Salience and Definiteness*

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1. Introduction

The concept of definiteness in natural language is of special interest because it seems to be pragmatic in nature but it has semantic impact. The analysis of definite expressions exhibits some aspects of the fuzzy borderline between semantics and pragmatics and the interaction between the two areas. In this paper, I will examine four semantic theories about definiteness with particular view on English. I conclude that the pragmatic concept of "salience" is the underlying principle for definiteness. However, no theory has given a formal account of this pragmatic principle. I show that choice functions provide the adequate means to reconstruct salience in a formal theory. They are functions that assign to each non-empty set one of its elements. In this formal approach the pragmatic principle of salience gets its semantic reconstruction which yields a unified account of the semantics of definite noun phrases and pronouns.

The paper is organized in the following way: In the second section I introduce five different groups of definite expressions, namely proper names, definite NPs, demonstratives, personal pronouns, and possessive constructions. In the third section, I focus on definite NPs as the most complex kind of definite expressions and discuss the relevant contexts where they are used: the anaphorical linkage, the relational dependency, the situational salience, and the unique case.

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In the fourth section, I shortly sketch three semantic theories of definiteness. Each of the theories focuses on one of the typical contexts of definite expressions: Russell's Theory of Descriptions focuses on uniques, Kamp and Heim's familiarity theory takes the anaphorical use as fundamental, and Löbner's relational approach bases definiteness on relational dependencies. However, none of these three theories gives a complete picture of all uses of definite NPs. Therefore, the more general salience approach is presented in the fourth section. In this approach, the context crucially contributes to the interpretation of the definite NP by forming a salience hierarchy among the potential referents. It is assumed that each context can be associated with an ordering among the elements of subsets of the domain of discourse. This ordering reconstructs the intuitive idea of a salience hierarchy. The three historical sources of this salience theory are outlined: Lewis' semantic criticism of Russell, the linguistic conception of the Prague School and the investigation of AI researchers. However, there has not been any attempt to formalize the principle of salience.

In the sixth section, I give a formal representation of the concept of salience by means of context dependent choice functions, which pick out from a set one of its elements or a "representative". Due to this formal account of the pragmatic principle of salience it becomes possible to reconstruct definiteness in the logical representation of natural expressions. It will be shown that the developed formalism can uniformly describe all four different uses of definite NPs.

2. Definite Expressions

In a pretheoretical definition, a definite singular expression unambiguously denotes or refers to one object, i.e. the object can be identified as the only one that is denoted by the expression. The fixed reference of a definite expression depends on different grounds: it can be determined by lexical material, by semantic rules or by pragmatic strategies. Traditionally, proper names, definite NPs, demonstratives, personal pronouns and possessive constructions are regarded as definite. In this section I will give a short overview of these types on the example of English expressions and discuss some of their properties. I confine the presentation to expressions referring to singular countable objects.

2.1 Proper Names

A proper name is a prototypical definite expression. It refers to exactly one individual, namely the bearer of the name. The reference is purely conventional since no internal part of the expression points or gives any relation to its bearer. Despite their treatment as constants in formal semantics, proper names are highly context dependent as the list (1) shows. There are many Johns and Janes and there is even more than one Václav Havel and one Helmut Kohl. However, these problems of proper names should not concern us here too much.

(1a) *John*
(1b) *Jane*
(1c) *Václav Havel*
(1d) *Helmut Kohl*

2.2 Definite NPs

Definite NPs, like the list in (2), refer to their objects not by convention but due to their descriptive content. Since there is only one person who has been the first man on the moon the definite NP *the first man on the moon* refers to exactly that man. This behavior of definite NPs caused their use in mathematics and epistemology for definitions where they are called definite descriptions. In the context of a definition, a definite description refers to the unique object that satisfies the descriptive material. Russell's Theory of Descriptions is based on such cases and, therefore, entails the uniqueness condition for definite descriptions. However, in normal natural language discourse we find definite NPs whose descriptive material can be satisfied by more than one individual, like *the sun*, *the university*, *the table* etc. Such NPs are sometimes called incomplete definite descriptions. They refer uniquely to one object due to their descriptive material and further information, like our shared background knowledge about the astronomical system of the earth, or contextual information about the place and time of utterance.

(2a) *the first man on the moon*
(2b) *the sun*
(2c) *the university*
(2d) the table

2.3 Demonstratives

Demonstrative expressions include demonstrative pronouns or demonstrative NPs. Demonstrative pronouns like *this* or *that* refer to an object only if the linguistic utterance is accompanied by a non-linguistic demonstration or ostension. They form a borderline case of the semantic-pragmatic interface since they do not determine the referent of the expression by themselves but rather indicate that an additional demonstration is to be undertaken. Like deictic expressions (*here, now* etc.) demonstrative pronouns have a very impoverished lexical content. They express the *here-there*-distinction in English and can indicate gender, case and number in other languages. Demonstrative NPs like *this man, that book* etc. consist of a demonstrative and a descriptive part. Thus, they identify their referent by combining a demonstrative action with a descriptive information about the referred object.

(3a) *This* is my teacher.
(3b) I take *that.*
(3c) *This man* is very late.
(3d) I bought *that book.*

It is noteworthy, that in all Indo-European languages that have a definite article the form of the article has developed out of the demonstrative pronoun. We come back to this point later.

2.4 Personal Pronouns

The use of personal pronouns are traditionally analyzed either as deictic or as anaphoric. In absence of any linguistic context, the pronoun *he* in (4a) most likely refers to an object that must be in some way prominent in the context or "easy to access". This deictic interpretation of the pronoun is licensed if the pronoun is accompanied by a demonstration or if the non-linguist context contains some prominent or salient object. Background knowledge may play an important role, too. A pronoun is interpreted anaphorically, if it refers to an object that has been already introduced into the discourse, as in (4b). The analysis of pronouns is crucial for any theory of reference. Therefore, examples similar to (4c) and (4d) have been discussed since classical times

illustrating the interaction with other expressions and constructions, like conditionals.

(4a) *He* will be late again.
(4b) A man walks. *He* whistles.
(4c) If a man is in Athens he is not in Rhodes.
(4d) If a man has a donkey he beats it.

2.5 Possessives

Possessive constructions like *John's car* consist of a common noun or head noun (*car*) that is preceded by a definite expression or a modifier, like a pronoun, a proper name or a definite description, but not by a demonstrative pronoun. Both expressions are conjoined by the possessive "s" which indicates the definiteness of the whole expression. Personal pronouns and the possessive "s" merge to possessive pronouns as in (5a). The possessive expression denotes exactly the object that fulfills the property that is expressed by the common noun (cf. *car*) and that further stands in a certain relation to the object that is denoted by the modifier (cf. *John*). This relation can be determined by the lexical material of the head noun if it is a functional concept, like *father*. Since for each person there exists exactly one father, an expression of the kind *X's father* denotes always one person. If the head noun does not denote a functional concept, but rather a sortal one as in (5b) the relation is usually the possessor relation. *John's car* is that object that is a car and has a certain relation to John, which is probably the car that John owns. Possessive constructions of this kind should not be mixed with constructions of the kind *the car of John*, because the definiteness in the latter case comes from the definite article and not from the possessive relation.

(5a) *his claim*
(5b) *John's car*
(5c) *Lisa's father*
(5d) *the man's bag*

In the following I will concentrate on the use of definite NPs in natural language since they form the most complex group of definite expressions. Definite NPs need for their reference not only descriptive content but also

contextual information of a different kind. This combination of descriptive content and contextual information makes their analysis not only difficult and controversial but also a very challenging enterprise for semantic analysis. Definite NPs exhibit an interaction between the different mechanisms and, hence, call for general principles explaining the way they are linked with their referents.

3. The Uses of Definite NPs

There are several different uses of definite NPs and even a more subtle categorization of these uses. We will start with the overview that was presented by Christophersen (1939). His work on articles is very prominent for two reasons. Firstly, he not only summarizes the descriptive state of art, but also tries to give a more abstract categorization of definiteness. And secondly, he was one of the first who reacted to Russell's Theory of Descriptions. It is interesting to note that all approaches except Russell's theory refer to Christophersen's work as precursor of their ideas.

Christophersen (1939, 29) distinguishes between *the explicit contextual*, *the implicit contextual* and *the situational basis* use for definite NPs. According to the contemporary terminology in the literature we will call these three main groups *anaphorical*, *relational* and *situational* use, respectively. I discuss a fourth group of unique uses though Christophersen does not recognize it as a proper use, but rather subsumes it under the three other uses.

3.1 Anaphorical Linkage

In the anaphorical use (Christophersen's explicit contextual), the definite NP refers to an object that is explicitly introduced by the linguistic context. Thus, definiteness is based on the principle of coreference.

(6) Once upon a time, there was a king, ... and *the king* ...

The object is introduced by the indefinite expression *a king* and then the reference is picked up by the definite NP *the king*. It could be picked up by the pronoun *he* or by the demonstrative NP *that king*, as well. However, there are differences in application of anaphorical pronouns, demonstratives or definite

NPs. One principle concerns the distance between the antecedent and the anaphorical expressions: The further the distance between the first mention and the resumption, the more likely it is to use the definite NP.

3.2 Relational Dependency

In the relational (associative, implicit contextual) use, the definite NP refers to an object due to another already mentioned object in the discourse. However, it does not refer to the same object like in the anaphorical linkage discussed in the last subsection. The definite NP *the author* receives its referent not by coreference with an antecedent expression, but rather by a significant association relation to the antecedent *a book*.

(7a) I read a book. I cannot remember *the author*.
(7b) I bought a new car. I had to change *the motor*.
(7c) I bought a new car. ?I had to change *the wheel*.

The definite NP *the author* does not pick up the referent of another expression, but it refers to an object that is unequivocally linked to a just mentioned object. This is possible due to the relational (or functional) nature of the expression. An author has to be an author of something, probably a book. The definite NP expresses two things: its descriptive material delimits the class of potential referents and then establishes a relation to a mentioned object in discourse. In the example (7a) this is done by the common noun *author*, which expresses the relational concept between a person and a written text such that the person has produced the text.

The link between a definite NP and an expression it is related to must be in some way unique. Since nothing else than the relation is expressed the relation itself must unequivocally determine exactly one object. Otherwise one has to use the indefinite article. The sentence *I bought a new car. I had to change the wheel* is awkward without any further context. Therefore, functional expressions like *the father* are preferred to relational expressions like *the wheel*. One can think of such relational definite NPs as abbreviated possessive constructions. *The author* stands for *the author of the book* or *its author* etc. It seems that the definite article stands for the possessive construction discussed in section 2.5 and could be easily replaced by the appropriate possessive pronoun.

However, the definite NP cannot be substituted by a pronoun or by a demonstrative expression as illustrated in (7d).

(7d) I read a book. ?I cannot remember *this author/him*.

The relational concept of an definite NP must be lexically determined, whereas possessive construction can be used in a wider range of contexts. The relational property need not be lexically expressed, but can also be given by the context.

3.3 Situational Salience

Definite NPs that are neither relational nor just mentioned can be used if the situation or the non-linguistic context delivers additional information to single out the referent.

(8a) *The island* is beautiful.
(8b) *The sun* shines.
(8c) *The talk* will start soon.
(8d) *The train* left two minutes ago.

The isolated sentences in (8) can only be uttered felicitously if the non-linguistic context specifies which object is uniquely meant. This non-linguistic context can consist in the shared background knowledge or in the actual circumstances. The latter should be the case when uttering (8a). If we stand at the University of Konstanz and look around the lake uttering (8a) we mean the only visible island, namely the Mainau. This use is sometimes called deictic or demonstrative and has a special relation to demonstrative NPs (cf. 2.3), as the definite article can be substituted by the demonstrative pronoun *this* or *that*. It is interesting to note that in all Indo-European languages the definite article is derived from the demonstrative pronoun. Therefore, Lyons (1977, II, 671ff.) assumes that every definite NP contains a deictic element. This idea will be formalized in section 6. However, there are some cases in which we cannot replace the definite article by the demonstrative: The definite NP *the sun* in (8b) refers uniquely due to our background knowledge that there is only one sun (in the relevant circumstances). In this case we cannot replace the definite article with the demonstrative pronoun.

3.4 Uniques

Despite the fact that uniques do not form an independent class of definite NPs in Christophersen's classification they should be discussed here. Uniques are nouns whose lexical content is such that only one object can fit it. Thus, we find such nouns in the latter two groups of definite NPs discussed above: A unique can consist in a noun that expresses a functional concept, i.e. a concept that gives exactly one value for each argument. It can also consist in a noun that due to its meaning refers only to one object (in the relevant context) like *the first man on the moon*. The sun refers uniquely because there is only one sun in our solar system. Or one can argue that *the sun* stands for the relational concept of *sun of something* and given the case that all of us live on the same planet, the sun of this planet refers to the only sun we have. Finally, the definiteness could be reduced to the principle of salience as well: we refer to the sun with "the sun", because it is the most salient sun. Uniques are used for definitions and have got, therefore, a special place in logic and epistemology. Certainly, in formal semantics their role is overestimated because they can be captured by the other classes. In the remainder, we will disregard uniques as an independent class and consider only the other three classes.

These uses of definite NPs are not independent of each other and sometimes it is hard to classify a particular use. They often overlap and a definite NP refers uniquely because there are linguistic and non-linguistic pieces of information given in distinct ways. The question that arises is whether there is one basic use or function of the definite NP and how we can describe it. In the next section we will see that different approaches take different uses as primary and try to define the other uses in terms of the chosen one.

4. Three Theories of Definiteness

We have mentioned above that definiteness is a pragmatic principle that has a semantic impact. An analysis of definite expressions is a central task for every semantic theory. In this section, I will characterize three alternative theories of definiteness: Russell's classical Theory of Descriptions, Heim and Kamp's Familiarity theory and Löbner's relational approach to definite expressions. In section 5, I introduce the salience approach which is based on the situational salience of the referred object. Though the theories are confronted with the multiple uses of definite NPs discussed in the last section, they assume that there is only one underlying meaning of the definite NP that can be found in all of its uses. However, each of the theories chooses a different use of definite NPs as the primary one and gives an adequate analysis of this use. The analysis is then extended to the other uses. Further arguments for each of the discussed theories are gained if other definite expressions, as discussed in section 2, can be described in the same format or according to the same principles. The first three theories mentioned are successful in their primary area, but they cannot convincingly describe other uses of definite NPs. Therefore, a more general approach will become necessary.

The Russellian Theory of Descriptions is the clearest and the best understood approach. It gives a clear formal representation of definite and indefinite NPs as quantifier phrases. In this way certain ontological and epistemological problems with non-existent objects are solved. The definite article and its indefinite counterpart get a lexical meaning and their difference is expressed by the uniqueness condition. Definite NPs are represented as quantifier phrases. Certain ambiguities can be explained in terms of quantifier interaction and scope. However, this approach is conceptually and technically grounded on uniques and not easily transferable to other uses of definite NPs. The uniqueness condition is a too big obstacle, and several arguments show that definite and indefinite NPs are not quantifier phrases but terms (e.g. Löbner 1985; Egli 1991; von Heusinger 1997)

All of the three following theories, namely Heim and Kamp's familiarity theory, Löbner's functional approach and the salience approach, introduced in the next section, can be understood as a reaction to the very strong Russellian assumptions. It is noteworthy that all of them refer in one way or another to Christophersen's original work and claim that they spelled out his original ideas. Heim and Kamp's approach focuses on the anaphorical use of definites in

a discourse. This view gave rise to the new generation of dynamic semantic theories, which do not analyze isolated sentences, but an entire discourse. Heim and Kamp's familiarity theory claims that there is a uniform representation of definite and indefinite NPs as open sentences with free variables at the additional level of discourse representation. The indefinite article indicates that a new variable has to be introduced whereas the definite article expresses that the open sentence has to be linked to an already introduced variable, i.e. to a familiar variable. Thus, Heim and Kamp claim to have adapted Christophersen's familiarity on the level of discourse representation. Anaphorical pronouns can be described by means of the same formalism and for deictic expression the formalism can be extended in an acceptable way. In this view, definite and indefinite NPs are not represented as quantifier phrases but as singular terms, which nevertheless can be bound by higher operators.

Löbner's relational approach occupies a position between the two former theories. On the one hand he focuses on the relational use of definites like Russell (i.e. narrow scope definites) and rejects Heim and Kamp's approach that concentrates on the anaphorical use. On the other hand he refuses all three of Russell's claims, namely (i) that definite NPs are quantifier phrases, (ii) that there is a uniform semantics of definite and indefinite NPs, and (iii) that uniqueness is a property of the descriptive material of a definite NP. He rather takes definite NPs as terms like proper names, whereas indefinites are quantifier phrases. Instead of Russell's uniqueness condition he uses Christophersen's view according to which definite NPs refer unambiguously. This fits well into the formal representation of definites as terms since a term refers uniquely *per definitionem.* In contrast to Heim and Kamp's approach, definites do not express a global definiteness (wide scope) but rather a local definite relation. A global relation can be constructed by chains.

4.1 Russell's Theory of Descriptions

Russell takes the uniques as the prototype of definite NPs or definite description, as he calls it. His uniques are generally functional concepts, like *the center of the solar system* or *the father of Bertrand Russell*. He does account for context dependencies, which do not play any role in mathematics and logic. Furthermore, context has no place of its own at the formal level of analysis in his conception of a language as formal system (or *ars characteristica*). However, Russell's Theory of Descriptions is a very common

view among formal semanticists since it is a well developed theory, which fulfills logical, ontological and epistemological standards. Russell (1905) represents the definite article with the “iota operator” as in (9a), which is contextually defined as a complex quantifier phrase consisting in the uniqueness condition, the existential condition and the matrix predication, as spelled out in (9b). The iota operator can represent complex possessive constructions, like in (10):

(9) The father of Bertrand Russell was English.
(9a) English(ιx Father_of(b, x))
(9b) ∀x [Father_of(b, x)) & ∃y [(Father_of(b, y)) -> x = y] & English(x)]

(10) Bill’s father’s dog’s basket = the basket of the dog of the father of Bill
(10a) ιx [Bx(ιy (Dy ιz(Fzb))]

Neale (1990) gives a very good defense of the Russellian approach and extends it to more sophisticated problems. Especially, he successfully exploits the Russellian iota terms for describing functional dependencies as in (11). He further integrates the treatment of so called “E-type pronoun”, i.e. cross-sentential pronouns, into this formalism by using complex iota terms like in (12b):

(11) Every man loves the woman that raised him.
(11a) ∀x Mx -> Lx(ιy)(Wy & Ryx))
(11b) ∀x Mx -> ∃y [(Wy & Ryx) & ∀z [(Wz & Rzx) -> z = y] & Lxy]

(12) A man walks. He whistles.
(12a) A man walks. The man who walks whistles.
(12b) ∃x [Mx & Wx] & Wh(ιx [Mx & Wx])

However, there seem to be unsolvable problems with Russell’s theory that concern the uniqueness condition: it is too strong for natural language descriptions. An additional problem is that the difference between the definite and the indefinite article lies only in this problematic uniqueness condition. Finally, in this analysis definite NPs do not belong to the class of referring terms like proper names and pronouns, but to the class of denoting phrases like quantifiers.

4.2 Heim and Kamp's Familiarity theory

With the beginnings of the eighties a new generation of semantic theories was developed (Kamp 1981, Heim 1982) that uses an additional level of representation. This representational level was motivated by linguistic investigation into anaphora (Karttunen 1976), by research of artificial intelligence into the representation of discourse (e.g. Webber 1979) and by philosophical investigations (cf. Stalnaker 1978). There are two main aims of these new theories. One is to extend the semantic representation from the sentence to discourse phenomena. The discourse representation level should model not only the meaning of a sentence, but also the information of a whole discourse. The second aim is to represent definite and indefinite NPs in a uniform way as discourse referents that 'live' on the discourse representation level, but not necessarily in the real world. Hence, ontological problems with non-existent objects can be solved by describing them as discourse referents with a short 'livespan'. The emphasis of these theories lies in the investigation of discourse anaphora that carry on certain information from one sentence to the following sentences. This is also the beginning of a dynamic view of meaning.

Thus, the most prominent discourse phenomenon that is treated in this approach is the anaphorical linkage between sentences. The core meaning of definite NPs is seen in the anaphorical use. An indefinite NP introduces a new discourse referent into the discourse representation, whereas a definite NP is anaphorically linked to an already introduced or 'familiar' discourse referent. This view on definiteness is traced back to Christophersen (1939) and his familiarity theory, which says that an indefinite NP introduces a new referent and a definite NP refers to an old or familiar referent. However, Heim and Kamp transfer this principle to the level of discourse representation to avoid ontological problems. The indefinite NP *a man* in (13) introduces a new discourse referent d_1 in (13a). The definite pronoun *he* in the second sentence of (13) introduces the discourse referent d_2 which is identified with the first one in (13b) expressing the anaphoric relation in (13). Discourse referents can also be bound by other operators like conditionals in (14) and (15) which are interpreted as universal adverbial quantifiers (cf. Lewis 1975):

(13) A man walks. He whistles.
(13a) $\{d_1 \mid M(d_1) \& W(d_1)\}$
(13b) $\{d_1, d_2 \mid M(d_1) \& W(d_1) \& d_1 = d_2 \& Wh(d_2)\}$

(14) If a man is in Athens he is not in Rhodes.
(14a) $\forall\{d_1 \mid M(d_1) \& A(d_1)\}\ \{d_1 \mid \neg Rh(d_1)\}$

(15) If a man has a donkey he beats it.
(15a) $\forall\{d_1, d_2 \mid M(d_1) \& D(d_2) \& O(d_1, d_2)\}\ \{d_1, d_2 \mid B(d_1, d_2)\}$

In this analysis indefinite NPs always get the narrowest scope and definite NPs get the wide scope, i.e. at least the scope over the sentence they are constituents of. This mechanism explains the anaphorical use of definite NPs in a very neat way. They show how the information that is needed for establishing anaphorical linkages is carried on in discourse.

However, such theories face problems with the other uses of definite NPs. The situational use is explained by the assumption that in such cases non-linguistic information may introduce discourse referents to which definite NPs can be linked. The sentences listed in (8) can only be uttered if the non-linguistic context delivers an object that introduces a discourse referent. This mechanism allows for an analysis of both deictic pronouns and definite NPs by creating one domain for linguistic and non-linguistic information. However, there may be a problem of delimiting the non-linguistic information that is needed for the semantic analysis.

Relational definite NPs cause a different problem. They can be bound by a higher operator in the same sentence (cf. Heim 1982, 245ff.).

(16) Every man saw the dog that barked at him

This problem is generally solved by introducing a new kind of rule, namely accommodation according to Lewis (1979). An accommodation is possible if the sentence cannot be interpreted felicitously. This may be the case if one processes a sentence and comes across a definite NP without an antecedent. Then the alternative consists in rejecting the whole sentence or in accommodating it. If one has good reasons to think that the given sentence is felicitous, one has to apply accommodation. The accommodation rule says that one can add a new property that stands for a functional concept whose

argument must already be given. In the following sentence, the definite NP *the dog that barked at him* introduces a new complex *D(x) & B(x, y)* for the functional concept *dog that barked at y* and the argument *y* refers to the discourse referent d_1 that is introduced by the NP *a man*.

(17) A man saw the dog that barked at him.

(17b) $\{d_1, d_2 | [D(x) \& B(x, y)] M(d_1) \& d_2 = \iota x [D(x) \& Bark(x, d_1)] \& S(d_1, d_2)\}$

To sum up, we have seen that the representational approach with the familiarity principle explain the anaphorical use of definites in an elegant way. However, for the situational and relational use, some modifications are necessary. The situational use is explained by stipulating that non-linguistic context can establish discourse referents as well. In this way, the deictic use of definites in general (i.e. deictic NPs and deictic pronouns) gets a uniform analysis together with the anaphorical use (of NPs and pronouns). The most obvious problem with this stipulation is that it is difficult to delimit the non-linguistic information that is necessary. The relational use of definites is explained by accommodation, i.e. a pragmatically determined repair of semantic procedures. If the semantic analysis does not find an antecedent for a definite expression, one may introduce the relational concept such that one argument is filled by an antecedent expression. This genius move to save the theory is not unproblematic since the restriction of this very powerful rule is not obvious. And if one needs such powerful mechanism, the question arises whether this mechanism is only a repair mechanism or whether it represents the real character of the definite NP. This position is discussed in the next section.

4.3 Löbner's Relational Approach

Löbner takes the complementary position to Heim, namely that the prototypical use of definite NPs is not the anaphorical but the relational or functional use. However, he differs also dramatically form the Russellian approach. According to Löbner the definite article is not a part of the lexical meaning of the expression, but indicates the way of reference, namely that the expression refers non-ambiguously. The function of the definite article is to show that the

expression refers unambiguously to an object.[1] This function was already defined by Christophersen. “I agree with Christophersen that the crucial feature of definiteness is non-ambiguity of reference” (Löbner 1985, 291).[2] It means that a definite NP cannot be represented by a quantifier phrase, but must be reconstructed by a term, like proper names and pronouns. The Russellian case, where the definite NP refers due to its descriptive material that uniquely denotes an object, comes out as a special case of unambiguous reference.

Löbner (1985, 299) distinguishes between semantic and pragmatic definites. “Semantic definites refer unambiguously due to general constraints; Pragmatic definites depend on the particular situation for unambiguous reference.” Thus, he merges the anaphorical use and the situational (or deictic) use into one class, which he coins pragmatic definite. The relational use becomes the semantic definites and the paradigm of definite NPs. “An NP is semantic definite if it represents a functional concept, independently of the particular situation referred to” (Löbner 1985, 299). An expression is inherently functional if it needs a further argument to refer to an object. This argument can be implicitly expressed by the situation like *weather, prime minister, post office* etc. and like proper names. This is what we have called the larger situational use of the definite article. The argument can also be explicitly expressed by an overt object argument like *father of_, capital of_,* The argument slot need not be filled by another definite expression. It can also be filled by an indefinite or quantificational expression:

(18) the mayor of a small town in Wales
(19) Every man loves his wife.

Examples like these suggest that the definiteness has not to be considered as a property of (global) reference (cf. Lyons 1977) but as a local property of the link between the head and its argument. (18) means that there is a definite relation from the town (whatever it is) and its mayor. Löbner confirms this view of definiteness by the following class of examples, which he calls configurational use.

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[1] Löbner (1985, n8) notes that the German word *eindeutig* expresses this very accurately.

[2] He further rejects the claim of Heim and Kamp to have reformulated Christophersen’s familiarity theory, but argues that they have deviated from the original idea. However, I do not find Löbner’s arguments convincing.

(20) He was the son of a poor farmer.
(21) He put his hand on her knee.

Again, the definiteness expresses a local determined relation between two arguments. It expresses neither a global definite reference nor any uniqueness condition of the definite term.

Pragmatic definites consist in anaphoric and deictic uses of definites. Löbner explains their use in terms of functional concepts. A pragmatic definite is a function from an established situation to an (unique) object. He develops some kind of discourse network to show that definite relation exists in local relation. However, Löbner does not give any formal definition of what a discourse consists of and which parts influence the definite NPs. Since he focuses on the local effect of definiteness he cannot account for the discourse phenomena of definite NPs. Therefore, he regards anaphora only as an epiphenomena and not as the central use of definite NPs.

5. The Salience Theory of Definiteness

Neither Russell's Theory of Description, nor Heim and Kamp's discourse representation or Löbner's relational view can analyze all uses of definite NPs. Therefore, a more general approach is necessary, which takes the situational use as the central one of definite NPs. The salience approach essentially incorporates contextual information into the representation of definite expression. The contribution of the context to the interpretation of the definite NP consists in a salience hierarchy. It is assumed that each context can be associated with an ordering among the elements of subsets of the domain of discourse. The definite NP *the F* denotes the most salient F according to the situation *i*. This representation completes the ideas of discourse representation theories by producing a more comprehensive picture: a definite NP is not only linked to an already introduced discourse referent, it is rather linked to the most salient discourse referent of the same kind so far.

The salience theory of definiteness has three historical sources: first, Lewis (1979) criticizes Russell's Theory of Descriptions and sketches an alternative theory using a salience ranking instead of Russell's uniqueness condition. Second, the investigation of the Prague School (cf. Sgall et al. 1973; Hajicová et al. 1995) developed an information structure of a sentence the pragmatic

background of which is a hierarchy of "activated" referents. Third, research in artificial intelligence showed that discourse models need a structure or hierarchy of referents that is very similar to Lewis' concept of salience (cf. Grosz et al. 1995).

5.1 Lewis' Theory of Salience

Lewis (1970, 63) develops the concept of salience in the philosophical and linguistic discussion of the Russellian Theory of Descriptions:

> Second, consider the sentence 'The door is open'. This does not mean that the one and only door that now exists is open; nor does it mean that the one and only door near the place of utterance, or pointed at, or mentioned in previous discourse, is open. Rather it means that the one and only door among the objects that are somehow prominent on the occasion is open. An object may be prominent because it is nearby, or pointed at, or mentioned; but none of these is a necessary condition of contextual prominence. So perhaps we need a *prominent-objects coordinate*, a new contextual coordinate independent of the other. It will be determined, on a given occasion of utterance of a sentence, by mental factors such as the speaker's expectation regarding the things he is likely to bring to the attention of his audience.

Lewis (1979, 178) rejects Russell's uniqueness condition for definites or any modified version of it: "It is not true that a definite description 'the F' denotes x if and only if x is the one and only F in existence. Neither is it true that 'the F' denotes x if and only if x is the one and only F in some contextually determined domain of discourse." He considers the following examples, in which two individuals are introduced by the same definite NP (in the non-generic reading):

(22) The pig is grunting, but the pig with floppy ears is not grunting.
(23) The dog got in a fight with another dog.

In both examples two individuals with the same property are introduced into the discourse. However, the definite NP should unambiguously refer to one object. Note that no functional concept plays a role, since *pig* and *dog* are sortal concepts (except one would claim a functional concept from situations into objects of the mentioned kind). An anaphorical link to another expression seems not to be relevant here. Thus, the definite NP must refer uniquely according to another and more general principle. Lewis (1979, 178) names this principle *salience*:

> The proper treatment of description must be more like this: ‘the F’ denotes x if and only if x is the most salient F in the domain of discourse, according to some contextually determined salience ranking.

However, there has been no attempt to formalize this concept in order to integrate it into formal semantics.[3]

5.2 The Praguian School

The Prague School has developed a dynamic view of the information expressed in a sentence. In this approach, the “stock of shared knowledge” (Sgall et al. 1973, 70) constitutes the common background of the speaker and the hearer. It is the set of potential referents for definite expressions. This set is further divided into background and foreground information, which depends on encyclopedic knowledge, context information and thematic structure of the sentence. Besides this dichotomy, there is a further structure which are described in the following way (Sgall et al. 1973, 70f.):

> There is no clear-cut dichotomy in the stock of shared knowledge, and it would be, probably, more adequate to work here with a kind of ordering than with two subclasses. Let us remark that the mentioning of an element of the stock of shared knowledge brings this element into the foreground of the stock, and, in some respects, it is possible to conceive the last mentioned element to be more foregrounded that the elements mentioned before, the foregrounding of which already shades away step by step, if it is not supported by some specific moments due to the given situation.

In the extended system of Sgall et al. (1986, 54f.), different ways of shifts in a discourse model (“hearer’s image of the world”) are assumed. One of this shift is described in terms of a salience hierarchy:

> not the repertoire [of objects, relations etc., K.v.H.] itself is changed, but a certain relationship between its elements, namely their salience, foregrounding, or relative

---

[3] Heim (1982, 21f.) additionally shows that the pragmatic concept of salience is too coarse-grained (the argument is due to Barbara Partee). In examples (i) and (ii), the salience of the lost marble is raised by the preceding sentence. However, only in (i) the anaphorical linkage is possible. It seems that the structure of the expression plays an important role:

(i) I dropped ten marbles and found all of them, except for one. It is probably under the sofa.
(ii) I dropped ten marbles and found only nine of them. *It is probably under the sofa.

> **activation** (in the sense of being immediately 'given', i.e. easily accessible in memory).

Hajicová et al. (1995, 14ff.) show how the position of an element in a sentence may effect its force to shift the salience: "(...) the activation of an item in SSK [= stock of shared knowledge, K.v.H.], if conceived as its attractiveness towards pronominal anaphora, seems to depend on in which position the item has been mentioned for the last time and on how many utterances have passed since that time point." They show that the choice of different pronouns (weak or strong) in Czech depends on this hierarchy of salience in the stock of shared knowledge. This view differs from Lewis' concept in that salience is regarded as a property of the cognitive discourse model, rather than as a property of the discourse such. Furthermore, it concentrates on the use of pronominals rather than on the analysis of definite NPs.

5.3 The AI approach

Computational analyses of discourse assume additional structures for discourse models in form of a hierarchy. Such analyses treat referential process on par with the representation of the discourse in structured models. Sidner (1983) develops a system in which a focus-algorithm administrates the activation and focusing of potential referents such that anaphorical expressions can be linked to a focused expression. According to Grosz & Sidner (1985, 3), a general discourse model consists of three components: "a linguistic structure, an intentional structure, and an attentional state." The third component encodes the dynamic hierarchy between the different discourse objects. Grosz & Sidner (1985, 9) define them in the following way:

> The third component of discourse structure, the attentional state, is an abstraction of the participants' focus of attention as their discourse unfolds. The attentional state is a property of discourse, not of discourse participants. It is inherently dynamic, recording the objects, properties, and relations that are salient at each point in the discourse.

In contrast to the Praguian approach, this structure does not depend on the hearer or speaker, but it is a property of the context (like in Lewis' view). Webber (1983, 335) distinguishes between the act of reference by the speaker, and the referential behavior of expression in a certain discourse:

> That is, "referring" is what people do with language. Evoking and accessing discourse entities are what texts/discourses do. A discourse entity inhabits a speaker's discourse model and represents something the speaker has referred to. A speaker *refers* to something by utterances that either *evoke* (if first reference) or *access* (if subsequent reference) its corresponding discourse entity.

Grosz et al. (1995, 205) use the term "centering" instead of "focusing" or "evoking". They distinguish between "forward looking centering", which raises certain entities to salience, and "backward looking centering", which links anaphorical expression to such salient entities. The elements of the set of forward looking centers "are partially ordered to reflect the relative prominence" (209). They discuss a number of factors that may affect the ordering on these elements. However, they do not give a formal account of this that could be integrated into a formal approach to sentence and discourse meaning.

5.4 Salience and Discourse

According to Lewis (1979), a definite NP refers to the most salient object in the discourse that fits the descriptive content. And he notes further that the salience ranking depends on the context, i.e. it is not global in the sense that each expression gets its referent for global constraints nor it is local in the sense of Löbner, since once established it can keep its ranking during the whole discourse if there is no other salience changing expression. This property of changing the salience may be exemplified by the following example given by Lewis (1979, 179):

> Imagine yourself with me as I write these words. In the room is a cat, Bruce, who has been making himself very salient by dashing madly about. He is the only cat in the room, or in sight, or in earshot. I start to speak to you:
>
> (24) The cat is in the carton. The cat will never meet our other cat, because our other cat lives in New Zealand. Our New Zealand cat lives with the Cresswells. And there he'll stay, because Miriam would be sad if the cat went away.

In terms of discourse representation theory, where the salience shifting potential cannot be encoded, the representation would look as follows: The first sentence in (24) introduces a discourse referent, that must be linked to an already introduced one. The second sentence refers to this referent by the

expression *the cat* and introduces a new discourse referent with the same property of being a cat and the further relation that belongs to the speaker (and the presupposition that the first cat belongs to the speaker, as well). The third sentence refers to the second introduced cat by the expression *our New Zealand cat*. And the fourth sentence is anaphorical linked to that cat by the expression *he* and *the cat*. However, in a discourse representation there would be no difference in the accessibility of the discourse referents. Therefore, the theory must rely on further information.

However, if we modify the theory and let the indefinite NP not introduce a discourse referent but let it give the highest salience ranking to an individual that fits the description, a definite NP would then refer to the object that fits the description and that has the highest salience rank.[4] The first sentence introduces a new cat, lets say Bruce, into the discourse and raises him to the most salient cat, such that the definite NP *the cat* in the next two sentence can refer to this salient cat Bruce. The third sentence refers to this cat and introduces a second cat Albert, that gets a lower rank. Therefore, in the following two sentences we have to refer to Albert by an unambiguous description (*our other cat* and *our New Zealand cat*). Since in sentences (iv) and (v) only we talk only about Albert, he gains it the first rank of the salience hierarchy such that in the last sentences we can refer to Albert by the pronoun *he* and by the definite NP *the cat*.

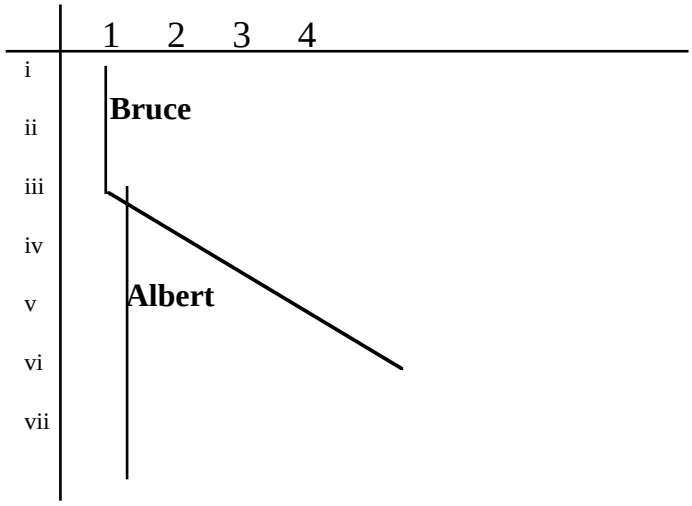
(25)	Discourse	Ranking
(i)	In the room is a cat	Bruce
(ii)	The cat is in the carton.	Bruce
(iii)	The cat will never meet our other cat,	Bruce > Albert
(iv)	because our other cat lives in New Zealand.	Albert, Bruce
(v)	Our New Zealand cat lives with the Cresswells.	Albert, Bruce
(vi)	And there he'll stay, because Miriam would	Albert > Bruce
(vii)	be sad if the cat went away.	Albert > Bruce

This salience ranking can be represented in the following schema, which goes back to Hajicová (1993, 77). The mechanism used there is more fine-grained since it also considers the topic-focus structure of the text. This is especially

4 "Thus although indefinite descriptions -- that is, idioms of existential quantification -- are not themselves referring expressions, they may raise the salience of particular individuals in such a way as to pace the way for referring expressions that follow" (Lewis 1979, 180).

important for the resolution of anaphorical pronouns. However, it seems that it is less important for anaphorical definite NPs. Moreover, it is not clear how the Praguian approach integrates the descriptive material of the NPs in questions. This becomes relevant in cases where we have more than one individual of the same kind, like in sentence (iii). The anaphorical reference in sentence (iv) is possible because the definite NP contains the description “other cat”, which identifies only one cat.

(25a) *Schematic representation of the salience ranking*



With the illustration of this small discourse the anaphorical use of definite descriptions is explained in terms of salience. That means that the anaphorical use can be seen as a specialized form of deictic use. In this way a uniform conception of definite NPs and deictic and anaphorical pronouns is possible.

6. Salience and Choice Functions

The concept of salience was never formally reconstructed although it was often regarded as an essential part for fixing the referent of definite expressions. In this section I develop a formal reconstruction of salience by means of context dependent choice functions. As formal semantem we will use the epsilon operator that was introduced into metamathematics by Hilbert & Bernays (1939). The epsilon operator is interpreted by a choice function that assigns to each non empty set one of its elements and to the empty set an arbitrary

element. Thus, the choice function selects the first element of an ordered set. In mathematics, this is the smallest number. However, natural language expressions do not refer to an naturally ordered set but to sets of objects whose order may vary with the linguistic context or the non-linguistic situation. Therefore, we do not use one choice function, but a family of choice functions that vary according to the situation or context (cf. Egli 1991). Another extension of the classical epsilon calculus concerns the dynamicity of the formalism. Peregrin & von Heusinger (1996) and von Heusinger (1995) combine the choice function approach with a dynamic logic. I try to keep the choice function mechanism as informal as possible.

For the interpretation of the modified epsilon operator we have to extend the individual domain *D* of the model *M* by the set of indices $\mathbb{I}$. Furthermore, we add the function Φ that assigns to each index *i* of $\mathbb{I}$ a choice function Φ_i.

(26) $[[\varepsilon_i x\ \alpha]]^{M,g,} = \Phi([[i]]^{M,g})(\{d: [[\alpha]]^{M,g\ d/x} = 1\})$
(26a) $[[\varepsilon_i x\ \alpha]]^{M,g,} = \Phi_i(\{d: [[\alpha]]^{M,g\ d/x} = 1\})$

Let us consider a situation where we have three cats *Albert, Bobby* and *Casimir* and three owners of the cats, *Ann, Beatrice* and *Carola*, respectively. The definite NP *the cat* is represented as the epsilon term $\varepsilon_i x\ Cat(x)$, which refers to the most salient cat in the context *i*. The different situations and accordingly the choice functions vary in the cat that is the most salient cat of the set of the three cats. We can define three choice functions (I use bold letters for indicating the objects of the model: **bobby** is the object we refer to by the name "Bobby"):

(27a) Φ_{ann} assigns to the set {**albert**, **bobby**, **casimir**} the cat **albert**
(27b) $\Phi_{beatrice}$ assigns to the set {**albert**, **bobby**, **casimir**} the cat **bobby**
(27c) Φ_{carola} assigns to the set {**albert**, **bobby**, **casimir**} the cat **casimir**

Given this model with the defined choice functions, we can represent sentence (28) by the logical form (28a). The context index is informally integrated into the logical form in (28b). The interpretation (28c) of this representation proceeds according to compositional rules: The sentence is true if the extension of the definite NP *the cat* lies inside the extension of the predicate *very intelligent*.. In order to fix the extension of the definite NP, the choice function $\Phi_{beatrice}$ is applied to the set of cats yielding the individual **bobby** as value:

(28) The cat is very intelligent uttered by Beatrice
(28a) Very_Intellegent(ε_ix Cat(x)) uttered by Beatrice
(28b) Very_Intelligent($\varepsilon_{beatrice}$x Cat(x))
(28c) $[[\text{Very\_Intelligent}(\varepsilon_{beatrice}\text{x Cat(x)})]]^{M,g} = 1$ iff
$[[\varepsilon_{beatrice}\text{x Cat(x)}]]^{M,g} \in [[\text{Very\_Intelligent}]]^{M,g}$ iff
$\Phi_{beatrice}([[\text{Cat(x)}]]^{M,g} \in [[\text{Very\_Intelligent}]]^{M,g}$ iff
bobby $\in [[\text{Very\_Intelligent}]]^{M,g}$

A sentence with two individuals of the same characterization can be analyzed like (29). The two individuals are described by epsilon terms using the characterization of being a dog. Additionally, the second mentioned dog is represented by the more complex epsilon term $\varepsilon_i y\ [Dog(y) \& y \neq \varepsilon_i x\ Dog(x)]$, which indicates that the referred object is not identical with the first chosen dog. i.e. it is the second most salient dog (cf. von Heusinger 1997, section 3.5):

(29) The dog got in a fight with another dog.
(29a) Got_a_Fight(ε_ix Dog(x), ε_iy [Dog(y) & y ≠ ε_ix Dog(x)])

6.1 The situational use

In the following subsections we will apply this formal reconstruction of salience, and hence definiteness, to the different uses of the definite NP, which were already discussed in section 3. In the last example we saw how the situational context determines the choice of the object. Definite descriptions of the following kind crucially depend on context information. We will encode this information into the context index:

(30a) the sun ε_ix Sun(x)
(30b) the university ε_ix University(x)
(30c) the republic ε_ix Republic(x)
(30d) the table ε_ix Table(x)

We can now insert an argument in the situational index and fix the choice function. For example, if we are here in Prague and speak of the republic we can fill the index slot with *czech* and get the following expression:

(30e) $\varepsilon_{czech}x$ Republic(x)

This term denotes that object that is a republic and that is first selected by a choice function, called *czech*. Of course, we would define this choice function in such a way that it picks up first the Czech Republic. This formalism implies that definite NPs are deictic expression like *here* and *now*, because they have a situational argument. This representation resembles to Löbner's function from contexts into objects.

The example shows further that we have different possibilities to single out one object. In the above case we have represented the definite NP as a function from contexts into objects (from situations into functions from sets into objects). We would have represented this example as a functional noun whose argument is missing, as well. Indeed, there are formal means to materialize the situation index as an additional argument inside the term (cf. von Heusinger 1997, section 4.5):

(30f) $\lambda y\ \varepsilon_i x$ Republic_of(x, y)

6.2 The anaphorical use

As mentioned before, the representation of definite NPs as context dependent choice functions is the most general analysis. Therefore, the general pattern has to be adapted to the special uses. In the case of the anaphorical use the situation index has to be made exclusively dependent on the linguistic information of the discourse. We assume that the linguistic context in the discourse can raise the salience of an object by different means. One very obvious means is to refer to this object by a definite or an indefinite NP. The indefinite NP is used when the object has not yet been mentioned and the definite NP is used if the object was mentioned before. However, both make the object salient as the example (24) with the cats showed.

The anaphorical linkage can be decomposed into the salience change potential of an expression and the contextually dependent interpretation of another expression as illustrated in example (31). In (31) the indefinite NP *a man* in the first sentence changes the given salience structure such that the referent of the indefinite NP becomes the most salient man. Therefore, the definite NP, which refers to the most salient man, denotes the same object as the indefinite. In the representation, we assume that the indefinite NP change

the given context *i* to the context *j*. The difference between the two context indices reduces to the difference of choice function assignment. The assignment of the choice function Φ_j is equal to that of the choice function Φ_i except for the value of the set of men, which is **d**. This individual has been introduced by the indefinite NP *a man* (for a more detailed formalism, see von Heusinger 1995).

(31) A man comes. The man smokes.
(31a) $\text{Comes}(\varepsilon_i x\ \text{Man}(x)) \,\&\, \text{Smokes}(\varepsilon_j x\ \text{Man}(x))$
(31b) $\Phi_j = \Phi_i\langle\langle[[\text{man}]]^{M,g}/\mathbf{d}\rangle\rangle$

We generally indicate the update of a choice function by a set **s** and its new assignment **a** inside double angle brackets: $\Phi_j = \Phi_i\langle\langle \mathbf{s}/\mathbf{a}\rangle\rangle$: $\Phi_j$is equal to Φ_i except for the assignment to the set **s**, which is **a**.

We can explain anaphorical pronouns in the same way. They are represented as very general epsilon terms: $\varepsilon_i x\ [x = x]$. The property *[x = x]*. denote the individual domain *D*. Such an epsilon term picks up the most salient object in discourse, which is in sentence (32) identical with the most salient man: $\varepsilon_j x\ [x = x] = \varepsilon_j x\ Man(x)$. In order to license the link between the indefinite NP *a man* and the anaphorical pronoun, we must modify the salience change potential of NPs. It does not only change the assignment for the set of men, but also for certain supersets, e.g. the set of all (male) objects (in the following we disregard gender differences):

(32) A man comes. He smokes.
(32a) $\text{Comes}(\varepsilon_i x\ \text{Man}(x)) \,\&\, \text{Smokes}(\varepsilon_j x\ [x = x])$
(32b) $\text{Comes}(\varepsilon_i x\ \text{Man}(x)) \,\&\, \text{Smokes}(\varepsilon_j x\ \text{Man}(x))$
(32c) $\Phi_j = \Phi_i\langle\langle[[\text{man}]]^{M,g}/\mathbf{d}, D/\mathbf{d}\rangle\rangle$

We have now created the adequate means to describe even longer discourse fragments like (25), which is repeated as (33). We assume that each sentence has its own contextual index, i.e. is interpreted according to a particular choice function. The relation between the different choice functions is indicated by the equations. Generally, the choice functions are identical except for the assignment of the sets that are denoted by the properties in the NPs and the domain *D* of individuals, i.e. they are updates of the preceding choice functions in respect to the used NPs. In (33i), the indefinite NP *a cat* refers to Bruce and

changes the choice function Φ_i to the choice function Φ_1. Φ_1 is equal to Φ_i except that is assigns **bruce** to the set of cats and to *D*. Therefore, the definite NP *the cat* refers to **bruce**, too. Since **bruce** is already the most salient cat, sentence (33ii) does not change the actual salience hierarchy and its formal counterpart, the choice function Φ_2 . Sentence (33iii) changes the assignment to the set of *other cats* to **albert**, and the next two sentences change the assignments to the set of cats and the universal set to **albert**, too. The definite expressions *he* in (33vi) and *the cat* in (33vii) refer to this very cat **albert**:

(33i) In the room is a cat
In_the_Room(ε_1x Cat(x)) $\Phi_1 = \Phi_i$«[[cat]]^{M,g}/**bruce,** D/**bruce**»

(ii) The cat is in the carton.
In_Carton(ε_2x Cat(x)) $\Phi_2 = \Phi_1$

(iii) The cat will never meet our other cat,
Never_Meet(ε_3x Cat(x), ε_3y [Cat(y) & y ≠ ε_3x Cat(x)])
$\Phi_3 = \Phi_2$«[[other cat[[^{M,g}/**albert**»

(iv) because our other cat lives in New Zealand.
Lives_in_New_Zealand(ε_4y [Cat(y) & y ≠ ε_4x Cat(x)] $\Phi_4 = \Phi_3$

(v) Our New Zealand cat lives with the Cresswells.
Lives_with_Cresswells(ε_5x [Cat(x) & In_New_Zealand(x)])
$\Phi_5 = \Phi_4$«[[New Zealand cat]]^{M,g}/**bruce,** D/**bruce**»

(vi) And there he'll stay,
Stay(ε_6x [x = x]) $\Phi_6 = \Phi_5$

(vii) because Miriam would be sad if the cat went away.
Miriam_Would_Sad_If_Went_Away(ε_7x Cat(x)) $\Phi_7 = \Phi_6$

6.3 The relational use of definite NPs

An epsilon term can express complex dependencies by embedding, i.e. if a term is dependent on other terms this can be expressed by a parameter inside the epsilon term. Definites without further modification have wide scope since they are dependent on the situation whose scope is certainly wider than the sentence in which the definite NP stands. The definite NP in (34) has wider scope than the quantifier expression *every man*. However, if we add the relative clause *that barked at him* the definite NP becomes narrow scope, since the universal quantifier binds a variable inside the epsilon term. The denotation of the set depends on the choice of the variable of the universal quantifier.

(34) Every man saw the dog.
(34a) $\forall x$ (Man(x) -> Saw(x, $\varepsilon_i y$ Dog(y))

(35) Every man saw the dog that barked at him
(35a) $\forall x$ (Man(x) -> Saw(x, $\varepsilon_i y$ [Dog(y) & barked_at(x, y)])

Summary

The different uses of definite NPs can be best reconstructed with modified epsilon terms that represent context dependent choice functions. This representation focuses on the situational use of definite NPs and extends its analysis to the anaphorical and relational uses as well. This methods mirrors the historical circumstances according to which the use of the definite article spread from the situational use to the other two. Thus, the semantic category of definiteness can be understood as reflecting the pragmatic salience hierarchy of a context. It is integrated into a formal semantics by using choice functions.

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