

A REVIEW OF THE LINGUISTIC RESEARCH ON DEFINITE DESCRIPTIONS

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ABSTRACT: *We present in this paper a review on the linguistic literature on the types of uses of definite descriptions (noun phrases with the definite article the). Definite descriptions have been studied extensively by linguists, philosophers, psychologists, and computational linguists. The theories discussed in this paper help us to understand the problem of interpreting definite descriptions. We look at research studying the various ways in which definite descriptions relate to their antecedents and/or to the context. We compare terms referring to the various types of uses of definite descriptions by presenting tables that relate examples of definite description use to different terminology, according to different authors.*

This review is mainly motivated by the necessity of understanding the role of definite descriptions for co-reference processing. Co-reference processing has been one main issue in natural language processing, artificial intelligence and computational linguists. It has direct applications in the field of information extraction. Much work has been done in anaphora resolution, and usually definite descriptions are considered as a special case of anaphora and their treatment is included in general frameworks that mainly deal with pronouns. The work presented here aims to provide a concise material reviewing several works on the use of definite descriptions revealing the complexity of the problem, which we believe to deserve a particular treatment of its own.

Key-words: Comparison, Linguistic, terminologic description.

RESUMO: *Este artigo apresenta um resumo da literatura linguística sobre os tipos de usos de descrições definidas (sintagmas nominais com o artigo definido). Descrições definidas têm sido estudadas extensivamente por linguistas, filósofos, psicólogos, e linguistas computacionais. As teorias discutidas neste artigo nos ajudam a entender o problema da interpretação de descrições definidas. Apresentamos trabalhos sobre as várias maneiras com que descrições definidas relacionam-se com antecedentes textuais e/ou com o contexto. Apresentamos uma comparação de terminologias apresentadas por diferentes autores através de tabelas de exemplos de descrições definidas.*

Esta revisão é motivada pela necessidade de entendimento do papel das descrições definidas para o processamento de co-referências. O processamento de termos co-referentes tem sido largamente abordado nas áreas de processamento de linguagem natural, inteligência artificial, e linguística computacional. Este tem aplicações diretas na área de extração automática de informações. Muitos dos trabalhos conhecidos nesta área tratam descrições definidas como um caso especial de resolução de anáforas. Com este artigo apresentamos uma revisão de diversos trabalhos da área de Linguística sobre o uso de descrições definidas que revelam a complexidade do problema, o qual acreditamos merecer um tratamento diferenciado.

Palavras-chave: Comparação, descrição terminológica, Linguística.

1. Hawkins' descriptive list of the uses of the definite article

The wide range of uses of definite descriptions was already highlighted in (Christopherson, 1939). In the third chapter of his book, Hawkins (1978) further develops and extends Christopherson's descriptive analysis. According to Hawkins, the definite article may be used on the basis of a discourse antecedent (anaphoric and associative anaphoric uses) as well as independently from the previous discourse (situational, unfamiliar with explanatory modifiers and unexplanatory modifier uses). We present below Hawkins'

taxonomy. The examples are often repeated from or similar to those in (Hawkins, 1978).

Anaphoric Use

These are definite descriptions that refer back to an antecedent in the discourse (both description and antecedent evoke the same entity).

1.

(a) Fred was discussing an interesting book in his class. I went to discuss the book with him afterwards.

(b) Fred was wearing trousers. The pants had a big patch on them.

(c) Bill was working at a lathe the other day. All of a sudden the machine stopped turning.

(d) Mary travelled to Paris. The journey lasted six hours.

(e) A man and a woman entered restaurant. The couple was received by a waiter.

As seen in the examples, a definite description may use the same descriptive predicate as its antecedent, or any other capable of indicating the same antecedent (e.g., a synonym, a hyponym, a nominalization, summation, etc.).

Associative Anaphoric Use

Speaker and hearer may have (shared) knowledge of the relations between certain objects evoked by the discourse (the triggers) and their components or attributes (the associates): associative anaphoric uses of definite descriptions exploit this knowledge.

2.

(a) Bill drove past our house in a car. The exhaust fumes were terrible.

- (b) Bill bought a new car to please Mary but she didn't like the colour.
- (c) Fred was discussing an interesting book in his class. He knows the author.
- (d) I went to a wedding last weekend. The bride was a friend of mine. She baked the cake herself.

Immediate Situation Use

The next two uses of definite descriptions identified by Hawkins are used to refer to an object in the situation of utterance. The referent may be visible, or its presence may be inferred.

Visible situation use This type of use occurs when the object referred to is visible to both speaker and hearer, as in the following examples:

3.

- (a) Please, pass me the salt.
- (b) Put it on the table.

Immediate situation use These are definite descriptions whose referent is a constituent of the immediate situation in which the use of the definite description is located, without necessarily being visible. This use is commonly found in notices such as:

4.

- (a) Beware of the dog.
- (b) Don't feed the pony.

At the same time the hearer is informed of the existence of these objects, he is also being instructed to use the immediate situation of utterance to determine which dog or pony is meant.

Larger Situation Uses

Hawkins lists two classes of definite descriptions that are used in situations in which the speaker appeals to the hearer's knowledge of entities existing in the non-immediate or larger situation of utterance---knowledge they share by being members of the same community, for instance. Whereas in associative anaphoric uses the trigger is a NP introduced in the discourse, in larger situation uses the trigger is the situation itself.

Specific knowledge in the larger situation This is the case in which both the speaker and the hearer know about the existence of the referent, as in the example below, in which it is assumed that speaker and hearer are both inhabitants of Halifax, a town which has a gibbet at the top of Gibbet Street:

5. The Gibbet no longer stands.

General knowledge in the larger situation use Specific knowledge is not a necessary part of the meaning of definite descriptions in larger situation uses. While some hearers may have specific knowledge about the actual individuals referred to by a definite description, others may not. General knowledge about the existence of certain types of objects in certain types of situations is sufficient. An example is the following utterance in the context of a wedding (as first utterance between two people):

6. Have you seen the bridesmaids?

Such a first mention of the bridesmaids is possible on the basis of the knowledge that weddings typically have bridesmaids. In the same way, a first mention of the bride, the church service, or the best man would be possible.

Note, however, that background knowledge may be different from individual to individual: one hearer might rely on his specific knowledge of a particular referent to interpret a description, whereas the other relies on his general knowledge to interpret the same description.

Unfamiliar Uses with Explanatory Modifiers

Hawkins classifies as unfamiliar those definite descriptions that are not anaphoric, do not rely on information about the situation of utterance, and are not associates of some trigger in the previous discourse. Hawkins groups these definite descriptions in classes according to their syntactic and lexical properties, as follows.

NP complements One form of unfamiliar definite descriptions is characterised by the presence of a complement to the head noun.

7.

- (a) Bill is amazed by the fact that there is so much life on Earth.
- (b) The philosophical aphasic came to the conclusion that language did not exist.
- (c) Fleet Street has been buzzing with the rumour that the Prime Minister is going to resign.
- (d) I remember the time when I was a little girl.

Nominal modifiers The presence of a nominal modifier is, according to Hawkins, the distinguishing feature of these phrases.

8.

- (a) I don't like the colour red.
- (b) The number seven is my lucky number.

Referent establishing relative clauses Relative clauses may establish a referent for the hearer without a previous mention, when the relative clause refers to something mutually known.

9.

- (a) What's wrong with Bill? Oh, the woman he went out with last night was nasty to him. (But: ?? Oh, the woman was nasty to him.)
- (b) ...the box (that is) over there.

Associative clauses Associative clauses incorporate both the trigger and the associate of an associative anaphoric sequence.

The modifiers of the head noun specify the referent with which the definite description is associated.

10.

- (a) I remember the beginning of the war very well.
- (b) There was a funny story on the front page of the Guardian this morning.
- (c) ... the bottom of the sea.
- (d) ... the fight during the war.

The syntactic structure of a definite description does not guarantee that it is unfamiliar.

Unexplanatory Modifiers Use

Finally, Hawkins lists a small number of modifiers (that he calls unexplanatory) which require the use of the definite article:

11.

- (a) My wife and I share the same secrets.
- (b) The first person to sail to America was an Icelander.
- (c) The fastest person to sail to America ...

There is nothing in the modifier that informs the hearer what is being referred to; Hawkins says that in the first of the examples above the definite points merely to an identity between two sets of secrets.

2. Prince's theory of familiarity

Prince studied in detail the connection between the speaker/writer's and hearer/reader's assumptions about each other and the linguistic realisation of noun phrases (Prince, 1981; Prince, 1992). Although she studies noun phrases in general, the taxonomy she proposes has proved equally useful for our analysis of definite descriptions in particular. What is original and especially interesting in Prince's work is the

important distinction between two kinds of familiarity, a distinction not explicitly observed in Hawkins' theory. She distinguishes between discourse and hearer familiarity, as seen below.

Hearer new / Hearer old

One factor affecting the choice of a noun phrase, according to Prince, is whether a discourse entity is old or new with respect to the hearer's knowledge. Typically, a speaker will use a proper name or a definite description when he or she assumes that the addressee already knows the entity whom the speaker is referring to, as in:

12. I'm waiting for it to be noon so I can call Sandy Thompson.

On the other hand, if the speaker believes that the addressee does not know of Sandy Thompson, in general, an indefinite will be used:

13. I'm waiting for it to be noon so I can call someone in California.

Discourse entities can also be new or old with respect to the discourse model.

Discourse new / Discourse old

According to Prince, a NP may refer to an entity that has already been 'evoked' in the current discourse (textually evoked), or it may evoke an entity which has not been previously mentioned (situationally evoked, unused, inferrable, containing inferrable, brand new). "Discourse novelty" is distinct from "hearer novelty": both Sandy Thompson and someone in California mentioned above may well be discourse new even if only the second one will be hearer new. On the other hand, for an entity being discourse old entails it being hearer old. As pointed out by Prince, the distinction between containing inferrable and unused is sometimes ambiguous: what is unused for one reader may be containing inferrable for another, depending on their individual knowledge background.

Prince criticises the traditional binary distinction between “given” and “new” discourse entities as too simplistic, and proposes a much more detailed taxonomy of “givenness”---or, as she calls it, assumed familiarity---meant to address this problem.

Assumed Familiarity

Brand-new A NP may introduce an entity which is both discourse and hearer new. Brand new entities are usually introduced by indefinites, such as someone in California in the example above.

Brand new anchored A new entity is anchored, according to Prince, if it is linked to another discourse entity, this link is contained in the NP representing the entity and this link is not itself new. An example is: A guy I work with... Prince seems to be considering only indefinites in this class, but a definite such as the guys I work with could perhaps be regarded as brand new anchored in the same sense. There are also some definite descriptions that describe new entities and are linked to entities that are new, as in the footsteps of a yeti. Their place in Prince’s framework is not clear.

Evoked NPs may invoke situationally evoked or textually evoked entities. Only textually evoked entities are discourse old. Situationally evoked entities correspond to Hawkins’ visible/immediate situation use.

Unused NPs may evoke hearer old but discourse new entities. Unused NPs describe entities that are known to the speaker/hearer but which haven’t been mentioned (used) previously in the discourse. These are like those cases called by Hawkins larger situation/specific knowledge.

Inferrable Some discourse entities are not discourse old or even hearer old, but they are not entirely new, either. Hawkins called such uses of definite descriptions associative anaphoric: a book, the author. Prince called such entities inferrables. Prince did not introduce a class for those entities which are inferrable from the situation (Hawkins' larger situation/general knowledge); they will be referred to later as situationally inferrable.

Containing inferrable Prince proposes a category for entities, which are like inferrables, but whose connection with previous hearer's knowledge is specified as part of the NP itself. Her example the door of the Bastille in the example below.

14. The door of the Bastille was painted purple.

At least three of the unfamiliar uses of Hawkins–NP complements, referent-establishing relative clauses, and associative clauses—fall in this category. As pointed out by Prince, the distinction between containing inferrable and unused is sometimes ambiguous: what is unused for one reader may be containing inferrable for another, depending on their individual knowledge background.

3. Löbner's theory

Löbner (Löbner, 1985) observes that the interpretation of descriptions may depend on arguments and attributes given in the referring act itself or by the immediate situation, and not only on textual antecedents. He takes descriptions to be terms like proper names. Löbner adopts Christopherson's (1939) view according to which the fundamental property of definite NPs is that they refer unambiguously. Löbner claims that the definite article indicates that the noun is to be taken as a functional concept (FC). This idea is based on the distinction between sortal and relational nouns: sortal nouns identify a class (woman), while relational nouns describe objects as standing in a certain relation to others (wife). Functional nouns are a

subclass of relational nouns. Functions relate objects unambiguously (one to one) to others: they assign values to arguments. Functional concepts identify a referent when the situation and proper arguments are given. Löbner's classificatory scheme is based on the distinction between semantic and pragmatic definites. Semantic definites are those cases in which the interpretation is independent of the utterance's previous discourse or immediate context of utterance; the general situation, however, is always an argument¹. The semantic definites Löbner lists correspond to Hawkins' larger situation and unfamiliar uses. Pragmatic definites, on the other hand, are essentially dependent on the particular context of utterance for their non-ambiguous interpretation.

Semantic Definites

Löbner defines a semantic definite as a NP denoting a functional concept. According to the number of arguments definites take, they are classified into FC1s, FC2s and FC3s. All of them involve the general situation as one of their arguments, often implicitly.

Semantic FC1s These semantic definites are concepts for objects that play a unique role in a given situation. This class includes:

- a) proper names;
- b) sortal nouns followed by a proper name of some sort;
- c) cases in which a subordinate clause specifies an abstract sortal head as FC1s;
- d) combinations of certain adjectival attributes (superlatives, ordinals, as well as *next*, *last*, *only*, etc.) with sortal or relational nouns forming a complex FC1; and

¹This argument relates the description to the location, time and circumstances of the utterance.

e) those cases called simple FC1s which are dependent on temporal and spatial location.

Examples of each type are shown below:

12.

- a) the Empire State Building, the London Symphony Orchestra;
- b) the year 1984, the word "the", the opera Rigoletto;
- c) the rumour that Reagan is going to resign, the dream to become rich;
- d) the next/last/third president of the association;
- e) the weather, the time, the air, the moon.

All these definite descriptions yield functional concepts. They always take one argument relative to the given situation. These concepts assign a functional value to situations. Descriptions such as the sun, the moon, the Earth assign the same value to a wide range of locations and time. For other descriptions the referents or values are more locally determined: the weather, the atmosphere. Proper names usually apply to a certain referent relatively to a domain of situations. A name like Paul is dependent on the social circumstances for its unambiguous interpretation. In many languages personal names are used with the definite article. They name something unambiguously which may not have been mentioned before; hearers do not need to find this named entity in the immediate context. These descriptions correspond to some of Hawkins' larger situation and unfamiliar uses.

Semantic FC2s with explicit arguments Generally an FC2 is connected to its second argument by a possessive relation (in the sense that something or someone has something). These cases syntactically consist of a definite article which precedes a complex expression containing the FC2 noun and a PP of the form of NP, as the examples below. A FC2 results in a FC1 when complemented with its argument. Löbner notes that the number of arguments referring to the situation may in fact vary: compare, for instance, descriptions such as the price of an

apartment, the price of an apartment in Korea, the price of an apartment in Korea in the eighties.

16.

- a) the president of the U.S.;
- b) the meaning of the definite article.

Semantic FC2s with implicit arguments These descriptions depend on the immediate physical environment, which functions as an implicit deictic argument. Hawkins' introductory situational uses fall in this category.

16. This is the clutch.

In the example above, the argument is a car in the immediate physical environment. Another example of implicit deictic FC2 is Hawkins' larger situation use based on general knowledge:

17. The Prime Minister has resigned.

The location of the utterance is included in the territory of a state to which the description refers (indirectly). Löbner also includes in this class those expressions that refer indirectly to referents previously introduced in the discourse, such as a book... the author, referring to them as FC2s with implicit anaphoric argument. (These cases correspond to Hawkins' associative anaphoric uses.) Löbner states that the crucial condition under which FC2s with implicit arguments are possible is that the head noun in these uses provides a two-place functional concept for which there is an appropriate argument in the immediate context (physical or linguistic). In (Löbner, 1996) it is claimed that the semantic/thematic roles of verbs are also FC2s. For every reading event, he says, there is the role of the reader and the role of the read; underlying these roles are the functional concepts the reader of this reading event, and what is read in this reading event. Further roles may be connected to a reading event, such as medium, time, location, speed and others.

In this later paper Löbner adopts a frame-like semantic network to explain FC2s with implicit anaphoric argument.

Semantic FC3s In these cases the definite article precedes a noun that is complemented with two arguments.

18. the distance between A and B

Pragmatic Definites

Pragmatic definites have non-functional head nouns (notice that it is the use, not the noun itself, that is relational or sortal) and thus depend on the particular situation or immediate context for unambiguous reference. They are divided in anaphoric, endophoric and deictic uses.

Anaphoric These descriptions are resolved to a previously introduced referent (as in *a book... the book*). Hawkins' anaphoric uses fall in this category.

Endophoric (cataphoric) These definites have relational or sortal head nouns with disambiguating attributes, as in the example below. Hawkins classifies this use as unfamiliar with referent establishing relative clauses.

19. the woman Bill went out with last night

Deictic These uses refer to the immediate context, and correspond to Hawkins' immediate situation uses.

4. Fraurud's study of first mention and subsequent uses

Fraurud (1990) presents a corpus-based study of definite NPs use in Swedish distributed between the following text types: brochures, newspapers, textbooks and debate books (all professional, non-fiction prose, and based on a binary classification scheme:

- Subsequent mention: (corresponding to Hawkins' anaphoric definite descriptions and Prince's discourse old), and
- First mention: including all other definite descriptions.

Fraurud's notion of subsequent mention is defined in terms of co-referentiality (NPs referring to the same entity). She notes that a NP that is co-referent with another NP is not necessarily anaphoric. The interpretation of an anaphor is crucially dependent on the identification of a discourse referent introduced by an antecedent (as is usually the case for pronouns); whereas co-referentiality only implies that a discourse referent previously mentioned in the discourse is evoked by an NP, but the NP's interpretation need not to be essentially dependent on this previous mention (as for subsequent mention of proper names). Fraurud's simplified taxonomy is due to the fact that she was primarily interested in verifying the empirical basis for the claim that indefinite NPs trigger the establishment of a new discourse referent in a discourse model while definite NPs trigger the search for or the retrieval of a prior discourse referent. She recognises that the existence of first mention definite NPs is acknowledged in the literature, but criticises the fact that they tend to be treated as secondary relative to the anaphoric use of definite NPs, giving as example Heim's File Change Semantics (discussed earlier). In her study Fraurud observes that only 34.8% of initial mention NPs were actually indefinites, and of all indefinites, only 9.4% were referred back to. She points to the problem for NP processing of having a vast number of entities made available for anaphoric reference and just a small portion being referred to. But perhaps the most interesting result is the large proportion of definite NPs in first mention uses found in her corpus: 60.9%. Also interesting is Fraurud's observation about the syntactic complexity of first mention definite NPs. She claims that genitive/possessive constructions of the form *the X's Y* or *the Y of X*, postposed prepositional phrases, and restrictive adjectival modifiers make the NP "self-contained". These NPs, as Löbner's FC2s, explicitly sign their relation to other

referents; and therefore, one would expect that complex definites be more often used as first than subsequent mention. And in fact, 75% of the complex definite NPs in her corpus were first mention.

5. Clark's bridging references

Clark's paper "Bridging" (1977) is concerned with the construction of implicatures as part of the process of comprehension (understood as the computation of an antecedent). He identifies the possible semantic relations between the referring expression and its antecedent. Clark is only concerned with implicatures derived from textual relations, which correspond to Hawkins' anaphoric and associative anaphoric uses. The distinctions he made are reviewed here for the specific case of definite descriptions.

Direct reference

Clark notes that a description often makes direct reference to previously mentioned objects, events or states.

Identity Examples given for this class are:

16.

- a) I met a man. The man told me a story.
- b) I ran two miles. The run did me good.

He also gives as an example of direct reference (identity) the following:

16. Her house was large. The size surprised me.

In (24) shown above, the term "direct" refers to the fact that the size (of the house) has already been mentioned (when describing it as being large). This notion of "identity" does not seem to conform to a notion of co-referentiality. In other

approaches (see Strand, below, for instance) the reference the size is seen as associated to the noun the house rather than to the adjective large.

Pronominalizations These are cases in which the description uses only a subset of the properties that characterise a previously mentioned entity. We have a continuum: an elderly gentleman, the elderly gentleman, the elderly man, the gentleman, the man, the oldster, the adult, the person, he. The semantic relations of synonymy and hypernymy belong to this class together with the use of pronouns.

17. I met an elderly gentleman. The man told me a story.

Epithets This class contains those cases in which the bridging reference adds new information to the entity referred to.

18. I met a man. The bastard stole my money.

In the example above (26) the antecedent for the bastard is the entity referred to by a man—that entity is also a bastard, but this information is new. The extra information is concerned with the speaker's opinion of the facts rather than the facts themselves.

Set membership In this class are those cases in which the description picks out an element from a previously mentioned set.

19.

a) I met two people. The woman told me a story.

b) I swung three times. The first swing missed by a mile.

Indirect reference by association

Clark, like the other authors we have discussed, notes that the description may not have a directly mentioned antecedent but one that is closely related to it. He notes that the associated information varies in its predictability from

absolutely necessary to quite unnecessary, distinguishing three levels:

Necessary parts

16.

- a) I entered the room. The ceiling was high.
- I entered the room. The size was overwhelming.

Probable parts

16.

- a) I entered the room. The windows looked out to the bay.
- b) I went shopping. The walk did me good.

Inducible parts

16. I entered the room. The chandeliers sparkled brightly.

Indirect reference by characterisation

A description may characterise a role played in an event or circumstance mentioned earlier. Clark presents a variety of such cases:

Necessary roles

17.

- a) John was murdered. The murderer got away.
- b) I went shopping. The time I started was 3 p.m.

Optional roles

16.

- a) John died. The murderer got away.
- b) John was murdered. The knife lay nearby.

Clark observes that often noun phrases contain as part of their specification the information of how they relate to other events as in the person who murdered John, the knife with which it was done. Adjectives can carry out a characterising function too, as in the guilty party got away. He says that what

adjectives, relative clauses and derived nouns (such as murderer) do is to pick out the role the intended antecedent plays in the previously mentioned events. Clark comments that sometimes the distinctions between parts and roles may be impossible to maintain.

Relations of reasons, causes and consequences As we have already seen, the antecedent of a bridging description is often an event and not an object and may give the reason for, cause of, or consequence of other events or states. Clark's examples for this class do not include the use of definite descriptions. We present as an example (33).

16. An earthquake... The suffering people are going through...

6. Sidner's co-specification and specification rules

BSidner (1979) lists several ways (rules) in which a full definite NP may derive its co-specification or specification from the focus (a list of the most salient elements in the discourse, i.e., what the discourse is about). The focus for definite description interpretation includes:

- the current focus, the most salient element in the last sentence according to a set of rules proposed by Sidner;
- the potential focus, elements in the last sentence other than the current focus;
- the stacked focus, the set of current foci previous to the last sentence (It is not clear if the Actor Focus Stack should be also considered for definite description interpretation.).

Sidner presents several algorithms that work together to resolve anaphoric NPs and to keep track of the discourse focus. Her algorithms rely on a semantic network that encodes elements and their associations, provides links expressing their general class, and provides for inheritance of associations. The rules listed by Sidner are the following:

Explicit Backwards Co-specification

Co-specification 1 Definite description and focus have the same head and no new information is introduced by the definite.

16. A small office... The office

She mentions the difficulty imposed by definites with new information since it is not clear whether they co-specify with the focus or refer to a new discourse element. Clark, however, has observed that a definite description may specify or add new information to the antecedent (epithet).

Co-specification 2 The definite's head noun lexically generalises that of the focus and has no restrictive postmodifiers.

17. A ferret... The animal...

She claims that generalisations accompanied by restrictive relative post-nominal modifiers fail to co-specify with the focus. This class is similar to Clark's pronominalization.

Implicit Backwards Specification

Here the definite does not co-specify with the focus. It is said, instead, to specify an element closely related to the focus by association. She proposes the following restriction on the elements available for the computation of specifications: NPs in the stacked foci are not considered as focus for these cases. Sidner says that stacked foci do not seem to be used in this way perhaps because the additional processing time would not make it possible to extend the judgements to the focus stack. This means that a definite description can only specify an element in the previous sentence.

Associated Specification The definite names an entity associated with the focus directly or by inheritance on the network hierarchy. The inferences made in the association involve common sense knowledge about the world.

18. Meeting... The participants...

Inferred Specification As above but the inferences involve hearers' suppositions that are not necessarily true. (This class may include a broad range of relations.)

19. The dead heiress... The murderer

Set-element Specification The focus is a set, the description is singular and has the same head as the focus and additional modifiers whose role is to determine which member of the set is being discussed.

20. There were clowns performing in the square. The clown with the unicycle did a fantastic stunt.

Sidner comments that these cases are easier to distinguish than other specifications, because the head noun is the singular form of the noun phrase represented in the focus. There are, however, set-element sequences such as *a couple...the woman* which would involve knowledge of set-element relations as well as generalisation and/or associations. It is not clear whether the associated specification or inferred specification rules would handle cases like this.

Computed Specification The specification of the description may be computed from that of the focus. The description has an ordinal modifier, the same head as the focus and no relative clause modifiers. Sidner observes that descriptions containing full relatives (such as *the first person to sail to America*) use the relative clause and not the focus to compute its specification.

21. A meeting... The last meeting but two

With the restrictions she imposes, Sidner misses cases like *A conference ... the first talk*, or

Clark's example *I swung three times. The first swing...* Again, it is not clear if these would be cases treated by the rules of associated or inferred specification. When no relation can be

established, Sidner says that definite NPs with no modifiers are odd uses. For those descriptions that have modifiers she says that they specify outside the discourse context.

7. Strand's taxonomy of linking relations

Strand's approach (Strand, 1996) is also mainly concerned with those cases of definite description use in which an explicit contextual relation (link) holds between the description and an antecedent (anchor). Strand, as Sidner, assumes the availability of a semantic representation of the text (in this case, DRT) and inference mechanisms. He proposes taxonomy of linking relations in which five main classes are distinguished along with fifteen subclasses. They are as follows:

Co-referentiality

The antecedent and definite refer to the same entity through identical or different description.

Identical head The anchor and the definite description share the same head noun

16. A yellow car... The car...

Generalization The definite description is more general than or is a synonymous of the antecedent.

17. A car... The vehicle...

Specification The description is more specific than the antecedent.

18. A car... The sedan...

Redescription The definite description is a fully alternative description of the antecedent which neither entails nor is entailed by any conditions on (properties of) the antecedent.

19. A car... The notorious wreck...

Strand's co-referential class differs from Clark's direct reference. Whereas Clark classifies *the house was large... The size surprised me* as direct reference, Strand does not. Other differences in their taxonomies are discussed below.

Narrowing

The definite is part/member or an argument/role of the antecedent.

Set-member The description is a member or a subset of the set indicated by the antecedent.

16. A school class... The girls...

Whole-part The description constitutes a part of its antecedent.

17. A car... The engine...

Event-argument The description is an argument of an antecedent event.

18. John was murdered. The murderer...

Widening

These are cases which expand on familiar sets.

Member-set The description is a set of which the antecedent is a member or a subset.

19. John and his nephew... The family...

Part-whole The description has the antecedent as its part.

20. A wall... The building...

Adjoining

Part-part The antecedent and description are members of the same state or parts of the same whole.

21. Last Wednesday... The next day...

Possessor-thing The antecedent possesses the description.

22. A professor... The car...

Delimitation

In these cases the anchor may be seen as an argument to the description.

Argument-event The description is an event in which the antecedent is an argument delimiting its denotation.

23. Israel and Egypt... The peace agreement...

Subcategorization The description subcategorizes for something of the antecedent's type. This applies to so called relational nouns like *father, weight, price, owner, driver*, etc.

24. A bicycle... The price...

Time-anchored The time region indicated by the antecedent gives a more delimited or unambiguous reading to the description.

25. Last Wednesday... The news...

Space-anchored The space region indicated by the antecedent delimits the description.

26. A Greek village... The taxi drivers...

Strand also mentions the existence of implicit or inferred anchors: for instance, when someone is telling about a visit to a Greek village, the (implicit) time of visit may be an anchor to the referents of the descriptions.

Strand acknowledges the problem of multiple anchors/links being available for a description resolution. He says that one should give preference to the most informative link and that identity should be preferred whenever possible. However, besides the problem of deciding between identity and non-identity, it seems hard to find a way of identifying a 'most

informative' link. Strand mentions that an opposite approach is one like Sidner's, where a saliency order is followed.

8. Comparison of terminology

In this section we compare the classifications presented in the previous sections. We present tables which relate examples of definite description use with the classes identified by the authors we have discussed. Tables 1 (a and b) and 2 (a, b, c and d) describe the anaphoric and associative uses respectively. Seven different schemes are listed (Hawkins, 1878; Prince, 1992; Fraurud, 1990, Löbner, 1985; Clark, 1977; Sidner, 1979; Strand, 1997). The other tables (Tables 3 and 4) consider only four of the authors, since not all authors refer to the phenomena presented there (situational and unfamiliar uses). Although Sidner notices that definite descriptions may specify outside the linguistic context, she does not explain in which different ways. Strand briefly mentions the existence of implicit and inferred anchors. Clark is only concerned with discourse relations. The terms that appear in the tables in *Italics* are our guesses for the examples not explicitly discussed by the author of the corresponding scheme. Question marks were placed where the authors were generally silent about the case, and it was not clear whether their classification would apply or not to the example. We can see that those authors who present a more comprehensive characterisation of uses of definite descriptions (Hawkins, Prince, Fraurud and Löbner) do not discriminate anaphoric and associative descriptions in as much detail as the others (Clark, Sidner and Strand) do. On the other hand the first authors pay special attention to situational and unfamiliar uses. Also note that there is no absolute consensus about the sub-classifications of the various uses.

Tables 1 (a and b) lists the anaphoric uses. Hawkins and Prince do not make any distinction among them. It is not clear whether Prince would consider the definite description in a

sequence like *he travelled... the journey* as textually evoked, nor if Fraurud would consider that as subsequent mention. Löbner only refers explicitly to "direct anaphora", those cases based on an antecedent with identical head. But what he calls pragmatic anaphoric seems to apply well for all examples in the table. Löbner says that the construction of a universe of discourse is comparable to the braiding of a complex multi-dimensional network, with object and event nodes; every node is a potential discourse referent, and anaphoric descriptions are used to refer to nodes in the net, usually providing only sortal information for the retrieval of their referent. Clark, on the other hand, distinguishes among four different ways in which a co-reference relation may be realised, but he is silent about the cases that Strand calls specification and widening. Sidner considers only two types of co-reference: identical head and generalization. Both Fraurud and Strand observe for a sequence like *a man, a woman ... the couple* a difference in the entities represented by the description and antecedent. Strand (1997) explains that events in his framework are represented by discourse referents and a link for cases like *he travelled... the journey* would be of the coreferentiality class. For named entities he explains that usually the relation is coreference, and the subclass specification or redescription. Clark and Strand give the most comprehensive account for the anaphoric use.

Anaphoric uses	a book the book	a lathe the machine	a car the sedan	a man the bastard
Hawkins	anaphoric	anaphoric	anaphoric	anaphoric
Prince	textually evoked	textually evoked	textually evoked	textually evoked
Fraurud	subseq. mention	subseq. Mention	subseq. mention	subseq. mention
Löbner	pragmatic anaphoric	<i>pragmatic anaphoric</i>	<i>pragmatic anaphoric</i>	<i>pragmatic anaphoric</i>
Clark	identity	pronominalization	?	epithet
Sidner	co-spec. 1	co-specific2 (generalizing)	?	?
Strand	coref id. head	coref (generalization)	coref (specification)	coref (redescription)

Table 1(a) Classifications of definite descriptions: anaphoric uses

Anaphoric uses	he travelled the journey	a man a woman the couple	Pinkerton Inc. the company
Hawkins	anaphoric	anaphoric	anaphoric
Prince	?	textually evoked	textually evoked
Fraurud	?	? (summation)	subseq. mention
Löbner	pragmatic anaphoric	<i>pragmatic anaphoric</i>	<i>pragmatic anaphoric</i>
Clark	identity	?	pronominalization
Sidner	?	?	<i>co-specific 2 generalizing</i>
Strand	coref (event)	widening (members-set)	coref (redescription)

Table 1(b) Classifications of definite descriptions: anaphoric uses

Tables 2 (a, b, c and d) summarises the classifications of associative uses and is the most complex of all. It is difficult to complete the table for each different author, since usually they are not explicit about all the possible associations capable of linking bridging descriptions with their anchors. Hawkins reckons the difficulty in providing the defining parameters for the set of possible associates; he then comments on the more general defining characteristics of these associations. He says that speaker and hearer share general knowledge of relationships between triggers and associates, usually part-of relations and attributes. It is not clear if he would consider event roles or cases involving hearers' supposition as associative anaphora. Hawkins does not explicitly refer to a description as being associated to a previous VP, although this is considered in the examples of anaphoric uses. Prince is not specific, either, about which are the possible associations between bridging descriptions and their anchors. She calls them all inferrables and says that "when a speaker evokes some entity in the discourse, it is often the case that s/he assumes that the hearer can infer the (discourse) existence of certain other entities, based on the speaker's beliefs about the hearers' beliefs and reasoning ability" (Prince, 1992 - page 304). Based on a general idea of "reasoning ability of speakers" I inferred that she would classify as inferrable all the examples in the table.

Fraurud's first mention class seems to apply in general; exceptions are, perhaps, those uses classified by Clark as set-membership. Löbner says that associative anaphora are semantic FC2s with anaphoric arguments. He considers, in particular, those descriptions which have a relational noun (use), and whose argument is specified by an antecedent. Some of the associations exemplified in the table seem to be based on other grounds,

however; such cases were indicated by question marks. Clark's account points to several distinct relations. His set-membership relation is classified as direct reference; all other relations listed under Clark in Table 2 are classified as indirect reference. Sidner's cases of associated specification descriptions correspond clearly to those explicitly referred by Hawkins and Prince as associative anaphoric and inferrable. It is not clear how broad her class of associated specification was meant to be, but we considered it to be very general; her inferred specification rule applies for those cases based on hearers' suppositions. Clark's and Strand's classifications are the most detailed. Strand (1977) suggests that a causation link (a third subclass in the adjoining class) might be applied for the cases in which there is a relation of reason, cause and consequence. Strand does not classify optional roles (cases which involve hearers' suppositions) which are observed by Clark.

Associative uses	a book the author	the room the ceiling	the wall the building	the room the window
Hawkins	associative	associative	associative	associative
Prince	inferable	inferable	inferable	inferable
Fraurud	first mention	first mention	first mention	first mention
Löbner	semantic fc2 (anaphoric arg.)	semantic fc2 (anaphoric arg.)	?	semantic fc2 (anaphoric arg.)
Clark	?	necessary parts	?	probable parts
Stolner	associated specific.	associated specific.	associated specific.	associated specific.
Strand	delimit. (subcateg.)	narrowing (whole-part)	widening (part-whole)	narrowing (whole-part)

Table 2(a) Classifications of definite descriptions: associative uses

Associative uses	the room the chandelier	a couple the woman	clowns the clown with the unicycle	she was killed the murderer
Hawkins	<i>associative</i>	<i>associative</i>	<i>associative</i>	?
Prince	<i>inferrable</i>	<i>inferrable</i>	<i>inferrable</i>	<i>inferrable</i>
Fraurud	first mention	?	?	first mention
Löbner	?	?	?	semantic fc2 (event role)
Clark	inducible parts	set- membership	set- membership	necessary roles
Sidner	inferred specific.	<i>associated specific.</i>	set-elem. specific.	<i>Associated specific.</i>
Strand	delimit. (space anch.)	narrowing (set-member)	narrowing (set-member)	narrowing (event-arg.)

Table 2(b) Classifications of definite descriptions: associative uses

Associative uses	she died the murderer	a professor the car	an earthquake the suffering of people
Hawkins	?	?	<i>associative</i>
Prince	<i>inferrable</i>	<i>inferrable</i>	<i>inferrable</i>
Fraurud	first mention	first mention	first mention
Löbner	?	?	?
Clark	optional roles	?	reason/cause/ conseq.
Sidner	inferred specific.	<i>inferred specific.</i>	inferred specific.
Strand	?	adjoining (poss.-thing)	adjoining (causation)

Table 2(c) Classifications of definite descriptions: associative use

Associative uses	Israel and Egypt the peace agreement	last Wednesday the news	the first... the next... the last ...²
Hawkins	<i>associative</i>	<i>associative</i>	?
Prince	<i>inferrable</i>	<i>inferrable</i>	<i>inferrable</i>
Fraurud	first mention	first mention	?
Löbner	semantic fc3	?	?
Clark	?	?	set- membership
Sidner	<i>associated specific.</i>	<i>associated specific.</i>	computed specific.
Strand	delimit. (arg.-event)	delimit. (time anch.)	adjoining (part-part)

Table 2(d) Classifications of definite descriptions: associative uses

The situational uses are presented in Tables 3 (a and b). Hawkins and Löbner agree that some cases refer directly to the physical context (pragmatic deictic, visible and immediate situation) whereas others (semantic FC2s with deictic argument and larger situation) only relate to the context, in the sense that their interpretation involves context identification and reasoning. Some uses may rely either on specific or general knowledge: in the example of a wedding situation, the interpretation of a description such as *the bride* may involve either specific knowledge of the referent or the general knowledge that weddings have brides. The same ambiguity is expressed in terms of situationally inferable³ or unused in Prince's taxonomy. Fraurud also reckons that first mention uses may require situational anchors or referents, although she does not name different classes for them.

Situational uses	pass me the salt	beware of the dog	(at a wedding) the bride	the Prime Minister
Hawkins	visible situation	immediate situation	larger sit. (gen./sp. kn.)	larger sit. (gen./sp. kn.)
Prince	situationally evoked	situationally evoked	situationally infer./unused	situationally infer./unused
Fraurud	first mention	first mention	first mention	first mention
Löbner	pragmatic (deictic)	pragmatic (deictic)	semantic fc2 (deictic arg.)	semantic fc2 (deictic arg.)

Table 3(a) Classifications of definite descriptions: situational uses

Situational uses	the weather	the Gibbet
Hawkins	larger sit. (general kn.)	larger sit. (specific kn.)
Prince	?	unused
Fraurud	first mention	first mention
Löbner	semantic fc1 (simple NP)	semantic fc1 (proper name)

Table 3(b) Classifications of definite descriptions: situational uses

In Tables 4 (a and b) the description *the colour red* is given as unfamiliar by Hawkins but would probably fit better in Prince's unused. All but one unfamiliar use are semantic definites in Löbner's scheme. Löbner discriminates *the woman Bill went out with* from uses like *the fact that...* probably because in the first case the referent is just associated to another known entity, whereas in the latter the conceptual referent is determined by the complement (although both are based on complements which disambiguate a sortal head noun). Later in (Löbner 1996) he presents *the book I gave you yesterday* as an FC1 but he does not say whether he is considering it semantic or pragmatic. Note that the descriptions that illustrate situational and unfamiliar uses are potentially discourse new. However, nothing prevents them from being used in subsequent mention. Hawkins and Löbner give the most complete classifications for discourse new descriptions.

Unfamiliar uses	the fact that ...	the colour red	the woman Bill went out with
Hawkins	unfamiliar (np compl.)	unfamiliar (nom. modif.)	unfamiliar (rel. clause)
Prince	containing inferrable	unused	containing inferrable
Fraurud	first mention	first mention	first mention
Löbner	semantic fc1	semantic fc1	prag. endoph. (with attribute)

Table 4(a) Classifications of definite descriptions: unfamiliar uses

Unfamiliar uses	the bottom of the sea	the same secrets	the first person to sail to ...
Hawkins	unfamiliar (ass. clause)	unexplan. Modifiers	unexplan. Modifiers
Prince	containing inferrable	?	containing inferrable
Fraurud	first mention	first mention	first mention
Löbner	semantic fc2 (explicit arg.)	semantic fc1 (complex NP)	semantic fc1 (complex NP)

Table 4(b) Classifications of definite descriptions: unfamiliar uses

In this review we have considered research that looks at different types of uses of definite descriptions mainly in a classificatory way. We have not compared them with other well-known theories of definiteness which are based on principles of uniqueness and familiarity. Russell's influential work (Russell, 1905; Russell, 1919) is the best known work in the uniqueness perspective. In Russell's analysis, descriptions do not belong to the class of referring terms (or constants) like proper names, but to the class of denoting phrases like quantifiers. More recent approaches to natural language semantics still follow Russell's analysis of definite descriptions; an example is Montague semantics (Montague, 74; Gamut, 91) a very influential work in the field. However, while Russell's analysis works well for functional concepts (descriptions such as *the father of Russell*, or *the centre of the solar system*), the uniqueness condition is too strong for natural language description in general. Russell's analysis has been revised by

several authors who have addressed the problem of making uniqueness relative to the relevant situation (Kadmon, 1987; Neale, 1990; Cooper, 1993). Examples of work following the familiarity approach to definite NPs are Discourse Representation Theory (DRT) (Kamp, 1981; Kamp and Reyle, 1993) and File Change Semantics (FCS) (Heim, 1982). They extend the semantic representation from the sentence level (as considered by Russell) to the discourse level. The goal of these authors is to account for the interpretation of new utterances with respect to a given context, and the integration of the utterance information into that context, dealing with referential processes. The most distinguished phenomenon treated by such approaches is the anaphoric linkage between sentences. However, these authors have found problems when integrating definite descriptions in their frameworks.

According to these two approaches the referent of a definite description is required to be either uniquely identifiable or familiar to the hearer. A great number of uses of the definite article can be accounted for using either familiarity or uniqueness but neither approach alone can account for all felicitous uses. In (Birner and Ward, 1994) we find a clear discussion of this problem. Birner and Ward (1994) give as an example of non-unique referent referred to by a definite description:

16. [In a room with three equally salient windows.] It's hot in here. Could you please open the window?

Birner and Ward's example of an unfamiliar entity referred to by a non-anaphoric definite description is:

17. In her talk, the lecturer introduced the notion that syntactic structure is derivable from pragmatic principles.

9. Summary

Together, the theories we have discussed in this chapter account for both the anaphoric and non-anaphoric uses of definite descriptions. For the anaphoric uses, we need to understand the

ways in which a definite description may relate to its antecedent. We have presented studies that consider various kinds of relations between a description and its antecedent. One main distinction of the different types of relations is between co-referential and associated relations, and each of them may be realised in several distinct ways.

Anaphoric (co-referential) relations may be direct (description and antecedent having the same head noun) or they may be expressed by equivalent nouns (synonyms), through generalization (hypernyms), and sometimes through specialisation (hyponyms). Also, a proper name may introduce an entity that is afterwards referred to by a description of the entity type. Some authors also consider that a VP may introduce the antecedent for a definite description. The first type (direct anaphora) is the easiest to be treated systematically; the other co-referential relations are based on common sense knowledge, a requirement that is also essential for the interpretation of the associative uses. One extra difficulty in dealing with descriptions interpreted through associated relations is that the discourse might provide various anchors/links (different but equally suitable entities) for their interpretation. When associative relations need to be established we might have to face a difficult decision among several options. Strand's idea of deciding on a more informative relation is plausible but still difficult to implement, or even to define. For other uses of definite descriptions the interpretation is not based on an antecedent given by the linguistic context of utterance (or discourse): a description may refer to an entity in the physical environment, or something of the speaker's common knowledge. Also, the complexity of the description's syntactic structure may provide complementary information to the interpretation of a definite description (within the description itself).

These theories serve as the background for the work discussed in (Poesio and Vieira, 1998), where we present two related experiments involving:

- an empirical analysis of the uses of definite descriptions, aimed at further evaluating the relative importance of the different uses of descriptions; and
- the development and testing of a hypothesis about differences in interpretation related to the use of definite descriptions in written discourse.

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