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the
Definite Article of the English Language

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1. Overview

1.1 Introduction

The goal of this paper is to identify a viable analysis of *the* for use in semantic theories in the tradition of Montague (1974a,b).[*] I shall argue that the sentiment expressed by Lewis (1983), and developed in more formal detail by von Heusinger (1997), is essentially correct, and that, when an analysis is placed in a suitable formal context, it is capable of accounting for a much greater range of phenomena than Lewis and von Heusinger consider. The basic claim is that the expression “the N” denotes the uniquely most salient N, when such an entity exists. I shall begin by enumerating every credible semantic effect attributed to “the” when used in connection with count nouns that I have encountered in the literature or noticed in the course of personal reflection on the subject. Sometimes several conflicting views on the same basic phenomenon will be condensed into one entry in the interests of compactness, and sometimes well known effects will be omitted altogether on the grounds that they seem not to be semantic at all, but to be of an entirely pragmatic, psychological, or metaphysical nature[1]. The decision to restrict my attention to count nouns is motivated by a desire to pick out a problem of reasonable size, and to avoid discussion of the difficult but tangential subject of the semantics of mass nouns.

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[1] I have generally tried to include phenomena that seem to involve a mix of pragmatic and semantic effects, or of which the status is otherwise ambiguous.

1.2 Enumeration of Data

1.2.1 Unique Existence

By far the most widely discussed aspect of the meaning of *the* (at least in the singular), formalized (quite controversially) in Russell (1905)[2], is that it is thought to indicate the existence of a unique entity fitting the description. This can best be seen by considering a few examples:

1a. The current British Prime Minister needs oxygen to live.

1b. The current American Prime Minister needs oxygen to live.

1c. The current American Senator needs oxygen to live.

On one reading of the above sentences, (1a) is judged to be true, (1b) is judged to be untrue (intuitively, because America has no Prime Minister), and (1c) is also judged to be untrue[3] (the intuition here is that the problem arises because, although there is an individual who has the property of being an American senator, the description "the current American Senator" does not pick out a unique individual)[4]. These observations are often summed up in the assertion that a definite description entails that there is exactly one entity fitting the description.

[2] I don't mean to attribute the first observation of this phenomenon to Russell – it is discussed earlier in the philosophical literature (though often for analogous cases for languages other than English), and is not hard to notice.

[3] Some readers may have different intuitions about this sentence, interpreting (1c) as a general statement about American Senators, as in the sentences "the whale is a mammal" and "the fashionable lawyer is wearing whale fur this season", and not even considering a reading where uniqueness is involved. This phenomenon is discussed below under the heading of "genericity". Since the generic reading is much less plausible for a sentence like "the current American senator is stealing my tea strainer", I think it is quite reasonable to consider it as a separate phenomenon.

[4] I have been saying "untrue" rather than "false" here because some people, including many respectable philosophers, have a strong intuition that sentences like (1b) are neither true nor false. I wish, at least for now, to remain neutral on this issue.

Russell (1905, 1919) gave a formal analysis of these observations by claiming that (1c) is true if and only if "*x* is currently an American Senator" is true for some *x*, "if *x* and *y* are American Senators, then are *x* and *y* identical" is true for all *x* and all *y*, and "if *x* is currently an American Senator, *x* needs oxygen to breathe" is true for all *x*, and that other sentences of the same form could be analyzed in an analogous way[5]. Formally, we might say that Russell's analysis interprets *the* into a typical extensional lambda calculus as (2):

2. $\lambda P \lambda Q \exists x(P(x) \wedge \forall y(P(y) \leftrightarrow \mathrm{x{=}y}) \wedge Q(x))$

Authors like Strawson (1950) and Cresswell (1973) have called attention to the fact that definite descriptions, beyond merely entailing unique existence, seem to presuppose it. Thus (3c) is said to follow from both (3a) and (3b).

3a. The current British Prime Minister drowns kittens.

3b. The current British Prime Minister does not drown kittens.

3c. There is exactly one current British Prime Minister.

Followers of Russell tend to argue that this is because the quantificational component of a definite description tends to take wider scope than the negation, while many alternative approaches involve asserting that a sentence containing a definite description is neither true nor false (but still unquestionably untrue) when unique existence is not satisfied, and that the negation of such a sentence is likewise neither true nor false. Both of these accounts are, in principal, capable of providing the desired prediction that, for either (3a) or (3b) to be true, (3c) must be true as well. On the anti-Russellian account, sentences that violate their presuppositions in this way are alleged to be inappropriate, and

[5] The presentation here is a slight variation of the one given in Russell (1919).

advocates of this view claim that there is evidence for inappropriate sentences being neither true nor false, in the form of the tendency of conversational participants to say "what are you talking about?" rather than "no" when presented with such sentences. The Russellian can always counter by saying that the presupposition-violating sentence is in fact false, but that, for reasons of maximal conversational cooperativeness, accusing it of falsehood is not the most useful response. Both of these analyses have been expanded upon considerably by various authors (see, for example, Strawson (1950) for a canonical presentation of the anti-Russellian account). As it turns out, the analysis we shall adopt can be made to accommodate either view, so I shall not say much about the issue of presupposition.[6]

A major objection to the "unique existence" account (with or without presupposition) is that singular definite descriptions can be used truthfully when more than one entity fitting the description exists, as in (4).

4. It's Herman's turn to let the dog out.

This sentence might be perfectly true even though there are numerous dogs in the world. The traditional response to this complaint is to say that, within a particular discourse, only entities in a restricted domain of discourse may be discussed, quantified over, etc. This approach raises a number of issues, as we shall see in a little bit. For now, we shall content ourselves with a weaker assertion than Russell's: "['the man sleeps'] does not

[6] For a discussion of how issues of presupposition might be accounted for in my analysis, see Appendix A.

presuppose that there is exactly one man. What it does presuppose is that there is only one man being spoken about."(Cresswell, 1973).[7]

1.2.2 Indexicality or Salience

Lewis (1983) objects to Russell's account of definite descriptions for reasons relating to those discussed at the end of the last section. Citing examples like (5), (6), and (7), Lewis contends that "the N" denotes neither the only N nor the only N in the domain of discourse, but rather the most salient N in the domain of discourse.

5a. The king who likes waffles has a pet toad.

5b. The king, who likes waffles, has a pet toad.

5c. The king has a pet toad.

6. The pig is grunting, but the pig with floppy ears is not grunting. (Lewis)

To see why an example like (5) is such a problem for the Russellian analysis, consider the case where both Tonga and Denmark have kings, the king of Tonga is known for being the only king in the world who has a fondness for waffles, and happens to have a pet toad, and in which these various sentences are uttered in Denmark in a conversation between two Danes, in which Tonga and things Tongan have not previously been brought up, but in which the king of Denmark has been mentioned in passing. Under these circumstances, (5a) amounts to saying that the king of Tonga (who was identified by his love of waffles) has a pet toad (and is thus true), whereas (5b) indicates that the king of Denmark both likes waffles and has a pet toad, and (5c) simply that the king of Denmark has a pet toad (so (5b) is false, and (5c) is true if and only if the king of Denmark has a

[7] Of course, this constraint can be voided in many intensional contexts, including those generated by verbs like *seek*.

pet toad). There are clearly multiples kings available in the normal domain of discourse, but in every case the singular definite description picks out exactly one king. Likewise, the very fact that we can make sense of (6), and imagine situations in which it could be true, suggests that it is possible to have more than one pig in the domain of discourse and still speak of “the pig”.

A longer example, like (7) below, can provide further insight into these matters.

7. 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. (Lewis 1983)

(7) is interesting because it demonstrates how the denotation of the same definite description can change as a result of developments in a discourse. If we imagine things like (7) and (4) being said by different speakers who own different dogs or cats, it is clear that the relative salience of entities being discussed depends not only on what the immediate situation is and what has already been said, but also on who is speaking.

When *the* is used in various plural contexts, it also introduces a salience consideration. Consider the following:

8a. Children love puppies.

8b. The children love puppies.

I take (8a) to mean that, in general[8], being a child means loving puppies. (8b) is trickier; if it said without any particular context, one might claim that its truth conditions are

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[8] If pressed on the matter, I would probably say that I favor an analysis of generics along the lines of the one propose by Carlson (1979), but very little of what I shall say hinges on this.

indistinguishable from those of (8a)[9]. But consider both sentences said by the administrator of a day care center, who is, at the time, surrounded by children, or who has simply been talking about his or her work. In this case (8a) still seems like a statement about children in general, but (8b) is more likely to be taken as “in general, being one of the children associated with my business means loving puppies”. In this situation, the speaker could honestly assert (8a) even if, as it happened, a majority of the children present feared and despised puppies (although it would be a bit strange), whereas (8b) would be much more problematic in such a case. Note, however, that a single child in the group referred to who did not care for puppies would not necessarily invalidate (8b).

An analogous effect occurs in the partitive construction, as the following examples indicate:

9a. Each child is a pyromaniac.

9b. Each of the children is a pyromaniac.

10a. Some children have pet aardvarks.

10b. Some of the children have pet aardvarks.

If, when the children are not immediately present, the caretaker described above says (9a), it comes across as a sweeping assertion about all children (and so is almost certainly false), whereas (9b) could quite easily be true when uttered in such a situation, if, for instance, the facility in which the sentence is uttered is one that specializes in dealing with pyromaniacal children. Likewise, in a context like the one described above (10b) makes a much stronger assertion than (10a), since, by uttering (10b), the speaker appears

[9] Although for many people the utterance of (8b) is taken as a prompt to look around for where the children are, and if there are no children at hand or conversationally relevant, it may have a nonsensical feeling to it.

to assert that one[10] of the relevant little pyromaniacs has a pet aardvark, whereas if the speaker says (10a) then all that has been asserted is that there is a child someplace in the world who keeps an aardvark as a pet.

The intuition I shall work from is that “the child” denotes the most salient child, “the children” denotes the most salient group of children, and “each of the children” should be taken as talking about each child in the most salient group of children.

Since, as has been noted above, the action of *the* in such cases is dependent on both speaker and discourse context, I shall consider *the* to be an indexical in the sense that its meaning is not fixed by our interpretation of the language, but instead varies with pragmatic factors.

1.2.3 Universality

Plural definite descriptions are often argued to have a “universal” flavor to them. For example, (11a) and (11b) can, at least in certain contexts of utterance, be regarded as having quite similar truth conditions.

11a. All lions in Luxemburg like soybeans.

11b. The lions in Luxemburg like soybeans.

There are certain intuitions that (11b) may be more “general” than “universal”, but the general and the universal appear to be indistinguishable in (12)[11].

[10] It might be more accurate to say read “some” in the above sentences as “more than one” instead of “at least one”, but the same issues arise under either reading.

[11] (12) and (14) are derived from examples in Link (1998), who appears to share Sharvy’s (1980) general attitude about the plural definite description “the lions” denoting the collective of all lions.

12a. All real numbers can be expressed as nonterminating decimals.

12b. The real numbers can be expressed as nonterminating decimals.

Here, we could say that the default "most salient" collective of real numbers is simply the totality of all real numbers, and that, as it happens, for a mass of numbers to be collectively expressible as nonterminating decimals each must individually be expressible as a nonterminating decimal. Indeed, the attitude that "the real numbers" needn't mean "all real numbers" is borne out in (13):

13. Consider two real numbers *w* and *z*, and two complex numbers *x* and *y*, and suppose further that the real numbers are *computable* in the sense of Turing...

However, there is an interesting related issue. Plural definite descriptions often have only a generic or universal reading, even in contexts where bare plurals only admit an existential reading, as in (14).

14a. Soldiers died.

14b. The soldiers died.

While (14b) is best understood as meaning that all the soldiers in a particular group we were interested in died, (14a) does not appear to assert the same thing about soldiers in general. This pair stands in contrast to (8), where both the bare plural and the plural definite description preferred a generic reading. That (14) and (8) should work differently is not surprising, since "love puppies" is an example of what is generally known as an *individual-level predicate*, whereas "died" is what is a *stage-level predicate*, the distinction between these two sorts of predicates is widely discussed in the semantic and syntactic literature (see, for example, Carlson (1979) and Fernald (2000)), and there are several available accounts of why (14a) allows only an existential reading, while (8a) also allows (and indeed prefers) a generic reading. What is interesting here is that, unlike a bare plural, a plural definite description appears never to allow an "existential" reading (in the sense that we cannot read (14b) to mean that only some representatives of the most salient group of soldiers died), thus, although plural definite descriptions often allow a generic reading, their behavior is quite different from that of bare plurals.[12]

1.2.4 Genericity

As several authors, including Ojeda (1991) and Strawson (1950), note that "the N" can sometimes encode a generic statement about Ns. Consider the following (derived from examples in Strawson (1950) and Ojeda (1991), respectively):

15. The whale is a mammal.

16a. Babbage invented the computer.

16b. Babbage repaired the computer.

On the most likely reading, what is asserted in (15) clearly has nothing to do with any specific whale, but is rather about a property associated with whalehood (of course, (15) also admits the reading where were are talking about a specific whale, as well). (16a) is, for similar reasons, argued to have two readings, one on which a specific computer at hand was invented by Babbage, and one on which the invention of computers in general is to be attributed to Babbage, whereas (16b) seems only to have a reading analogous to the first of these. Citing examples like (16a), where *the* appears to be able to take distinct

[12] In terms of Carlson's (1979) and Link's (1998) ontologies, this observation shows that kinds and pluralities are not the same thing. Some issues relating to the incorporation of Carlson's ontology into the analysis will be discussed in Appendix B.

“generic” and “descriptive” readings, Ojeda (1991), concludes that there are two fundamentally distinct meanings of *the* (in essence, that *the* is lexically ambiguous).

Another approach to sentences like (16a) might be to say that sometimes the most salient computer is not any individual physical computer but rather the *kind* of computers (where some analysis of kinds like the one advocated by Carlson (1979) is adopted). On this view, there would be no lexical ambiguity for *the*, and pragmatic principles would be invoked to account for the contrast between (16a) and (16b). Although I will not discuss the generic[13] reading of (16a) in my primary account of *the*, my analysis will certainly be compatible with the latter view (provided that it is integrated into a suitable theory of kinds), and, naturally, it will be compatible with the former view, since another basic expression phonetically realized as “the”, and given some translation to make it act as a “definite generic operator”, can always be added later.

1.2.5 Collectivity

The reader is urged to consider sentences (17a) and (17b).

17a. Cats think only of themselves.

17b. Americans think only of themselves.

The intuition with both of these sentences is that they express a general tendency of individual cats or Americans. Now compare (17c)

17c. The Americans think only of themselves.

[13] “Generic” is used here in a broad, nontechnical sense. I do not wish to claim that this sort of generic has exactly the same semantic properties as other generics (such as certain uses of bare plurals).

For many people, there is a strongly preferred reading of (17c) on which it means that Americans think only of the collective interest of Americans. That is, roughly, that bare plurals prefer a reading involving a fact that is true "in the general case" with respect to individuals, whereas plural definite descriptions prefer a reading where a fact is true of some collective. However, intuitions on these matters are highly variable. Although many people express strong intuitions of the sort just mentioned when first presented with the issue, prolonged thought on the matter tends to reduce one's ability to see any difference. It should also be noted that this preference, even if admitted in general, fails in many special cases, including the one presented in (18).

18. The French kings thought only of themselves.

Because intuitions on this issue are so weak, and because it represents a tendency rather than an absolute contrast, I will not have much to say about it, although in Appendix B I will discuss how such a contrast might be accounted for by integrating my analysis into a theory of kinds.

1.2.6 Anaphorical Linkage and Relational Dependency

As von Heusinger (1997) points out, definite descriptions appear to sometimes assume a function much like that of typical discourse-anaphoric expressions, as in sentences of the form outlined in (19) below.

19. Once upon a time, there was a king, ... and the king ...

Here, "the king" appears to do the same work as "that king" or "he" might. (19) has very much the same character as (7), and von Heusinger concludes (quite properly, in my opinion) that this is a special case of the salience effect discussed at the beginning of section 1.2.2.

As von Heusinger (1997) also notes, a definite description sometimes receives its reference from some relation to a prior expression, as in (20).

20a. I read a book and cannot remember the author.

20b. I bought a new car. I had to change the motor.

As with anaphorical linkage, it seems reasonable to regard this phenomenon as a special case of sensitivity to salience.

1.2.7 Scope Sensitivity

In analyzing many of the effects discussed above, especially indexicality and unique existence, it is tempting to assert that a definite description simply directly refers to an entity once and for all. For example, one might claim that the correct analysis of the expression "the goat" involves having it denote the singular most salient goat (relative to the particular discourse in which it is uttered) available, and then simply evaluating any expressions it is involved in by treating it as a name for that entity. As Fodor and Sag (1982) point out in a quite different context, such an approach is problematic, as it is ill-equipped to account for the fact that the following sentences all have at least two readings:

21. At every inauguration, the president gives a boring speech.

22. When I was a boy, the richest man in America worked at a gas station.

23a. In every right-thinking monarchy, the King is an object of ridicule.

23b. In every movie, the sidekick dies.

24. Amanda believes that the richest man in America works at a gas station.

In each of these, there is one reading in which we are saying something about the entity that we would normally think of as referred to by a definite description, and another in which the definite description has "narrow scope" and so its denotation may depend on some other element that has scope over it. In (22), for example, the narrow scope reading causes the definite description to denote not the current richest man in America, but the person who was the richest man in America when the speaker was a boy. In (21) and (23), the effect is even clearer: there is no one thing we can point to as the denotation of the definite description as it apparently takes on a different denotation for each case considered by a universal quantification. In (24) the definite description likewise need not refer to anything, since it occurs within a belief context, and so, on the narrow scope reading, we can imagine that Amanda believes this even if there is no richest man in America and there are no gas stations. This turns out to be a significant complication for a number of popular approaches to definite descriptions.

1.3 Summary of Issues

The previous section has established what I consider to be the major semantic characteristics of *the*. Given the observations above, I think that an analysis of *the* should provide a reasonable account of the fact that a definite description always talks about at most one thing, that definite descriptions are subject to scope interactions, and that definite descriptions appear to pick out the "most salient" entity satisfying the description. It must also provide at least a sketch of how it can account for presupposition phenomena and for the interaction of definite descriptions with plurals, partitives, and various generic effects. In the next two chapters, I shall develop an analysis which accounts for all of the effects I describe as essential, along with the phenomena related to plurals and partitives. A discussion of why I believe that generics and presupposition are not problems for my analysis is relegated to the appendices.

2. Conceptual Background

2.1 Overview

In this chapter, I shall develop various ideas that are necessary for my analysis. I shall present my views on salience as it pertains to definite descriptions, discuss a notion of plurality based on the one developed by Link (1998), and provide a formal language that can accommodate these notions, to be used when encoding the meanings of various expressions of English. The tools and ideas developed here will make possible the analysis given in the next chapter.

2.2 Salience

As I suggest earlier, my analysis of *the* shall revolve around the idea that it picks out the most salient member of a set, when such exists. On a naïve view, one might say that there is one salience ordering for all entities, but, for reasons I will discuss below, I think this may be too strong, and so, in keeping with von Heusinger (1997), I will not assume that "most salient" means the same thing, regardless of what property it is considered over. In this section, I will discuss the various structural properties that I consider fundamental to a formal representation of salience, and discuss two general ways of thinking about salience, which I shall dub the *deterministic* understanding of salience and the *psychological* understanding of salience.[14] I will also give my reasons for favoring the psychological understanding in the present treatment.[15]

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[14] Some additional remarks on salience can be found in appendices C and E.

[15] It is worth noting, however, that the key elements of the formal structure of my analysis are compatible with either approach, or with any other approach that can provide a salience function with the proper formal characteristics.

2.2.1 The Structure of Salience

Since the notion of salience will play a key role in what follows, it is important to explain, and justify, the kind of mathematical object that will be used to represent it. The simplest approach, which Lewis (1983) seems to endorse[16], is that all the needed salience information at a particular point in time is expressed as some kind of "ordering" over some portion of the domain of discourse. On this view, to find the denotation of a definite description one would simply restrict attention to the set of things satisfying the description, and find its maximal element under the universal salience ordering. Although this approach has great intuitive appeal, I believe it to be inadequate.

My position is motivated by the consideration of cases like the one in which the king of Tonga happens to like waffles, and this bit of trivia is known to all Tongans, but, on the other hand, the king of Denmark is known throughout the world for the fact that he obsesses over waffles to a degree that borders on the fetishistic, demands that waffles be a part of every meal served in his presence, and has occasionally ordered people who greet him without offering him a waffle banished. In a world where this is true, one Tongan could say (25) to the other truthfully, and be understood:

25. The king likes waffles, but he doesn't like them nearly so much as the king who likes waffles does.

On an ordering analysis, if "the king" denotes the king of Tonga, then the king of Tonga must be more salient than any other king, including the king of Denmark. It follows that

[16] The one reservation he does express will not be expanded upon here, but is discussed briefly in Appendix D.

the king of Tonga is more salient than any king who likes waffles, and so he must be the most salient king who likes waffles. Thus, “the king who likes waffles”, which denotes the most salient member of the set of kings who like waffles, should also denote the king of Tonga. This is clearly contrary to our intuitions about (25). The issue is that, although both the king of Denmark and the king of Tonga are kings who like waffles, one can be more salient than the other in his capacity as a king, but this relation can be reversed when the individuals are considered in their capacity as kings who like waffles. Analogous remarks could be made about (6) above, considered in the imaginary situation where, although both pigs have floppy ears, this property is a major distinguishing characteristic of one but not the other. A simple ordering analysis appears to be fundamentally incapable of accounting for this sort of thing.[17]

Keeping this in mind, I shall adopt an approach very similar to the one adopted by von Heusinger (1997), to the effect that salience, so far as we need to understand it to understand *the*, is a sort of “choice function”. That is, salience is a function the domain of which is the class of available properties, and the range of which is some class of entities. In addition, it will be understood that in general the value of the salience function at a particular property is an entity that has that property. This entity is understood to be the entity that is most salient considered in its capacity as a thing with the property in question. I shall, however, sometimes allow myself to slip back into talking about the “most salient N”, where this should always be understood as “entity which is most salient in its capacity as an N”. Of course, one might want to say a great deal more about

[17] This example is not above question, although I find it persuasive and will take its implications seriously in my main analysis. The possibilities of understanding salience as a relation that “orders” the domain of discourse are discussed in Appendix C.

salience than that it is a function of this kind. For one thing, it is necessary to say something about which function it is. For another, it might be profitable to say that salience is better understood as being some more complicated mathematical object from which a function of the necessary sort can be derived. For example, in the system outlined by von Heusinger (1997) there is, associated with each member of the conversation and each set, a salience ordering on that set. Thus, assuming there are three cats – Bruce, Nobuhiko, and Sarah – and two conversational participants – Juan and Megumi – then at some particular point in the conversation, Juan's salience ordering for cats might be <Sarah, Nobuhiko, Bruce>, while Megumi's was <Bruce, Nobuhiko, Sarah>. In such a case, when Juan said "the cat" the expression would denote Sarah, but when Megumi said the same thing she would be talking about Bruce. (Von Heusinger allows for these orderings to be updated by various discourse effects.) I have no objections to such claims, but, since all I need to consider is the salience function discussed above, I won't concern myself with what other features may be needed for the underlying representation of salience.

My treatment shall differ from Von Heusinger's in another important respect: I don't think it is correct to analyze the definite article as denoting a total choice function. We often encounter cases of "reference failure" when the predicate to which the definite article is being applied is non-empty, but where there is no uniquely most salient member of it. I shall capture this by saying that the salience function is a function that takes a property as an argument, and that the value it returns is always either a certain "error code" value, or in the extension of the property in question.

Besides being a partial choice function, salience has two other key formal properties. The first is that it is indexical, in the sense that it can depend on the speaker, discourse context, and imminent surroundings, and is so apparently part of something more malleable than the choice of models, but at the same time distinct from the intensional index. The second is that it has a sense, which will be used to account for sentences like (21), (22), (23), and (24) above, in which it definite descriptions gain the ability to denote different things by interacting with scoped intensional expressions, or to be given a *de dicto* reading.

One of the major ideas that this paper is intended to flesh out and put in a meaningful context is that *the* denotes the salience choice function. This claim, by itself, goes a long way. Most notably, simply by requiring that *the* denote a function into the class of entities, I have guaranteed that, whenever a definite description is used, only one thing is being talked about. The other advantages of considering *the* to denote the salience function will become apparent when it is considered in the context of other semantic phenomena.

2.2.2 Understanding Salience Deterministically

Lewis (1983), along with most other advocates of a salience-based analysis of definite descriptions, seems to favor the idea that the way salience operates is changed by discourse effects in a more or less objective and rule-governed way (Lewis even goes so far as to suggest that we should think of updating the salience hierarchy as keeping score). This basic attitude is fleshed out in a number of different accounts of discourse structure, including those advocated by Grosz et al. (1995) and Hajičová et al. (1995). One can think of the salience update process as either maintaining a stock of shared pragmatic data, which is not integrated by the semantics but can be referred to by it, or one can treat it as an integral part of the model theory in some system of dynamic semantics (perhaps an extension of the one proposed by Groenendijk and Stokhof (1990)).

So far, my discussion of the deterministic approach to salience has been lamentably vague and abstract. I have included (26) below in order to provide a concrete example of such a theory in action (this example was originally provided by Von Heusinger as a sample analysis of the example from Lewis (1983) in terms of the system used by what he calls the "Praguian School"):

26.	Discourse:	[Salience] 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.	Bruce, Albert
(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

The development of deterministic theories of salience is certainly a worthy scientific project, and may be indispensable to the field of artificial intelligence, but it seems to me that its strength lies in describing general tendencies, and in modeling the sorts of heuristics speakers employ when trying to interpret each other. For this reason, I do not think that it is appropriate to entangle it too much with a theory of semantics, in which the goal is not to provide rules of thumb that will tend to provide the right meanings, but to offer more concrete and objective rules about what meanings are permissible. Things are, of course, never quite this clear-cut, but it seems worthwhile to maintain some distinction. My anxieties about deterministic approaches stem from a number of sources, but most of them relate to intensional contexts. To begin with, consider sentence (4), said to oneself without warning among people who do not know Herman, or even that the speaker has a dog. No conversational common ground will pick out which dog "the dog" is, but the speaker's utterance is still understood to mean something, and listeners will typically respond not with some systematic objection, but by asking the speaker for enough information to interpret the utterance (by saying, for example, "which dog?"). Furthermore, in sentences like (20a) and (23b), the entity denoted by the definite description was neither proximate in the context nor introduced explicitly as a discourse referent. In (23b), the difficulty is especially striking, it seems to me that it could be said truthfully in a situation where the speaker has never seen a movie, and in which many movies have more than one sidekick (one for the hero and one for the villain, say), provided that in every movie the hero has a sidekick, that the speaker has somehow developed the tendency to consider the hero's sidekick the primary one, and that the hero's sidekick in fact always dies. On the reading of (24) where *the* has narrow scope with respect to *believe*, the definite description is likewise still meaningful, although it does not "refer" to anything, and doesn't seem to have in any way been fixed by discourse. All of these situations seem based not on any rule-governed rearrangement of the salience ordering, but on the speaker's personal biases regarding who counts as the primary sidekick.

2.2.3 Understanding Salience Psychologically

When I speak of the psychological understanding of salience, I mean the view that salience is not so much an objective property of the conversational common ground, but is rather a personal and idiosyncratic tendency on the part of the speaker to consider some entities more easily than others[18]. On this view, listeners understand salience-dependant utterances by using their intuitive understanding of human thought to attempt to determine what the speaker might be inclined to judge more salient. Since the listeners are generally in the same surroundings and aware of the same prior discourse as the speaker, their own tendencies in this regard will often be the same as the speaker's, making the determination process easy. Certain general principles of conversational cooperation would presumably also dictate that the listener should, in the process of attempting to reconstruct the relevant considerations, assume that the speaker is trying to say something reasonable (this intuition appears to be present in Lewis's (1983) discussion of the conditions of salience update), and that the listener, when confused, should request more information, in order to better reconstruct the relevant part of the speaker's psychological state (leading to the tendency, when presented with a definite description of uncertain reference, to ask questions like "which one?"). In a cooperative conversation, a speaker would also presumably make some effort to call attention to important changes in his or her attitudes about salience. In the case of *the*, I shall assume that "the N" denotes the entity that first jumps to the speaker's mind as an N, or that

[18] Ideas along these lines seem to be at work in Fodor and Sag's (1982) account of indefinite descriptions, and have a certain consistency with some of Donellan's (1966) remarks on definites.

would first jump to the speaker's mind as an N in the intensional context in which the definite description is evaluated.

My decision to favor a psychological understanding of salience is based entirely on evidence from definite descriptions, mostly relating to the apparent inadequacy of deterministic accounts[19], and to the intuition that having a specific thing that fits the description in mind is always enough to use a definite description. It is possible that it is necessary to subdivide salience into two totally distinct notions: a psychological one to be invoked in the interpretation of definite descriptions, and a deterministic one used in the analysis of other salience effects. If such a step proved advisable, it would presumably be preferable to reserve the word "salience" to describe the deterministic notion, and provide a new name for the psychological "first one to jump to mind" operation that I will assume for my analysis of definite descriptions. I have no informed opinion regarding the merits of such a split.

2.3 Plurals

I shall, more or less in accordance with the views of Link (1998), assume that the universe of discourse contains both individual entities and plural entities. Link motivates this view by appealing to sentences like (27) and (28), both of which are analyzed naturally if we accept that there is an entity that is the plurality of all of the speaker's friends or all the columns, which is participating collectively in the predicate.

(27) The thing I most appreciate about my friends is that they are few.

[19] It is, of course, crucial to bear in mind that my beliefs about the inadequacy of deterministic accounts may simply stem from my lack of imagination regarding their possibilities.

(28) The columns hold up the ceiling.

I shall not attempt to restate Link's entire theory (which also includes a fascinating and very promising analysis of mass terms) here. What is important for the present discussion is that an ontology involving plural entities is motivated by a variety of data that have nothing to do with definite descriptions. It will also be helpful to offer a few descriptive remarks about the details of Link's system. In Link's ontology, entities can either be atomic or plural (plural entities are understood to contain atomic entities as members); for completeness, there is also a null entity. The entities are considered under two binary operations individual-wise union and individual-wise intersection. The individual-wise union of two distinct entities is the entity (plural or singular) that contains as members all entities that are members of either of the entities being united. Individual-wise intersection is understood similarly. The domain of entities considered under individual-wise union and individual-wise intersection is taken to form a complete atomic Boolean algebra.[20]

Although my analysis of certain specific phenomena (most notably the definite article), differs considerably from Link's, I think that both his general approach and many of his specific examples can be fruitfully employed, and shall adopt his basic assumptions regarding the ontology and algebraic structure of the domain of discourse.

2.4 The Intensional Logic

[20] Although Link's approach is axiomatic, the same effect could be accomplished constructively by assuming an initial universe of entities, and then using as the domain of discourse the class of sets of entities.

In this section I will outline a typical typed intensional lambda calculus, augmented to account for certain aspects of our ontology of plurals and to recognize a notion of salience; I call this language L_I (*I* being a mnemonic for "intensional"). The exposition of L_I will be somewhat condensed as similar languages are used throughout the literature. For those unfamiliar with this sort of formalism, expositions of intensional logic can be found in Montague (1974a,b) and in Dowty, et al. (1985). In addition, I shall presuppose the theory of plurals outlined above, derived essentially from the theory of Link (1998). The salience function will not receive any special treatment in the presentation of the language, but will simply be associate with a symbol of the appropriate type, and will have its behavior constrained by a meaning postulate.

I will begin by outlining the system of types for L_I:

1. e is a type.
2. t is a type.
3. If τ is a type, $<s,\tau>$ is a type.
4. If σ and τ are types then $<\sigma,\tau>$ is a type.
5. Nothing not generated by the above rules is a type.[21]

Here the types are to be understood as in Montague (1974a,b) or Dowty, et al. (1985). Thus, e is the type of expressions that denote entities, t is the type of expressions that denote truth values, $<s,\tau>$ is the type of senses of expressions of type τ (that is, it is the type of expressions that denote functions from spatio-temporal locations in possible worlds to the sorts of things denoted by expressions of type τ), and $<\sigma,\tau>$ is the type of

[21] Closure rules of this sort can be made more formal by any of a variety of normal means, including an explicit reference to a finite number of applications of the available rules, and statement of a principle of induction, but I do not think anything is gained by introducing such rigor to the present discussion.

expressions denoting functions from the kinds of things denoted by expressions of type σ to the kinds of things denoted by expressions of type τ.

L_I is assumed to have an arbitrary supply of non-logical constant symbols of each type τ, written $c_{n,\tau}$, where n is a non-negative integer[22], an arbitrary supply of indexical[23] symbols, written $j_{n,\tau}$, where n is a non-negative integer, and a countably infinite supply of variables of each type τ, written $v_{n,\tau}$, where n is any integer (negatively indexed variables are allowed for purely cosmetic reasons). The syntax of L_I is given by the following rules:

1. If, for a given nonnegative integer n and a given type τ, $c_{n,\tau}$ is in the language, it is an expression of type τ.
2. If, for a given nonnegative integer n and a given type τ, $j_{n,\tau}$ is in the language, it is an expression of type τ.
3. For any integer n and any type τ, $v_{n,\tau}$ is an expression of type τ.
4. For any types σ and τ, if α is an expression of type $<\sigma,\tau>$ and β is an expression of type σ, then $\alpha(\beta)$ is an expression of type τ.
5. For any types σ and τ, if α is an expression of type τ, then, for any non-negative integer n, $\lambda v_{n,\sigma}\alpha$ is an expression of type $<\sigma,\tau>$.
6. For any type τ, if α and β are both expressions of type τ then $[\alpha=\beta]$ is an expression of type t.

[22] Since we don't specify which constants are actually involved, we are technically defining not a single language but a family of languages.
[23] An indexical is a symbol the semantic value of which is held to be independent of the model, or, intuitively, of the lexically defined interpretation of the language.

7. For any type τ and any non-negative integer n, if φ is an expression of type t then $\forall v_{n,\tau}\varphi$ and $\exists v_{n,\tau}\varphi$ are both also expressions of type t.

8. If φ and ψ are both expressions of type t, then $\neg\varphi$, $[\varphi\wedge\psi]$, $[\varphi\vee\psi]$, $[\varphi\rightarrow\psi]$, and $[\varphi\leftrightarrow\psi]$ are also expressions of type t.

9. If α is an expression of type τ, then ${}^{\wedge}\alpha$ is an expression of type $<s,\tau>$.

10. If α is an expression of type $<s,\tau>$, then ${}^{\vee}\alpha$ is an expression of type τ.

11. If φ is an expression of type t then $\Box\varphi$ is an expression of type t.

12. If φ is an expression of type t then $\mathbf{F}\varphi$ and $\mathbf{P}\varphi$ is are expressions of type t.

13. If α and β are both expressions of type e, then $[\alpha\oplus\beta]$ and $[\alpha\otimes\beta]$ are also expressions of type e.

14. Nothing not generated by these rules is an expression of any type.

In order to develop the model theory of L_I, it will be necessary to associate with each type τ the set of possible denotations of type τ, written $\mathbf{D}(\tau)$. This association is defined below, where we take A, W, V, and H to all be nonempty sets, understood as the set of entities, the set of possible worlds, the set of spatial vicinities, and the set of moments in time, respectively:

1. $\mathbf{D}(t) = 2$ (that is, the set containing the two ordinals 0 and 1, associated with the two truth values true and false).

2. $\mathbf{D}(e) = A$.

3. For any type τ, $\mathbf{D}(<s,\tau>) = \mathbf{D}(\tau)^{W\times V\times H}$.

4. For any types σ and τ, $\mathbf{D}(<\sigma,\tau>) = \mathbf{D}(\tau)^{\mathbf{D}(\sigma)}$.

We further introduce the set of possible senses of a type τ, written $\mathbf{S}(\tau)$, to be $\mathbf{D}(<s,\tau>)$.

A model of L_I will be an ordered octuple $<A, W, V, H, f, a, m, B>$ where A is some nonempty set understood to be the universe of objects (including plural objects); W is some nonempty set understood to be the collection of possible worlds; V is some nonempty set understood to be the collection of spatial vicinities; H is some nonempty set understood to be the collection of moments in time; f is a function defined on the constants of L_I which satisfies the constraint that, for every constant $c_{n,\tau}$, $f(c_{n,\tau}) \in \mathbf{S}(\tau)$ (we say that f is an *interpretation function* for L_I); a and m are functions in $A^{A\times A}$ such that, where a is interpreted as "addition" (or "join") and m is interpreted as "multiplication" (or "meet"), $<A, a, m>$ forms a complete atomic Boolean algebra (these operations are understood as individual-wise union and individual-wise intersection in the sense of Link (1998)); and B is a subset of $H\times H$ that serves as a linear ordering on H (H is mnemonic for "history", and B is mnemonic for "before").

In order to give a complete account of denotations in L_I, It will be necessary to define two additional sorts of functions. Where M is as above, a function g such that, for every integer n and for every type τ, $g(v_{n,\tau}) \in \mathbf{D}(\tau)$ is called a *variable assignment function for L_I with respect to M*, and a function h such that, for every constant $j_{n,\tau}$, $h(j_{n,\tau}) \in \mathbf{S}(\tau)$, is called a *contextualization function for L_I with respect to M*. The idea of a contextualization function is that it assigns values to the indexical expressions of the language, serving to fill in the information that is provided by discourse context rather than by the interpretation of the language. It will also be important to restrict the admissible models and contextualization functions by the use of meaning postulates, and I will propose several such postulates in this sections and in later ones.

The definitions above make it possible to provide L_I with a semantics. Where M = <A, W, V, H, f, a, m, B> is a model of L_I, g is a variable assignment function for L_I, h is a contextualization function for L_I, $w \in W$, $l \in V$, $i \in H$, and α is an expression of L_I, $\|\alpha\|^{M,g,h,w,l,i}$ (the *denotation of* α *with respect to M, g, and h at w, l, and i*) is defined by the following rules:

1. For any non-logical constant $c_{n,\tau}$, $\|c_{n,\tau}\|^{M,g,h,w,l,i} = f(c_{n,\tau})(w,l,i)$.
2. For any indexical $j_{n,\tau}$, $\|j_{n,\tau}\|^{M,g,h,w,l,i} = h(j_{n,\tau})(w,l,i)$
3. For any variable $v_{n,\tau}$, $\|v_{n,\tau}\|^{M,g,h,w,l,i} = g(v_{n,\tau})$.
4. For any types σ and τ, if α is an expression of type $<\sigma,\tau>$ and β is an expression of type σ, then $\|\alpha(\beta)\|^{M,g,h,w,l,i} = \|\alpha\|^{M,g,h,w,l,i}(\|\beta\|^{M,g,h,w,l,i})$.
5. For any types σ and τ, if α is an expression of type τ, then, for any non-negative integer n, $\|\lambda v_{n,\sigma}(\alpha)\|^{M,g,h,w,l,i}$ is the unique function $\gamma \in D<\sigma,\tau>$ such that, for any $\delta \in D\sigma$, $\gamma(\delta) = \|\alpha\|^{M,g',h,w,l,i}$, where g' is the variable assignment function on M that is identical with g except that $g'(v_{n,\sigma}) = \delta$ regardless of whether or not $g(v_{n,\sigma})$ does.
6. For any type τ, if α and β are both expressions of type τ then $\|[\alpha=\beta]\|^{M,g,h,w,l,i}$ is 1 if and only if $\|\alpha\|^{M,g,h,w,l,i} = \|\beta\|^{M,g,h,w,l,i}$.
7. For any type τ and any integer n, if φ is an expression of type t then $\|\forall v_{n,\tau}(\varphi)\|^{M,g,h,w,l,i}$ is 1 if and only if $\|\varphi\|^{M,g',h,w,l,i}$ is 1 for every variable assignment g' such that $g'(u) = g(u)$ for any variable u such that $u \neq v_{n,\tau}$ (the value of $g'(v_{n,\tau})$ is not

specified), and $\|\exists v_{n,\tau}(\varphi)\|^{M,g,h,w,l,i}$ is 1 if and only if $\|\varphi\|^{M,g',h,w,l,i}$ is 1 for some variable assignment g' such that $g'(u) = g(u)$ for any variable u such that $u \neq v_{n,\tau}$.

8. If φ and ψ are both expressions of type t, then $\|\neg\varphi\|^{M,g,h,w,l,i}$, $\|[\varphi\wedge\psi]\|^{M,g,h,w,l,i}$, $\|[\varphi\vee\psi]\|^{M,g,h,w,l,i}$, $\|[\varphi\rightarrow\psi]\|^{M,g,h,w,l,i}$, and $\|[\varphi\leftrightarrow\psi]\|^{M,g,h,w,l,i}$ receive their accustomed truth-functional definitions.

9. If α is an expression of type τ, then $\|{}^\wedge\alpha\|^{M,g,h,w,l,i}$ is the unique function χ such that $\chi(w',l',i') = \|\alpha\|^{M,g,h,w',l',i'}$. (That is, the expression ${}^\wedge\alpha$ is understood as denoting the intension of α.)

10. If α is an expression of type $<s,\tau>$, then $\|{}^\vee\alpha\|^{M,g,h,w,l,i} = \|\alpha\|^{M,g,h,w,l,i}(w, l, i)$.

11. If φ is an expression of type t then $\|\Box\varphi\|^{M,g,h,w,l,i} = 1$ if, for all $w' \in W$, $l' \in V$, $i' \in H$, $\|\Box\varphi\|^{M,g,h,w',l',i'} = 1$.

12. If φ is an expression of type t then $\|\mathbf{F}\varphi\|^{M,g,h,w,l,i} = 1$ if, for some $i' \in H$ such that $i\neq i'$ and $<i, i'> \in R$, $\|\varphi\|^{M,g,h,w,l,i'} = 1$, and $\|\mathbf{P}\varphi\|^{M,g,h,w,l,i} = 1$ if, for some $i' \in H$ such that $i\neq i'$ and $<i', i> \in R$, $\|\varphi\|^{M,g,h,w,l,i'} = 1$.

13. If α and β are both expressions of type e, then $\|[\alpha\oplus\beta]\|^{M,g,h,w,l,i} = a(\|\alpha\|^{M,g,h,w,l,i}, \|\beta\|^{M,g,h,w,l,i})$ and $\|[\alpha\otimes\beta]\|^{M,g,h,w,l,i} = m(\|\alpha\|^{M,g,h,w,l,i}, \|\beta\|^{M,g,h,w,l,i})$.

It will be helpful to have some more familiar variable names, here are a few that I shall use:

w should be understood as $v_{0,e}$.

x should be understood as $v_{1,e}$.

y should be understood as $v_{2,e}$.

z should be understood as $v_{3,e}$.

For all non-negative integers n, x_n should be understood as $v_{n+4,e}$.

P should be understood as $v_{1,<s,<e,t>>}$.

Q should be understood as $v_{2,<s,<e,t>>}$.

For all non-negative integers n, P_n should be understood as $v_{n+3,<s,<e,t>>}$.

I will now define a few expressions by the use of shorthand and meaning postulates:

The first meaning postulate is for $c_{0,e}$, and it asserts that $c_{0,e}$ is the "zero" of the Boolean algebra of individuals and pluralities:

MP0. $\forall x[[c_{0,e} \oplus x]=x]$

It will also be helpful to give $c_{0,e}$ a less cumbersome name:

o should be understood as $c_{0,e}$.

Some other important notations relating to the algebra of pluralities and to various useful operations for the analysis of English are provided below:

If α and β are both expressions of type e, $\alpha \leq \beta$ is understood as shorthand for for $\exists w[\alpha \oplus w=\beta]$[24]. (Intuitively, this expression is supposed to describe the "is an individual-wise part of" relation.)

If α is an expression of type e, At(α) is understood as shorthand for $\forall$z[$z \leq \alpha \rightarrow [z=\alpha \vee z=o]] \wedge \alpha \neq$o. (Intuitively, this At(α) means "α is atomic".)

If φ is an expression of type <e,t> then $^\star\varphi$ is shorthand for $\lambda x(\neg\text{At}(x) \wedge \forall y[[y \leq x \wedge \text{At}(y)] \rightarrow \varphi(y)])$. (Intuitively, * is the operation which takes a

[24] The result of this shorthand will be somewhat counterintuitive if the variable w occurs free in α or β, but in the context of the present discussion this issue will not be relevant.

predicate and which generates a new predicate which is true only of pluralities of things that satisfied the original predicate.)

This concludes our exposition of L_I. Of course, in the presentation of actual sentences of L_I, some minor abuses of notation will be introduced for readability. I shall proceed to define a limited but illustrative fragment of English by translation into L_I, in order to demonstrate how the analysis of *the* as a partial choice function is capable of accounting for the data discussed above.

3. The Fragment

3.1 Overview

In this chapter, I shall present a fragment of English adequate to illustrate how many of the phenomena discussed above can be accounted for in the framework of Montague grammar[25]. I have kept the fragment quite modest in scope so that it can be presented in its entirety, but the components needed to account for the data above (that is, the translation of the definite description, along with the analyses of noun pluralization (rule 10) and the partitive construction (rule 12)) could be incorporated into almost any system of Montague grammar that is compatible with basic idea of an ontology of plural entities.

3.2 Categories and Features

The syntactic behavior of an expression of the fragment shall be determined by which category it belongs to, and which features it is assigned (we could, of course, do away with features in favor of greatly expanding the supply of categories, so the syntax supposed here can be analyzed within the general theory of Montague (1974a)).

The syntactic categories are defined as follows:

e is a category.

t is a category.

If A and B are categories, then (A/B) and (B\A) are categories.

No other categories will be considered.

[25] The main omissions shall be issues relating to presupposition and generics, which are discussed in appendices A and B.

Here, A/B is understood as the category of left-applied A-generating functions on B, and B\A is understood as the category of right-applied A-generating functions on B[26].

The following categories are given names and abbreviated notations:

N, the category of *count noun expressions*, is (t/e).

VI, the category of *intransitive verb phrases*, is (e\t).

T, the category of *term phrases*, is (t/VI).

VT, the category of *transitive verbs*, is (VI/T).

DET, the category of *determiners*, is (T/N)

The following categories also occur in the fragment, although they will not be given convenient abbreviations:

e, the category of "referential" names.

t, the category of *forumulae*.

(e/N), the category to which the definite article belongs.

(T\(e/N)), the category to which the possessive marker belongs.

(t/t), the category of *adforumulas*.

((t/t)/T), the category of *adformula generating prepositions*.

(VI/t), the category of verbs taking a sentential object.

We make the same generalization about the relationship between syntactic categories and types that is found in Dowty, et al. (1985):

1. Expressions of category e translate as logical expressions of type *e*.

[26] The limitation to only these categories is accidental to the present fragment. In a larger fragment it would be desirable to subdivide these sorts of functions into multiple categories; the new categories would be written in the accustomed way (e.g. A//B, B\\A, A///B).

2. Expressions of category t translate as logical expressions type *t*.

3. Expressions of categories t/e and e\t translate as logical expressions of type <*e*,*t*>.

4. For any category A/B or B\A not listed above, where expressions of category A translate as logical expressions of type A’ and expressions of category B translate as logical expressions of type B’, expressions of categories A/B, and B\A translate as logical expressions of type <<*s*,B’>,A’>. (That is, as in Montague (1974b), just about everything acts on the senses of its arguments.)

Every expression η is also associated with a septuple $F_\eta = \langle \mathrm{Num}_\eta, \mathrm{Gen}_\eta, \mathrm{Hum}_\eta, \mathrm{Per}_\eta, \mathrm{Var}_\eta, \mathrm{Part}_\eta, \mathrm{Quant}_\eta \rangle$[27], called the *feature specification of* η, where the components of F_η are understood as follows.:

$\mathrm{Num}_\eta \in \{s,p,x\}$. Num_η is called the *number of* η, and its possible values stand for “singular”, “plural”, and “indefinite”[28].

$\mathrm{Gen}_\eta \in \{m,f,x\}$. Gen_η is called the *gender of* η, and its possible values stand for “masculine”, “feminine”, and “undetermined”.

$\mathrm{Hum}_\eta \in \{h,i,x\}$. Hum_η is called the *humanity of* η, and its possible values stand for “human”, “inhuman”, and “undetermined”.

$\mathrm{Per}_\eta \in \{1,2,3,x\}$. Per_η is called the *person of* η, and its possible values stand for “first”, “second”, “third”, and “indefinite”.

[27] There is no category for which all these features are relevant, and there are in fact many categories for which none of them are. Some may consider it more elegant to associate a separate feature space with each category, and the adjustment is not a difficult one.

[28] Here “s” (along with “i” and “f” below) is used simply as a syntactic marker, and has no connection with the use of the same letter in the development of the L_I.

Vars$_\eta$, the *free variable signature of* η, is a finite subset of

$\mathbb{N}\times\{s,p,x\}\times\{m,f,x\}\times\{h,i,x\}\times\{1,2,3,x\}$[29], understood to index and associate features with the set of variables that occur in η.

Part$_\eta \in \{0,1\}$. Part$_\eta$ is called the *partitive availability of* η[30], and its possible values stand for "false" and "true".

Quant$_\eta \in \{0,1\}$. Quant$_\eta$ is called the *quantifierhood of* η, and its possible values stand for "false" and "true".

Given two feature specifications *F* = <Num, Gen, Hum, Per, Var, Part, Quant> and *F'* = <Num', Gen', Hum', Per', Var', Part', Quant'>, we say *F* and *F' agree for variable bindings* if the following holds:

For all v, $v' \in \mathbb{N}\times\{s,p,x\}\times\{m,f,x\}\times\{h,i,x\}\times\{1,2,3,x\}$, where $v = \langle n,a,b,c,d\rangle$ and $v' = \langle m,a',b',c',d'\rangle$, if $v \in$ Var, $v' \in$ Var', and $m=n$, then $a=a'$, $b=b'$, $c=c'$, and $d=d'$.

We say *F* and *F' weakly agree* if all of the following hold:

Num = x, Num' = x, or Num = Num'.

Gen = x, Gen' = x, or Gen = Gen'.

Hum = x, Hum' = x, or Hum = Hum'.

Per = x, Per' = x, or Per = Per'.

F and *F'* agree for variable bindings.

And we say *F* and *F' strongly agree* if all of the following hold:

Num = Num'.

---

[29] Here $\mathbb{N}$ is understood as the set of positive integers. The purpose of this syntactic feature is to preserve agreement when "quantifying in", and to prevent certain troublesome cases of vacuous quantification.

[30] The partitive availability and quantifierhood features are both used to record directly whether a particular rule can be applied to an expression. Partitive availability is required by rule 12, and quantifierhood is required by rule 13.

Gen = Gen'.

Hum = Hum'.

Per = Per'.

F and *F'* agree for variable bindings.

Finally, for *F* and *F*', we define the *composition of F and F'*, written *F•F'*, to be <Num'', Gen'', Hum'', Per'', Var∪Var', Part*Part', Quant*Quant'>, understood as follows:

If Num = x, then Num'' = Num', otherwise, Num'' = Num.

If Gen = x, then Gen'' = Gen', otherwise, Gen'' = Gen.

If Hum = x, then Hum'' = Hum', otherwise, Hum'' = Hum.

If Per = x, then Per'' = Per', otherwise, Per'' = Per.

∪ operation is set-theoretic union.

* operation is arithmetic multiplication.

Where η and η' are expressions, η and η' *strongly agree, weakly agree*, or *agree for variable bindings* if F_η and $F_{\eta'}$ strongly agree, weakly agree, or agree for variable bindings, respectively.

3.3 Basic Expressions

Here we shall list the basic expressions of the fragment, giving their translations into the L_I, their shorthand representations, their categories, and their features:

Expression:	Cat:	Translation:	Shorthand:	Features:
Cassandra	e	$c_{1,e}$	Cassandra'	<s, f, h, 3, ∅, 0, 1>
Hideo	e	$c_{2,e}$	Hideo'	<s, m, h, 3, ∅, 0, 1>
Pat	e	$c_{3,e}$	Pat'	<s, x, h, 3, ∅, 0, 1>

Expression:	Cat:	Translation:	Shorthand:	Features:
Ender's Game	e	$c_{4,e}$	EndG'	<s, x, i, 3, ∅, 0, 1>
Emma	e	$c_{5,e}$	Emma'	<s, x, i, 3, ∅, 0, 1>
Belgium	e	$c_{6,e}$	Belgium'	<s, x, i, 3, ∅, 0, 1>
I	e	$j_{0,e}$	I'	<s, x, h, 1, ∅, 0, 0>
man	N	$c_{1,<e,t>}$	man'	<s, m, h, 3, ∅, 1, 1>
woman	N	$c_{3,<e,t>}$	woman'	<s, f, h, 3, ∅, 1, 1>
person	N	$c_{5,<e,t>}$	person'	<s, x, h, 3, ∅, 1, 1>
king	N	$c_{7,<e,t>}$	king'	<s, m, h, 3, ∅, 1, 1>
sidekick	N	$c_{9,<e,t>}$	sidekick'	<s, x, h, 3, ∅, 1, 1>
child	N	$c_{11,<e,t>}$	child'	<s, x, h, 3, ∅, 1, 1>
ewe	N	$c_{13,<e,t>}$	ewe'	<s, f, i, 3, ∅, 1, 1>
fish	N	$c_{15,<e,t>}$	fish'	<s, x, i, 3, ∅, 1, 1>
wasp	N	$c_{17,<e,t>}$	wasp'	<s, x, i, 3, ∅, 1, 1>
movie	N	$c_{19,<e,t>}$	movie'	<s, x, i, 3, ∅, 1, 1>
ansible[31]	N	$c_{21,<e,t>}$	ansible'	<s, x, i, 3, ∅, 1, 1>
country	N	$c_{23,<e,t>}$	country'	<s, x, i, 3, ∅, 1, 1>
each	DET	$\lambda P\lambda Q(\forall x[[\mathrm{At}(x)\wedge {}^{\vee}P(x)]\rightarrow {}^{\vee}Q(x)])$		<s, x, x, x, ∅, 1, 1>
every	DET	$\lambda P\lambda Q(\forall x[[\mathrm{At}(x)\wedge {}^{\vee}P(x)]\rightarrow {}^{\vee}Q(x)])$		<s, x, x, x, ∅, 0, 1>
some	DET	$\lambda P\lambda Q(\exists x[{}^{\vee}P(x)\wedge {}^{\vee}Q(x)\wedge x\neq o])$		<x, x, x, x, ∅, 1, 1>
no	DET	$\lambda P\lambda Q(\neg\exists xy[{}^{\vee}P(x)\wedge y\neq o\wedge y\leq x\wedge {}^{\vee}Q(y)])$		<x, x, x, x, ∅, 1, 1>
walk	VI	$c_{2,<e,t>}$	walk'	<x, x, x, x, ∅, 1, 1>
work	VI	$c_{4,<e,t>}$	work'	<x, x, x, x, ∅, 1, 1>
reign	VI	$c_{6,<e,t>}$	reign'	<x, x, x, x, ∅, 1, 1>
die	VI	$c_{8,<e,t>}$	die'	<x, x, x, x, ∅, 1, 1>

[31] An ansible is a device common to certain works of science fiction, including Orson Scott Card's *Ender's Game*, that is used for faster-than-light communication. Needless to say, there are not believed to be any working ansibles in the actual world.

Expression:	Cat:	Translation:	Shorthand:	Features:
love	VT	$c_{1,<<s,<<s,<e,t>>,t>>,<e,t>>}$	love’	<x, x, x, x, ∅, 1, 1>
hate	VT	$c_{2,<<s,<<s,<e,t>>,t>>,<e,t>>}$	hate’	<x, x, x, x, ∅, 1, 1>
seek	VT	$c_{3,<<s,<<s,<e,t>>,t>>,<e,t>>}$	seek’	<x, x, x, x, ∅, 1, 1>
believe that	VI/t	$c_{1,<<s,t>,<e,t>>}$	believe’	<x, x, x, x, ∅, 1, 1>
the[32]	(e/N)	$j_{0,<<s,<e,t>>,e>}$	the’	<x, x, x, x, ∅, 1, 1>
’s[33]	T\(e/N)	$j_{0,<<s,<<s,<e,t>>,t>>,<<s,<e,t>>,e>>}$	Pos’	<x, x, x, x, ∅, 1, 1>
in	(t/t)/T	$c_{1,<<s,<<s,<e,t>>,t>>,<<s,t>,t>>}$	in’	<x, x, x, x, ∅, 1, 1>
For all n>0:				
he$_n$	e	$v_{-n,e}$	$v_{-n,e}$	<s,m,x,3,{<*n*,s,m,x,3>},0,0>
she$_n$	e	$v_{-n,e}$	$v_{-n,e}$	<s,f,x,3,{<*n*,s,f,x,3>},0,0>
it$_n$	e	$v_{-n,e}$	$v_{-n,e}$	<s,x,i,3,{<*n*,s,x,i,3>},0,0>
zie$_n$[34]	e	$v_{-n,e}$	$v_{-n,e}$	<s,x,h,3,{<*n*,s,x,h,3>},0,0>
they$_n$	e	$v_{-n,e}$	$v_{-n,e}$	<p,x,x,3,{<*n*,p,x,x,3>},1,0>

3.4 Syntactic and Translation Rules

In the following chapter, I shall build up simultaneously the operations of the syntax and of a compositional translation function r, which is intended to provide translations of the fragment into L_I.

[32] This translation encodes most of the formal features attributed to the salience choice function. Specifically, *the* is taken here to denote a function from properties to entities, it is specified to be indexical, and so dependent on a contextualization function and not on the selection of a model, and, since a contextualization function always assigns senses (and not just denotations) to indexicals, it is sensitive to intensional contexts. This definition does not, by itself, guarantee that the function will be a choice function, but this constraint will be introduced by a meaning postulate.

[33] The inclusion of this item is obviously not anything resembling complete analysis, but is instead intended to hint at how the approach used for *the* could be extended to apply to other constructions for which definiteness is relevant.

[34] This choice isn’t intended as much of a political statement, but is instead used to provide a one-word symbol for purposes of economy, the pronoun used for humans of indeterminate gender in completed sentences is **he or she**. Substituting **he** would not complicate the system, although the (more natural) use of **they** would create certain syntactic difficulties.

3.4.1 Syntactic Functions

Here I shall give a complete list of the syntactic operations used in the specifications of syntactic rules[35].

$G_0(\kappa) = \kappa$.

$G_1(\kappa,\eta) = \kappa\eta$.

$G_2(\kappa,\eta) = \kappa\eta'$, where η' is η unless η is **he**$_n$, **she**$_n$, **zie**$_n$, **they**$_n$, or **I**, in which case η' is **him**$_n$, **her**$_n$, **zir**$_n$, **them**$_n$, or **me**, respectively.

Where $a \in$ {s, p, x}, b $\in$ {m, f, x}, c $\in$ {h, i, x}, and $d \in$ {1, 2, 3, x}, $G_{3,a,b,c,d}(\kappa)$ is the result of replacing the first verb in κ with its present tense number a and person d counterpart.

$G_4(\kappa)$ is the result of pluralizing the head noun of κ.

$G_5(\kappa,\eta) = \kappa'$ **of** η, where κ' = **none** if κ = **no**, and $\kappa' = \kappa$ otherwise.

For any positive integer n, $G_{6,n}(\kappa,\eta)$ is the result of replacing the first instance of **he**$_n$, **him**$_n$, **she**$_n$, **her**$_n$, **zie**$_n$, **zir**$_n$, **it**$_n$, **they**$_n$, or **them**$_n$ in η with κ, replacing every subsequent of instance of **he**$_n$ with **he**, **him**$_n$ with **him**, **she**$_n$ with **she**, **her**$_n$ with **her**, **zie**$_n$ with **he or she**, **zir**$_n$ with **him or her**, **it**$_n$ with **it**, **they**$_n$ with **they**, and **them**$_n$ with **them**.

[35] Of course, many of these operations would require some morphology to define completely and rigorously.

3.4.2 Categorial Rules

3.4.2.1 Direct Object

SR1. If μ is an expression of category T and ζ is an expression of category VT, and μ and ζ agree for variable bindings, then $G_2(\zeta,\mu)$ is an expression of category VI with features: $<Num_\zeta, Gen_\zeta, Hum_\zeta, Per_\zeta, Var_\zeta \cup Var_\mu, Part_\zeta, Quant_\zeta>$.

TR1. Here, $r(G_2(\zeta,\mu)) = r(\zeta)(\hat{}r(\mu))$.

3.4.2.2 Subject

SR2. If μ is an expression of category T and ζ is an expression of category VI, and μ and ζ strongly agree, then $G_1(\mu,\zeta)$ is an expression of category t with features $F_\mu \bullet F_\zeta$.

TR2. Here, $r(G_1(\mu,\zeta)) = r(\mu)(\hat{}r(\zeta))$.

3.4.2.3 Term Formation

SR3. If ρ is an expression of category DET and μ is an expression of category N, and ρ and μ weakly agree, then $G_1(\rho,\mu)$ is an expression of category T with features $F_\rho \bullet F_\mu$.

TR3. Here, $r(G_1(\rho,\mu)) = r(\rho)(\hat{}r(\mu))$.

3.4.2.4 Genitive Formation

SR 4. If ρ is an expression of category T\(e/N) and μ is an expression of category T, and ρ and μ weakly agree, then $G_1(\mu,\rho)$ is an expression of category e/N with features $F_\rho \bullet F_\mu$.

TR4. Here, $r(G_1(\mu,\rho)) = r(\rho)(^{\wedge}r(\mu))$.

3.4.2.5 Referential Expression Formation

SR5. If ρ is an expression of category e/N and μ is an expression of category N, and ρ and μ weakly agree, then $G_1(\rho,\mu)$ is an expression of category e with features $F_\rho \bullet F_\mu$.

TR5. Here, $r(G_1(\rho,\mu)) = r(\rho)(^{\wedge}r(\mu))$.

3.4.2.6 Preposition Application

SR6. If μ is an expression of category T and ζ is an expression of category (t/t)/T, and ζ and μ weakly agree, then $G_1(\zeta,\mu)$ is an expression of category t/t with features $F_\zeta \bullet F_\mu$.

TR6. Here, $r(G_1(\zeta,\mu)) = r(\zeta)(^{\wedge}r(\mu))$.

3.4.2.7 Sentential Adjunction

SR7. If ζ is an expression of category t/t and ϑ is an expression of category t, and ζ and ϑ agree for variable bindings, then $G_1(\zeta,\vartheta)$ is an expression of type t with features $F_\zeta \bullet F_\vartheta$.

TR7. Here, $r(G_1(\zeta,\vartheta)) = r(\zeta)(^{\wedge}r(\vartheta))$.

3.4.2.8 Sentential Object

SR8. If ϑ is an expression of category t and ζ is an expression of category VI/t, and ϑ and ζ agree for variable bindings, then $G_1(\zeta,\vartheta)$ is an expression of category VI with features: $\langle \mathrm{Num}_\zeta, \mathrm{Gen}_\zeta, \mathrm{Hum}_\zeta, \mathrm{Per}_\zeta, \mathrm{Var}_\zeta \cup \mathrm{Var}_\vartheta, \mathrm{Part}_\zeta, \mathrm{Quant}_\zeta \rangle$.

TR8. Here, $r(G_1(\zeta,\vartheta)) = r(\zeta)(\hat{}r(\vartheta))$.

3.4.3 Idiosyncratic Rules

3.4.3.1 Verb Featuring

SR9. If ζ is an expression of category VI, and $\mathrm{Num}_\zeta = \mathrm{Gen}_\zeta = \mathrm{Hum}_\zeta = \mathrm{Per}_\zeta = \mathrm{x}$, $a \in \{\mathrm{s, p, x}\}$, $\mathrm{b} \in \{\mathrm{m, f, x}\}$, $\mathrm{c} \in \{\mathrm{h, i, x}\}$, and $d \in \{1, 2, 3, \mathrm{x}\}$, then $G_{3,a,b,c,d}(\zeta)$ is an expression of category VI with features $\langle a, b, c, d, \mathrm{Var}_\zeta, \mathrm{Part}_\zeta, \mathrm{Quant}_\zeta \rangle$.

TR9. Here $r(G_{3,a,b,c,d}(\zeta)) = r(\zeta)$.

3.4.3.2 Pluralization

SR10. If μ is an expression of category N and $\mathrm{Num}_\zeta = \mathrm{s}$, then $G_4(\mu)$ is an expression of category N with features $\langle \mathrm{p}, \mathrm{Gen}_\mu, \mathrm{Hum}_\mu, \mathrm{Per}_\mu, \mathrm{Var}_\mu, \mathrm{Part}_\mu, \mathrm{Quant}_\mu \rangle$.

TR10. Here, $r(G_4(\mu)) = {}^\star r(\mu)$.

3.4.3.3 Implicit Type Cast (Sublimation)

SR11. If μ is an expression of category e, then $G_0(\mu)$ is an expression of category T with the same features as μ.

TR11. Here $r(G_0(\mu)) = \lambda P(\check{}P(r(\mu)) \wedge r(\mu) \neq o)$.

3.4.3.4 Explicit Type Cast (Partitive)

SR12. If ρ is an expression of category DET and μ is an expression of category e, ρ and μ agree for variable bindings, and $\text{Part}_\rho = \text{Part}_\mu = 1$ and $\text{Num}_\mu = \text{p}$, $G_5(\rho,\mu)$ is an expression of category T, with features $F_\rho \bullet F_\mu$.

TR12. Here, $r(G_5(\rho,\mu)) = \lambda P(r(\rho)(^\wedge\lambda x(x \leq r(\mu)))(P) \wedge r(\mu) \neq o)$.

3.4.4 Quantification Rule

3.4.4.1 Quantifying In

SR13. If μ is an expression of category T, ϑ is an expression of category t, $\text{Quant}_\mu = 1$, n is a positive integer, and $<n,a,b,c,d> \epsilon \text{Var}_\vartheta$, for some a, b, c, and d such that $<a, b, c, d, \varnothing, 1, 1>$ weakly agrees with F_μ, and μ and ϑ agree for variable bindings, then $G_{6,n}(\mu,\vartheta)$ is an expression of type t with features $<\text{Num}_\vartheta, \text{Gen}_\vartheta, \text{Hum}_\vartheta, \text{Per}_\vartheta, \text{Var}_\mu \cup (\text{Var}_\vartheta - \{<n,a,b,c,d>\}), \text{Part}_\vartheta, \text{Quant}_\vartheta>$.

TR13. Here $r(G_{6,n}(\mu,\vartheta)) = r(\mu)(^\wedge\lambda v_{-n,e}(r(\vartheta)))$

3.5 Some New Meaning Postulates

In the present analysis, there are any number of meaning postulates which it might be useful to adopt (for example, many of those in Montague (1974b)), and I shall not attempt to provide an exhaustive list of desirable meaning postulates for English. However, certain features of the present analysis may call for new, or at least ammended, meaning postulates. In particular, it is important to guarantee that the definite article behaves in appropriately (that is, as a partial choice function):

MP1. $\Box \forall P[^\vee P(\text{the}'(P)) \vee \text{the}'(P) = o]$

MP1 codifies the intuition that "the dog", can suffer from denotation failure, or it can denote a dog, but there are no other options available to it. For example, it could never denote a book (at least, not a world where the set of dogs and the set of books are disjoint).

This is the only interesting new meaning postulate that I would consider essential to the analysis, but a few others may recommend themselves:

MP2. $\Box\forall x[\omega(x)\rightarrow \mathrm{At}(x)]$, where ω is any of the singular count nouns in our list of basic expressions.

MP3. $\exists x\Box[\mathrm{I'}=x]$

MP4. $\Box\mathrm{At}(\omega)$, where ω is I', Hideo', Cassandra', Pat', Emma', or EndG'.

MP2 says that singular count nouns contain only atomic entities. MP3 says that the first person singular pronoun is a rigid designator. MP4 guarantees that various expressions that we think of as individual names will denote individuals.

In addition, we should say about the possessive operation what we have already said about the definite article in MP1:

MP5. $\forall v_{0,<s,<<s,<e,t>>,t>>}\Box\forall P[{}^{\vee}P(\mathrm{Pos'}(v_{0,<s,<<s,<e,t>>,t>>})(P))\vee \mathrm{Pos'}(v_{0,<s,<<s,<e,t>>,t>>})(P)=o]$

Finally, some minor revisions and extensions of Montague's (1974b) meaning postulate (4). To do this, a little new shorthand will be needed:

If α is an expression of type $<<s,<<s,<e,t>>,t>>,<e,t>>$, $\alpha_{\blacklozenge}$ is shorthand for

$\lambda x(\alpha(^\wedge\lambda P(^\vee P(x)\wedge x\neq o)))$.

Likewise, in'$_\blacklozenge$ is shorthand for $\lambda x(\text{in'}(^\wedge\lambda P(^\vee P(x)\wedge x\neq o)))$

The appropriate meaning postulate for non-intensional transitive verbs is given in MP6 below:

MP6. $\exists v_{0,<s,<e,<e,t>>>}\forall y\forall v_{1,<s,<<s,<e,t>>,t>>}\Box[[\exists z(^\vee v_{0,<s,<e,<e,t>>>}(y)(z)) \rightarrow y\neq o]$

$\wedge\ \omega_\blacklozenge = {}^\vee v_{0,<s,<e,<e,t>>>} \wedge [\omega(v_{1,<s,<<s,<e,t>>,t>>})(y) \leftrightarrow {}^\vee v_{1,<s,<<s,<e,t>>,t>>}(^\wedge\lambda z(^\vee v_{0,<s,<e,<e,t>>>}(z)(y)))]]$

Where ω is either love' or hate'.

MP7. $\exists v_{0,<s,<e,<<s,t>,t>>>}\forall v_{1,<s,<<s,<e,t>>,t>>}\forall v_{2,<s,t>}\Box[[\forall y[^\vee v_{0,<s,<e,<e,t>>>}(y)(v_{2,<s,t>}) \rightarrow y\neq o]]$

$\wedge\ [\text{in'}(v_{1,<s,<<s,<e,t>>,t>>})(v_{2,<s,t>}) \leftrightarrow {}^\vee v_{1,<s,<<s,<e,t>>,t>>}(^\wedge\lambda z(v_{0,<s,<e,<<s,t>,t>>>}(z)(v_{2,<s,t>})))]$

$\wedge\ \text{in'}_\blacklozenge = {}^\vee v_{0,<s,<e,<e,t>>>}]$

MP6 and MP7 basically say that taking an expression of type *T* as an argument is generally equivalent to taking a variable as an argument, and being "quantified over" by the other expression.

I do not mean to suggest that the meaning postulates given here are beyond dispute, but they provide examples of the sorts of meaning postulates we might wish to invoke in a system such as this one.

3.6 Accounting for the Data

Here I shall provide sample derivations that I think reasonably show that the translations for pluralization, the definite article, and the partitive construction given above lead to plausible translations of sentences like many of those discussed in chapter 1. I shall not attempt to exhaustively list the possible translations of any of the sentences I discuss. The derivations of some of these sentences can be found in Appendix F.

3.6.1.

the fish loves Hideo is an expression of category t in the fragment, and it can be translated as a formula equivalent to

$$\text{love'}_{\blacklozenge}(\text{Hideo'})(\text{the'}(^\wedge\text{fish'})) \wedge \text{the'}(^\wedge\text{fish'}) \neq o$$

Taking MP1 into account, this can be read as “there is an entity that is uniquely most salient in its capacity as a fish, and that entity loves Hideo”, or, if, we apply the psychological reading “one thing in particular springs to mind as a ‘fish’ for the speaker, and that thing loves Hido”. Here, the “one thing in particular” constraint corresponds to the second conjunct of the logical formula above, and the claim that that one thing loves Hideo corresponds to the first conjunct. This sentence provides an example of how the translation of *the* being used guarantees unique reference, without requiring that there will be exactly one thing fitting the description in the domain of discourse. This is in keeping with the observations in 1.2.1.

3.6.2.

the children hate Cassandra is an expression of category t in the fragment, and it can be translated by a formula equivalent to

$$\text{hate'}_{\blacklozenge}(\text{Cassandra'})(\text{the'}(^{\wedge\star}\text{child'})) \wedge \text{the'}(^{\wedge\star}\text{child'}) \neq o$$

This is reasonably read as "there is one entity that is most salient in its capacity as a plurality of children, and that collective entity hates Cassandra". This reading is consistent with the observation in 1.2.2 that "the children" appears to refer to the group of children that is, as a group, most relevant.

3.6.3

each of the children hates Cassandra is an expression of category t in the fragment, and it can be translated as a formula equivalent to

$$\forall x[[\text{At}(x) \wedge x \leq \text{the'}(^{\wedge\star}\text{child'})] \rightarrow \text{hate'}_{\blacklozenge}(\text{Cassandra'})(x)] \wedge \text{the'}(^{\wedge\star}\text{child'}) \neq o$$

This can be read as "there is a uniquely most salient plurality of children and every individual child who is a part of this plurality hates Cassandra". Or, if we introduce the psychological understanding directly "there is a particular thing that springs to mind when the speaker thinks about groups of children, and every individual child that is a member of that thing hates Cassandra.

3.6.4 "Some of the children hate Cassandra"

some of the children hates Cassandra is an expression of category t in the fragment, and it can be translated as a formula equivalent to

$$\exists x[x \leq \text{the'}(^{\wedge\star}\text{child'}) \wedge \text{hate'}_{\blacklozenge}(\text{Cassandra'})(x) \wedge x \neq o] \wedge \text{the'}(^{\wedge\star}\text{child'}) \neq o$$

This means that some nontrivial part of the uniquely most salient plurality of children hates Cassandra. Together with 3.6.3 above, this provides evidence that the fragment analyzes partitives in a way consistent with the data in 1.2.2, where it is remarked that “some of the children” and “each of the children” appear to involve quantifying over the members of the most salient group of children.

3.6.5
in *Ender’s Game* some ansible works is an expression of category t in the fragment, and can be translated as a formula equivalent to

$$\text{in'}_{\blacklozenge}(\text{EndG'})({}^\wedge\exists x[\text{ansible'}(x)\wedge\text{work'}(x)\wedge x\neq o])$$

This should be read as “the intensional context generate by *Ender’s Game* accepts as true the proposition that there exists at least one ansible, and that ansible works”. This is a reasonable, although by no means complete, account of this sentence. Most relevantly, it provides a minimally adequate translation of sentence-adjoined *in* phrases, which will make it possible to discuss what happens when they are given wide or narrow scope with respect to definite descriptions.

3.6.6
in *Ender’s Game* the wasp dies is an expression of category t in the fragment, and can be translated as a formula equivalent to

$$\text{in'}_{\blacklozenge}(\text{EndG'})({}^\wedge[\text{die'}(\text{the'}({}^\wedge\text{wasp'})) \wedge \text{the'}({}^\wedge\text{wasp'})\neq o])$$

This can be read as “the intensional context generated by *Ender’s Game* accepts as true the proposition that there is a uniquely most salient wasp, and it dies”, where the criteria for being a uniquely most salient wasp can be affected both by the intensional context (since the' has a potentially nontrivial sense), and by context of utterance (since the' is an indexical). This reading is consistent with our observations in 1.2.1, 1.2.2, and 1.2.7. Specifically, the formula given above does not commit us to any assertion about wasps in the real world.

3.6.7

in every movie the sidekick dies is an expression of category t in the fragment, and can be translated by a formula equivalent to

$$\forall x[\text{movie'}(x)\rightarrow\text{in'}_{\blacklozenge}(x)(\hat{}[\text{die'}(\text{the'}(\hat{}\text{sidekick'})) \wedge \text{the'}(\hat{}\text{sidekick'})\neq o])]$$

This is given the same kind of reading as the sample sentence in 3.6.6 above, and shows how the fragment correctly interprets wide-scope quantification in sentences like this.

3.6.8

in every country some child loves the king is an expression of category t in the fragment, one of its possible translations is equivalent to

$$\forall x[\text{country'}(x)\rightarrow \text{in'}_{\blacklozenge}(x)(\hat{}\exists y[\text{child'}(y)\wedge\text{love'}_{\blacklozenge}(\text{the'}(\hat{}\text{king'}))(y)])]$$

while another is equivalent to

$$\lambda v_{-2,e}(\forall x[[\text{At}(x)\wedge\text{country'}(x)] \rightarrow (\text{in'}_{\blacklozenge}(x)(\hat{}\exists y[\text{child'}(y)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(y)]))])(\text{the'}(\hat{}\text{king'}))$$

$$\wedge\ \text{the'}(\hat{}\text{king'})\neq o$$

The first of these corresponds to the assertion that in every country some child loves whoever qualifies as "the king" with respect to that country, while the second corresponds to the claim that, regarding the person judged to be the most salient king, it is the case that in every country some children love him.

3.7 Concluding Thoughts on the Fragment

The fragment presented in this chapter provides analyses of definite descriptions, plurals, and partitives adequate to account for all of the data presented in the first chapter that do not relate directly to presupposition and generic effects, and is compatible with the most typical processes for incorporating presupposition and generics into model-theoretic accounts of English.

The tools used in the present analysis are not new, and most of the data presented in the first chapter has already been discussed in the literature, so it is worth comparing with other major formal accounts. The two most inclusive formal approaches to definite descriptions that I am aware of are the one advocated by Von Heusinger (1997) and the one advocated by Sharvy (1980) and Link (1998). Like my analysis, both of these have little to say about generic effects. Von Heusinger accounts for most of the context-dependent phenomena given above, but does not discuss plurals, partitives, or scope phenomena. The Link-Sharvy approach, on the other hand, is well equipped to discuss plurals and partitives, but offers no convenient way to account for salience and other context-dependent effects, and suffers from severe empirical inadequacy (as it predicts that the expression “the soldiers” will always denote the collective of all soldiers in the domain of discourse).

My approach, by combining the major ideas of both of these approaches, along with a suitable intensional apparatus, combines the strengths of both with an effective account of scope-sensitivity. Further, thanks to the “implicit type cast” and “quantifying in”, the present account of scope-sensitivity has the happy property of allowing definite descriptions to both denote entities and act as quantifiers; some previous accounts (such as the one in Fodor and Sag (1982)) have been able explain this duality only by including two distinct translations of *the*.

Although my account provides substantially greater coverage of the data than the alternatives discussed above, it has the disadvantage that it gains this coverage only by combining the full ontological commitments and structural complexity of all of its major competitors. The resulting system is rather unwieldy. In addition, for an account along these lines to be truly complete, several areas would require further research: in the first place, it will be necessary to analyze in detail the semantic characteristics of definite generics, and to provide and incorporate some adequate account of them; in addition, to apply the present account to the analysis of particular conversations it will be necessary to develop a rich account of the psychology and pragmatics of salience; finally, more needs to be said about the interactions between plural entities and the distinction between individual-level and stage-level predicates. I have outlined approaches to some of these problems in the appendices.

Despite its shortcomings, my analysis accounts for a wide range of data involving definite descriptions, and shows how insights from two very different approaches to these issues can be combined to provide a more robust and empirically adequate account.

Appendix A: Negation and Presuppositon

As I mentioned earlier, there are two general approaches to the presuppositional phenomena associated with *the*. These might be called *neither true nor false* approach and the *scope tricks approach*, and are discussed briefly in 1.2.1, above. Insofar as each approach is viable, the analysis I have given is compatible with it.

The *scope tricks* approach involves contriving things so that an expression of category T tends to have wide scope over main verb negation. One might pursue this by introducing a set of syntactic rules that demand that all non-intensional transitive verbs take either variables or proper names as objects, and then incorporate **do not** as an "adverb" type expression (of a category like VI/VI), translated as $\lambda P(\lambda x(\neg {}^{\vee}P(x)))$. Another approach might involve separate verb negation functions for transitive and intransitive verbs, and yet another might involve refusing to give a direct translation of verb negation at all, and instead associating it with sentential negation by way of meaning postulates. In any such system, it would be necessary to provide pragmatic theory of cooperative conversation that accounts for why speakers tend to react differently to sentences which are false for normal reasons and sentences which are false by virtue of violated presuppositions.

On the *neither true nor false* approach, one might introduce a new truth value as an error code for presupposition failure, and then specify the meanings of expressions and effects of rules of semantic combination so that, whenever an expression that denoted the null object occurred, the sentence in which it occurred assumed the new truth value.

It is worth noting that both approaches are compatible with the observation that the presupposition effects can be blocked by certain intensional contexts. Since intensional expressions can simply be given wide enough scope to avoid presupposition (on a *scope tricks* analysis), or fail to generate the error code truth value if a presupposition is violated in their argument (on a *neither true nor false* analysis).

Appendix B: Incorporating Generics

B.1 Carlson's Account

In order to discuss the relationships between *the* and generic phenomena, it will be necessary to adopt, at least for the sake of discussion, a theory of generics. The theory I shall assume is the one advocated by Carlson (1979), in which the domain of entities is subdivided into *stages*, *objects*, and *kinds*.[36] Objects are understood as the things we normally think of as entities, stages are understood as some sort of temporal pieces of objects (one's attitude about the details and credibility of stages won't be terribly relevant to the discussion here), and kinds are understood as the overarching, abstract entities that, as their name suggests, stand for whole kinds of things. Predicates can be stage-level, object-level, or kind-level (examples of kind-level predicates include words like *widespread*). Carlson develops these ideas in considerable detail within the framework of Montague grammar. While discussing the possibility of combining Carlson's and Link's approaches to the theory of entities, I shall assume that normal pluralities are objects, rather than kinds. This decision is motivated by a number of factors, including the difficulty of combining plurality-denoting expressions with kind-level predicates:

29. ?The children are widespread.

I do not mean to rule out the possibility of there being pluralities of kinds, which should presumably be kind-level entities, but most of the pluralities that have been considered so far are pluralities of objects, and so will be considered to be object level. Carlson further assumes that a bare plural denotes the appropriate kind (thus *cats* denotes the kind of all cats). The stage is now set to discuss the generic phenomena mentioned in chapter 1.

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[36] See the earlier chapters of Fernald (2000) for an overview of some of the alternatives to an ontology of stages. The part of Carlson's ontology that is of interest here is the kind/object distinction, not the part that directly involves stages.

B.2 Bare Plurals and *The*

A major prediction of Carlson's analysis is that stage-level predicates will only allow an existential reading when combined with a bare plural noun phrase (or any kind-denoting expression), as in (13a). However, since pluralities do not denote kinds, they are not subject to this constraint, and, in accordance with Link's (1998) approach, will always tend towards a generic or universal reading[37]. Likewise, such a distinction could be invoked in the discussion of any perceived contrast of the kind discussed in 1.2.5 (since plural definite descriptions would denote actual groups, whereas bare plurals would denote abstract kinds that can only participate in anything in a sort of general way). If one were to pursue a program of integrating Carlson's and Link's approaches, one might introduce the something following meaning postulate (where *R*' is Carlson's "realizes" relation, and variable superscripts indicate that they are variables over objects, stages, or kinds, and we assume that pluralities of stages are available to us).

MP8. $\forall x^o \forall y^o \forall z^s[[y^o \leq x^o \wedge R'(z^s,x^o)] \rightarrow \exists w^s[w^s \leq z^s \wedge R'(w^s,y^o)]]$

A serious and systematic attempt at integrating Carlson's and Link's theories into a single system would be beyond the scope of this paper, especially since most of the phenomena it would account for are not phenomena associated with *the*, but rather phenomena that are notable for their absence from constructions in which *the* occurs. The remark that some other process is clearly at work in the formation of normal generics is adequate to

[37] I do not have any strong intuitions regarding whether the preference for a universal or generic reading of sentences like (13b) and (7b) correlates in any way with whether the predicates involved are object-level or stage-level.

account for the data, so far as they pertain to the correct interpretation of definite descriptions.

B.3 Definite Generics

With Ojeda (1991), I am inclined to say that the observations in 1.2.4 are best accounted for by ascribing a lexical ambiguity to *the*. However, the introduction of kinds to our domain of objects indicates another alternative – it would be possible to say, for example, that the kind of cats is itself in the extension of the noun *cat*. On this approach, sentences like (14) and (15a) would be special cases of the analysis I have already given, on the assumption that the "most salient whale" in (14) happens, in most intelligible contexts, to be the kind of all whales. This approach is not without its difficulties, however, as the decision whether to interpret as a generic or as a normal definite description is sensitive to more than just prior context, as the contrast between (15a) and (15b) indicates, and the idea that the kind of all whales is itself a whale is a bit counterintutive. Various pragmatic explanations are available, however, including the invocation of a general principle of charity that inclines one to assume other speakers have whatever basic salience ordering would make their statements more reasonable, or Lewis's (1983) suggestion that salience is retroactively reordered as part of a best effort to make utterances come out true.

Appendix C: Salience as an Ordering

Not everyone considers the arguments my arguments against considering salience as an ordering convincing, and, if one rejects them (and so accept that sentence (25) is necessarily untrue, at least on the most straightforward reading), it is possible to express a stronger meaning postulate for *the*. Naïve intuitions regarding salience, and indeed my own usage throughout most of this paper, lead to the understanding of salience as a universal “ordering” over individuals, such that salience within a particular domain (like kings, cats, or kings who like waffles) is always merely the universal salience relation restricted to that domain (this relation, of course, can still be different for different discourse participants, and dependent on context or prior discourse). This is in accordance with certain formal treatments of discourse reference, and, apparently, with the intuitions of Lewis (1983). On this view an “is at least as salient as” relation, associated with the indexical $j_{0,<e,<e,t>>}$, is assumed. Where α and β are expressions of type e, $j_{0,<e,<e,t>>}(\alpha)(\beta)$ is read “α is at least as salient as β”, and associated with the shorthand $\beta \lll \alpha$. One can then uniquely specify the meaning of **the** in the fragment with the following meaning postulate:

MP1a. $\Box\forall P[[{}^{\vee}P(\text{the'}(P)) \wedge \forall x[{}^{\vee}P(x) \rightarrow x \lll \text{the'}({}^{\vee}P)]] \vee [\text{the'}(P)=o \wedge \neg\exists y[{}^{\vee}P(y) \wedge \forall x[{}^{\vee}P(x) \rightarrow x \lll y]]]]$

As its name suggests, this MP1a would replace the original MP1, and would uniquely define the’ in terms of the salience ordering as the function that picks out the most salient available object with the property under consideration, if one exists, and otherwise yields the null object.

If one accepts a salience relation, there are some intuitively plausible constraints on it, among them the following:

Totality: $\forall x \forall y[x \leqslant y \vee y \leqslant x]$

Reflexivity: $\forall x[x \leqslant x]$

Transitivity: $\forall x \forall y \forall z[[x \leqslant y \wedge y \leqslant z] \rightarrow x \leqslant z]$

Although antisymmetry is a traditional property of “orderings”, it seems unjustified here, as it would rule out the possibility of denotation failure resulting from the presence of more than one most salient entity.

Appendix D: Montague's Intensionality and "Individuals in Guises"

The most significant general semantic difference between the approach in the fragment in chapter 3 and the one in Montague (1974b) is that I consider predicates (categories N and VI) to denote sets of individuals (type $<e,t>$) rather than sets of individual properties (type $<<s,e>,t>$)[38]. This change is introduced for reasons discussed in Dowty, et al. (1985), and for simplicity, but it is not essential to the approach. In adapting the analysis outlined above to such a system, the following changes would be necessary.

D.1 Denotation of **the**

The translation of **the** would be changed to: $j_{0,<<s,<<s,e>,t>>,e>}$.

D.2 Error code

There would have to be an "error code" constant of type $<s,e>$. It would probably be best to associate with the constant function of the null object (that is, the function on indices the value of which was always the additive identity of the Boolean algebra of pluralities).

D.3 Pluralization

A new pluralization operation for nouns would be required. The following shorthand definition would be one approach: If φ is an expression of type $<<s,e>,t>$ then ${}^{\star}\varphi$ is shorthand for

$$\lambda v_{0,<s,e>}(\lambda v_{2,<<s,e>,t>}(\Box[\neg At({}^{\vee}v_{0,<s,e>}) \wedge \forall v_{1,<s,e>}[\Box[{}^{\vee}v_{1,<s,e>} \leq {}^{\vee}v_{0,<s,e>} \wedge At({}^{\vee}v_{1,<s,e>})] \rightarrow v_{2,<<s,e>,t>}({}^{\vee}v_{1,<s,e>})]]])(\varphi)).$$

[38] This distinction is especially relevant because, as Lewis (1983) points out, it is sometimes tempting to think of salience as a property not of individuals but of "individuals in guises".

This is not the only approach, of course. For example, we might contend that the necessity constraint is too strong, in which case an appropriate treatment of noun pluralization could be achieved by defining $^{\star}\varphi$ as

$$\lambda v_{0,<s,e>}(\neg \mathrm{At}({}^{\vee}v_{0,<s,e>}) \wedge \forall x[[x \leq {}^{\vee}v_{0,<s,e>} \wedge \mathrm{At}(x)] \rightarrow \exists v_{1,<s,e>}[x = {}^{\vee}v_{1,<s,e>} \wedge \varphi(x)]]).$$

D.4 The Partitive

To translate the partitive construction, an approach similar to the one used above would be called for. The simplest translation would require that the old partitive rule be replaced with the following:

SR12a. If ρ is an expression of category DET (which is now associated with type $<<s,<<s,e>,t>>,t>$) and μ is an expression of category e, ρ and μ agree for variable bindings, and $\mathrm{Part}_{\rho} = \mathrm{Part}_{\mu} = 1$ and $\mathrm{Num}_{\mu} = \mathrm{p}$, $G_5(\rho,\mu)$ is an expression of category T, with features $F_{\rho} \bullet F_{\mu}$.

TR12a. Here, $r(G_5(\rho,\mu)) = \lambda P(r(\rho)({}^{\wedge}\lambda v_{0,<s,e>}({}^{\vee}v_{0,<s,e>} \leq r(\mu)))(P) \wedge \neg\Box r(\mu)=o)$.

As with pluralization, there are many other alternatives, depending on one's attitude about the significance of intensionality in these cases.

Appendix E: Further Remarks on the Nature of Salience

I have remarked above that salience choice function is an indexical expression, that it has an intension, that it is to be understood psychologically, and that it is subject to a certain meaning postulate. Now that the formalism has been laid out, it may be worthwhile to go back and consider the relationship among these comments.

Normally, a meaning postulate is a restriction on which models of the language are deemed “logically possible”. In the case of an indexical expression, however, a meaning postulate is a restriction on permissible contextualization functions and so is better thought of as a conventional restriction on the use of the expression. Thus, MP1 can be read as a requirement that the speaker make a good faith effort to only identify things by descriptions that are true of them. (Of course, on the psychological understanding, it is possible to violate MP1 unknowingly.) In light of this, the most conspicuous thing about a sentence in which MP1 is violated is not that it is false, but that is rooted in an impermissible use of the language. This has a certain intuitive appeal, especially in light of Donellan’s (1966) remarks on the use of such sentences. Successful reference with an inaccurate description will be achieved pragmatically when listeners, assuming that the speaker did not mean to break the rules, attempt to put themselves in the speakers shoes and assess what might have been meant.

That *the* is understood psychologically means that it denotes the function that, when applied to a property, picks out the thing that first jumps to mind for the speaker as an entity with that property. That *the* is also endowed with an intension means that, when it is evaluated with respect to a possible world and a spatio-temporal location, it is the function that picks out the entity that would first spring to the speaker's mind, were the speaker "transported" to that possible world and spatio-temporal location.

Appendix F: Derivations of Examples

This section contains the derivations of some of the sample sentences discussed in 3.6.

F.1 “The fish loves Hideo”

(i) By SR11 and TR11, **Hideo** is an expression of category T with features <s, m, h, 3, ∅, 0, 0> and is given the translation

$\lambda P({}^{\vee}P(\text{Hideo'}) \wedge \text{Hideo'}{\neq}o)$.

(ii) By MP4, the translation given in (i) above is equivalent to

$\lambda P({}^{\vee}P(\text{Hideo'}))$.

(iii) By (i) and (ii) above, SR1, and TR1, **love Hideo** is an expression of category VI with features <x, x, x, x, ∅, 1, 1> and a translation equivalent to

$\text{love'}({}^{\wedge}\lambda P({}^{\vee}P(\text{Hideo'})))$.

(iv) By (iii) above, SR9 and TR9, **loves Hideo** is an expression of category VI with features <s, x, i, 3, ∅, 1, 1> and a translation equivalent to

$\text{love'}({}^{\wedge}\lambda P({}^{\vee}P(\text{Hideo'})))$.

(v) By SR5 and TR5, **the fish** is an expression of category e with features <s, x, i, 3, ∅, 1, 1> and translation

$\text{the'}({}^{\wedge}\text{fish'})$.

(vi) By (v) above, SR11, and TR11, **the fish** is an expression of category T with features <s, x, i, 3, ∅, 1, 1> and translation

$\lambda P({}^{\vee}P(\text{the'}({}^{\wedge}\text{fish'})) \wedge \text{the'}({}^{\wedge}\text{fish'}){\neq}o)$.

(vii) By (vi) and (iv) above, SR2, and TR2, **the fish loves Hideo** is an expression of category t with features <s, x, i, 3, ∅, 1, 1> and a translation equivalent to

$$\lambda P({}^{\vee}P(\text{the}'({}^{\wedge}\text{fish}')) \wedge \text{the}'({}^{\wedge}\text{fish}') \neq o)({}^{\wedge}\text{love}'({}^{\wedge}\lambda P({}^{\vee}P(\text{Hideo}')))).$$

(viii) By standard rules of manipulation, along with MP6, the translation given in (vii) above is equivalent to

$$\text{love}'_{\blacklozenge}(\text{Hideo}')(\text{the}'({}^{\wedge}\text{fish}')) \wedge \text{the}'({}^{\wedge}\text{fish}') \neq o.$$

F.2 "The children hate Cassandra"

(i) By SR11 and TR11, **Cassandra** is an expression of category T with features <s, f, h, 3, ∅, 0, 0> and translation

$$\lambda P({}^{\vee}P(\text{Cassandra}') \wedge \text{Cassandra}' \neq o).$$

(ii) By MP4, the translation given in (i) above is equivalent to

$$\lambda P({}^{\vee}P(\text{Cassandra}')).$$

(iii) By (i) and (ii) above, SR1, and TR1, **hate Cassandra** is an expression of category VI with features <x, x, x, x, ∅, 1, 1> and a translation equivalent to

$$\text{hate}'({}^{\wedge}\lambda P({}^{\vee}P(\text{Cassandra}'))).$$

(iv) By (iii) above, SR9 and TR9, **hate Cassandra** is an expression of category VI with features <p, x, h, 3, ∅, 1, 1> and a translation equivalent to

$$\text{hate}'({}^{\wedge}\lambda P({}^{\vee}P(\text{Cassandra}'))).$$

(v) By SR10 and TR10, **children** is an expression of category N with features <p, x, h, 3, ∅, 1, 1> and translation

$^\star\text{child}'$.

(vi) By (v) above, SR5 and TR5, **the children** is an expression of category e with features <p, x, h, 3, ∅, 1, 1> and translation

$\text{the}'({}^\wedge{}^\star\text{child}')$.

(vii) By (vi) above, SR11, and TR11, **the children** is an expression of category T with features <p, x, h, 3, ∅, 1, 1> and translation

$\lambda P({}^\vee P(\text{the}'({}^\wedge{}^\star\text{child}') \wedge \text{the}'({}^\wedge{}^\star\text{child}') \neq o)$.

(viii) By (vi) and (iv) above, SR2, and TR2, **the children hate Cassandra** is an expression of category t with features <p, x, h, 3, ∅, 1, 1> and a translation equivalent to

$\lambda P({}^\vee P(\text{the}'({}^\wedge{}^\star\text{child}') \wedge \text{the}'({}^\wedge{}^\star\text{child}') \neq o)(\text{hate}'({}^\wedge\lambda P({}^\vee P(\text{Cassandra}'))))$

(ix) By standard rules of manipulation and MP7, the translation given in (viii) above is equivalent to

$\text{hate}'_\blacklozenge(\text{Cassandra}')(\text{the}'({}^\wedge{}^\star\text{child}')) \wedge \text{the}'({}^\wedge{}^\star\text{child}') \neq o$

F.3 “Each of the children hates Cassandra”

(i) As shown in F.2, **hate Cassandra** is an expression of category VI with features <p, x, h, 3, ∅, 1, 1> and a translation equivalent to

$\text{hate}'({}^\wedge\lambda P({}^\vee P(\text{Cassandra}')))$.

(ii) As shown in F.2, **the children** is an expression of category e with features <p, x, h, 3, ∅, 1, 1> and translation

$$\text{the}'({}^{\wedge}{}^{\star}\text{child}').$$

(iii) By (i) above, SR9 and TR9, **hates Cassandra** is an expression of category VI with features <s, x, h, 3, ∅, 1, 1> and a translation equivalent to translation

$$\text{hate}'({}^{\wedge}\lambda P({}^{\vee}P(\text{Cassandra}'))).$$

(iv) By (ii) above, SR12 and TR12, **each of the children** is an expression of category T with features <s, x, h, 3, ∅, 1, 1> and translation

$$\lambda P(\lambda P\lambda Q(\forall x[[\text{At}(x)\wedge{}^{\vee}P(x)]\rightarrow{}^{\vee}Q(x)])({}^{\wedge}\lambda x(x\leq\text{the}'({}^{\wedge}{}^{\star}\text{child}')))(P) \wedge \text{the}'({}^{\wedge}{}^{\star}\text{child}')\neq o).$$

(v) By standard rules of manipulation, the translation given in (iv) above is equivalent to

$$\lambda P(\forall x[[\text{At}(x) \wedge x\leq\text{the}'({}^{\wedge}{}^{\star}\text{child}')]\rightarrow{}^{\vee}P(x)] \wedge \text{the}'({}^{\wedge}{}^{\star}\text{child}')\neq o).$$

(vi) By (v) and (iii) above, SR2, and TR2, **each of the children hates Cassandra** is an expression of type t with features <s, x, h, 3, ∅, 1, 1> and a translation equivalent to

$$\lambda P(\forall x[[\text{At}(x)\wedge x\leq\text{the}'({}^{\wedge}{}^{\star}\text{child}')]\rightarrow{}^{\vee}P(x)]\wedge\text{the}'({}^{\wedge}{}^{\star}\text{child}')\neq o)({}^{\wedge}\text{hate}'({}^{\wedge}\lambda P({}^{\vee}P(\text{Cassandra}')))).$$

(vii) By standard rules of manipulation and MP7, the translation given above is equivalent to

$$\forall x[[\text{At}(x) \wedge x\leq\text{the}'({}^{\wedge}{}^{\star}\text{child}')]\rightarrow\text{hate}'_{\blacklozenge}(\text{Cassandra}')(x)] \wedge \text{the}'({}^{\wedge}{}^{\star}\text{child}')\neq o.$$

F.4 “In *Ender’s Game*, some ansible works”

(i) By SR3 and TR3, **some ansible** is an expression of type T with features <s, x, i, 3, ∅, 1, 1> and translation

$$\lambda P\lambda Q(\exists x[{}^{\vee}P(x)\wedge{}^{\vee}Q(x)\wedge x\neq o])({}^{\wedge}\text{ansible'}).$$

(ii) By standard rules of manipulation and MP2, the translation given in (i) above is equivalent to

$$\lambda Q(\exists x[\text{ansible'}(x)\wedge{}^{\vee}Q(x)]).$$

(iii) By SR11 and TR11, ***Ender's Game*** is an expression of category T with features <s, x, i, 3, ∅, 0, 0> and translation

$$\lambda P({}^{\vee}P(\text{EndG'}) \wedge \text{EndG'}\neq o).$$

(iv) By MP4, the translation given in (iii) above is equivalent to

$$\lambda P({}^{\vee}P(\text{EndG'})).$$

(v) By SR9 and TR9, **works** is an expression of category VI with features <s, x, i, 3, ∅, 1, 1> and translation

$$\text{work'}.$$

(vi) By (ii) and (v) above, SR2, and TR2, **some ansible works** is an expression of category t with features <s, x, i, 3, ∅, 1, 1> and a translation equivalent to

$$\lambda Q(\exists x[\text{ansible'}(x)\wedge{}^{\vee}Q(x)])({}^{\wedge}\text{work'}).$$

(vii) By standard rules of manipulation, the translation in (vi) above is equivalent to

$$\exists x[\text{ansible'}(x)\wedge\text{work'}(x)].$$

(viii) By (iii) above, SR6, and TR6, **in *Ender's Game*** is an expression of category t/t with features <s, x, i, 3, ∅, 0, 0> and translation

$\text{in'}(\lambda P({}^\vee P(\text{EndG'}) \wedge \text{EndG'}{\neq}o))$.

(ix) By (vii) and (viii) above, SR7, and TR7, **in *Ender's Game* some ansible works** is an expression of category t with features <s, x, i, 3, ∅, 1, 1> and a translation equivalent to translation

$\text{in'}(\lambda P({}^\vee P(\text{EndG'}) \wedge \text{EndG'}{\neq}o))({}^\wedge\exists x[\text{ansible'}(x) \wedge \text{work'}(x)])$.

(x) By (ix) above and MP7, the translation given above is equivalent to

$\text{in'}_\blacklozenge(\text{EndG'})({}^\wedge\exists x[\text{ansible'}(x) \wedge \text{work'}(x)])$

F.5 "In every movie, the sidekick dies"

(i) By SR11 and TR11, **it**$_1$ is an expression of category T with features <s, x, i, 3, {<1,s,x,i,3>}, 0, 0> and translation

$\lambda P({}^\vee P(v_{-1,e}) \wedge v_{-1,e}{\neq}o)$.

(ii) By (i) above, SR6, and TR6, **in it**$_1$ is an expression of category t/t with features <s, x, i, 3, {<1,s,x,i,3>}, 0, 0> and translation

$\text{in'}({}^\wedge\lambda P({}^\vee P(v_{-1,e}) \wedge v_{-1,e}{\neq}o))$

(iii) By SR5 and TR5, **the sidekick** is an expression of category e with features <s, x, h, 3, ∅, 1, 1> and translation

$\text{the'}({}^\wedge\text{sidekick'})$.

(iv) By (iii) above, SR11, and TR11, **the sidekick** is an expression of category T with features <s, x, h, 3, ∅, 1, 1> and translation

$$\lambda P({}^{\vee}P(\text{the'}({}^{\wedge}\text{sidekick'})) \wedge \text{the'}({}^{\wedge}\text{sidekick'}) \neq o).$$

(v) By SR9 and TR9, **dies** is an expression of category VI with features <s, x, h, 3, ∅, 1, 1> and translation

$$\text{die'}.$$

(vi) By (iv) and (v) above, SR2, and TR2, **the sidekick dies** is an expression of category t with features <s, x, h, 3, ∅, 1, 1> and translation

$$\lambda P({}^{\vee}P(\text{the'}({}^{\wedge}\text{sidekick'})) \wedge \text{the'}({}^{\wedge}\text{sidekick'}) \neq o)({}^{\wedge}\text{die'}).$$

(vii) By well known rules of manipulation, the translation in (vi) above is equivalent to

$$\text{die'}(\text{the'}({}^{\wedge}\text{sidekick'})) \wedge \text{the'}({}^{\wedge}\text{sidekick'}) \neq o.$$

(viii) By (vii) and (ii) above, SR7, and TR7, **in it**$_1$ **the sidekick dies** is an expression of category t with features <s, x, i, 3, {<1,s,x,i,3>}, 0, 0> and a translation equivalent to

$$\text{in'}({}^{\wedge}\lambda P({}^{\vee}P(v_{-1,e}) \wedge v_{-1,e} \neq o))({}^{\wedge}[\text{die'}(\text{the'}({}^{\wedge}\text{sidekick'})) \wedge \text{the'}({}^{\wedge}\text{sidekick'}) \neq o]).$$

(ix) By MP7, the translation given in (viii) above is equivalent to

$$\text{in'}_{\blacklozenge}(v_{-1,e})({}^{\wedge}[\text{die'}(\text{the'}({}^{\wedge}\text{sidekick'})) \wedge \text{the'}({}^{\wedge}\text{sidekick'}) \neq o]).$$

(x) By SR3 and TR3, **every movie** is an expression of category T with features <s, x, i, 3, ∅, 0, 1> and translation

$$\lambda P \lambda Q(\forall x[[\text{At}(x) \wedge {}^{\vee}P(x)] \rightarrow {}^{\vee}Q(x)])({}^{\wedge}\text{movie'}).$$

(xi) By standard rules of manipulation, the translation given in (x) above is equivalent to

$$\lambda Q(\forall x[[\text{At}(x) \wedge \text{movie'}(x)] \rightarrow {}^{\vee}Q(x)]).$$

(xii) By (viii) and (xi) above, SR13, and TR13, **in every movie the sidekick dies** is an expression of category t with features <s, x, h, 3, ∅, 0, 0> and a translation equivalent to

$$\lambda Q(\forall x[[\mathrm{At}(x)\wedge \mathrm{movie}'(x)]\rightarrow {}^{\vee}Q(x)])({}^{\wedge}\lambda v_{-1,e}(\mathrm{in}'_{\blacklozenge}(v_{-1,e})({}^{\wedge}[\mathrm{die}'(\mathrm{the}'({}^{\wedge}\mathrm{sidekick}'))\wedge$$

$$\mathrm{the}'({}^{\wedge}\mathrm{sidekick}')\neq o]))).$$

(xiii) By standard rules of manipulation, the translation in (xii) above is equivalent to

$$\forall x[[\mathrm{At}(x)\wedge \mathrm{movie}'(x)]\rightarrow \mathrm{in}'_{\blacklozenge}(x)({}^{\wedge}[\mathrm{die}'(\mathrm{the}'({}^{\wedge}\mathrm{sidekick}'))\wedge \mathrm{the}'({}^{\wedge}\mathrm{sidekick}')\neq o])].$$

F.6 "In every country, some child loves the king" (on one reading)

(i) As shown in F.5, **in it**$_1$ is an expression of category t/t with features <s, x, i, 3, {<1,s,x,i,3>}, 0, 0> and a translation equivalent to

$$\mathrm{in}'_{\blacklozenge}(v_{-1,e}).$$

(ii) By SR3 and TR3, **some child** is an expression of category T with features <s, x, h, 3, ∅, 1, 1> and translation

$$\lambda P\lambda Q(\exists x[{}^{\vee}P(x)\wedge {}^{\vee}Q(x)\wedge x\neq o])({}^{\wedge}\mathrm{child}').$$

(iii) By SR5 and TR5, **the king** is an expression of category e with features <s, m, h, 3, ∅, 1, 1> and translation

$$\mathrm{the}'({}^{\wedge}\mathrm{king}')$$

(iv) By (iii) above, SR11, and TR11, **the king** is an expression of category T with features <s, m, h, 3, ∅, 1, 1> and translation

$$\lambda P({}^{\vee}P(\mathrm{the}'({}^{\wedge}\mathrm{king}'))\wedge \mathrm{the}'({}^{\wedge}\mathrm{king}')\neq o).$$

(v) By SR11 and TR11, **he**$_2$ is an expression of category T with features <s, m, h, 3, {<2,s,m,h,3>}, 0, 0> and translation

$\lambda P({}^{\vee}P(v_{-2,e}) \wedge v_{-2,e}\neq o)$.

(vi) By (v) above, SR1, and TR1, **love the him**$_2$ is an expression of category VI with features <x, x, x, x, {<2,s,m,h,3>}, 1, 1> and translation

$\text{love'}(\lambda P({}^{\vee}P(v_{-2,e}) \wedge v_{-2,e}\neq o))$

(vii) By (vi) above, SR9, and TR9, **loves the him**$_2$ is an expression of category VI with features <s, x, h, 3, {<2,s,m,h,3>}, 1, 1> and translation

$\text{love'}(\lambda P({}^{\vee}P(v_{-2,e}) \wedge v_{-2,e}\neq o))$.

(viii) By definition, the translation given in (vii) above is equivalent to

$\text{love'}_{\blacklozenge}(v_{-2,e})$.

(ix) By SR3 and TR3, **every country** is an expression of category T with features <s, x, i, 3, ∅, 0, 1> and translation

$\lambda P\lambda Q(\forall x[[\text{At}(x)\wedge{}^{\vee}P(x)]\rightarrow{}^{\vee}Q(x)])({}^{\wedge}\text{country'})$.

(x) By (viii) and (ii) above, SR2, and TR2, **some child loves him**$_2$ is an expression of category t with features <s, x, h, 3, {<2,s,m,h,3>}, 1, 1> and a translation equivalent to

$\lambda P\lambda Q(\exists x[{}^{\vee}P(x)\wedge{}^{\vee}Q(x)\wedge x\neq o])({}^{\wedge}\text{child'})({}^{\wedge}\text{love'}_{\blacklozenge}(v_{-2,e}))$.

(xi) By standard rules of manipulation and MP2, the translation given in (x) above is equivalent to

$\exists x[\text{child'}(x)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(x)]$.

(xii) By (i) and (xi) above, SR7, and TR7, **in it$_1$ some child loves him$_2$** is an expression of category t with features <s, x, i, 3, {<1,s,x,i,3>, <2,s,m,h,3>}, 0, 0> and translation

$$\text{in'}_{\blacklozenge}(v_{-1,e})({}^{\wedge}\exists x[\text{child'}(x)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(x)])$$

(xiii) Bi (ix) and (xii) above, SR13, and TR13, **in every country some child loves him$_2$** is an expression of category t with features <s, x, i, 3, {<2,s,m,h,3>}, 0, 0> and translation

$$\lambda P\lambda Q(\forall x[[\text{At}(x)\wedge{}^{\vee}P(x)]\rightarrow{}^{\vee}Q(x)])({}^{\wedge}\text{country'})({}^{\wedge}\lambda v_{-1,e}(\text{in'}_{\blacklozenge}(v_{-1,e})({}^{\wedge}\exists x[\text{child'}(x)\wedge$$

$$\text{love'}_{\blacklozenge}(v_{-2,e})(x)])))$$

(xiv) The translation given in (xiii) above can be simplified to

$$\forall x[[\text{At}(x)\wedge\text{country'}(x)]\rightarrow(\text{in'}_{\blacklozenge}(x)({}^{\wedge}\exists y[\text{child'}(y)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(y)]))]$$

(xv) By (xiv) and (iv) above, SR13, and TR13 **in every country some child loves the king** is an expression of category t with features <s, x, i, 3, Ø, 0, 0> and a translation equivalent to

$$\lambda P({}^{\vee}P(\text{the'}({}^{\wedge}\text{king'}))\wedge\text{the'}({}^{\wedge}\text{king'})\neq o)({}^{\wedge}\lambda v_{-2,e}(\forall x[[\text{At}(x)\wedge\text{country'}(x)]\rightarrow$$

$$(\text{in'}_{\blacklozenge}(x)({}^{\wedge}\exists y[\text{child'}(y)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(y)]))]))$$

(xvi) By standard rules of manipulation, the translation given in (xv) above is equivalent to

$$\lambda v_{-2,e}(\forall x[[\text{At}(x)\wedge\text{country'}(x)]\rightarrow(\text{in'}_{\blacklozenge}(x)({}^{\wedge}\exists y[\text{child'}(y)\wedge\text{love'}_{\blacklozenge}(v_{-2,e})(y)]))])(\text{the'}({}^{\wedge}\text{king'}))$$

$$\wedge\ \text{the'}({}^{\wedge}\text{king'})\neq o.$$

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