

Accessibility and definite noun phrases

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1. Introduction¹

The interpretation of a discourse essentially depends on the referential link between the linguistic expressions. In this paper I discuss in particular the interaction of definite (full) noun phrases and the accessibility structure, which is assumed to be a network of semantically related sets of ranked discourse items associated with the predicates that have introduced them, rather than one single set of ranked items. I contend that not only does the accessibility structure determine the definiteness status of referring expressions, but also that definite noun phrases change this accessibility due to their descriptive content. The definite noun phrase *the small bird* refers not only to the most accessible small bird in the context, but in general also raises the accessibility of that bird with respect to the predicate *small birds* and some hyperonyms such as *birds* and *animate objects*. I will show that this interaction between accessibility and definite noun phrases is one of the central principles that constitutes the coherence of a discourse.

In section 2, I discuss this interaction in four types of common phenomena: (i) disjoint reference of different occurrences of the same definite noun phrase; (ii) the alternation between definite noun phrases and pronouns in anaphoric chains; (iii) the type of anaphoric relation; and (iv) the conditions for a “first-mentioned” definite noun phrase. In section 3, I examine the different aspects of accessibility (i) as activation, (ii) as relation, (iii) as hierarchies, and (iv) as salience. In section 4, I discuss different concepts of accessibility as activation and discuss two accessibility hierarchies: Ariel’s Accessibility Marking Scale and Gundel & Hedlands & Zacharski’s Givenness Hierarchy. I show the particular role of definite noun phrases

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es in these two scales and maintain that both scales neglect some essential features of definite nouns, namely that they are dynamic expressions. The comparison of Discourse Representation Theory and Centering shows that there are different notions of accessibility: a categorical and a graded one. Section 5 discusses the notion of salience in the accessibility structure and in anaphoric relations. Salience denotes a relation between different (semantic) objects of the same kind, which are defined by the descriptive content of the expression. The most salient object is the most-accessible object for an anaphoric term. Referring expressions, such as indefinite and definite noun phrases, raise the salience of their referent with respect to the set associated with their descriptive content. Furthermore, they also change the salience structure of some semantically related sets, a process that I term “salience spreading”, accounting for the dynamic processes in the accessibility structure. Section 6 gives a brief summary and further research prospects,

2. Discourse coherence and definite noun phrases

In the late 70s increasing interest in discourse analysis led to a new generation of semantics that investigated discourses rather than isolated sentences. The research was initiated in disciplines as different as philosophy (Stalnaker 1978), logic (Lewis 1979), semantics (Heim 1982; Kamp 1981), the structuralism of the Prague School (Sgall & Hajicová et al. 1973; 1986), discourse pragmatics (Chafe 1976; Prince 1981), and artificial intelligence (Webber 1979). All these approaches were mainly interested in the way the coherence of texts or discourses is linguistically established. Anaphoric and definite expressions are in the center of interest, since they are the main means to creating coherence between sentences. Thus, discourse anaphora reflect the interaction between the discourse structure and the interpretation of a particular linguistic expression. The interpretation depends on discourse structure, as noted by Grosz et al. (1990, 445):

Discourse context affects the interpretation of individual phrases and clauses within a single utterance. The meaning of pronouns and definite descriptions is quite obviously influenced by the context in which they are used, among the most widely studied problems in discourse processing are those concerning the influences of context on the processes of generating and interpreting such phrases.

In this paper I will focus on definite noun phrases, on contextual parameters that determine their reference, but also on their unique context change potential. It will be shown that the descriptive content of definite noun phrases changes the accessibility structure of the context. This influence of definite noun phrases on the accessibility is illustrated by the following four phenomena: (i) disjoint reference of differ-

ent occurrences of the same definite noun phrase; (ii) the alternation between definite noun phrases and pronouns in anaphoric chains; (iii) the type of anaphoric relation; and (iv) the conditions for a “first-mentioned” definite noun phrase.

2.1 Disjoint reference of different occurrences of the same definite noun phrase

Different occurrences of the same definite noun phrase can refer to distinct objects or discourse items, as illustrated in (1). The noun phrase *two sharks* introduces two discourse items. One is picked up by *the one* and continuously referred to by *his*, *the shark* and *the shark*. The other discourse item is picked up in the next paragraph by *the other shark*, but then referred to by *his*, *his*, *he*, *his*, *him* and *the shark*. By mentioning the second discourse item and ascribing predicates to it, its salience or accessibility has been raised such that the last occurrence of *the shark* refers to it. Similar examples are well-known from the literature (see Lewis 1979 for a comparable example with cats):

- (1) The **two sharks**_{1⊕2} closed together and as he saw **the one**₁ nearest him open **his**₁ jaws and sink them into the silver side of the fish, he raised the club high and brought it down heavy and slamming onto the top of **the shark**₁'s broad head. He felt the rubbery solidity as the club came down. But he felt the rigidity of bone too and he struck **the shark**₁ once more hard across the point of the nose as he slid down from the fish.

The other shark₂ had been in and out and now came in again with **his**₂ jaws wide. The old man could see pieces of the meat of the fish spilling white from the corner of **his**₂ jaws as **he**₂ bumped the fish and closed **his**₂ jaws. He swung at **him**₂ and hit only the head and **the shark**₂ looked at him and wrenched the meat loose. (Hemingway, *The Old Man and the Sea*, 64)

Such disjoint references of one and the same definite noun phrase cannot be explained in static semantics with a strong uniqueness condition for definiteness. We need rather a more flexible condition for definiteness, namely salience, and a dynamic interpretation of definite noun phrases, which accounts for their context change potential.

2.2 Alternation between definite noun phrases and pronouns in anaphoric chains

The indefinite description *a small bird* introduces a new discourse item that is subsequently picked up by the anaphoric pronoun *he* or the anaphoric definite noun phrase *the bird*. The distribution of these two alternatives is not well understood. In the example below, it seems that the full definite noun phrase is necessary

to bring the discourse item back into the topic function. However, there is a general observation that we often find anaphoric chains such that a full noun phrase introduces an item which is subsequently picked up by pronouns. But after two or three pronouns another full noun phrase seems necessary to keep the activation level of the item high. So we generally find anaphoric chains of the following type: *(in)definite noun phrase₁, pronoun₂, pronoun₃, (... pronoun_n), definite noun phrase_{n+1}, pronoun_{n+2}* etc. with *n* not much greater than 3. Again, a discourse semantics has to account for this distributional behavior of pronouns vs. full definite noun phrases.

- (2) A **small bird**₁ came toward the skiff from the north. **He**₁ was a warbler and flying very low over the water. The old man could see that **he**₁ was very tired. **The bird**₁ made the stern of the boat and rested there. Then **he**₁ flew around the old man's head and rested on the line where **he**₁ was more comfortable. (Hemingway, *The Old Man and the Sea*, 28)

2.3 The type of anaphoric relation

The prototypical anaphoric relation consists of an antecedent and an anaphoric expression where the anaphoric expression contains less information than the antecedent one, such as *a bird... he* or *a small bird... the bird* in (3a). This corresponds to the function of an anaphoric expression, namely to establish a link to the already introduced discourse item. The semantic relation between two such expressions can be described as a “superset”-relation, i.e. the descriptive content of the anaphoric term is associated with a superset of the set that is associated with descriptive content of the antecedent term, as in (3a). Anaphoric pronouns do not contain content except for gender and number information; so they are associated with sets of all (male, female, inanimate) objects. However, it is also possible to pick up a discourse item with the same expression as it was introduced, as in (3b). This seems to be a marked option, but it can be appropriate in certain contexts. Here the anaphoric relation corresponds to the semantic relation of identity between the sets associated with the descriptive content of the two expressions involved. These two types of anaphoric relations, i.e. (3a) and (3b), are also known as semantic anaphora, since their relations are encoded in the lexical semantics of the corresponding descriptive terms (or to the composition of such terms).

- (3) Types of anaphoric links and corresponding semantic relations

	anaphoric link	semantic relation
a	<i>a bird... he, a small bird... the bird</i>	superset
b	<i>a bird... the bird</i>	identical sets

c	<i>a small bird... the beautiful animal</i>	intersection
d	<i>a bird... the small bird</i>	subset

However, we also find anaphoric relations like (3c) and (3d), which are known as pragmatic anaphora, since additional knowledge is necessary to establish the anaphoric link. In (3c), the anaphoric term expresses additional content and can therefore be linked only to the antecedent if there is either no competitor in the context, or the reference is established by other means. The corresponding semantic relation is intersection (which might be – in extreme cases – empty). Similarly in (3d), where the link is only possible if additional knowledge is supplied, the semantic relation corresponds to the subset-relation. Such pragmatic anaphora are used to introduce background information by forcing the hearer to accommodate the new information into the background. They are often used in newspapers, where it seems necessary to integrate much (background) information into little text. A theory of dynamic accessibility has to account for these different anaphoric relations and must make a distinction between the semantic and pragmatic type.

2.4 Conditions for a “first-mentioned” definite noun phrase

It was observed (see Fraurud 1990, Poesio & Vieira 1998, Poesio 2003 and others) that we find many definite noun phrases being used to introduce new discourse items, even though dynamic theories say that only indefinite noun phrases (and proper names) can introduce new discourse items, while definite noun phrases refer to already established ones. These “first-mentioned” definite noun phrases can be divided into different classes depending on the conditions under which they are licensed. The definite noun phrase *the government* in (4) is licensed by our knowledge that Koreans, like other people, have a government (this is the “broader situational use” of Christophersen 1939, 29). Other cases include different types of bridging, such as in (5), where the relation between the antecedent term and the anaphoric term is a functional relation, here of authorship (this corresponds to the “implicit contextual basis” of Christophersen 1939, 29). Such indirect anaphoric expressions can also be licensed by frames, as in (6), or other kinds of linguistic or encyclopedic knowledge:²

- (4) For the Parks and millions of other young Koreans, the long-cherished dream of home ownership has become a cruel illusion. For **the government**, it has become a highly volatile political issue. (Poesio & Vieira 1998, 198)
- (5) John bought a book. **The author** is well known.

2. See Schwarz 2000, who distinguishes between the following kinds of indirect anaphors: (i) semantic type, (ii) encyclopedic and (iii) inferential; Consten 2004 extends these domains by others such as pictorial information.

(6) John entered a restaurant and sat at a table. **The waiter brought the menu.**

Other than in the examples in (3), the licensing term (or *anchor*) and the definite term are not co-referential (this is the reason we do not call them antecedent and anaphoric). The interaction between the descriptive content of two noun phrases and the accessibility structure of the text is more intricate. Still, a dynamic theory of accessibility has to pay attention to these data. Before we develop a dynamic theory that accounts for this interaction, we first present a detailed presentation of the different aspects of accessibility discussed in the literature.

3. Aspects of Accessibility

The notion of accessibility plays a crucial role in the discussion of discourse structure and referential behavior of linguistic expressions. The general picture of an anaphoric relation is illustrated in Figure 1. The anaphoric relation is not a direct relation between the antecedent and the anaphoric expression, nor a direct relation to some object in the world, but a mediated one at the level of discourse representation (see Karttunen 1976 and subsequent work). A referring expression (the antecedent) is associated with a mental object, a discourse item or discourse referent. In some theories, this item is additionally linked to an object in the “world” or in a model representing the world by particular rules. A subsequent referring expression, the discourse anaphor, is associated with the discourse item establishing the anaphoric link.

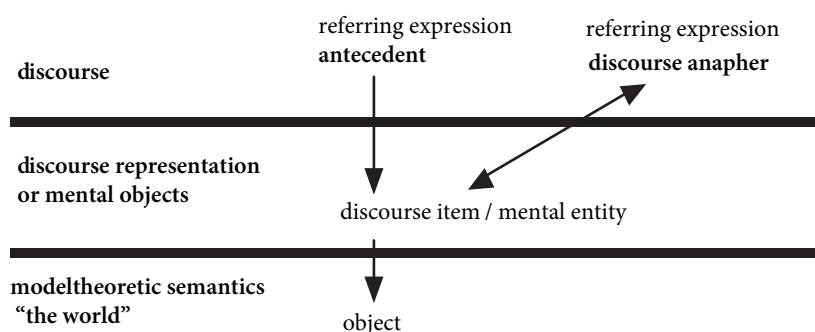


Figure 1. Discourse representation and anaphoric relations

As presented above, the relation between the antecedent and the discourse anaphor is determined by the accessibility (structure) of the discourse, i.e. the access of the anaphoric term to the discourse item, on the one hand, and the ranking of

different discourse items, on the other. This intuitive notion can be separated into several aspects of accessibility, which are not, however, always clearly distinguished in the literature. Figure 2 attempts to illustrate five different aspects of accessibility: *activation* [1], the *accessibility relation* [2], *accessibility hierarchy* [3], *accessibility structure* [4], and the *saliency* [5] of the objects in some model (or the “world”). These different, though closely related, aspects have characteristic features, which are presented in the following subsections.

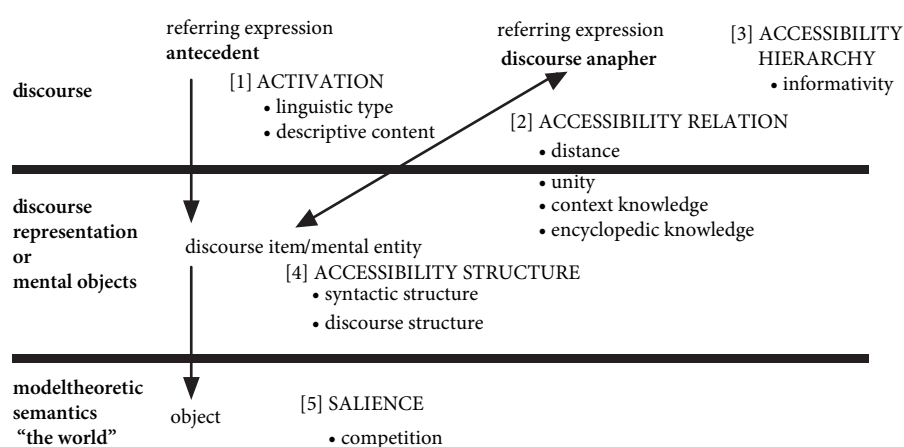


Figure 2. Five aspects of accessibility

3.1 Accessibility status or activation

A referring expression introduces, activates or evokes a mental object or discourse item. This entity is assigned a certain accessibility status or activation based on the linguistic or lexical type (pronoun, proper name, full noun phrase), the descriptive content and syntactic function of the associated expression. For instance, an entity associated with a subject receives a higher accessibility than one associated with an object, which amounts to one of the central rules in Centering Theory (see below). A definite noun phrase or a proper name activates its associated referent in a different way than an indefinite noun phrase. Inherent properties, such as animacy, of the referred to objects are sometimes also included in this activation.

However, little attention is paid to the descriptive content's role with respect to activation. It is generally assumed that the descriptive content restricts the class of elements to which the activation applies. The mirror of this is discussed below in section 3.5 under the heading “saliency”.

3.2 Accessibility relation

The accessibility relation holds between an already activated or established element in the discourse and another referring expression that is associated with it, the discourse anaphor. This anaphoric expression “accesses” the discourse entity. The access is determined, among other factors, by the distance and the syntactic structure between the anaphoric expression and the antecedent that has activated or introduced the entity. Furthermore, contextual and encyclopedic, as well as inferential knowledge, may constrain the relation. This relation can be understood as an instantiation of the more general reference relation. If the reference relation holds between a linguistic expression and an object in the immediate context or situation, we call it a deictic reference. If the expression refers to an object that is available in our encyclopedic knowledge, we call it an encyclopedic reference. Only if the relation holds between an expression and an entity that was introduced by the preceding discourse is the accessibility relation adequate. Furthermore, any reference to discourse items has two different incarnations: activating or accessing. If the expression refers for the first time to an entity, it evokes or activates it; while a reference to an already accessible or activated entity is described by accessing this entity. A discourse semantics should be able to describe both aspects – activation and accessibility relation, by the same mechanism.

3.3 Accessibility hierarchies

The accessibility hierarchy is reflected in the choice of the anaphoric expression. If the intended entity is easily accessible, the anaphoric expression need not be very informative (e.g. a *pro*-form or an unstressed pronoun), while less accessible entities need more information in the anaphoric expression (full noun phrases, full names). This reflex of the anaphoric expression with respect to the status of the intended referent is described in various hierarchies, such as in Ariel’s (1990) Accessibility Marking Scale or in the Givenness Hierarchy of Gundel et al. (1993). One interesting question relating to these hierarchies is whether they only reflect the degree of accessibility of the associated entity or whether they also show the degree of activation for a newly activated entity. In other words, does the hierarchy express only the degree of context dependency of the referring expression, or does it also possess the potential for changing the context? We discuss this in more detail in section 4.

3.4 Accessibility structure

The accessibility relation depends on a variety of factors, one of which is the structure of the discourse. Thus, we can assign to a discourse domain, segment or structure an ordered set of accessible entities. The accessibility structure can be understood as a property of a discourse which yields an ordered set of accessible items (with respect to a certain structural position). This notion is predominant in the discussions of Centering Theory and Discourse Representation Theory, and is illustrated in Figure 3:

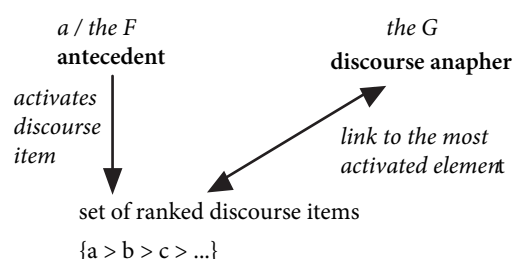


Figure 3. Accessibility to one set of ranked elements

3.5 Accessibility and properties: Saliency

The description of an accessibility structure for a discourse captures important grammatical parameters, however it misses to account for one of the most important semantic contributions to accessibility: the descriptive material that introduces an entity. Accessibility in this sense is an instantiation of the more general principle of saliency (see Lewis 1979, von Heusinger 1997). Saliency is a property of a set associated with descriptive material expressed in a referring expression. The accessibility structure of a discourse is formed by listing the salient items of each set associated with some predicate used in that discourse, and the relations between the listed sets, such as hyponymy etc., as illustrated in Figure 4.

This different view of accessibility can be illustrated mainly by the behavior of definite and indefinite noun phrases, since they exhibit a considerable descriptive material. Pronouns or proper names do not, and form therefore an unlikely testing field for this view. Nevertheless, most theories focus on the use of pronouns and their antecedents, but not on definite description, thus missing interesting generalizations.

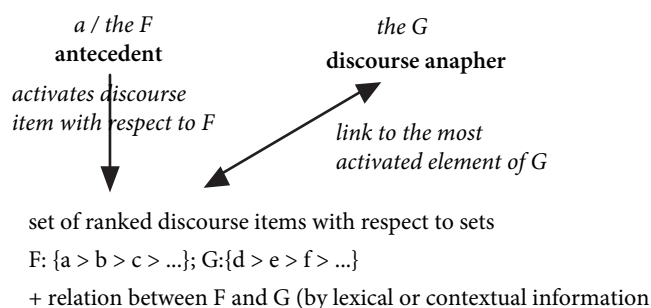


Figure 4. Accessibility to sets of ranked elements with respect to predicates

4. Accessibility and descriptive content

One approach to discourse structure and coherence in discourse focuses on the activation of mental entities which are taken to be associated with linguistic expression. In these theories, the mental entities are activated by uttering an associated expression. The choice of a subsequent expression associated with the same entity reflects the activation or accessibility status of the mental entity. Referring expressions can be ordered according to their informativity. The more informative they are, the less accessible the associated entity. These accessibility hierarchies (or informativeness hierarchies) come in different guises. Prince (1981) is one of the first hierarchies of this sort, in which the following types of referential statuses are distinguished: *evoked {textually, situationally}* > *unused* > *inferable* > *brand-new*. I will discuss and compare the two further developed hierarchies of Ariel (1990) and Gundel et al. (1993) with respect to the five aspects of accessibility in the last section. A brief comparison between Discourse Representation Theory and Centering Theory will show that there are different concepts of accessible discourse items – a categorical and a graded one.

4.1 Accessibility Marking Scale


Ariel (1988, 1990, 73) proposes the Accessibility Marking Scale (1), according to which the speaker selects an expression to refer to an accessible entity. If the entity is highly accessible a pro-form or a pronoun is used, whereas definite noun phrases are employed for less accessible items. The speaker must make sure that the degree of accessibility marked by the referring expression matches the degree of accessibility associated with the mental entity by the addressee.

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(7) Accessibility Marking Scale

Low Accessibility (of the antecedent):

- 
- (a) Full name + modifier
 - (b) Full („name“) name
 - (c) Long definite description
 - (d) Short definite description
 - (e) Last name
 - (f) First name
 - (g) Distal demonstrative + modifier
 - (h) Proximal demonstrative + modifier
 - (i) Distal demonstrative (+ NP)
 - (j) Proximal demonstrative (+ NP)
 - (k) Stressed pronoun + gesture
 - (l) Stressed pronoun
 - (m) Unstressed pronoun
 - (n) Cliticized pronoun
 - (o) Extremely High Accessibility Markers (gaps, including pro, PRO and wh traces, reflexives, and Agreement)

High Accessibility (of the antecedent)

This hierarchy is the result of empirical observations and merges three different kinds of contexts: the encyclopedic context, which is mainly responsible for proper names and unique definite descriptions; the situational context, which licenses deictic expressions; and the linguistic context, which determines the anaphoric expressions. Since Ariel is not only interested in the anaphoric use of referring expressions, she subsumes all these kinds of contexts under one general scale. Ariel (1990, 28–29) lists four main parameters which govern these scales. (i) The *Distance* between the antecedent and anaphor, what we have subsumed under the accessibility relation in section 3.2. (ii) The *Competition* is determined by the number of potential antecedents. According to Ariel (1990, 28) “the more competitors the less accessible will be the referenced entity.” However, we have seen that it is not just the number of competitors, but the number of competitors with the same properties. (iii) The *Saliency* expressing whether an antecedent is topical or not. This corresponds to our concept of activation in 3.1, and not to what we have termed *saliency* in 3.5. (iv) The *Unity*, which expresses different aspects of the discourse structure, including whether the antecedent is in the paragraph or discourse segment as an anaphoric term. This corresponds to our accessibility structure in 3.4. The activation aspect is described by

Ariel (1990, 22) as depending on two main factors, namely salience (in our sense described in 3.5) and the relation between them:

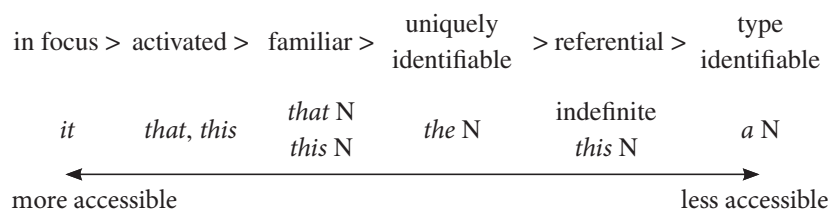
The degree of accessibility of the mental entity serving as linguistic antecedent varies according to two main factors. First, some antecedents represent mental entities inherently more salient (...) The second factor that determines the degree of accessibility of a specific antecedent (or rather its mental representation) at the time when the potentially anaphoric expression is being processed, is the nature of the relation between the two. Thus, the distance between the last mention of the potential antecedent and the putative anaphoric expression determines how accessible the antecedent is to the addressee when interpreting the potentially anaphoric expression.

We will come back to these two notions: salience is discussed in section 5, and the “distance” is worked out in theories like Centering Theory or DRT, which are briefly characterized in section 4.3.

4.2 Givenness Hierarchy

Gundel, Hedland & Zacharski (1993) present the Givenness Hierarchy (8), which ranks the different linguistic expressions in an order of statuses. The Givenness Hierarchy confines the domain of potential antecedents in the following way: since pronouns are more likely to relate to highly activated elements, definite noun phrases are only used if one refers to less activated elements (by some general conversational principles).

(8) Givenness Hierarchy (Gundel, Hedland & Zacharski 1993)



Unlike Ariel, they do not list a set of parameters that determine the accessibility, but give a particular description of each of the statuses, which makes strong reference to the cognitive status of the referent in some mental domain. *In Focus* means that the referent is at the current center of attention. *Activated* expresses that the referent is represented in current short-term memory. *Uniquely Identifiable*: the addressee can identify the speaker’s intended referent on the basis of the nominal alone. *Referential*: the speaker intends to refer to some particular object or objects.

Type Identifiable: the addressee is able to access a representation of the type of object described by the expression.

This scale is simpler than Ariel's, but it is surprising that indefinite noun phrases are included in it. Indefinite noun phrases refer to predicates rather than to accessible discourse items. Therefore, there are some problems with the description of these statuses, which are defined by very different concepts as activation, reference and identification. Reference is a relation between an expression and an object in the "real world", it is not clear whether it is helpful to explain the activation status of a mental or cognitive entity. Both hierarchies are very similarly designed and differ only in some minor points. Both theories conceive accessibility as a gradable property of a mental or "cognitive" entity, which can be more or less accessible. The linguistic expression associated with this entity must match the degree of accessibility associated with the intended entity. The two approaches differ in whether the categories in the hierarchy are mutually disjointed (Ariel) or whether less accessible statuses include more accessible (Gundel et al.). They agree, however, in the view that the accessible items are listed simply at some level of the discourse structure. They do not assume a more complex accessibility structure, nor do they say more about the discourse structure in general.³

4.3 Discourse structure and accessibility

Discourse structure restricts accessibility in two respects: (i) whether or not an item is accessible, and (ii) how accessible it is. Discourse Representation Theory (DRT) formulates the rules for (i), while Centering Theory is more concerned with (ii). The two approaches differ in whether accessibility is a gradable or non-gradable notion, and whether it is applied to discourse domains or discourse segments. A discourse domain contains all expressions that have an equal relation to discourse-domain-creating operators like negation, modals or verbs of attitudes. Discourse domains are nested and represented as DRSs or boxes in DRT. Discourse segments, on the other hand, are suprasentential units of two or more connected sentences. They determine a local domain in which certain rules for pronominal reference are defined.

In the DRT of Kamp & Reyle (1993), or more recently Kamp & von Stechow (to appear), both indefinite and definite expressions introduce new discourse referents. The discourse referent of a definite or anaphoric expression must be identified with an already established discourse referent to meet the familiarity condition. Hence, the anaphoric relation is represented as an identification of the

3. Hegarty & Gundel & Borthen (2001) combine the Givenness Hierarchy with Information Structure. However, they only compare demonstrative anaphors with pronominal ones.

new discourse referent with an accessible one. There are structural restrictions on the accessibility of discourse referents, which are encoded in the construction rules for DRSs. For instance, a discourse referent can only be linked to another one that is represented in the same discourse domain or box. The discourse referents form a set of accessible antecedents with respect to a discourse domain, as illustrated in the schematic representation of a discourse consisting of sentences *S1*, *S2*, *S3*, and *S4*, with a logical form $P(a)$, $R(\text{he},b)$, $Q(c,a)$, $T(d,\text{him})$ (think of sentences like: *Arno comes. He greets Benno. Chris looks at Arno. Dora talks to him*). DRT incrementally translates these forms into DRSs (boxes), in which the accessible items (discourse referents) are listed simply.

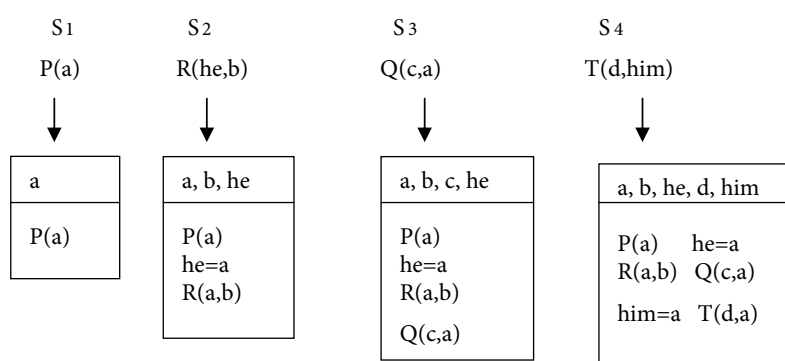


Figure 5. Incremental translation into DRSs with sets of accessible discourse referents

Accessibility in DRT is a non-gradable notion and the property of the discourse domain. The problem is that there is no additional “fine-tuning” between different accessible discourse referents in the same domain, a fact already noted by Bosch (1988, 207):

Although a limitation of the search to discourse domains is certainly a step in the right direction, and although the assumption of discourse domains seems useful also for a number of other purposes, they are still too large to serve as search spaces for reference resolution. It is highly implausible, for instance, that a personal pronoun like *she* should be interpretable unambiguously only in a discourse where precisely one woman has occurred.

A more promising alternative is the notion of temporary salience of particular discourse referents and a corresponding dynamic salience structure or focus structure, which may or may not be superimposed on discourse domains.

In Centering Theory, an alternative family of approaches to the representation of discourses (cf. Grosz et al. 1995), the discourse structure has three components: linguistic structure, intentional structure and an attentional state. The attentional state represents the availability of discourse referents at any given point in the discourse. Centering Theory assumes a fine-tuning among accessible discourse items, which is mirrored in the ranking of accessible items. The subject of the first sentence is the only item, and therefore the pronoun can refer back to it. In the third sentence, however, the actual subject becomes the highest ranking element; and in sentence four, the referent *b* has already disappeared, as sketched in Figure 6:⁴

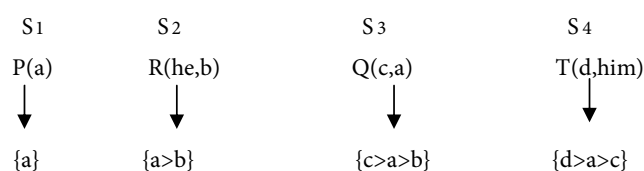


Figure 6. Ranking of accessible discourse referents in Centering Theory

This approach to the local coherence of discourse segments provides strategies for finding antecedents for anaphoric pronouns. However, it does not account for the antecedent of a definite noun phrase, which depends on a global accessibility. Centering Theory distinguishes between local and global accessibility or focusing, but describes only the local interaction with pronouns (Gordon et al. 1993, 312):⁵

Two kinds of focusing were distinguished: global focusing and immediate focusing. It was claimed that global focusing affected the production and interpretation of definite descriptions, whereas immediate focusing affected the production and interpretation of pronouns.

In summary, DRT perceives accessibility as a function of the structure of a discourse domain (box) that yields a set of discourse referents. The structure is defined by the construction rules of DRSs. Expressions like negation or modals create subdomains, and referring expressions like proper names and indefinites differ in whether they introduce their discourse referents in the current domain or in the main domain,

4. See Grosz et al. 1995 for a comprehensive presentation of Centering Theory, Gundel 1996 for a comparison with Relevance Theory, and Beaver (2004) for an OT-version of Centering and an evaluation.

5. Passonneau (1998) gives an account of definite anaphoric noun phrases in Centering Theory. She discusses the principles according which such a anaphoric expression selects one out of many potential antecedents. However, she does not discuss cases in which two occurrences of the same expression can refer to different antecedents.

reflecting the traditional concept of scope interaction. The set of accessible discourse referents constantly increases in a progressive discourse. However, there is no “competition” or ranking between different discourse referents in the same domain. Centering Theory, on the other hand, assumes that accessibility is a function of a discourse segment that yields an ordered set of discourse items. Linguistic expressions introduce discourse items into the set and rank them. Subsequent expressions not only introduce new elements but also change the ranking. Once a referent is not mentioned for a certain span of sentences, the associated discourse referent is eliminated. This model gives only constraints on pronominalization in local domains, but no rules for accessibility of anaphoric expression in general. Both approaches assume one set of accessible items for each discourse, which they describe in structural terms: DRT in scope interaction, and Centering Theory in grammatical roles. However, they neglect the role of the descriptive content of the expression by which the discourse item is introduced.⁶

5. Salience and accessibility structure

In this section I focus on the analysis of anaphoric expressions with descriptive material, i.e. definite noun phrases, and maintain that accessibility is not the function of a discourse that yields a single set of accessible elements; it is rather a function of the discourse that yields various ordered sets, each set corresponding to the descriptive content of a referring expression.

5.1 Uniquely accessible referent

In order to distinguish this notion of accessibility from the gradable and non-gradable one, I call the accessible referent of the set s associated with a predicate P (representing the descriptive content) the “most-accessible” or the “uniquely accessible” referent of P . The phenomena which are captured by this notion are illustrated by the discourse in (9), which has the schematic structure (9a) and the representation (9b). Two discourse referents dn and dk are introduced by two occurrences of the indefinite noun phrase *a student*. The two discourse referents for the two occurrences of the anaphoric noun phrase *the student* are unambiguously related to one of the two already introduced referents. However, in DRT there is no formal tool to decide why to identify the discourse referent dl as the second definite noun phrase *the student*, with the discourse referent dk standing for the sec-

6. See also Roberts (1998) and Cornisch (1999) for a more detailed comparison between DRT and Centering.

ond indefinite noun phrase, and not with *dm* representing the first indefinite noun phrase. In Centering Theory, there is no principle to relate definite noun phrases to their indefinite counterparts.

- (9) The dean is very busy these days: this morning *a student* complained about his exam. The dean had to talk to *the student* for more than two hours. Then *a student* came to talk about his neighbors who play the trumpet every night. The dean moved *the student* to a different place.

(9a) $P_1(a \text{ student}) \dots P_2(\text{the student}) \dots P_3(a \text{ student}) \dots P_4(\text{the student})$

(9b) $\{\dots, d_n, \dots, d_m, \dots, d_k, \dots, d_l, \dots \mid \dots P_1(d_n) \dots P_2(d_m) \ \& \ d_n = d_m \dots P_3(d_k) \dots P_4(d_l) \ \& \ d_k = d_l, \dots\}$

While (9) is a constructed example and somewhat artificial, example (1), repeated as (10), is taken from the novel *The Old Man and the Sea* by Ernest Hemingway. Here, as in (9), different occurrences of one and the same definite noun phrase refer to different objects.

- (10) The **two sharks**_{1⊕2} closed together and as he saw **the one**₁ nearest him open **his**₁ jaws and sink them into the silver side of the fish, he raised the club high and brought it down heavy and slamming onto the top of **the shark**₁'s broad head. He felt the rubbery solidity as the club came down. But he felt the rigidity of bone too and he struck **the shark**₁ once more hard across the point of the nose as he slid down from the fish.
The other shark₂ had been in and out and now came in again with **his**₂ jaws wide. The old man could see pieces of the meat of the fish spilling white from the corner of **his**₂ jaws as **he**₂ bumped the fish and closed **his**₂ jaws. He swung at **him**₂ and hit only the head and **the shark**₂ looked at him and wrenched the meat loose. (Hemingway, *The Old Man and the Sea*, 64)

5.2 Salience change

In the view defended here, the first indefinite noun phrase *a student* changes the accessibility structure of the discourse in the following way: first, it introduces a new discourse referent *a*, and second, it makes this discourse referent the most salient one for the predicate *student*. This is illustrated in (10), here the first step (i). (10) represents only the salience change for the set of students. No other set is represented and neither are the predications in the sentence. For a formal reconstruction, see von Heusinger (2003) and Peregrin & von Heusinger (2004). The definite noun phrase *the student* refers to this student since it is the only student introduced so far, see (ii). The indefinite *a student* in the third sentence introduces a new discourse referent *b* and makes this discourse referent the most salient one for the set of students, as in (iii). Here I assume that the first introduced discourse

referent is not overwritten, but only pushed back one place. This is a controversial issue, but does not play a role for the given example. We now can account for the reference of the occurrence of *the student* in the fourth sentence: it refers to the most salient student, who is associated with the discourse referent *b*, as in (iv).

(11) Saliency Change

This morning *a student* complained about his exam. The dean had to talk to *the student* for more than two hours. Then *a student* came to talk about his neighbors who play the trumpet every night. The dean moved *the student* to a different place.

P1(a student)...	P2(the student)...	P3(a student)...	P4(the student)
(i) ↘	(ii) ↙	(iii) ↘	(iv) ↙
[Students: {a}]	[Students: {a}]	[Students: {b>a}]	[Students: {b>a}]

5.3 Saliency spreading

The formalism given in the last section must be modified in order to catch, in addition, the saliency-change potential of definite expressions. In the last section, it was assumed that definite noun phrases do not exhibit a saliency-change potential since they would raise to saliency an object that was already salient. However, the example (12), a slightly modified version of (2), clearly shows that definite expressions can change the actual accessibility of a discourse. The definite *the small bird* refers to a small bird. The subsequent definite *the bird* refers to the same one. We can explain this by assuming that an expression not only changes the most-accessible element of the set introduced, but also that of some relevant supersets of this set – a behavior which I have termed “saliency spreading” (see von Heusinger 2003). The definite *the small bird* changes the most-accessible element of the set of small birds and that of the set of birds into the same element. Furthermore, the set of animate objects are also assigned the very same referent, accounting for the use of the pronoun *he*. This saliency spreading is illustrated in (13) by the downward arrows, while the upward arrows indicate the licensing conditions for the different definite expressions: *he* refers to the small bird, since it is the most salient of the animate objects; while *the bird* refers back to the original discourse item, since it is the most salient or accessible referent, etc.⁷

- (12) **The small bird**₁ came toward the skiff from the north. **He**₁ was a warbler and flying very low over the water. The old man could see that **he**₁ was very tired.

7. McCoy & Strube (1999) give an account for the choice of anaphoric pronouns vs. anaphoric full noun phrases in terms of distance, or more adequate: in terms of the temporal structure of the discourse.

The bird₁ made the stern of the boat and rested there. Then he₁ flew around the old man's head and rested on the line where he₁ was more comfortable. (Hemingway, *The Old Man and the Sea*, 28)

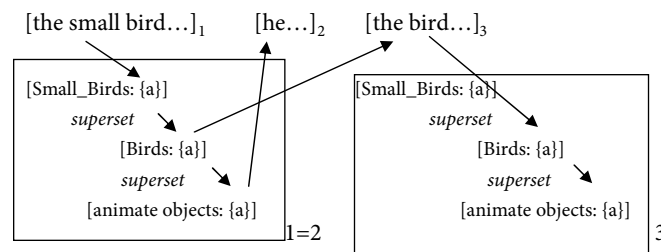


Figure 7. Saliency spreading

The box indicates a small fragment of the whole accessibility structure of the discourse. It also tries to indicate the dynamic change of the accessibility structure, which in this example is not very large. The noun phrase *the small bird* changes the most salient referent of the associated set and some supersets, the anaphoric pronoun *he* does not change the accessibility structure, however the anaphoric noun phrase *the bird* activates the referent back again to the set of birds and animate objects. As long as no clear competition exists, this update does not change the most salient element, but it still seems necessary to raise the activation above a certain level.

In (12) the saliency spreads along the lexically encoded relation of hyponymy (superset relation). However, in sections 2.3 we also discussed instances of pragmatic anaphora, where the relation is of a different type, e.g. the subset relation (*the bird ... the beautiful bird*). We also saw that such an anaphoric link needs additional plausibility and cannot be reconstructed solely by the descriptive material. I affirm, therefore, that such cases cannot be covered alone by the given mechanism on saliency spreading. However, I assume that the given mechanism can be extended to certain cases of indirect anaphora, as discussed in section 2.4 in examples (4)-(6), repeated as (13)-(15). We can account for the anchoring of the indirect anaphoric expression by assuming the additional information is included in the accessibility structure. For (13) we need the encyclopedic knowledge that people are associated with governments, for (14) the lexical knowledge that a book has an author, and for (15) the frame that a restaurant has a waiter and a menu.

- (13) For the Parks and millions of other young Koreans, the long-cherished dream of home ownership has become a cruel illusion. For **the government**, it has become a highly volatile political issue. (Poesio & Vieira 1998, 198)

- (14) John bought a book. **The author** is well known.
(15) John entered a restaurant and sat at a table. **The waiter** brought **the menu**.

6. Summary

Interpreting a discourse we link referential expressions to each other, thus reconstructing the coherence of the discourse. There are many aspects of the coherence structure that determine the exact conditions under which an anaphoric expression is linked to its antecedents. Most of these parameters are summarized under the general term of “accessibility” or “accessibility structure”; this paper has investigated how accessibility and definite noun phrases interact. It is generally assumed that the definiteness status is determined by the accessibility structure, while definite noun phrases are interpreted as static terms, i.e. as terms that change the accessibility. In contrast to this commonly held view, it was shown that definite noun phrases dynamically change the accessibility structure. In order to model this dynamic behavior, we first need to revise our representation of accessible discourse items. These are sets of ranked discourse items with respect to the predicate by which they were introduced or activated, rather than one single set of ranked elements without further association to the predicate by which they were introduced. This model allows us to show the dynamic potential of definite noun phrases by the process of salience spreading, which also accounts for the difference between anaphoric pronouns and anaphoric definite nouns.

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