selling situations, however, the task-oriented thread is only a part of the whole.³⁵ In fact, in order to set up a successful selling interaction, much more information is needed from the sale-ring. I am alluding to the explication of the *raison d'être* of the object on sale (sometimes given by the seller through a comparison with familiar objects), the concrete demonstration that the object is really capable of doing what it is said to do, etc. The task-oriented thread, moreover, may be performed by the seller:

- a) by giving only a visual explanation of the steps to be executed in order to properly assemble and utilize the object on sale;
- b) by saying what a buyer has to do in order to assemble and utilize the object; therefore, in this case, we have one or more verbal instructional sequences of the type: 'in order to assemble the object, do action *a*, and then *b*, etc.; in order to properly utilize the object, do action *x*, and then *y*, etc.';
- c) by mixing these two strategies.

In my corpus, only this third solution occurs. But this solution, for the purposes of the current paper, is also the most interesting one. By mixing the two strategies, in fact, the objects and the situations which should be managed in the course of the task-oriented thread —and therefore by the discourse model— are at least two:

- i. a) The object directly manipulated by the seller in order to visually present the object's characteristics, its use, etc., and b) the situation in which this object inhabits, i.e., the situation bounded to the here and now of the selling interaction.
- ii. a) The object that a (still potential) buyer may use when he needs this object to do something, and b) the situation in which this object inhabits, i.e., a 'pure', abstract instructional sequence. This sequence, of course, has its own internal ordered steps. In any case, it is inherently unbounded

³⁵Note that I use here the term 'thread' not in the technical, computational sense (i.e., a lightweight process that shares some system resources, such as a virtual address space, with a group of other processes), but in the ordinary sense utilized by a widespread metaphor (Cardona 1976:210) in order to represent the structure of discourse (e.g., "discourse is structured as a tapestry of interwoven threads", Rosé 1995:1).

to any specific time or place, and can be encapsulated in a time and place bound situation only for the sake of exemplification.

Despite instances of the same entity, the two objects —like, in a sense, the two 'punches' of example (23)— are therefore distinct but in some way interrelated, and the situations onto which these objects are mapped are equally distinct — even if, to some extent, they are conceptually overlapping. Moreover, it should be noted that the sequence of actions mentioned in the course of the task-oriented thread is in various ways interwoven with the sequence of actions performed by the seller during his speech (i.e., the 'visual' explanation), and with what the seller says in order to explain the sequence of actions he is actually doing.

Normally, these interwoven threads of differently situated information result in complex shared properties and relations between the pegs which inhabit the two co-occurring situations. But again, note that, in these selling interactions, frequently the sharing is not equal to that shown above on the basis of Simenon's novel. As a matter of fact, in the discourse model related to example (41) we have a single 'Judel' peg, and this peg —much like the 'Chicago' node of Lakoff's example given here as (40)— belongs to two distinct layers. In the selling interactions contained in my AESS-based corpus, on the contrary, the sharing may be a matter of complex and subtle interrelationships between distinct pegs belonging to distinct layers. In fact we may have a peg for the object which inhabits the abstract instructional sequence, a peg for the object actually used in the here and now of the interaction, a peg —evoked by a situational anaphora pertaining to the here and now of the interaction— which must be instantiated on the basis of the recruitment of one or more §-type elements of the *s/w* structure related to the abstract instructional sequence, etc.

Here follows an example in which one of such situations appears.

- (43) [The example is an excerpt of a selling interaction recorded in Piazza del Duomo (Milan) in date 12-03-1982 by AESS staff. The seller (S) makes his speech trying to sell to the audience (A) a portable, small VHF/UHF antenna (= type-A antenna) that he claims to be usable in place of a standard, big roof-type VHF/UHF TV antenna (= type-B antenna). The selling-point of type-A antenna put forward by the seller is that type-A antennas allow a potential buyer to use a standard TV in places where no antenna sockets exist (e.g., in one specific room of a house) and in places where no type-B antennas are available (e.g., holiday homes, campers, etc.). At his pitch the seller has, inter alia, a) a portable TV; b) a huge type-B antenna —located at the top of a high post and connected to the portable TV— which stands for a roof-placed antenna; c) a lot of type-A antennas on sale. The seller is explaining to the audience how to unplug from a TV a type-B antenna in order to replace it with a type-A antenna. The symbol '†' in the utterance (b) is a *crux desperationis*.]

- a. [S to A:] Noi a casa giriamo il TV. *At home, let's turn the TV.*
- b. E arriviamo († in) un attimo all'allaccio dell'antenna.

And let's arrive in a moment at the antenna plug [of the TV].

- c. *Stacciamo il cavo dell'antenna del TV. Let's unplug the [type-B] antenna's cable from the TV.*
- d. *[S, executing the action evoked in the preceding line:] Guardate quanto \emptyset è semplice. Look how simple \emptyset (=it/this/that) is.*

In (43), the first three lines give the instructions that a type-A antenna potential buyer —i.e., the 1st pl. person which in the utterances stands for ‘anyone who wants to use a type-A antenna’— has to follow in order to unplug a type-B antenna from a TV. Therefore, in terms of the G&S's theory, what is conveyed by (43a) satisfaction-precedes (43b), which in its turn satisfaction-precedes (43c).

(43d), on its part, has three possible interpretations. Ignoring the first one (which can be rendered as ‘look, here and now, how simple it is to execute the action I am doing here and now’), the second interpretation frames (43d) as a further step of the preceding (43a-c) instructional sequence, and the third interpretation frames (43d) as linked to the selling interaction (i.e., ‘look, here and now, how simple it is to execute the aforementioned step(s) (43c)/(43a-c)’), where the choice of the \S -type node(s) of the s/w structure of the abstract instructional sequence is a matter of the hearer(s)).

However, this third interpretation seems much more plausible than the second. In fact:

- i. (43d) expresses an atelic eventuality. Given the absence of temporal expressions like ‘for x time’, ‘until t ’, ‘from t_x to t_y ’, in a step-by-step instructional sequence the use of such an atelic eventuality appears quite odd.
- ii. (43d) marks a shift in grammatical person, from the 1st pl. appearing in (43a-c) (the ‘we’ acting as ‘anyone who wants to use a type-A antenna’) to the 2nd pl. (the audience).

Adopting this third and much more plausible interpretation of (43d), no satisfaction-precedence holds between (43c) and (43d).

Needless to say, in order to support the information available in (43), the discourse model must be radically enriched with non-linguistic entities (see, for instance, the LuperFoy-based choices made by Pflieger 2004 and Wahlster 2003, 2006). In any case, leaving aside this very complex problem, it should be stressed that the \emptyset -anaphora in (43d) —assuming the third interpretation given above— has to recruit its sponsorship domain in a different situated region of the discourse, i.e., the abstract, time unbounded instructional sequence evoked by (43a-c). Therefore, in order to give a proper interpretation of the \emptyset -anaphora, in (43) we have to consider two heterogeneous, interacting, concurrent, and —as happens in fragments containing quoted speech— to some extent ‘distributed’ processes, which can be at least described (in order to evaluate the possible strategies adopted for pronoun interpretation) by means of layers.

7 Concluding remarks

In this paper I have presented a model for the interpretation of pronominal anaphors based on the notion of anaphoric associa-

tion. The model provides at least partial solutions to the problems, delineated in the introductory section, which characterize theories like Focus Theory and Centering Theory. In particular:

- i. The use of s/w trees makes it possible to define salient entities in an explicitly relational manner. In the model proposed there are no yes/no distinctions between what is in focus and what is not. All the pegs are in focus, but their focalization is a matter of degrees. Since all the pegs dominated by a R are salient and focalized, albeit to different extents, all the pegs can be used for the interpretation of pronominal anaphors. In principle, this permits to tackle in a principled way the interpretation of a theoretically unlimited number of pronouns.

- ii. By utilizing input units (U_{in}), processing units (U), and insertion units (U_I) as working domains, the model permits the evaluation of the anaphoric possibilities offered by complex NPs and nominalizations, the incremental analysis of input on the basis of cognitively plausible units, and the confluence within a single domain of syntactic constraints and pragmatic preferences.

- iii. The multi-dimensionality of salience is conceptualized through the use of preferential grids, capable of tempering the default preferences expressed by the trees.

- iv. Through the use of layers, the model permits an economic conceptualization of the structure of discourse as the result of interacting concurrent processes, thus providing a basis for the formulation of working hypotheses concerning pronoun interpretation in ‘distributed’ discourses and complex situations conducted with a great deal of talk.

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