

## Constraints, Coherence, Comprehension\*

### Reflections on anaphora

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#### 0.

In the linguistic discussion of pronouns and anaphora over the past two decades the notion of constraints has loomed large. And among the conceivable constraints on the interpretation of anaphoric expressions those formulated in syntactic terms have assumed the most central place. The idea is that it is such constraints that would have to explain why, for instance, in the following sentences the pronoun cannot normally be interpreted as coreferential with Flynn. Cf.

- (1) a. *Next to Flynn he noticed a car.*
- b. *McBride saw him as Flynn left.*
- c. *He had some trouble with Flynn's friend.*
- d. *Flynn thinks of him as a genius.*

But what is the value of such constraints in terms of a theory of comprehension? What would these constraints contribute to our understanding of how pronouns are understood? Embarrassing though it may be to admit: they can contribute very little indeed and the little they have to offer is on a level of abstraction not immediately relevant to a theory of comprehension.

All that a set of constraints on coreference relations can do is to exclude the interpretation of a particular pronoun occurrence as coreferential with one or the other referential expression. And as long as the constraints are syntactic ones, that other expression must be in the same sentence and must be syntactically realized. – But even if we supplement the set of constraints with non-syntactic ones to cover those cases that cannot be accounted for syntactically, in order to actually come to positive assignments of interpretations to particular pronoun occurrences, additional mechanisms of another kind are still needed.

If such mechanisms must be developed anyway and they yield the required interpretation for a pronoun – why then would we want constraints on coreference relations that give us an additional, and by now quite redundant, list of some of the interpretations the pronoun cannot have?

The embarrassment we find ourselves in as linguists could hardly be greater. For some twenty years intensive research on pronouns and anaphora has produced very little of any value that we could offer to colleagues in psychology and artificial intelligence whose interest is rather in processes of comprehension than in abstract grammatical structure. – Unfortunately, not

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each abstract grammatical algorithm has a straightforward interpretation in terms of mechanisms of comprehension.

Due to a dominant interest in matters of language structure, and in competence rather than performance, linguists' notions of comprehension processes have remained surprisingly unsophisticated. I believe that this is damaging not only to the relevance of linguistic work for neighbouring disciplines, but also for the investigation of abstract linguistic structures. It is at least not a priori implausible that some grammatical mechanisms are fairly directly controlled by the immediate needs of communication rather than by 'intrinsic' constraints, even though this is unlikely to be the case for all of grammar. Accordingly, the empirical basis for a theory of abstract grammatical structure might get very weak if interacting factors of a non-grammatical nature remain out of consideration. The data we have to work with are most plausibly regarded as the result of just such interactions. Hence even the linguist who is primarily interested in purely grammatical parameters must at least have a rudimentary theory of what the other parameters are, just in order to make sure he can keep them constant while investigating the grammatical parameters he wants to focus on.

In the following pages I want to discuss some of the factors relevant to the comprehension of pronouns. I shall concentrate on mechanisms that make a fairly direct and positive contribution to the comprehension process, rather than on constraints. Finally, I shall try to show what place the constraints on pronoun interpretation developed in Agreement and Anaphora (Bosch, 1983) take in relation to the considerations in this paper.

## 1.

A persistent bug in theories of pronoun comprehension has been the notion of identifying reference. Somehow it would seem that, in order to understand a singular definite NP, in particular of the semantically rich kind we find in Russellian descriptions, we would have to be able to identify its semantic or intended referent. Thus in order to understand the following sentence, we should know that the definite NP refers to Yuri Andropov:

(2) *The Soviet President died yesterday.*

I do not mean to say that we are supposed to know the man's name. The idea is rather that we should be able to identify the referent, by whatever means suitable, with respect to some general, common, or public – and not just a subjective – frame of reference.

It is this notion that has accompanied long stretches of the development also of the theory of indexical reference. There one would expect that understanding (2), as uttered on 10 February, 1984, should involve the notion that Andropov died on February, 1984. Similarly, if I now utter a sentence containing the word 'here', the understanding of this sentence would, among other things, comprise the notion that 'here' refers to Cambridge, Massachusetts, or, perhaps, to a slightly more or slightly less comprehensive spatial region.

This notion, however, of referent identification relative to some objective, common, or public frame of reference, is seriously mistaken. It forces us, on the one hand, into an unnecessarily abstract ontology when we have to establish referents for each and every referentially occurring NP. And on the other hand, it blocks outright the treatment of some pronoun occurrences that cannot be forced into this corset.

Cases of the latter kind were pointed out by Yule (1982). The pronouns in (3) and (4) certainly do not require the identification of any referents in the course of the understanding of these sentences. Cf.

(3) *They sent me a reminder for my phone bill.*

(4) *In Edinburgh, they do everything slowly.*

That no referent identification is required for the comprehension of these sentences is clear from the following essentially equivalent sentences, which do not even contain corresponding referential expressions:

(3') *I was sent a reminder for my phone bill.*

(4') *In Edinburgh, everything is done slowly.*

In other cases, we are forced, if we want to stick with the notion of understanding via referent identification, to assume abstract entities of a kind for which no general or objective identification would seem feasible. Cf.

(5) *No-one is allowed into this building, unless he can produce a valid identification card.*

(6) *If anyone had noticed the fire, he would surely have called the fire brigade.*

(7) *Either no letter was sent, or it got lost.*

(8) *Julius puts his money into a savings account, but his granny prefers to keep it under her pillow.*

(9) *If a really tall man comes in here, he will surely bump his head.*

Is the tall man in (9) the same man as the one referred to by he in (5) or (6)? Which letter is it that is supposed to have got lost in (7)? In what sense is what Julius puts into a savings account the same thing his granny keeps under her pillow? – If referent identification is the key to pronoun understanding, these questions must be answered. But we don't want to answer them. We cannot even see why we should, and we are certainly not bothered about them in the course of our understanding of the above sentences. These questions are as much besides the point for comprehension as the notion of referent identification itself.

If the idea of referent identification seems plausible for expressions referring to some old individuals in the lime light of public interest, then this might explain how the bug ever entered our thinking. But in view of the difficulties in taking this idea as fundamental for the comprehension of referential expressions, we had better admit that we were misled into too quick a generalization.

I want to propose that the comprehension of referential expressions should be seen as a more modest business, not in global, but rather local dimensions, and as strictly relative to momentary and personal needs.

When you phone me up and ask me to collect you somewhere, neither of us needs to know in any objective or public terms how to identify the location of the other. All that is required is the relative location of the two places with respect to each other. I only need to know how to get from my place to yours, and this path is the identification of your location for me, never mind what the town or street is called and where to find it in an official map.

Similarly, when you send me a holiday postcard and you write

(10) *The weather has been lousy here for the last week.*

I won't need to look at the post stamp or the date in order to understand what you have written. I have got the point once I have understood that you are having bad weather and have identified the place as your holiday resort (wherever it may be located) and the time as the last week or so before you wrote the card (whatever the date may be).

The point I am urging with these examples is that we should not dig any deeper than necessary in our modelling of linguistic communication, that we should not impute any more precise or objective understanding to the listener than is actually required and can be expected by the speaker. Too much precision is here as harmful as is too little. The point is to get as close as possible to the conceptual representation the listener constructs in the course of comprehension processes, and not to add to them or make them more precise at points where we cannot immediately see how the listener could possibly accomplish his task of comprehension with lesser means than those we are familiar with from rigid scientific procedures.

## 2.

The above suggestions do not depart as radically as might seem from honourable traditions in semantics. I can start my outline of an account of comprehension mechanisms with the fundamental idea underlying truth conditional semantics, as formulated by Wittgenstein in the Tractatus (4.024):

“To understand a sentence means to know what is the case if the sentence is true”.

Of course, I want to depart on a minor point and not speak of the understanding of sentences in the sense of sentence types, but of understanding particular utterances of sentences in particular environments. Then we might say that understanding consists in ‘picturing’ a situation in which the sentence is true, or, less misleadingly: in constructing a model that satisfies the sentence. In accordance with the considerations in the previous paragraph, I want to stress that, in the first instance, we are concerned here with a minimal model, thus without gratuitous though pleasing ornaments and without the addition of new dimensions that would make the model look more like a piece of sensual reality or that would make it conform better with our scientific world view. All we must require of such models in the first instance is that they be correct with respect to all the information the corresponding sentence actually provides. I have called such models Context Models (CMs) (see Bosch 1983). A simple example is  $CM_1$  below, which is built in response to sentence (11).

(11) *Fred walks.*

(12)  $CM_1 = \langle I, I^*, R \rangle$

$$I = \{i_1\}$$

$$I^* = \{i_1^*\}$$

$$i_1^* = \langle \{p_1\}, \{\text{“Fred”}\} \rangle$$

$$R = \langle K^1, K^2 \rangle$$

$$K^1 = \{p_1\}$$

$$p_1 = \langle \{i_1\}, \{\text{“walk”}\} \rangle$$

$$K^2 = \emptyset$$

$CM_1$  thus consists of a set of individual constants,  $I$ , a set of characterizations of individuals,  $I^*$ , and a pair of sets of relations,  $R$ . In  $CM_1$ ,  $R$  contains only a set of one-place relations, or properties,  $K^1$ , with only one element, and an empty set of two-place relations,  $K^2$ . Relations of more places may sometimes be required. The only element of  $K^1$ ,  $p_1$ , is given as a pair of what I call, following Goodman (1949), its primary and secondary extensions: the set of individuals (more properly: individual constants) to which the property applies, and the set of expressions used to refer to the property, here only the expression “walk”. The set  $I^*$  contains characterization constants,  $i_n^*$ , where each  $i_n^*$  is the characterization of the individual

represented by the constant in in I. A characterization of an individual is given by the pair of the set of the individual's properties and the set of the expressions used to refer to the individual.

Thus the information present in  $CM_1$  is extremely poor. All that is given is that some individual or other is referred to by the expression "Fred" and has some property or other which is referred to by the expression "walk".  $CM_1$  contains no more information than can be extracted from sentence (11) purely on the basis of grammatical parsing mechanism. In ordinary understanding, of course, we are not satisfied with this. We also draw upon a number of other sources. In the following sections, some of these other sources and some of the further interpretation mechanisms will be considered, together with richer versions of CMs. But before we come to that, a few remarks are in order concerning the basic idea of a CM.

For any organism or machine to interact with its environment, that is, to react to and to manipulate the environment, the machine or organism must possess a representation of the environment. It is these representations that I call CMs. In order to represent the up to date state of affairs as adequately as possible, the CM must change with each new information about the relevant environment that becomes available, with each new perception or each change in the environment that is perceived. It is primarily these perceptions that a CM is based on. However, the large number of possible perceptions and a comparatively limited processing capacity make some environment independent control necessary. I am thinking here of the control of attention by expectations that are aroused by what has been perceived already. Fundamental notions about this kind of control were sketched in Minsky's classic paper on frames (1974). I assume that such control mechanisms are available in what I have called Background Knowledge (BK), which is separate from the more incidental CMs, though not independent. BK is plausibly assumed to be largely built up on the basis of information in CMs and must be assumed to be subject to change, even though the change would be very slow and is sometimes difficult to bring about consciously. Our habits and expectations change in the course of our lives in a slow process of adaption to a changing environment and also in the course of an improved adaption to a stable environment.

One kind of sensory input to CMs is linguistic input. Not usually in neatly isolated form but in combination with other perceptions. Only in exceptional situations, like the reading of texts disconnected from their immediate environment or listening to speech that does not relate to the sensory environment of the listener, do we have situations in which the linguistic input is processed independently of other perceptions and only on the basis of routines and additional default specifications available from BK. – For the linguist this latter type of comprehension process is of particular interest. Here, again, the CM would change with each utterance or sentence that is processed so that the following processing unit (which is not quite the same as a sentence – see below) is dealt with already on the basis of a however slightly differing context representation. Clearly, the CM need not always be a model of the immediate sensory environment, and in the situation of abstract processing of a purely linguistic input, the CM will typically be a model of the environment the text or discourse is about. This much should suffice as a first sketch of the notion of a CM. Certain details will come up for closer discussion as they become relevant in the following sections.

### **3.**

I take it then that the comprehension of a sentence involves, among other things, the construction of a CM with respect to which the sentence is true. For the comprehension of referential expressions this means setting up representations for the corresponding referents in the CM. Such representations need not contain any more information than is actually present in the referential expression that has been processed. In particular, there is no reason to expect

that such representations should be sufficiently powerful to be matched up, by themselves, with objects outside the CM, perhaps in the 'real' world. Such matching processes would always be concerned with the CM as a whole and hence can make do with considerably weaker representations of individuals. Furthermore, of course, matching up with reality is not always the primary goal of the construction of a CM, and even in cases where it does take place, we are not always interested in a point to point match. This is the case, for instance, in how we ordinarily deal with fiction. In some sense, we do relate fiction to our world, and at some points even fairly precisely. For instance, when we decide to identify Thomas Hardy's Christminster with Oxford. But we would not expect to be able to do this for each and every thing in a novel, nor would that be very interesting.

If we decide then to represent an object in a CM, certainly in the first instance, by no more than the information present in the referential expression, we are opting for dynamic representations. That is, we leave the possibility open for future changes in the representation. And this is only realistic in view of ordinary epistemic and discourse processes. Once we have understood a sentence containing a particular referential expression, any number of questions may still be asked about the referent of the expression, and many questions may have to be asked before any identification of the referent is possible with respect to one or the other word outside the CM. Again: referent identification is a much higher goal than the comprehension of referential expressions.

Still, when we have created a minimal CM representation in response to a referential expression, we have not yet done everything we might do in order to achieve appropriate understanding.

Although we have abandoned the notion of objective or absolute identification of referents as part of the comprehension process for referential expressions, we must not throw out the baby with the bathwater. The sound nucleus of the identification idea is the notion that we have to keep track of our referents and must not establish a new referent for each new referential expression that turns up in the text. A coherent text must be understood as coherent. But objective, context independent, or absolute identification of referents is too much of a brute force device to achieve coherence and eventually provoke irrelevant and unanswerable questions, as we hinted above. What we need, in connection with the new notion of comprehension of referential expressions via the creation of CM representations, is mechanisms that ensure

- (a) internal coherence of CMs, that is, the identification of referents relative to the information already present in the CM with respect to which an utterance is being processed,
- (b) external coherence of CMs, that is, the coherence of information in particular CMs with our general BK.

Although these two types of coherence may look different at first glance, and could perhaps be analytically separated, I shall make not too much of an effort to do so but shall rather concentrate on their interactions.

In fact, internal coherence would largely seem to rest on external coherence. Even in a harmless case as the following,

(13) *Julius came into the shop. He wanted to buy a watch.*

where it would seem to be a straightforward matter of internal coherence to link up the reference of he to the representation created for Julius in the processing of the first sentence, we must be aware that the straightforwardness comes about partly because the resulting

representation makes sense with respect to what we know about going into shops and buying watches. If the second sentence in (13) were different semantically, even though grammatically parallel, as in (13'), the same referent identification as in (13) would be much less straightforward, and the reader would be more likely to consider preceding and perhaps following sentences in the text in order to avoid the new awkward link-up of he with the representation of Julius. Cf.

(13') *Julius came into the shop. He wanted to get off his horse.*

Internal coherence here seems inhibited because of lack of external coherence, that is, because of lack of coherence with BK. Sometimes stereotypical properties that are assigned to a representation by default thus make the construction of internal coherence difficult, even though the same default specifications are helpful for comprehension in most cases. Consider cases like the following:

- (14) a. *When the au pair arrived, he couldn't speak a word of English.*  
b. *Our carpenter came in late this morning. Her car couldn't start.*  
c. *Fred's secretary is pretty unreliable. Whenever one of his children is sick he stays off work.*

Most au pairs and secretaries are females, and this, presumably, is the basis for the default assignment of feminine sex to the corresponding representations in (a) and (c). And since for carpenters we have a male stereotype, a default assignment in (b) makes us expect a masculine pronoun. – What these cases show is that external coherence, in other words: coherence with typical expectations, cannot be the only and absolute guideline and sometimes must be abandoned in favour of internal coherence. If we still want to maintain the above hypothesis that internal coherence should rest on external coherence in view of such cases, we must allow for a ranking or different kinds of BK information. Some BK defaults are obviously of the kind that they would be given up in favour of others. One of the strongest default assumption then probably is that internal coherence can eventually be established in a way that does not conflict with the bulk of BK – another version of Wilson's Principle of Charity. Fortunately, in practical cases we hardly ever have to appeal to such high ranking BK principles, mainly because already low-level defaults are largely socially shared and a speaker would anticipate and thus try to avoid difficulties for the listener. Thus in (14a) a speaker may explicitly give the information that the au pair in question is a male, before continuing to refer to him by a masculine pronoun. It is rather in riddles that the weighing of different defaults against each other becomes a trying exercise. The riddle of the surgeon is a well known case in point<sup>1</sup>.

As far as most practical cases are concerned, external coherence, or simple reliance on default expectations, is a major factor in bringing about internal coherence and coreference relations in particular. Although it is hard, for instance, to identify the referents of Julius and he in (15), we only need to establish a sense-making connection between the two sentences, as in (16), and coreference relations come about naturally. Cf.

(15) *He was sick. Julius left.*

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<sup>1</sup> For readers unfamiliar with the riddle, the origin of which I do not know, I want to give the folk version of it, as I know it: A father and his son had a traffic accident, in which the father was killed. The son was taken to hospital for immediate surgery. The surgeon who was supposed to carry out the operation saw the young man and asked a colleague to take over. The reason: 'I can't possibly operate on the young man. He is my own son'. – Question: how can the young man be the surgeon's son?

- (16) a. *He was sick. That's why Julius left.*  
 b. *Because he was sick. Julius left.*  
 c. *When he was sick. Julius left.*

Also in the following sentences, coherence is clearly established on grounds of plausibility:

- (17) a. *Julius told Fred that his back was aching.*  
 b. *Julius told Fred that his back was full of chalk.*

Although grammatically parallel, the pronoun would link up to Julius in (a) and to Fred in (b), because we would assume that Julius and Fred are very much like us: each only feels his own pain and cannot see very well what his back looks like. A little fantasy and science fiction can of course easily change such defaults.

#### 4.

The close connection between external and internal coherence would suggest that a treatment of coreference relations that focuses exclusively on the grammatical and semantic properties of the coreferential expressions, plus, perhaps, their syntactic constellation, ignores parameters of crucial relevance to comprehension processes.

Apart from the BK defaults mentioned, also the predications about the referents of referential expressions enter their CM representations and may, via considerations of external coherence, be a relevant factor in assigning internal coherence or coreference relations.

Purely focussing on the referential expressions and ignoring the explicit predications – as is typical of practically all linguistic treatments of coreference – can lead into serious trouble. Cf. the following case (adapted from Yule 1982):

- (18) *Cut the onion into small pieces and fry it gently.*

The *it* here must not be taken to have the same referent, that is, the same CM representation, as *the onion*. You are not told to fry the onion, but to fry the onion-cut-into-small-pieces. If this difference were irrelevant, one might as well continue (18) as in (19):

- (19) *Then halve it.*

The point of course is that the referent here changes its properties, and what is appropriate to say of a whole onion is not necessarily appropriate of a chopped onion. Again: the point is not any cross-identification of referents, but the successive linking up of referential expressions to dynamic CM representations. And these representations are as much a result of earlier referential expressions that were connected with them as of the various predications made about them as well as the assignment of default properties. Without the richness of representations thus brought about, it is hard to imagine how the in general semantically very poor anaphors could succeed in linking up to particular representations. The point is that even a semantically very poor anaphor can succeed if its semantic content relates just to that part of a rich representation that distinguishes this representation from others. And the richer the representations are the more diversified they are likely to be with respect to each other.

But it is not just richness of CM representations that counts. Equally important is the additional information we get from the predication linked to a referential anaphor. This information must be seen as enriching the semantic content of the anaphor so as to again increase the probability of a unique match with one of the CM representations already

available<sup>2</sup>. In extreme cases, as in (3) or (4), repeated below, information of this latter kind may even be sufficient for the construction of a referent representation ad hoc. Cf.

(3) *They sent me a reminder for my phone bill.*

(4) *In Edinburgh, they do everything slowly.*

The resulting representations would take up the explicit predications made in (3) and (4) as well as default specifications concerning the subjects of such predications from BK. Thus the representations may well contain the information that in (3) we are concerned with the post office telephone department or telephone company and in (4) with the Edinburgh people. – Note, however, that in setting up such representations we are not concerned with the business of identifying referents. The representations just collect any information about whoever or whatever may be the referent, as this information becomes available in discourse.

The same mechanisms of assigning default arguments is operative in the following cases, where the fact that corresponding representations have become available is obvious from the pronouns in the continuation sentences. Cf.

(20) a. *Julius got married. Believe it or not, she is a Rothschild.*

b. *Jane can't take much alcohol and whenever she drinks she is sick. Poor Fred always has to clean it up.*

It is our knowledge about drinking, being sick, and getting married that provides, together with the predicates attached to the pronouns, for a clear interpretation for the pronoun at issue.

Note that the introduction of object representations in these cases crucially depends on the assumption that the first sentences in (20a) and (20b) are true. Negated versions of these sentences would not lead to corresponding object representations and the following pronouns would be hard to interpret. Cf.

(20') a. *Julius didn't get married. Believe it or not, she is a Rothschild.*

b. *It's not true that Jane can't take much alcohol and is sick whenever she drinks. Poor Fred always has to clean it up.*

It is this importance of truth that leads to the notion that pronouns like those in (20) have 'inferred' referents. The best known cases of course are those with non-referential indefinite antecedents, as in (21):

(21) *A man came into a shop. He wanted to buy a watch.*

Even though the expression *a man*, on its own, need not be considered referential, the assumption that the sentence in which it occurs is true allows for a CM object representation of a man who came into a particular shop.

Occasionally, the inferences that prompt such object representations are slightly more complex. Consider (22)-(24):

(22) *If anyone had noticed the fire, he would have called the fire brigade.*

(23) *Either no letter was sent, or it got lost.*

(24) *No one is admitted to the examination, unless he has registered four weeks in advance.*

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<sup>2</sup> The treatment of such matching processes would have been too complex to indicate in this paper. But cf. Bosch (forthcoming).

In (22), the speaker is talking about a counterfactual situation: the situation in which someone noticed a particular fire at issue. And he says that he expects that whoever gets this description would have called the fire brigade. The pronoun in (22) can thus link up to an object representation in a CM of this counterfactual situation, even though the assumption of any referent for *he* independent of the counterfactual situation would lead into grave problems of identification. A good way of looking at this and similar cases is perhaps this: we do not see the role of the pronoun as referential at all, but take the pronouns merely as a means to link up two descriptions or properties: the speaker expects that noticing the fire would result in calling the fire brigade. The device of CMs allows for this view despite the fact that it employs object representations, because CM representations are free of any ontological commitment whatever. Their object representations are means for collecting descriptions that are linked in discourse by the assumption that they should have common instantiations if any.

If the disjunction in (23) is true as a whole, only one of its two disjuncts must be true. If it is the second that is true, the first must be false, and one of the ways in which the first can be false is the case in which a letter was indeed sent. In a CM representing such a case, we do of course have an object representation for a letter that was sent. And to this representation the pronoun in the second clause can link up. Again: any assumption of a referent for it independent of such a CM would cause ontological and identificational turmoil.

(24) presents a similar situation again. Despite, perhaps, a first impression, the pronoun cannot be considered bound by the qualifier *no one*. This would lead to unintended truth conditions. Also the clause '*no one is admitted to the examination*' does not, on its own, cause the assumption of any referents for *no one*, or for that matter, for the following *he*. We have to focus again on the disjunctive nature of *unless*: for *p* unless *q*, *p* is false if *q* is true. Since the speaker is presumably interested in the situation where *q* is true, the interest is in a situation where *p* is false. And the interesting way for *p* to be false is that someone is actually admitted to the examination. The pronoun in the second clause can thus link up with an object representation in a CM for someone who is admitted to the exam. But also here we had better look at the pronoun just as a device for linking connected descriptions: being admitted to the exam as linked to having registered four weeks in advance. The fact that grammar assigns subjects to these descriptions is a matter of generality of linguistic form and of processing format, not a matter of ontology, that is, of the assumption (and hence identification) of objects independently of CMs.

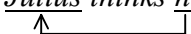
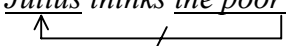
## 5.

In the preceding sections, I have sketched a number of factors involved in the comprehension of anaphoric pronouns, factors that make a positive contribution to comprehension rather than constrain interpretations. Before we consider constraints that may apply to the sort of comprehension mechanisms outlined, we have to distinguish the sort of pronoun occurrences we are concerned with, anaphoric ones, from other uses of the same pronoun forms.

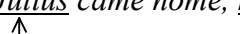
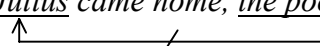
At first glance, one might think that perhaps all third person personal pronoun forms should function the same way. But, as most linguists will agree, this is not the case. One might think here, in particular, of the very typical anaphoric role pronouns play in linking CM representations to each other, of which we have seen a number of examples. Although this is a natural role for pronouns, it is not their only one.

Some pronoun occurrences not only do not link up to any CM representations, but do not function in any referential way at all. Some pronoun occurrences have a more abstract grammatical task. I have called such pronouns syntactic pronouns (SPs) in Bosch (1983).

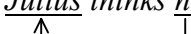
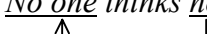
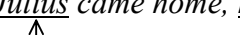
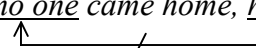
Their role is similar to that of morphemes of person agreement in the finite verb in Indo-European languages: they express congruence of a complex predicate with the expression (usually the subject) that occurs in the argument position of that predicate. In this use no referential device could take the role of the pronoun. Cf. the contrast between (25a) and (25b). In (a), he is an SP; when we substitute another, referential, expression for it as in (b), the link to the subject breaks down:

- (25) a. Julius thinks he is sick.  
  
 b. Julius thinks the poor soul is sick.  


The same substitution for an anaphoric pronoun, which is a referential device, does of course not disturb the anaphoric relation. Cf.

- (26) a. When Julius came home, he was tired.  
  
 b. When Julius came home, the poor soul was tired.  


Also, the non-referential SF can link up to non-referential antecedents. In fact, it just links up to a syntactic position, no matter how the position is filled semantically. Thus, any antecedent of an SP may be substituted for by a non-referential expression without disturbing the link. The same substitution for antecedents of anaphoric pronouns destroys the anaphoric relation. Cf. the following substitutions:

- (25) a. Julius thinks he is sick.  
  
 c. No one thinks he is sick.  
  
 (26) a. When Julius came home, he was tired.  
  
 c. When no one came home, he was tired.  


SPs are important devices for those cases where CM representations are not involved and the coherence must be established already within a sentence, before interpretation with respect to a CM takes place. They are devices that help integrating complex predicates, somewhat like lambda abstraction in logical languages. In (25a), for instance, we would assume a complex predicate to think that one is sick, which must agree with its subject in two places: in the person inflection of the finite verb (think) and in the pronoun (one). With respect to the CM, complex predicates are processed as wholes.

But also in cases where pronouns do function referentially, they do not always relate to CM representations. Like most other NPs, also pronouns may introduce new referents into the discourse. This is typically the case for accented occurrences of third person personal pronouns, whereas de-accented occurrences would function anaphorically. I have called such referent introducing, accented pronoun occurrences deictic occurrences, following Apollonius Dyskolus and Konrad Ehlich (1979) (cf. Bosch 1983). Typical cases are the following:

- (27) a. Look at HIM.  
 b. The one you are looking for is HE.

The pronouns here are means to focus the listener's attention on an object not yet assumed in preceding discourse, or to focus on one object in contrast to others.

We cannot go into the fine points of the classification of pronoun occurrences in this paper, and the above must serve as a rough indication of the intended distinctions<sup>3</sup>. So, we assume, next to properly anaphoric pronouns (AP), the equally referentially functioning deictic pronouns (DP), and the non-referential syntactic pronoun occurrences (SP).

## 6.

We shall here, because in this paper we are primarily interested in coherence, not deal with DPs. And since the parameters of comprehension processes discussed in previous sections were largely concerned with pronoun-CM interactions, we shall not say very much about SPs either, but concentrate on APs.

For the view that sees pronoun comprehension largely as a matter of referent identification, the prime question is: how do we find the referent for an AP? – As I indicated, this question is largely a red herring. The question I propose to consider instead is: What links between CM representations can an AP establish? Or: How is a particular CM representation selected to which an AP links up?

In Agreement and Anaphora, (Bosch, 1983) my favoured answer was this: the AP links up to the most prominent semantically suitable representation in the current CM. And the most prominent representation, I suggested, should always be the representation of the object which the sentence containing the AP is about. Hence I formulated the Aboutness Principle of Anaphora: (APA):

APA: An anaphor A that occurs in an independent or embedded sentence S refers to an object B, such that S is interpretable as being (directly or indirectly) about B.

Arguments for the assumptions of the APA and criteria for the aboutness relation were discussed in Agreement and Anaphora, and I shall not repeat them here. I assumed furthermore the following Principle of Natural Sequential Aboutness (PNSA):

PNSA: unless there is some reason to assume the contrary, each following sentence is assumed to say something about objects introduced in previous sentences.

The PNSA would account, for instance, for cases like those in (15) and (16), repeated below, where the pronoun in (15) cannot normally be seen as linking up to Julius, whereas in (15') it normally would. Once the sentences are changed so as to bring about the required aboutness relation, as in (16), the anaphoric relation comes about naturally. Cf.

- (15)     *He was sick. Julius left.*  
          └──────────┬──────────┘  
                                  ↑
- (15')    *Julius left. He was sick.*  
          └──────────┬──────────┘  
                                  ↑
- (16) a.   *He was sick. That's why Julius left.*  
          └──────────┬──────────┘  
                                  ↑
- b.   *Because he was sick, Julius left.*  
          └──────────┬──────────┘  
                                  ↑
- c.   *When he was sick, Julius left.*  
          └──────────┬──────────┘  
                                  ↑

That Julius was sick is here framed as a reason for his leaving. And reasons tend to be about those actions they are reasons for. In (16c) we are not dealing with an action-reason relation, but with a clause describing the circumstances of Julius's action. Also giving the

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<sup>3</sup> The classification of pronoun occurrences is dealt with in detail in Bosch 1983, Ch. 2. Operational criteria for the various distinctions are there explained.

circumstances of an action is naturally seen as a statement about that action. – More specifically, however, BK assumptions about plausible connections between being sick and leaving are required. Such connections would be lacking between shouting and leaving, for instance. Hence the lack of plausible anaphoric connections in the sentences in (28), which are otherwise parallel to those in (16):

- (28) a. *He was shouting. That's why Julius left.*  
 b. *Because he was shouting, Julius left.*  
 c. *When he was shouting, Julius left.*

Here, a connection between someone else's shouting and Julius's leaving is more plausible, and hence a non-coreferential interpretation of *he* and *Julius* would probably be preferable. Even in the sequentially appropriate version in (29), coreference is not easy to establish:

- (29) *Julius left. He was shouting.*

Let me now try to make a bit clearer, what aboutness comes to in terms of comprehension processes.

Each sentence in a discourse changes the CM,  $CM_i$ , with respect to which it is interpreted, into a following  $CM_{i+1}$ . For a sentence to accomplish this, it must link up to the preceding  $CM_i$  and introduce something new into  $CM_i$ . Each task is carried out by a separate constituent of the sentence. The constituent that does the linking up functions anaphorically, in the sense of retaining the listener's preceding focus; the other constituent makes the listener focus on something new or something not clearly in focus and thus functions deictically (in the sense hinted at above)<sup>4</sup>. The anaphoric constituent thus has the task of linking up to a  $CM_i$  representation, the one the sentence is about. Simple cases are the following:

already represented in $CM_i$	processed with respect to $CM_i$
(30) <i>Julius runs a sweet shop.</i>	(31) a. <i>He is a really nice man.</i> b. <i>It's on Elm Street.</i> c. <i>So does Brenda.</i>

*He, it, so does* are the anaphoric constituents in (31) a.-c., and they link up to representations of Julius, the sweet shop, and running a sweet shop respectively. What is added to Julius's  $CM_i$  representation is that he is a really nice man. To the representations of the sweet shop its location on Elm Street is added and to the representation of the property of running a sweet shop the fact that this property is instantiated not only by Julius but also by Brenda.

So much for the simple cases, But can we maintain this simple division of two constituents also for more complex sentences? I think that we can. We only have to part from the simplifying assumption that the processing of utterances proceeds sentence by sentence. And no one would probably want to maintain anyway that page-length sentences are processed in one piece. Short term memory must be able to hold what is processed in one step, and this limitation is severe. I do not know how large exactly short term memory is, and the little that is known still depends on the 'chunking' of information. But let us try to make do with as little memory capacity as possible and postulate Processing Units (PUs), each of which consists of just two 'chunks' or constituents: an anaphoric one and a deictic one. Simple sentences, like those in (31), would consist of just one PU. The APA and the PNSA are now

<sup>4</sup> The anaphor-deixis distinction is explained in detail in Bosch, 1983, Chs. 2.3 and 3.3.

reformulated, substituting ‘PU’ for ‘sentence’. PUs then are the units of text or discourse that are processed with respect to CMs in the fashion we have discussed.

There are four minor deviations from this first definition of PUs.

First, there are PUs that consist of only one constituent, the deictic one, as for instance, in (32b):

- (32) a. *Who was that on the phone?*  
b. *Julius.*

Second, some PUs are extended by some kind of stage setting device that indicates more clearly the kind of CM to which they must link up, or the kind of CM that must be constructed for their interpretation ad hoc. I speak here of Extended Processing Units (EPUs), and the ‘stage setting device’ I call Exposition Phrase (EP). EPUs thus are PUs with an added EP. EPUs typically occur discourse initially and at ‘turning points’ in discourse, where otherwise coherence might be threatened. The following are examples (EPs are underlined):

- (33) a. *Yesterday afternoon*, *I was sitting at my desk.*  
b. *Then*, *Julius left.*  
c. *In our front garden*, *we keep a nice display of weeds.*

The EP would here either preselect a particular CM that fits it, or lead to the construction ad hoc of a minimal CM satisfying it. The following PU in the EPU then is processed as usual with respect to this CM.

The third amendment to the above definition concerns a certain (fixed) class of expressions denoting what I called ‘syntactic concepts’ in Bosch (1983) that are comparable to logical constants in formal languages and that are neither concerned with linking up to CMs nor with adding to them, but with the structuring of processing with respect to different CMs. And, or, but, of course, however, because, for instance, either (...or) are some examples. These expressions do not normally form part of PUs but give instructions about how PUs are to be linked to BK and CMs.

The fourth modification concerns the notion of an anaphoric constituent in a PU. Not always, as we saw earlier, do anaphors link up to a representation already present in the relevant CM, but they may also implicitly introduce representations that are treated by speaker and listener as if they were already present in the CM. Any objects that may without contradiction be assumed in the relevant CM, or are even expected to be present on grounds of default specifications in BK linked with lexical material processes earlier, can be introduced this way. Typical examples are anaphorically occurring first and second person personal pronouns, but also many definite NPs relating to objects generally known or contextually expected.

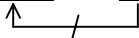
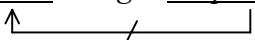
Having added these modifications to the notion of a PU, we can now illustrate by an example, how a slightly more complex sentence would be broken up into PUs. Consider:

- (34) *When Julius arrived, we had left and no one expected him.*

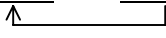
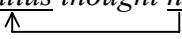
The first clause is here taken as an EP and is interpreted by the ad hoc construction of a CM, CM<sub>i</sub>, representing a situation in which someone called ‘Julius’ has a property called ‘arrived’, plus any default specifications from BK concerning the representation of both the individual and the property. This EP forms part of a larger EPU, “when Julius arrived, we had left“, the second part of which is a proper PU and is interpreted with respect to CM<sub>i</sub>, taking for granted a representation for we (as the anaphoric constituent) and adding the representation-of the property of having left to it, again, supplemented with any suitable BK specifications. The

result is  $CM_{i+1}$ . The last part of (34) again forms a separate PU, linking up to  $CM_i$  (if we read the *and* as an *and* of simultaneity and not as ‘*and then*’). The anaphoric constituent clearly is *him*, which links up with the representation of Julius, and the-property that no one expected him is added to this representation, yielding  $CM_{i+2}$ . The syntactic concept of *and* would also have to take care of the integration of the results of the two PUs it links, thus yielding a final  $CM_{i+3}$ , which is a mere addition of  $CM_{i+1}$  and  $CM_{i+2}$ .

On the background I have just sketched, the one and only constraint on anaphoric relations proper proposed in *Agreement and Anaphora* (Bosch, 1983) becomes apparent as a mere consequence of processing mechanisms: there are no anaphoric relations inside PUs. Thus we cannot have anaphoric links as in (35):

- (35) a. *Julius saw him in the mirror.*  
  
 b. *Julius thought the poor soul was sick.*  


But there can be pronoun-antecedent relations inside PUs if the pronouns are SPs. Thus (35a) with a reflexive – here the corresponding SP form – and (35b) with a personal pronoun (SP) instead of the anaphoric NP do allow for corresponding pronoun antecedent relations (which are then, of course, relations of syntactic agreement):

- (35') a. *Julius saw himself in the mirror.*  
  
 b. *Julius thought he was sick.*  


Thus, syntactic agreement relations (SP relations) are possible where proper anaphoric relations (AP relations) are excluded: inside PUs. The only constraint they are subject to is that the SP must occur as part of a complex predicate and its agreement constituent (‘antecedent’) must be in the argument position of that complex predicate<sup>5</sup>. Agreement relations then occur only inside PUs.

Thus we have one constraint on SPs and one on APs, or anaphoric relations more generally, both of which are part and parcel with the corresponding processing mechanisms. The APA should not be seen as a constraint. It is a general principle of coherence and really says no more than that if we cannot see how a particular PU (and PUs are the smallest units that can be about anything) can be about some particular object, that is, if our BK does not provide for any suitable links, then we can of course not relate a pronoun inside the PU to that object.

## 7.

Let me stress again that the constraints introduced in the last section are not isolated or abstract constraints but features of the hypothetical comprehension mechanisms we are assuming. They need thus not even be stated separately. One would state them separately and defend them on their own account – as I myself did in *Agreement and Anaphora* – only if the primary interest is in explaining why, in certain constructions and contexts and with particular lexical material, certain pronoun-antecedent relations or certain pronoun interpretations are impossible. And this was the central focus of linguistic pronoun research, and for many linguists it still is. I have tried to indicate above, however, that I think it would be more fruitful to move on to a new perspective, taking as fundamental the notion of comprehension

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<sup>5</sup> This constraint (the Syntactic Agreement Constraint, SAC, in Bosch, 1983) is what I take to be the sound nucleus of Reinhart’s (1976) C-Command Constraints, cf. Bosch (1983, Ch. 6).

and as a goal the clarification of the notion of coherence. Constraints will trivially result on such an approach, for those who want them, but as by-products.

Let me stress that this perspective need not involve the abandoning of any interest on linguistic universals or in physiological conditions of language. If such there are – and I have not the least doubt about that – they will show up also in the course of investigations of processes of comprehension. They may well turn out to be less purely linguistic in nature than is sometimes supposed. But if that is so, the worse for an autonomous view of linguistics and the better for cognitive science.

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