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# Constituting reference in natural language: the problem of referential opacity

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I declare that this thesis has been
composed by myself and that the research
reported herein has been conducted by
myself unless otherwise indicated.

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Yet what a noble role the 'relation between the name and the object named' has played in the eyes of certain philosophers! As if there were an invisible magical connection between the name and the object. There comes a point when a philosopher stares at the object, saying its name over to himself, and trying to elucidate the secret link which joins the object to the name. (Waismann 1965:199)

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## ABSTRACT

Reference is of fundamental importance in natural language semantics. In Formal Semantics, reference is regarded as an absolute relation between expressions and referents. Thus construed, reference is independent of the cognitive states of processors.

Various Formal theories of reference are examined. We review the solutions which these theories offer to the referential problems associated with 'Opaque Contexts'. Such problems must be resolved if the Formal concept of reference is to be maintained.

Formal explanations of other referential phenomena are also examined, viz. 'specificity', 'expressive responsibility', and 'referentiality'. The thesis demonstrates that certain paradoxes arise as a result of using the same logical apparatus to describe all of these separate phenomena.

It is argued that reference is not an absolute and invariant relation in language. Despite this claim, it is argued that a theory of the effectiveness of referential acts is still possible.

A system of referential description is presented that represents crucial aspects of the process of

performing and understanding referential acts. It is proposed that generating and interpreting natural language is best explained as a process of constructing cognitive models. The elements involved in constructing such models indicate that the state of a language processor is the most important determinant of the mechanics of the referential act.

The apparatus embodied in the system is used to explain 'specificity', 'expressive responsibility', etc., without recourse to the logical apparatus of scope. The system is also deployed in the analysis of discourse data. This data is derived from a task in which the participants, initially, do not have equal knowledge about the likely objects of discourse reference. The analysis reveals that referential expressions are constructed, used and interpreted, modulo the intentional states of the processors. These states include; the kinds of high-level 'resource allocation' strategies that are in force at any point in the discourse, the beliefs processor's have about the domain of discourse, and the beliefs they have about the beliefs of their fellow interlocutors.

## LIST OF ABBREVIATIONS AND SYMBOLS

The representation of certain logical symbols is as detailed in the translation table below. The right hand column is a description of the logical symbol; the left hand column gives the corresponding rpresentation used throughout this thesis.

| Symbol | Symbol Description |
|---|---|
| alpha | greek lower case alpha |
| beta | greek lower case beta |
| gamma | greek lower case gamma |
| delta | greek lower case delta |
| PHI | greek upper case phi |
| PSI | greek upper case psi |
| NOT | logical negation |
| POSS | logiacl modality possibly |
| <--> | logical equivalence operator |
| --> | logical conditional |
| & | logical conjunction |
| v | logical inclusive or |
| V | universal quantifier |
| E | existential quantifier |
| ¦[ | left semantic value bracket |
| ]¦ | right semantic value bracket |
| -in-set- | set inclusion |
| -not-in- | set exclusion |
| .: | up movement, with .:1:. superscript |
| :. | down movement, with :.1.: subscript |
| w,t | world time indices |
| w,t' | " |
| w',t | " |
| w1,t1 | " |
| w1,t2 | " |
| w1,t3 | " |
| w2,t1 | " |
| w2,t2 | " |
| w2,t3 | " |
| M | Model M |
| g | Assignment of values to variables g |
| => | variable is assigned value |
| P¯ | variable over predicates |
| Q¯ | variable over predicates |
| ? | lambda operator |

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A philosophical problem has the form: 'I don't know my way about' L.Wittgenstein Philosophical Investigations 123

## INTRODUCTION

By Wittgenstein's criterion this thesis starts with a philosophical puzzle. When I looked at the phenomenon of reference in language I became very unsure of 'my way about'. Reference has been approached from many directions; formal semantics, linguistics, psychology and artificial intelligence. This has produced different terminologies, different starting premises and different ideas about which paradigm really captures the essential elements of referential machinery.

Of course, one can make the point that no approach can monopolise the phenomenon, but this is too easy to say and much harder to translate into a productive, eclectic effort. Nevertheless the ultimate account must be interdisciplinary, and it is the job of the 'cognitive scientist' to attempt to regiment and integrate data and insights from different contributing fields.

However, it became clear, early on, that there are two basic views of reference currently in circulation. They have their roots in fundamentally different views of what meaning in natural language is.

One of these positions, the position occupied by formal semantics, has it that structural rules of syntax and semantics determine the meaning of sentences in a language by determining their truth conditions. Moreover, to have mastery of how these rules determine truth conditions is in a significant sense to understand the language.

Against this is the view I have characterised as Intentionalist. The Intentionalists argue that it is impossible to give an adequate account of the concept of meaning without appeal to the possession by speakers of audience directed intentions of various sorts. Language is an audience directed communicative activity. Scholars such as Austin, Grice and Searle claim that meaning can only be understood in terms of speakers' beliefs and intentions, because it is intentions that inform and direct acts of communication in specific contexts of social interaction involving discourse (Footnote 1).

Footnote 1. This is not to say, that a truth theory is absent from Intentionalist accounts of semantics. Although, the role it plays, the nature of the 'truth' predicate invoked, varies across Intentionalist theories. We shall be discussing the nature and place of 'truth' in an Intentionalist theory in later chapters.

The Formalists argue that the Intentionalists are over-impressed by the concept of intended communication. Whilst there may be regularities between what intentions lie behind a speaker's use of a sentence and what the sentence conventionally means, the underlying system of syntactic and semantic rules is not a system for communicating at all, although it may be incidentally used for this purpose.

Such a fundamental difference in opinion has, as I indicated, resulted in two very different views of reference in language.

## TWO VIEWS OF REFERENCE

Reference is, logicians argue, a relation between expressions in a language and elements in a world or model. Accordingly, when a world is constructed model-theoretically, the reference or extension of a singular term is an object, that of an n-place predicate a set of n-tuples of objects and that of a sentence a truth value. I will refer to this as the Principle of Extensional Reference.

To provide a coherent semantics, logicians require that the fundamental relations of reference between expressions in a language and the set theoretic objects in the model are fixed and independent of language users.

I will call this the Principle of Invariance of Reference.

Together the principles of extensionality and invariance form the core of an 'absolute theory of reference'.

The view of reference I want to contrast with the absolute one outlined above can be seen as related to an Intentionalist view of meaning. It derives most of its content from the claim that the fundamental principle behind a theory of reference for natural language ought to be a Principle of Context. The Principle would require the following as essential considerations in any account of reference in natural language:

> language understanding and generation takes place in linguistic processors
>
> linguistic processors are in complex internal and external states
>
> external processor states include at least the following; time, place, audience etc.
>
> internal processor states include at least; desires, goals, needs, memory states, beliefs etc.
>
> internal processor states sometimes represent the internal states of other processors (eg we have beliefs about the beliefs and internal states of others)
>
> linguistic processors perform audience directed linguistic and communicative acts

The 'intentional' view of reference construes all issues involving reference as involving language processors. Linguistic expressions in themselves are not held to refer. A definite description like 'the Departmental noticeboard' lacks reference unless it is invested with reference through a particular speaker's use of it.

> referring is not something an expression does; it is something that someone can use an expression to do. (P.F.Strawson 1950)

> reference is a speech act, and speech acts are performed by speakers in uttering words, not by words. (J.R.Searle 1969)

This thesis is an attempt to support an Intentionalist Processor oriented view of reference in language. I am not seeking to 'take on' logic, logic always has the formal capacity to model coherent and consistent theories. What I do want to claim is that the standard logical accounts of reference fail to highlight crucial aspects of the phenomenon as it occurs in natural language.

## REFERENTIAL OPACITY

The mass of problems surrounding the nature of reference has a long history and has generated a huge literature. I realised that in 'beginning to find my way' it would be wise to concentrate on a particular issue in the referential literature. I chose the area of 'referential opacity'. This is a problem of particular interest since it has largely preoccupied the Formalists, to whom it presents a serious threat, whilst Intentionalists have considered the issue to be largely a product of the Formalists making and not one they need be agitated by. My claim will be that , ironically, the phenomenon, properly understood, reveals cogent reasons for adopting an Intentional Process view of reference.

As a preliminary introduction to the problem of referential opacity we can say that since, for the Formalist, reference is often construed as a relation between words and those things in the world that give them meaning, any situation in which language seems to loose its grip on these referents is bound to be worrisome.

Referential opacity has been held to arise in contexts that are traditionally regarded as created by such explicit language terms as the adverbs 'necessarily', 'possibly'; the verbs 'hope', 'seek', 'want', 'believe', 'regret'; or tense-like modal operators such as 'will'. These contexts are known as intensional contexts (Footnote 2).

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Footnote 2. In this thesis I will be dealing with that set of intensional-context-creating operators known as the verbs of propositional attitude, examples are 'believe', 'think', 'assert', 'deny','heard','said' etc.

To see exactly why these contexts are problematic for the Formalist we must briefly consider in more detail the Formalists' programme. In formal semantics the aim is to produce for a language:

1. A characterization of the admissible sentences
2. An interpretation for the well-formed formulas
3. Laws of inference that determine the entailments of sentences

In this enterprise the syntax of a language is involved in a crucial way. First a set of recursive syntactic rules are given, these define the set of well-formed formulas (wffs), starting with the smallest, primitive elements and specifying how units of various categories can be combined to form larger units.

In developing the semantic theory the Formalist usually adheres to a Principle of Compositionality (Footnote 3). The Compositionality Principle begins with the supposition that each basic expression of the syntax is associated with something in that world or model the language is being interpreted against, be it an individual object, a relation or whatever. This correspondence of basic syntactic expressions with things

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This restriction is to enable me to concentrate on the problems of reference in 'belief contexts' rather than being sidetracked by the additional problems that surround modals, adverbs and various other types of intensional operator.

Footnote 3. This is not to say that Intentional theorists do not subscribe to some form of Compositionality thesis.

in the world or model is the first stage in the construction of a semantics, and we can recognise in this the fixing of the absolute referential relations of the language. The elements of the world or model are effectively the referential semantic values of the basic syntactic expressions (Footnote 4).

The next stage in following Compositionality is to produce syntactic and semantic rules of combination that take as their inputs various smaller expressions and produce as outputs more complex expressions constituted out of the more basic expressions. The formalist can then arrange a situation such that each syntactic rule of combination R, taking as inputs various smaller expressions and producing as output more complex expressions, has a corresponding semantic rule R' which takes as the input the semantic values of the smaller syntactic expressions and gives as output something which is the semantic value of the more complex syntactic expression generated by R. If the syntax and semantics are made to operate in tandem like this each sentence and each well-formed constituent will have a semantic value.

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Footnote 4. This is true of certain systems of formal semantics, we shall see, however, that in others, for example, Possible World semantics, the story is more complex than this.

In simple extensional formal languages the semantic values, assigned by the reference fixing assignment, given to basic expressions of the language are; objects to constants and sets of objects to predicates. These are the referents or denotations of these language terms. Full sentences are given truth values as their semantic values and denotations.

This adherence to the Principle of Compositionality means, in these languages, that the semantic value of the whole sentence is rigorously determined by the semantic value of its parts and the syntactic combination of these parts. But such a simple way of assigning an interpretation and ascertaining semantic value will not succeed for natural language.

To illustrate this point imagine we did try a simple extensional interpretation for natural language. Now consider the sentence triple (1)-(3);

(1) Cicero is Tully

(2) Claudius believes that Cicero denounced Catiline

(3) Claudius believes that Tully denounced Catiline

In such a case the denotation of the singular terms would be just those objects they named. Thus we might say the denotation of the proper name 'Cicero' was the individual Cicero, as was the denotation of the proper name 'Tully'

(Footnote 5).

There is a rule in ordinary formal extensional languages which states that two expressions of the language may be substituted for one another freely if they denote the same object. If this is accepted then for these languages the truth functional evaluation of the substitutans will not be different from the substitutandum (Footnote 6).

We can lay down this rule formally as in (4). We are to understand (4) as asserting that if the expressions 'a' and 'b' are identical (in the sense that they stand for the same object, set of objects etc.) then the formula of the language 'Fa\b' is equivalent in its semantic value to 'F'

(4) $a = b \rightarrow [\ F \leftrightarrow Fa\backslash b\ ]$

where 'Fa\b' is understood as substituting in 'F', 'b' for all free occurrences of the expression 'a'.

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Footnote 5. Throughout this thesis I have adopted the convention of placing the referring expressions themselves in single quotation marks, and the referents of these phrases are underscored.

Footnote 6. This test of substitutibility is one of two generally used to detect for the presence of Intensional contexts. The other is the failure of existential generalisation, exemplified in sentence (i). Once again this is a violation of a canon of extensional languages; in extensional languages the introduction of an existentially quantified noun-phrase implies the existence of an object satisfying the expression.

(i) Claudius believes a dryad broke his mirror.

This rule does not hold for English, (2) might be true and (3) false. In other words Cladius might believe and be rational about identity criteria, but not know that the Cicero of the orations and the Tully of 'De Senectute' were the same person. This problem holds generally for singular terms.

To summarise, the model of reference the Formalist, as characterised, advocates is that the referents of the singular terms in (1)-(3) are the objects named, thus the referents of the sentences (2)&(3) (i.e the respective truth values) should be the same. This not being necessarily so, the Formalist is pressed to explain why referential compositionality has broken down in natural language.

THESIS OUTLINE

The outline of this thesis, then, is as follows. The first part describes the development of the most influential Formalist approach to the problem of Intensional contexts. I indicate how, throughout, the approach has always embodied, at its base, the kind of Formalist theory of reference I have characterised. In the next part of the thesis I discuss certain problems that beset the Formalist's account of reference in natural language. I discuss how a 'non-absolute' view of reference can still suffice to secure 'communicative success' in our language. I then go on to introduce my proposals for a system that attempts to relieve some of the particular problems manifested by the Formalist theory I have been reviewing. My proposals require the introduction of processors and their intentional states. I make the point that analysing referential opacity in such a way reveals language to be in a certain sense 'radically opaque'. The system predicts that using language, whether in referential or other communicative acts is a 'risky' business and that misinterpretation will occur more often than a formal theory would predict. Finally I present the results of some discourse analysis work that supports an Intentional view of reference. The analysis relies heavily on apparatus embodied in the system of referential description developed earlier in this thesis.

# CHAPTER ONE FORMAL PERSPECTIVES ON REFERENCE AND OPACITY

## SECTION ONE FREGEAN SEMANTICS

Gottlobb Frege (1848-1925) was the first philosopher to formally investigate intensional phenomena. It is his celebrated distinction between sense and reference that will be of most relevance to this thesis.

For Frege the relation of reference secured the content of what we talk about. Frege held that the referents of proper names and complex descriptions are objects in the world. Frege makes the strong realist claim that in ordinary language what we talk *about* are objects in the real world. Frege also adhered in his semantic work to the Principle of Compositionality; the meaning of a sentence is rigorously determined by the meaning of its parts.

I said in the introduction, that the verbs of propositional attitude threaten this elegant account of reference and semantic compositionality.

Suppose we say, using examples similar to (1)-(3), that in (1.1)-(1.4) the referent of the terms 'the Morning Star' and 'the Evening Star' is the planet Venus.

The semantic values of (1.3) and (1.4) now look identical- these sentences are composed out of elements that are <u>about</u> the same things. But we know that (1.4) may be false and (1.3) true. How is this possible?

(1.1) The Morning Star is 7800 miles in diameter.

(1.2) The Morning Star is the Evening Star.

(1.3) Beverly believes the Morning Star is the Morning Star.

(1.4) Beverly believes the Morning Star is the Evening Star.

Frege's solution is simple, within opaque contexts descriptions do not have their normal referents. Within opaque contexts descriptions have as their referents objects called senses. In cases such as (1.3) and (1.4), Frege would say that the senses of the descriptions 'the Morning Star' and 'the Evening Star' can be different. Compositionality is saved because the semantic values associated with (1.4) and (1.3) need not be the same, to be the same the senses of the two descriptions would have had to have been identical.

This solution applies quite generally, not just to proper names and descriptions. Consequently a whole sentence occurring within an opaque context must be construed as not having customary reference (its truth value) but indirect reference (the sense it expresses (Footnote 1.1)).

Footnote 1.1. Frege called the senses of sentences

(1.5) Barry Smith plays rugby.

(1.6) Barry Smith lives at 29 Restalrig Terrace.

(1.7) Dr Gordon Baker believes that Barry Smith plays rugby.

(1.8) Dr Gordon Baker believes that Barry Smith lives at 29 Restalrig Terrace.

We can illustrate this using arguments analogous to those presented in examples (1.1)-(1.4). Suppose (1.5) and (1.6) are true- that is they have the same referent, the truth value 'true'. Notwithstanding, we do not want to say that substituting one for another in a complex pair of sentences such as (1.7) and (1.8) will preserve the truth values of these complex sentences.

The Fregean solution is to assert that Dr Baker's beliefs are not <u>about</u> truth values but senses. The senses of (1.5) and (1.6) are allowed to be different whilst there reference may be the same. Consequently, the complex sentences into which they are substituted need not have the same semantic values. There is compositionality of sense as well as reference.

Frege, by considering what substitutes are possible without change of truth-value in opaque contexts, was forced to conclude that we need an additional level of semantic theory; we need a theory of sense. But what is

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'thoughts'.

sense?

> We can think of the theory of [reference](Footnote 1.2), very generally as concerned with the relations between expressions of the language and entities in the world. Now, Frege came to see the need for another level of description and theory which is concerned, we might with equal generality say, with relations between expressions of the language and the understanding competent speakers have of them. He found it necessary to recognise the possibility of an objective semantic difference between two expressions not distinguishable by the theory of reference [...] - this difference having to do with the different ways in which the expressions are to be understood by competent speakers, these different ways in turn ultimately resting upon the different thoughts and propositional attitudes that competent speakers will have on hearing and understanding sentences containing the two expressions. (Evans 1982:13)

The sense of an expression seems to be the <u>means</u> by which a referent of an appropriate kind is determined for the expression. Though reference has a vital role in a theory of meaning, our understanding of a word or complex expression can never consist merely in associating word and object. There must be a means by which this association is grasped, by which sense is grasped. Frege himself in talking of sense used the metaphor of a route from the word to a referent. In opaque contexts what we are talking <u>about</u> are senses- we are talking about the

Footnote 1.2 . Evans actually uses the term 'Meaning' for reference, He is using the term 'Meaning' with this particular technical sense.

method by which a normal referent is identified. Sense is always present- within opaque contexts sense becomes the referent of language, it is what we are talking about.

The concept of sense renders another semantic problem tractable. How is it that certain statements of identity, such as (1.9) and (1.10), be informative?

(1.9) The Morning Star is the Evening Star.

(1.10) Cicero is Tully.

There is no more pungent account of the problem and its perceived solution than the one Frege gives himself in a letter he wrote to Philip Jourdain.

> Let us suppose that an explorer travelling in an unexplored country sees a high snow-capped mountain on the Northern horizon. By making inquiries among the natives he learns that its name is 'Aphla'. By sighting it from different points he determines its position as exactly as possible, enters it on his map, and writes in his diary: 'Aphla at least 5000 metres high'. Another explorer sees a snow-capped mountain on the Southern horizon and learns that it is called Ateb. He enters it on his map under that name. Later comparison shows that both explorers saw the same mountain. Now the content of the proposition 'Ateb is Aphla' is far from being a mere consequence of identity, but contains a valuable piece of geographical knowledge. What is stated in the proposition 'Ateb is Aphla' is certainly not the same thing as the content of the proposition 'Ateb is Ateb'. Now if what corresponds to the name 'Aphla' as a part of the thought was the referent of the name and hence the mountain itself then this would be the same in both thoughts. The thought expressed in 'Ateb is Aphla'

> would have to correspond to the one 'Ateb is Ateb', which is far from being the case. What corresponds to the name 'Ateb' as part of the thought must therefore be different from what corresponds to the name 'Aphla' as part of the thought. This cannot therefore be the reference which is the same for both names, but must be something which is different in the two cases, and I say accordingly that the sense of the name 'Ateb' is different from the sense of the name 'Aphla'. Accordingly, the sense of the proposition, 'Ateb is at least 5000 metres high' is also different from the sense of the proposition 'Aphla is at least 5000 metres high'. Someone who takes the later to be true need not therefore take the former to be true. An object can be determined in different ways, and every one of these ways of determining it can give rise to a special name and these different names then have different senses, for it is not self-evident that it is the same object which is being determined in different ways. We find this in astronomy in the case of the planetoids and comets. Now if the sense of a name was something subjective, then the sense of the proposition in which the name occurs, and hence the thought, would also be something subjective, and the thought one connects with this proposition would be different from the thought another man connects with it; a common store of thoughts, a common science would be impossible. It would be impossible for something a man said to contradict what another man said, because the two would not express the same thought at all, but each his own.
>
> For these reasons I believe that the sense of a name is not something subjective [crossed out: in one's mental life], that it does not therefore belong to psychology, and that it is indispensable (Frege, in Gabriel et al 1980:80).

Frege argues that the sense of a proper name such as 'Ateb' cannot consist in its having the reference it does. We need a second semantic element- the element of sense. In appealing to arguments about informational content Frege is explicitly linking the notion of sense and knowledge.

Since sense seems to have to do with information we might suppose that Frege belongs to a cognitivist tradition. However, a moments reflection on the passage quoted reveals the anti-cognitivist nature of Fregean sense. He outlines his objections forcefully. Objective sense is forced on us since we require an objective science and an account of why we can recognise and agree on a certain class of assertions as true. This requirement is constantly reiterated in Frege's writings.

> Whenever anyone recognises something to be true, he makes a judgement. What he recognises to be true is a thought (ie sense of a sentence). It is impossible to recognise a thought as true before it has been grasped. A true thought was true before it was grasped by anyone. A thought does not have to be owned by anyone. The same thought can be grasped by several people. Making a judgement does not alter the thought that is recognised to be true. (Frege 1915, in Hermes et al 1979:251)

Frege argues that what is recognizable in that class of sentences we agree to assent to, is the objective fact of sense. Moreover, in so far as sentential senses are functions of their constituent senses, then the constituent senses can no more be subjective than sentential ones.

In his letter to Jourdain Frege writes, 'An object can be determined in different ways, and every one of these ways of determining it can give rise to a special name and [..] these names then have different senses'. Is this really commensurable with what he writes a few lines later. 'I believe that the sense of a name is not something subjective'?

Surely people can come through different methods and contexts of presentations of objects to develop separate senses. These may be very particular and highly idiosyncratic. How can senses avoid the taint of subjectivity? How can there be any appropriate or correct way to characterise the sense of words?

Frege seems perfectly aware of the variation in sense attached, by different individuals or at different times, to the same expression. He also is sensitive to the fact that the senses so attached are often vague and indeterminate.

We might say that Frege's reaction was to see this haziness of sense in language as a defect. The lack of precision and ambiguity in language should be banished so as to achieve the logical clarity he sought. Dummett writes:

> The picture of language which Frege employs in discussing sense is that in which each logically simple expression of

> the language is introduced or explained, whether by means of definition or (since it is impossible that every expression be defined) by some other means, without room for variation, to each person when he first becomes familiar with its use. (Dummett 1981a:105)

Frege's response to the failure of natural language practice to meet this demand was to declare our practice defective.

At the very least the picture presented so far of Frege's notion of sense with its radically anti-psychologistic nature procures it a curious ontological status. There is nothing much that can be done with a sense except grasp it, subsequently to express it and so convey it to other in the linguistic community.

However, it is one thing to feel uncomfortable with Frege's ideas but if we reject them we are obliged to account for those semantic facts which Frege's theory of meaning render tractable.

Before leaving Frege I will outline his views on the classes of nominal expression with which I will be particularly concerned throughout this thesis. These are, proper names, definite descriptions and indefinite expressions. These three categories of expression are especially important in the reference literature because of the various claims made, and explanations given, of whether and how such expressions might refer.

Frege uses the term 'proper name' to talk both of ordinary names (such as 'Alexander', 'Berlin' etc.) and definite descriptions (such as 'the moon', 'the horse that carried Napoleon at Austerlitz' etc.). A proper name for Frege is any expression that refers to a definite object.

> It is clear from the context that by ... name I have understood any designator figuring as a proper name, which has as its meaning a definite object... The designator of a single object can also consist of several words or other signs. For brevity let every such designator be called a proper name. (Frege 1892a, in Geach et al 1980:57)

> the singular definite article always indicates an object. (Frege 1892b, in Geach et al 1980:57)

The senses of ordinary names and definite descriptions are placed in a close correspondence by Frege

> The sense of a proper name is grasped by anybody who is sufficiently familiar with the language or totality of designations to which it belongs; but this serves to illuminate only a single aspect of the thing meant, supposing it to have one. Comprehensive knowledge of the thing meant would require us to be able to say immediately whether any given sense attaches to it. To such knowledge we never attain. (Frege 1892a, in Geach et al 1980:57)

Frege goes on, in a footnote to the article from which the above quote comes, to describe the case of ordinary names as we might use them. He allows a surprising tolerance in this passage given that one constant objection he brings to the identification of the sense of expressions with their associated ideas is that this would allow sense to vary from person to person.

> In the case of an actual proper name such as 'Aristotle' opinions as to the sense may differ. It might, for instance, be taken to be the following: the pupil of Plato and teacher of Alexander the Great. Anybody who does this will attach another sense to the sentence 'Aristotle was born in Stagira' than will a man who takes as the sense of the name: the teacher of Alexander the Great who was born in Stagira. So long as the thing meant remains the same, such variations of sense may be tolerated, although they are to be avoided in the theoretical structure of a demonstrative science and ought not to occur in a perfect language. (Frege 1892a, in Geach et al 1980:58)

Frege held that objects are the referents of proper names. Moreover, only one object can be designated by each such name. However, more than one object can fall under a concept (the referent of a predicate). Thus a concept such as 'moon of Venus', or 'horse drawing the Queen's carriage' can have a number, the number of objects forming the extension of the concept. Concept signs, Frege maintained, can become names of objects, by being conjoined with a deictic expression or the definite article (eg 'The horse that carried Napoleon at

Austerlitz', 'This horse...' etc.) But in this case they are no longer functioning as concept signs. Moreover, a concept sign does not become a proper name merely because its extension happens to comprise of exactly one object. Thus 'moon of Earth' is a concept sign and not a proper name.

Frege also held that concept signs do not form proper names when combined with the indefinite article 'a'. Dummett (1981a:59) formulates the kind of criteria that Frege would have adopted in distinguishing whether or not an expression is a proper name in a particular context.

Dummett argues that it is a necessary condition for an expression, say 'h', to be a Fregean proper name (denote an object) that we should be able to infer from a sentence containing it the result of replacing in that sentence the expression 'h' by the word 'something'. To rule out the inference of (1.12) from (1.11) we add the requirement that we reframe the inference as (1.13) from (1.11).

(1.11) If Thatcher wins, we shall be out of work.

(1.12) If something wins, we shall be out of work.

(1.13) There is something such that if it wins, we shall be out of work.

The expression 'something' itself is taken not to refer for the very good reason that from (1.14) and (1.15) we cannot infer (1.16). Thus a further requirement is attached to the rule to detect proper names- from two sentences containing the alleged proper name 'S1(h)' and 'S2(h)' it should be possible to infer 'There is something such that S1(it) and S2(it)'. This rules out, as it should on a Fregean account, any case of naming in the indefinite expressions occurring in (1.17) and (1.18).

(1.14) Something raced past the barn.

(1.15) Something raced past the cottage.

(1.16) There is something such that it raced passed the barn and the cottage.

(1.17) A horse raced past the barn.

(1.18) A horse raced past the cottage.

It should be pointed out that a long tradition in formal semantics, which has also come to dominate linguistic attitudes, is to associate the indefinite article 'a' with the semantics of the existential quantifier 'Ex..'. This quantifier can be informally glossed as 'There exists something such that..'. Thus 'Ex(Man(x))' is usually understood as being equivalent to a form of words such as 'There exists an x such that x has the property of being a man'. Frege as the founder of quantification theory was also the first to identify the logical existential operator with the indefinite article of natural language.

> 'someone falling under the concept man' means the same as 'a man' (Frege 1892b, in Geach et al 1980:47).

The correctness of such an identification will be the subject of further discussion in this thesis (cf Chapter 7).

One of the main accomplishments of Frege and his formal semantic heirs lies in the provision of a recursive definition of the truth definitions of sentences of certain languages. This requires a rigorous definition of the truth conditions of all the complex sentences in terms of the truth conditions of the simpler sentences of which they are composed, and ultimately in terms of a set of basic assignment of objects to expressions and sets of objects to predicates etc. The existence in natural languages of opaque contexts threatens the success of such a simple and elegant recursive programme. Frege pointed the way to a means of saving the compositionality principle for reference.

For those Formalists sympathetic to Frege's semantic proposals two things had to be done:

1. formalise the notion of sense (the formal notion of sense was termed intension by Carnap (1947))

2. establish formal criteria to

distinguish when an expression normally denotes and when it denotes its sense.

Before discussing how these two desiderata were realised I want to look at a logical alternative to the Fregean proposals. It was advanced only a few years after Frege's and it claimed that a theory of reference exhausted the semantic content of language.

## SECTION TWO RUSSELLIAN SEMANTICS

Bertrand Russell (1872-1970) took up many of the issues Frege had raised about the semantic analysis of natural language.

Certainly with regard to the question 'What is referring?' Russell and Frege held similar views. Reference was the relation between an expression of the language and a designated object. The relation of reference thus underpinned for Russell and Frege the possibility of a theory of meaning.

But contra Frege, Russell held that referring expressions can only 'mean' by virtue of the objects they designate. Russell's Theory of Meaning makes no provision for sense.

In his 1905 article 'On denoting' Russell presented a new analysis of what he called 'denoting phrases'. Such denoting phrases include, 'a man', 'some man', 'every man', 'all men', 'the present Queen of England', 'the present King of France', 'the mass of the solar system at the first instant of the twentieth century', 'the revolution of the Sun round the Earth' etc. These denoting phrases are characterised purely in virtue of their form.

Russell distinguishes three cases within the class of denoting phrases.

1 A phrase may be denoting but not denote anything, eg 'the present King of France'.

2 A phrase may denote a definite object, eg 'the present Queen of England'.

3 A phrase may denote ambiguously, eg 'a man'.

Russell's Theory of Descriptions starts from the premise that denoting phrases do not reveal their actual logical form. In this respect denoting phrases such as 'the present King of France' are misleading natural language 'shorthand'. A shorthand that induces a <u>mistaken</u> perception of denoting phrases as subject terms. Russell analyses sentences containing denoting phrases as complex existential statements. A sentence like (1.19) is equivalent to the conjunction of the following three sentences:

(1.19) The present King of France is bald

(1.19a) There is at least one present King of France.

(1.19b) At most one person is presently King of France.

(1.19c) That person is bald.

We can symbolise the conjunction of these three sentences in the predicate calculus representation (1.19').

(1.19') (Ex)(F(x) & (y)(F(y) -> x=y) & G(x))

where 'F' is the predicate 'King of France' and 'G' the predicate 'is bald'.

Notice that all of (1.19a), (1.19b), and (1.19c) except the last two words of (1.19c) are in effect the original denoting phrase 'the present King of France'. Notice also that since (1.19a) is false the entire conjunction which is the analysis of (1.19) is false, but certainly not meaningless.

What struck Russell about his analysis was that the denoting phrase had expanded in such a way that the denoting phrase has disappeared upon logical analysis into quantified variables and predicates. Denoting phrases, on analysis, do not denote at all. Obviously, Russell's Theory of Descriptions depends upon a background theory of quantification. Russell defines 'the x' by means of

(a) the existential quantifier 'some x'

(b) the idea of 'not more than one x', which he defines in terms of the universal quantifier and identity.

Russell saw his theory of descriptions as demonstrating a radical difference between names and descriptions. This enables him to give an alternative explanation of the informativeness of identity statements to that provided by Frege. Russell recast the identity problem in the following amusing way:

> George IV wished to know whether Scott was the author of _Waverley_ ; and in fact Scott _was_ the author of _Waverley_. Hence we may substitute _Scott_ for _the author of 'Waverley'_, and thereby prove that George IV wished to know whether Scott was Scott. Yet an interest in the Law of Identity can hardly be attributed to the first gentleman of Europe. (Ibid;47-48)

Russell's solution to this absurdity was to assert that of course George IV did not wish to know whether Scott was Scott. What George IV did want to know was given that one and only one person authored Waverley was Scott that person. The point is that being the 'author of Waverley' does not, like 'Scott', get its meaning by naming, but in this indirect way by description. A name and a description that identify the same person cannot, therefore in general be substituted for each other. Russell's Theory of Descriptions makes it logically transparent why not.

But once embarked on this style of analysis what is Russell to say of identity statements such as (1.10) cited previously in this chapter.

(1.10) Cicero is Tully.

His response must be that these are not really proper names but disguised denoting phrases. Russell says explicitly that really proper names cannot be informative in the way (1.10) is.

> for the name itself is merely a means of pointing to the thing, and does not occur in what you are asserting, so that if one thing has two names, you make exactly the same assertion whichever of the names you use, provided they are really names <u>and not truncated descriptions</u>. (Russell: The philosophy of logical atomism, in Marsh 1956:245)

Russell was convinced that more often than not when proper names are used in <u>ordinary language</u> they are in fact truncated descriptions, these proper names are used as shorthand for more detailed meanings. Nevertheless, it is important to realise that for Russell the logical ideal underlying the distinction of descriptions and names is conceivable, even if it is not often approximated by the ordinary proper names of 'persons, places and things'. He came eventually to speak of logically proper names- names, that is, which pick out their referent without any description whatever.

Russell believed that logically proper names really get us to reality. And whereas logically proper names get us to reality directly, descriptive phrases only purport to. So how do 'denoting phrases' engage reality? If we suppose, with Russell, that a primary way of engaging reality is by naming or some variant of it then we must, show how 'denoting phrases' engage the world without being names.

To answer this problem Russell appeals to 'surrogate' names. Consider a description as in (1.20), the Theory of Descriptions would analyse this as in (1.21). We can think of 'x' as a 'deputy' proper name (Footnote 1.3). The variable 'x' together with the existential quantifier makes contact with 'reality' in the same radically simple manner as a logically proper name.

(1.20) The Prime Minister of Britain is a woman.

(1.21) (Ex)(P(x) & (y)(P(y) -> x=y) & W(x))

---

Footnote 1.3. This is similar to the logical device of Skolemisation. In the Predicate Calculus we are able to introduce new constant symbols, Skolem constants, in the place of the variables introduced by the existential quantifiers. Instead of saying that there exists an object with a certain set of properties, one can create a name for one such object and simply say that it has the properties. Skolemisation has the essential further property of guaranteeing that there is an interpretation for the symbols of a formula that makes the formula true if and only if there is an interpretation for the skolemised version of the formula.

The quantified variable, considered in isolation, is the logical device for making objective reference without any descriptive element (the descriptive elements are added by means of the logical symbols for the predicates). On this way of looking at the matter (1.20) conveys the proposition that two predicates '..is Prime Minister of Britain', '..is a woman', hang together in one term, call it 'x'. This we have distinguished the (deputy) naming and describing ingredients within the descriptive phrase.

Unfortunately, for Russell, quantification is not, and cannot be, genuine naming. Russell connects logical questions about reference and meaning with questions about epistemology.

> We must attach some meaning to the words we use, if we are to speak significantly and not utter mere noise; and the meaning we attach to our words must be something with which we are acquainted. (Russell 1912:32).

He must therefore deny naming to quantification because we do not have acquaintance with the object in question. It is not genuine naming because 'something' does not <u>pick out</u> an individual, it merely indicates that an individual or particular x, y, z...n is at issue. The quantified expression is not our route to <u>the individual</u>.

Grounding our descriptions in terms of acquaintance is a problem Russell never satisfactorily resolves. Even if he were to provide a compelling solution in the way outlined another problem immediately arises. The essential subjectivity of our immediate acquaintance of the world seems incompatible with objective meaning.

> When a person uses a word, he does not <u>mean</u> by it the same thing as another person <u>means</u> by it. I have often heard it said that this is a misfortune. That is a mistake. It would be absolutely fatal if people meant the same things by their words. It would make all intercourse impossible, and language the most hopeless and useless thing imaginable, because the meaning you attach to your words must depend on the nature of the objects you are acquainted with and since different people are acquainted with different objects, they would not be able to talk to each other unless they attached quite different meanings to their words (Russell 1918, in Marsh 1956:195).

This position seems directly contrary to the Fregean thesis of objective sense outlined in the last section. How can language, logic or science be used to assert, affirm or verify a common stock of truths on such a Russellian analysis? How can we effect a transition from the privacy of experience and the presumed privacy of language which depends on that experience to successful, public, communication?

Russell of course saw the problem. He was endeavouring to produce an heroic synthesis of language, logic, ontology and epistemology. In the end he was unable to reconcile the demands of a logical semantics with the subjective view of linguistic meaning which his epistemology required.

Frege legislated such a problem out of existence by de-psychologising meaning. He achieved his objective language semantics by placing 'meanings' or 'senses' out in the world quite apart from their referents.

As we shall see in the next section a later generation of logicians helped themselves to what they saw as the best of Frege and Russell.

## SECTION THREE INTENSIONAL SEMANTICS

Whilst it had been Russell's ambition to dispense with sense, other logicians attempted to develop and more fully formalise Frege's semantic theory.

I said at the end of Section One that any attempt to fully formalise Frege's programme, including his treatment of referential opacity, had to satisfy two desiderata:

1. formalise the notion of sense
2. establish criteria to distinguish when an expression directly refers and when it indirectly refers.

These desiderata where first considered by Carnap (1947) who coined the term 'intension' for his formalised notion of sense. And were subsequently developed by Church (1951), Kripke(1963) and Kaplan (1964). Montague in a series of papers (1968,1970a,1970b,1970c,1973) applied the resulting formal system to a substantial fragment of English.

An intension is a theoretical construct that does what a sense does; insofar as the sense of an expression is something that determines for any time, place and possible situation, the denotation of the expression in that time, place and situation (or in the case of a sentence, the truth value of the sentence in that time, place and situation).

Montague adopted the basic idea of using possible world semantics to define the notion of intensions for a formal language. Appeal to the notion of possible states of affairs had provided the ideas necessary for the development of co-ordinate semantics by Kripke (1959, 1963). He had suggested taking constructs he called 'possible worlds' as indices for modal logic semantics. Modal logic had its own set of opaque contexts to worry about. The logical operator 'Necessarily' (symbolised as 'NEC') is just such an opaque or intension creating operator. The truth of a sentence of the form 'NEC PHI' is not simply a function of the truth value of 'PHI'. Suppose it happens to be true in the actual world that the head of the linguistics department is the dean of the faculty of arts. Then (1.22) and (1.23) are both true, but (1.24) is true while (1.25) is false.

(1.22) The head of the linguistics department is the head of the linguistics department.

(1.23) The head of the linguistics department is the dean of the faculty of arts.

(1.24) Necessarily the head of the linguistics department is the head of the linguistics department.

(1.25) Necessarily the head of the linguistics department is the dean of the faculty of arts.

Such problems have a familiar look. It was the analysis of the semantics of the modal operators 'necessarily' and 'possibly' that provided, not only another motivation for formally characterising intension, but also an idea of what the apparatus might look like to do this.

The modal operators suggest very readily that we can think of the intension/sense of a sentence as a function from possible worlds to truth values. In each possible world the intension of a sentence assigns a truth value to that sentence. We can then define the intension of a sentence like (1.22) to be a function that assigns the value _true_ to that sentence in every possible world. The intension of a sentence like (1.23) will be a function that assigns _true_ to the sentence in some worlds, _false_ in others. The difference in these two intensions can then be made the basis for the solution to the substitutibility problem in (1.25). The expression 'PHI' in 'NEC PHI', say (1.24), has a different semantic value, different intension, than the expression 'PSI' in 'NEC PSI', say (1.25). So substitution of 'PSI' for 'PHI' in the frame 'NEC __' will not result in the same semantic values.

Along with possible worlds Montague added a further parameter relevant to the computation of formal intensions. He introduced point semantics that considered how denotations changed through time, effectively providing the capacity to handle certain tense phenomena in language. The truth value of a sentence containing a tensed verb depends not simply on the possible world in which the sentence is evaluated. The denotation of such a sentence also depends on the time instant that is chosen to designate the temporal present. Thus the truth value of (1.26) depends not only on the fact that the sentence is evaluated with respect to the actual world but also on the fact that the narrative present would have to be taken as sometime between 1837-1901 to make the sentence true.

(1.26) Queen Victoria reigns over Great Britain.

(1.27) John has beaten Jimmy. w1,t3

(1.28) John beats Jimmy. w1,t2

(1.29) John will beat Jimmy. w1,t1

In just the same way that a treatment of the semantics of a modal operator such as 'necessary' requires the denotation of formulas to be evaluated relative to possible worlds other than the actual one, so tense operators require other times than that understood as the narrative present to be taken into account. Consider the three sentences (1.27)-(1.29), (1.27) is true at w1 (world 1) and t3 (time 3) if and only if (1.28) is true at the world w1 at a time t2 earlier than t3.

Similarly, (1.29) is true at w1 and t1 if and only if (1.28) is true at the world w1 at some time later than t1.

The consequence of adding the temporal parameter is that all denotations must now be evaluated with respect to a particular world and a particular time. Intensions are then understood as functions from ordered pairs of a world and time to denotations.

Now the truth conditional semanticist can be characterised as defining for a language the recursive rules of syntax and the recursive rules of semantics that assign truth conditions to the syntactically well-formed formulas of the language.

If we look, first, at the requirements this places on the syntactic component we observe that two basic conditions must be met. Firstly, that a set of syntactic categories be provided. One of these categories, the 'sentence' or whatever other label is chosen, is to be associated with truth or falsity. Secondly, there must be an assignment of expressions in the language to the syntactic categories. Since we normally consider grammars capable of generating an infinite number of well-formed formulas there must exist rules to assign each of these well-formed expressions to syntactic categories.

Turning now to the semantic component, in the light of the syntactic requirements outlined above we can stipulate four conditions. Firstly, we require a set of things which can be assigned as semantic values to various expressions of the language. At a minimum this must be a set of individuals and a set of truth values, set theory then provides functions that construct more complex semantical objects out of these components to act as the semantic values for various other expressions besides individual constants and sentences. In addition, we need to specify for each syntactic category the type of semantic value that is to be assigned to expressions of that category (eg names are to have individuals assigned, sentences are to be assigned truth values etc.). Next we need a set of semantic rules to determine how the semantic value of any complex expression is a function of the semantic values of its components. And finally, we require an initial assignment of a semantic value of the appropriate type to each of the basic expressions of the language.

We can distinguish two classes of facts that go into determining the semantic values of sentences. One class of facts has to do with the formal structural properties which a sentence has (characterised in the formation rules of the semantics). The other class depends on certain contingent states of affairs in the world or 'model'.

The first class of facts are theory-internal conditions, whilst the second set of facts has to do with the connection between language and the world or model which the language describes.

Formally, we define a model to be an ordered pair $\langle A,F \rangle$ such that A is a set, the set of individuals in the model, and F is a function which assigns semantic values of the appropriate sort to the basic expressions. The individuals, and sets of individuals that comprise the semantic values of individual constants and predicate constants can now be anything one likes. Thus in one model the set of individuals might consist of the set of natural numbers, in another the same expressions of the language might be assigned members from the set A which consists only of ex-Prime Ministers of Great Britain etc.

The rest of the semantic apparatus, rules of semantic evaluation for the logical connectives etc., is taken as the fixed part of the semantics for a particular language. We can, therefore, examine the effect of allowing the model to vary in respect of the semantic values assigned to basic expressions of the language.

With this concept we now have a way of saying that a sentence of the language is no longer true simpliciter ; rather we now say that a sentence S is true with respect to (a particular) model M. (Footnote 1.4)

Montague's solution to the problem of intensional constructions was to increase the complexity of the model the language was interpreted over. The model structure he proposed contains more than a set of individuals and an assignment of individuals, sets of individuals etc. to various expressions of the language. The insight he exploited was, as outlined on page **, that sentences will have truth values relative to moments of time and possible worlds.

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Footnote 1.4 . I shall adopt the normal convention that for any expression alpha, |[alpha]|.:M:. denotes the semantic value of alpha with respect to the model M.

This means that to formally interpret a language containing both tense and modal operators we need a model with two other sets besides the set of individuals. Let us designate these sets as the set W (the set of possible worlds) and the set T (the set of times). In addition the model will contain an ordering function < on the set T, this function establishes the directionality and sequence of time.

Our definition of denotations will now be relative to a choice of some index, <w,t> out of W X T. Thus semantic rules will now provide a definition of |[alpha]|.:M,w,t,g:. for each expression alpha (Footnote 1.5).

The innovation of the intensional logician is not merely to add extra parameters to the structure of the model but to allow the semantic value or denotations of expressions to be actual intensions. Expressions are to be allowed to have two sorts of reference/denotation or semantic value- namely, extensions and intensions. Intensions will be understood as functions from indices to other denotations (these denotations may be extensions

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Footnote 1.5. The notion of g, is an assignment of values to variables, for a full explanation of this mechanism and, indeed, the general apparatus of quantification see Dowty et al (1981). As an aid to what follows the rules of formation and interpretation for Li are included as an appendix in this thesis.

or once more intensions). However, ultimately the semantics grounds out in extensions. Here then we discharge the Fregean insight that expressions of a language may have two sorts of semantic value, sense or reference. Thus the referent of an expression, what the expression is about, may be direct reference to an extension or normal referent, or it may be indirect reference to an intension or sense. What Montague produces, however, is a way of doing this within an entirely extensional semantics. He saw a way of accounting for intensions in terms, ultimately, of extensions. To this extent adopts a Russellian position.

In the next chapter I will present Montague's proposals for dealing with opaque constructions. In particular his treatment of three classes of nominal expression - names, descriptions and indefinites - which occur within sentences containing verbs of propositional attitude. Throughout I will use the Dowty, Wall and Peters (1981) characterisation of Montague's (1973) Intensional Logic, I will refer to their version of this Intensional Logic as 'Li' (Footnote 1.6).

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Footnote 1.6. Readers unfamiliar with the standard characterisation of a formal language are referred to Dowty et al (1981) which serves as an excellent introduction to formal semantics in general and Montague Semantics in particular.

# CHAPTER TWO PUTTING LOGIC TO WORK

## SECTION ONE INTENSIONS AND REFERENTIAL OPACITY

Section one of this chapter will consider the solutions which intensional logic has proposed for the problems of referential opacity. In section two we will consider claims made for extending the explanatory function of logical machinery- extensions which are directed towards some additional phenomena associated with reference in opaque contexts.

### 1 Proper Names and Belief Contexts

Let us first review how, in general, the formal characterisation of intensions is carried out in a language. I will define, for expository purposes, a model as an ordered quintuple

M = < A,W,T,<,F >

where:

A is the set of objects/individuals in the model,
in this case three individuals.
A= { a,b,c }

W is the number of possible worlds available to the
model, in this case two worlds.
W= { w1, w2 }

T is the set of time intervals at which the model
is sampled, in this case three.
T= { t1, t2, t3 }

< is a linear ordering of the set T, this establishes
the directionality and sequence of time. In this case
represented as a set of ordered pairs.
<= {< t1, t2 >, < t2, t3 >, < t1, t3 >}

F is a function that assigns semantic values of the
appropriate sort to each non-logical constant of
the language relative to each pair <w,t> where
w-in-set-W and t-in-set-T.

Let us consider the following non-logical constants of the language Li (Footnote 2.1.); j, m, d, n, and K, B. The assignments F makes for this model are given below in Table 2.1. For the six indices of this model the denotations of the names and predicates are fully determined for each of the index pairs by the function F.

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Footnote 2.1. Li is a characterisation of an Intensional Logic based on Dowty et al (1981). The rules of formation and interpretation of this language are provided in Appendix 1.

TABLE 2.1
Assignment of denotations to some basic expressions of Li under F (Footnote 2.2)

| | |
|---|---|
| F(j)=¦[^j]¦.:M,g:. | F(d)=¦[^d]¦.:M,g:. |
| = <w1,t1>=>a | =<w1,t1>=>b |
| <w1,t2>=>a | <w1,t2>=>b |
| <w1,t3>=>a | <w1,t3>=>b |
| <w2,t1>=>a | <w2,t1>=>b |
| <w2,t2>=>a | <w2,t2>=>b |
| <w2,t3>=>a | <w2,t3>=>b |
| | |
| F(n)=¦[^n]¦.:M,g:. | F(m)=¦[^m]¦.:M,g:. |
| = <w1,t1>=>c | =<w1,t1>=>b |
| <w1,t2>=>c | <w1,t2>=>b |
| <w1,t3>=>c | <w1,t3>=>c |
| <w2,t1>=>c | <w2,t1>=>c |
| <w2,t2>=>c | <w2,t2>=>c |
| <w2,t3>=>c | <w2,t3>=>b |
| | |
| F(K)=¦[^K]¦.:M,g:. | F(Bel)=¦[^Bel]¦.:M,g:. |
| = <w1,t1>=>{a,b} | =<w1,t1>=>{<a,R>} |
| <w1,t2>=>{a,c} | <w1,t2>=>{<a,R>,<a,S>} |
| <w1,t3>=>{b,c} | <w1,t3>=>{<a,S>} |
| <w2,t1>=>{b,c} | <w2,t1>=>{<a,S>} |
| <w2,t2>=>{a} | <w2,t2>=>{<a,R>} |
| <w2,t3>=>{a,b,c} | <w2,t3>=>{<a,R>,<a,S>} |

where R and S are meta-variables ranging over
the propositions associated with
the formulas K(n) and K(m) respectively,
ie R=¦[^K(n)]¦.:M,g:., S=¦[^K(m)]¦.:M,g:..

We have laid out the intensions of the basic expressions of our language using our "mini-model" by demonstrating all the varying extensions the terms can have in the model. The intensions are just functions which for any given argument pair (world, time index)

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Footnote 2.2. Let us adopt the convention that for any expression alpha and for any model M and value assignment g, ¦[^alpha]¦.:M,g:. is the intension of alpha with respect to M and g.

return a value (the extension of the term).

Suppose we translated the non-logical constants into expressions of English as indicated in Table 2.2. (Footnote 2.3)

Table 2.2

Translation of expressions of LI into English

j=John d=Dick n=Nick m=Mr. Universe

K=swims Bel=believes

Syntactic types of these basic expressions are (Footnote 2.4)

| | |
|---|---|
| j, d, n, m, | are of type e |
| K | is of type <e,t> |
| Bel | is of type <<s,t>,<e,t>> (a relation between persons and propositions) |

'j' translates as 'John'
'd' translates as 'Dick'
'n' translates as 'Nick'
'm' translates as 'Mr Universe'
'M' translates as 'swims'
'B' translates as 'is British'

Footnote 2.3. I will assume at this stage that the rules of syntactic combination of the English fragment can be specified so as to 'unscramble' the unnatural surface order for English that the syntax of Li would produce. In Montague's PTQ fragment these formation rules of English and their relation to the syntax and semantics of the intensional logic are rigorously specified.

Footnote 2.4. For an explanation of the conventions behind the categorial formulation of the syntactic classes of expression see Dowty et al (1981)

From the intension ¦[^j]¦.:M,g:. we can say that the non-logical constant 'j' is acting as a 'rigid-designator', and as such names the same individual at all indices. However, the intension ¦[^m]¦.:M,g:. shows that 'm' is acting as a non-rigid designator, that is the term holds of different individuals at different times (Footnote 2.5).

Now a rule of syntactic combination will allow basic terms and predicates to combine. The equivalent rules of semantic interpretation will allow us to construct intensions for formulas such as 'K(m)' and 'K(j)' (Table 2.3).

Table 2.3
Constructed intensions for two formulas of Li

| ¦[^K(m)]¦.:M,g:. | ¦[^K(j)]¦.:M,g:. |
| --- | --- |
| <w1,t1>=>1 | <w1,t1>=>1 |
| <w1,t2>=>0 | <w1,t2>=>1 |
| <w1,t3>=>1 | <w1,t3>=>0 |
| <w2,t1>=>1 | <w2,t1>=>0 |
| <w2,t2>=>0 | <w2,t2>=>1 |
| <w2,t3>=>1 | <w2,t3>=>1 |

The intensions of the two formulas 'K(m)' and 'K(j)' were determined by calculating the denotation of the formulas at each index and then collating the results of this computation into a function returning a truth value for each index.

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Footnote 2.5. Such expressions are not uncommon in English- examples are 'Miss England', 'Supergrass' etc.

Notice that intensions and extensions will be notions that are inter-definable relative to a completely specified model. Thus the intensions of an expression can be constructed from extensions laid out for each index, whilst an extension for the expression can be computed by applying the index as argument to the intension as function (Footnote 2.6).

To accommodate the two-tier system of semantic values outlined we need to change the syntax and the way the semantic rules compute the semantic value/denotations of a complex phrase in terms of the denotation of its parts. To do this in accord with the Fregean programme we have our language include expressions which denote, have as their semantic value, the intensions of certain other expressions (this of course reflects Frege's own view of certain expression which occurred in _oratio obliqua_ having indirect referents). We need to add a rule to the effect

If alpha is any expression, then ^alpha
is an expression which denotes |[^alpha]|.:M,g:..
(Footnote 2.7)

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Footnote 2.6. The extension of a variable is given by g and does not differ from index to index. Effectively, the intension of a variable is a constant function on indices. For any u then for all w and t
|[^u]|.:M,g:.(<w,t>)=g(u).
Footnote 2.7. These new intensional expressions will be characterised as of type <s,a>, where 'a' is the type of expression the intension is formed from. Thus <s,a> is

Since the notion of an intension is defined for every expression of the language, expressions such as '^alpha' will themselves have an intension, namely- '^^alpha'. However, these higher-order intensions are uninteresting since they represent constant functions returning the immediately embedded intensions as result.

A second syntactic device present in Montague's intensional logic is the operator '@', when applied to any expression alpha which denotes an intension this operator gives a new well-formed expression '@alpha' denoting whatever the value of ¦[alpha]¦.:M,g:. is at that index. Thus for any index <w,t>

¦[@alpha]¦.:M,w,t,g:.=¦[^alpha]¦.:M,g:.(<w,t>)

The semantic theory that is a consequence of the elements of Li provides for the construction of semantic objects corresponding to the kinds of intensional objects required in a two tier semantic system.

Thus the intensions that this language generates will correspond to functions that for each index determine a unique object. These functions are precisely what is needed to provide a denotation for a singular term in each 'situation'. But, as we commented earlier,

---

meant to suggest a function from indices to the denotations of expressions of type 'a'.

there is no need for such functions to be constant. Thus two of them, say N and M can have the same value in some but not all world/time indices. Here is the reason, embedded rigorously in the formal semantic theory, of why assertions of identity can be contingent, for 'alpha=beta' will be true in some but not all possible worlds and times if the intension of alpha is N and of beta is M.

To this see this in more detail let us consider the sentence (2.1). Suppose there is a particular

(2.1) John believes Mr Universe swims

(2.2) Bel(j,^(K(m)))

(2.3) ^(K(m))

(2.4) K(m)

(2.5) John believes Nick swims

(2.6) Bel(j,^(K(n)))

(2.7) ^(K(n))

(2.8) K(n)

(2.9) m=n

course of events (possible world) and a particular time at which Nick is Mr. Universe. And let us further suppose that in this particular world and at this time John really believes that whoever is Mr Universe, can swim. Two more facts about this world/time construct are pertinent- John does not know that the individual known to him as 'Nick' is 'Mr Universe', John also believes that the individual he knows as 'Nick' cannot swim. What I have described is a perfectly possible and consistent state of affairs. However, for a semantic theory which deals only in extensions, we have produced a very embarrassing state of affairs. Given the truth of a formula such as (2.9) (at the index <w2,t1> say) then at that same index, using an extensional semantics, it is possible to infer (2.5) from (2.1). Let us see in detail how the use of intensions as the semantic values of expressions blocks this kind of inference.

Given our assignment of syntactic categories to expressions (Table 2.2) and the rules of formation of Li one way of generating (2.1) is (2-I) below. This generative tree is determined by the rules of syntactic composition of Li (English translations are given on the appropriate nodes of the tree.

2-I

```
        John believes Mr Universe swims
        Bel(j,^(K(m)))  Relational Notation
        Bel(^(K(m)))(j) B2
        <t>
       /        \
John               believes Mr Universe swims
j B1               Bel(^K(m)) B2
<e>                <e,t>
                  /     \
        believes            Mr Universe swims
        Bel B1              ^K(m) B15
        <<s,t>,<e,t>>       <s,t>
                              |
                            Mr Universe swims
                            K(m) B2
                            <t>
                           /        \
               Mr Universe               swims
               m B1                      K B1
               <e>                       <e,t>
```

We can use this generative tree as a computational schema to evaluate the semantic value of its various nodes. The tree indicates which sub-parts each larger part depends on for its own semantic evaluation. Our syntactic structure is designed to reflect directly the semantic dependencies of the expressions. The various semantic values computed in the course of the generation of (2-I) with respect to a particular index, model and value assignment are shown in (2-II). We will see in working through an example how (2-II) is a graphical representation of the steps in computing the semantic value of its constituent nodes.

2-II

¦[Bel(j,^(K(m)))]¦.:M,w,t,g:.
¦[Bel(^(K(m)))(j)]¦.:M,w,t,g:. B2

¦[j]¦.:M,w,t,g:. B1

¦[Bel(^K(m))]¦.:M,w,t,g:. B2

¦[Bel]¦.:M,w,t,g:. B1

¦[^K(m)]¦.:M,w,t,g:. B15

¦[K(m)]¦.:M,w,t,g:. B2

¦[m]¦.:M,w,t,g:. B1

¦[K]¦.:M,w,t,g:. B1

Suppose we evaluate the truth of sentences (2.1) and (2.5) with respect to M and an index, say <w2,t1>. The logical formula (2.2) represents one of the ways the 'translated' sentence (2.1) can be generated- it corresponds to the top node of (2-II). Formula (2.2) asserts that the relation of believing holds between an individual <u>a</u> represented in the logical language by the rigid-designator 'j', and the proposition represented by the formula given as (2.3). Now consider how the semantic value of (2.3), the embedded proposition in (2.2), is computed in Li.

To compute the value of proposition (2.3) we need to compute the denotation of 'm' (translated as 'Mr Universe') at each index in the model as well as the denotation of 'K' (translated as 'swim') at the same indices to determine whether (2.4) is true at each of these indices. Given F and the co-ordinates <w2,t1> we can calculate the following semantic value for (2.3)

```
|[^(K(m))]|.:M,w2,t1,g:.= <w1,t1>=>1
                          <w1,t2>=>0
                          <w1,t3>=>1
                          <w2,t1>=>1
                          <w2,t2>=>0
                          <w2,t3>=>1
```

Given this way of breaking down sentence (2.1) and computing the semantic value of its embedded proposition, see what happens when we try to substitute an expression which at <w2,t1> is co-extensive with the expression 'm'.

The individual denoted by the term 'm' at <w2,t1> namely c, is in the set denoted by 'K' at <w2,t1>, as a consequence the complex formula (2.4) is also true at <w2,t1>. If we now substitute for 'm' in (2.4) the expression 'n', which also denotes c at this index <w2,t1>, then the resultant formula (2.8) remains true. Substituting one expression for another we preserve the truth value of the complex expression . This relies on the fact that

```
|[K(m)]|.:M,w2,t1,g:.=|[K(n)|[.:M,w2,t1,g:.,
```

which is a logical consequence of the fact that the denotations of |[m]|.:M,w2,t1,g:. and |[n]|.:M,w2,t1,g:. are identical.

But it does not follow from the above facts that the proposition denoted by (2.3) is identical to the proposition denoted by (2.7). In fact these two propositions are not identical in M as can be seen when we inspect the intensions of the respective formulae. The intensions of (2.3) and (2.7) are different because there are some indices at which (2.4) is true and (2.8) is false (eg <w1,t1>) (see Table 2.4 below).

Table 2.4
Constructed intensions for (2.3) & (2.7)

```
¦[^(K(m))]¦.:M,w2,t1,g:.= <w1,t1>=>1
                          <w1,t2>=>0
                          <w1,t3>=>1
                          <w2,t1>=>1
                          <w2,t2>=>0
                          <w2,t3>=>1

¦[^(K(n)]¦.:M,w2,t1,g:.= <w1,t1>=>0
                          <w1,t2>=>1
                          <w1,t3>=>1
                          <w2,t1>=>1
                          <w2,t2>=>0
                          <w2,t3>=>1
```

Regardless of the truth of (2.9), we are now in a position to give a perfectly consistent model, which we have done with the F assignment to 'Bel', such that (2.1) is true at <w2,t1>, whilst (2.5) is false at the same index. This analysis of one reading of (2.1) allows that John may perfectly well understand identity statements and what they entail and at the same time not be forced into inconsistency by asserting that (2.5) must be a logical consequence of (2.1). What John believes on this analysis of (2.1) is a proposition whose semantic value when computed is found not to be the same as the semantic value of the proposition contained in (2.5). The problem of substitutibility is solved by placing John in a belief relation to an intensional rather than extensional object.

We have shown in effect that the rule schema (2.10) (referred to on page 10) is not valid in intensional logic.

(2.10) alpha=beta-->(PHI<-->PHIalpha/beta)
Where 'PHIalpha/beta' is understood as substituting in 'PHI', 'beta' for all free occurrences of the expression 'alpha'

However, there are occasions when substituting co-extensive expressions in sentences such as (2.1) is allowed. An intensional system like Li offers an explanation of how and why this can be done. Using the rules of Li we can generate a tree exactly the same as the previous one except that the logical constant 'm' is not combined immediately with the predicate 'K'. Instead it is quantified into a variable of the appropriate sort, a variable which has been generated in the position the logical constant originally occupied. Effectively this means that the expression 'm' (translated as the singular term 'Mr Universe') stands outside the scope of the intensional operator '^'. The trees (2-I) and (2-III) capture the essential differences of the two derivations and their concomitant logical form.

The derivation 2-III is meant to represent a reading of (2.1) which in the semantics literature is often referred to as the 'de re' reading. The sentence (2.1) could be understood as describing a belief John has about a certain individual, and his belief is directly about the individual and not about any particular way the individual is described. The 'de re' interpretation is one where the belief concerns the object directly and not its manner of description.

Let us see how this 'de re' reading relates to the generative tree 2-III. The top node of 2-III is the formula (2.11)- this is the logical translation of a 'de re' reading of (2.1).

```
            2-III

       John believes Mr Universe swims
       ?x5(Bel(j,^(K(x5))))(m) B2
       <t>

?x5(Bel(j,^K(x5)))  B10
<e,t>

John believes he5 swims                          Mr Universe
Bel(j,^K(x5))    B2                              m   B1
Bel(^K(x5))(j)                                   <e>
<t>

j B1                 Bel(^K(x5)) B2
<e>                  <e,t>

       believes            he5 swims
       Bel B1              ^K(x5) B15
       <<s,t>,<e,t>>       <s,t>

                           he5 swims
                           K(x5) B2
                           <t>

                   he5                           swims
                   x5 B1                         K B1
                   <e>                           <e,t>
```

Let us consider how the semantic value of (2.11), is computed. Again take our model at index <w2,t1>, (2.11) is true at this index if and only if (2.12) is true at <w2,t1> where x takes on the value |[m]|.:M,w2,t1,g:. which in this case is the individual c (Footnote 2.8) In turn (2.12) depends on whether the individual denoted by 'j' at <w2,t1> (ie |[j]|.:M,w2,t1,g:.)- namely, a stands

Footnote 2.8. This is a consequence of the fact that we imagine g to have assigned the variable x to the individual c. However the truth conditions hold quite generally since we eventually consider all value assignments of variables to individuals.

in a belief relation to the proposition denoted by (2.13). In computing (2.13) we check the the denotation of 'K' at each index but hold the value of x constant for all indices, so x's value remains for all indices at whatever 'm' denotes at <w2,t1>.

(2.1) John believes Mr Universe swims.
(2.11) ?x[Bel(j, ^ [K(x)])](m)
(2.12) Bel(j, ^ [K(x)])
(2.13) ^ [K(x)]
(2.14) K(x)

The computation is carried out in this way because in our language the denotation of a variable will not change from one index to the next, the denotation of a variable depends only on the value assignment g not on the F assignment. We can read (2.11) as asserting that the individual denoted by 'm' is such that John believes the proposition that that individual swims .

Considering (2.11) as an alternative reading of (2.1) let us again try substituting the expression 'm' at index <w2,t1> for another coextensive with it at that index. Substituting 'n' at <w2,t1> for 'm' in (2.11) makes no difference to the evaluation of the proposition (2.13), since x remains for all indices at whatever 'n' denotes at <w2,t1>, the individual c.

The crucial difference between (2.2) and (2.11) is that the non-rigid designator 'm' stands within the scope of the opaque-context-creating operator ^ in (2.2) but outside it in (2.11).

(2.1) John believes Mr Universe swims
(2.11) ?x5[bel'[j,^[swim'(x5)]]](m)
(2.2) bel'[j,^[swim'(m)]]

We have shown that a restricted version of (2.10) is valid in the intensional logic, namely (2.15). Moreover another restricted version of (2.10) is also valid in Li, (2.16). This states that substitution of expressions is permissible where alpha and beta not only have the same extension at some index but also have the same intension as well. Rule (2.16) preserves the Fregean thesis of the compositionality of sense which asserts that the sense of a complex expression is always a function of the senses of its parts.

(2.10) alpha=beta-->(PHI<-->PHIalpha/beta)
Where 'PHIalpha/beta' is understood as substituting in 'PHI', 'beta' for all free occurrences of the expression 'alpha'

(2.15) alpha=beta-->(PHI<-->PHIalpha/beta), where alpha does not stand within the scope of ^,NEC,Past or Fut

(2.16) ^alpha=^beta-->(PHI<-->PHIalpha/beta)

In the derivational tree 2-III at the top node the logical formula (2.11) contains a number of important elements that are not represented at all in the in the English surface structure (2.1). Montague was particularly concerned that logical syntactic form should mirror English syntactic form, what was to be done in this case? It might seem that the obvious move is to apply the operation of lambda conversion whereby (2.11) is converted to (2.2) (see Dowty et al (1981) for a detailed exposition of the apparatus of lambda abstraction). Lambda conversion would give a more faithful approximation of the syntactic elements in (2.1). But this immediately destroys the basis for a solution to the substitutibility problems for this class of expressions by making (2.11) & (2.2) equivalent.

Montague chose the uncompromising position of allowing such a conversion to occur with these types of expression, thus preserving the generality of lambda conversion. The cost was to decree that expressions in the category of proper names were to be assigned semantic values which did not vary from index to index. By assigning proper names unvarying extensions, Montague was in effect denying the possibility in his semantics of the kind of semantic anomaly that quite patently arises in natural language. The alternative is to state that in a language like Li containing non-rigid designators, lambda conversion dos not hold with full generality. A constraint on its application, such as that below, is required.

(2.17) ?u(PHI)<-->PHIu/alpha, provided that u does not stand within the scope of ^, NEC, Past, or Fut in PHI

As already mentioned Montague found this restriction so odious that in the (1973) PTQ system the semantics for proper names did not allow them to function as non-rigid designators. He thus ruled out of court the application of the necessary apparatus to deal with the class of substitution problems associated with proper names.

## 2 Definite Descriptions and Belief Contexts

We have reviewed how an intensional logic could be used to solve the substitution problems associated with Proper Names. In the next two parts of this chapter I will consider the analysis Montague provides for two other sorts of noun-phrase.

First, let us consider the treatment of definite descriptions. Formula (2.19) would result from a Montague analysis of (2.18) (Footnote 2.9). It will be apparent that Montague is presenting a Russellian account of the semantics of the definite determiner. The translation of the definite determiner 'the' in combination with the

Footnote 2.9. This is a 'boiled down' representation of Montague's analysis. There is, however, a strict equivalence between this representation and the rather fuller one presented in Dowty et al (1981).

rest of the formula (2.19) effectively asserts that there exists one and only one individual who is a butler and that individual limps.

(2.18) The butler limps
(2.19) Ey ( Vx [ butler'(x) <--> x=y ] & limps'(y))

Now consider a sentence triple of, by now, a familiar sort (2.20)-(2.22). At the home of Lady Devonshire a dastardly murder has been committed. Holmes and Watson have been called in to help. Let us suppose that Watson noted whilst talking to the staff that the butler suffers from a severe limp, a war wound perhaps. Now the vital piece of evidence which Watson has over looked, but which we can be assured Holmes will have noticed, is a trail of dragging foot prints through the conservatory where the crime was committed. In this case it would be perfectly truthful to assert (2.20). But what about (2.21) ?

(2.20) Watson believes the butler limps
(2.21) Watson believes the murderer limps
(2.22) The butler is the murderer

Montague's intensional analysis seeks to explain why (2.21) can be false whilst (2.20) and (2.22) are true. It goes further and suggests a reading of (2.21) in which it would be a true assertion. This would be a reading in which the way the individual of Watson's belief is described is irrelevant. So what could such an assertion about a belief of Watson's be about? From Watson's point of view it is about, an individual and not about any way of describing the individual, it is a de re reading.

On Montague's analysis the two readings of (2.21) revolve round the scope possibilities of the noun phrase 'the murderer'. There are two possible Montague derivations of the surface sentence (2.21), represented as the compositional syntactic trees 2-IV & 2-V. Each generative possibility has a parallel logical tree that results in two formulas shown in (2.23) and (2.24) which are the logical translations of the two interpretations of (2.21).

(2.23) bel'[n,^Ey[Vx[murderer'(x)<-->x=y]&limp'(y)]]

2-IV

```
        Watson believes the murderer limps
          /                  \
Watson                     believes the murderer limps
                           /           \
        believes                 the murderer limps
                                        |
                                 the murderer limps
                                 /                 \
                    the murderer                    limps
                    /          \
                 the          murderer
```

(2.24) Ey[Vx[murderer'(x)<-->x=y]&bel'[n,^(limp'(y))]]

```
                2-V

         Watson believes the murderer limps

     Watson believes he5 limps            the murderer
                                       the          murderer
Watson      believes he5 limps
        believes          he5 limps
                          he5 limps
                he5                        limps
```

On the (2-IV) analysis the definite description is seen to fall within the scope of the intension creating context (the verb 'believe' induces this context). It is therefore the intensional semantic values of the elements in the embedded proposition that must be calculated. Now suppose that the intension given to the descriptive element ('murderer') in the definite description is as given below in Table 2.5 (this describes a model M2 with an assignment F2 of intensions to basic expressions). It is easy to see that the intensions of the descriptive elements 'butler' and 'murderer' are quite distinct. We will not be at liberty to substitute the intensions of expressions containing these elements.

However, with this assignment there is a world/time index pair at which all the predicates, 'murderer', 'butler', 'limps', are true of the same individual, this is the index <w1,t1>. So lets consider (2.21) having wide scope as in (2-V) and (2.24). Let us evaluate the sentence at index <w1,t1> with respect to a particular fixed assignment of values to variables.

TABLE 2.5

```
F2(murderer')=|[^K]|.:M2,g:.= <w1,t1>=>{a}
                              <w1,t2>=>{a}
                              <w1,t3>=>{b}
                              <w2,t1>=>{c}
                              <w2,t2>=>{b}
                              <w2,t3>=>{c}

F2(butler'  )=|[^B]|.:M2,g:.= <w1,t1>=>{a}
                              <w1,t2>=>{c}
                              <w1,t3>=>{a}
                              <w2,t1>=>{c}
                              <w2,t2>=>{b}
                              <w2,t3>=>{b}

F2(limps'   )=|[^L]|.:M2,g:.= <w1,t1>=>{a,b}
                              <w1,t2>=>{a}
                              <w1,t3>=>{a,b}
                              <w2,t1>=>{c}
                              <w2,t2>=>{b}
                              <w2,t3>=>{a}
```

Because the definite description is not generated within the scope of the opaque operator '^', the value of the embedded proposition is computed with respect to a variable (represented in the analysis tree as 'he5') and the intension of the predicate 'limps'. Now, recall that in model theoretic systems variables are constant functions which have, modulo a g assignment, the same extension at every index. Thus the complex intension of the embedded proposition will turn out to depend on whatever the value the embedded variable is when it is bound by the definite description. And this definite description since it has wide scope and is outside the scope of any intensional operator will have an extensional semantic value depending on the index at which it is being evaluated. Now if this index is <w1,t1> then we can construct a perfectly consistent model in which the extensional values of the predicates 'murderer' and 'butler' are the same, ie the individual a. We are also assured, by the semantic rules of evaluation for quantifiers, that there will be a g assignment of the form [ga/x]a/y (the value of x and y are both the individual, a).

These facts ensure that in the embedded proposition the compound intension of the bound variable and predicate 'limps' will be the same (in this evaluation context) regardless of the particular manner of description of the individual a in the wide scope definite noun-phrase. We might say, echoing our comments about proper names, that the way the individual is described is irrelevant to the evaluation of the embedded proposition in (2.21).

3 Indefinite expressions and Belief Contexts

An ambiguity exactly analogous to the singular term and definite description cases can be found in sentences like

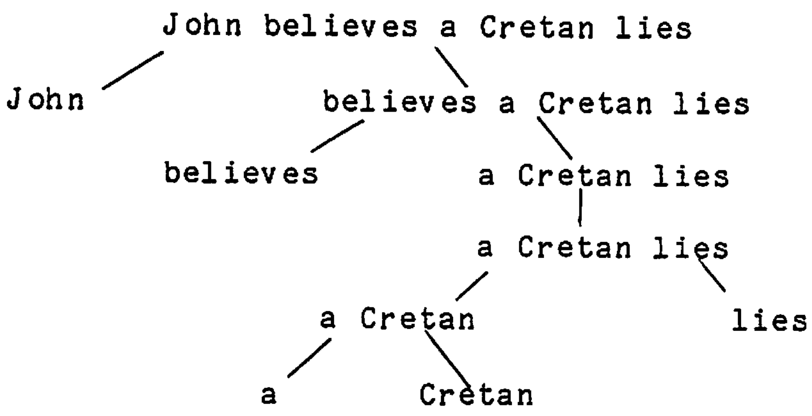
(2.25)

(2.25) John believes a Cretan lies
(2.26) bel'[j,^Ex[Cretan'(x)&lies'(x)]]
(2.27) Ex[Cretan'(x)&bel'(j,^[lies'(x)])]

There are, in Montague's system, two analysis trees of this sentence (Footnote 2.10).

(2.26) bel'[j,^Ex[Cretan'(x)&lies'(x)]]

2-VI

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Footnote 2.10 Montague did not consider the so-called 'generic' interpretation of indefinites as represented in such sentences as (i)

(i) A lion is fierce.

(2.27) Ex[Cretan'(x)&bel'(j,^[lies'(x)])]

2-VII

```
              John believes a Cretan lies
          John believes he5 lies          a Cretan
                                        a          Cretan
John      believes he5 lies
        believes          he5 lies
                          he5 lies
                 he5                     lies
```

Again the crucial between the analyses has to do with scope, where in the generative tree the quantifying expression is inserted. If we look at the final, surface level, logical translations of these two trees we see that in the first, narrow scope, reading of (2.25), represented as (2.26), the existential quantifier and associated common noun 'Cretan' occur inside the scope of '^', whilst in the wide scope reading of (2.25), represented as (2.27), the quantifier and CN occur outside the scope of the opaque operator '^'.

The formula produced in (2.27), as one reading of (2.25), seems to make the assertion that a particular Cretan exists. This is not a problem in this example, but consider (2.28) which is structurally exactly like (2.25). Here the commitment to existence, the canon of existential generalisation mentioned on page 10, seems more of an embarrassment.

(2.28) John believes a leprechuan lies

Montague's way out of this dilemma is very simple. He treats existence as a simple predicate. Recall that the model structure, over which Montague's intensional logic is interpreted, has available to it a set of individuals, A. This set of individuals is, in fact, the set of all possible individuals. Montague states in a footnote in PTQ

> if there are individuals that are only possible but not actual, A is to contain them (Montague 1973: 257)

The assignment of intensions to expressions can turn out to assign possible individuals to the extension of expressions at a particular index. Consequently we can read line (2.28) as saying that there is available from A a 'possible individual'. The question as to whether or not that possible individual has the additional property of 'existence' is determined by pragmatic world knowledge. Montague does not view this issue as something that need concern him

> this is an issue it would be unethical for me as a logician (or linguist or grammarian or semanticist for that matter) to take a stand on (Ibid: 257)

Let us take stock of Montague's position on the three classes of nominal expression examined; proper names, definite descriptions and indefinite expressions. Only the category of proper names 'denotes' or 'refers' in the sense that their use can make reference to individuals. Both definite and indefinite expressions do not denote in this sense.

> 'The' turns out to play the role of a quantifier in complete analogy with 'every' and 'a' and does not generate ( in combination with common noun-phrases) denoting expressions. This does not mean that it would not be possible to assign complex and artificial denotations to such phrases as 'The alpha', 'every alpha', and 'a alpha', but in no case would the denotation be an individual. (Montague 1970b:216)

All these categories can exhibit scopal variations depending where, in the analysis trees, they are 'quantified in'. If one of these categories of nominal has wide scope with respect to an opaque operator in a sentence containing an embedded proposition Montague talks of the reading as <u>referential</u> or <u>de re</u>. If it has narrow scope, he talks of the <u>non-referential</u> or <u>de dicto</u> reading of the sentence.

> Our fragment is very rich in structural ambiguities, all roughly describable as arising from the various possible orders in which the syntactic operations...may be applied...the <u>de re</u> and <u>de dicto</u> interpretations correspond to two ways of generating the sentence in question. (Ibid:214)

In a sentence such as (2.25) we have two different analyses represented by the two trees (2-VI) & (2-VII).

> the first of these two tress corresponds
> to the de dicto (or non-referential)
> reading of the sentence, and the second to
> the de re (or referential reading)
> (Montague 1973:255)

Now the terms 'referential' and 'non-referential' used in this way should be distinguished from the use of the word 'refer' used in contexts such as 'the expression alpha refers'. Montague's referential/non-referential distinction had to do with the type of semantic object an expression takes as its semantic value.

In the wide scope readings of (2.21) or (2.25) the respective definite and indefinite expressions have referential readings.

(2.21) Watson believes the murderer limps
(2.25) John believes a Cretan lies
(2.5) John believes Nick swims

That is, they contain on analysis variables that denote extensional objects, these variables are <u>about</u> individuals. But this is not to say that the expressions 'a Cretan', or 'the murderer' refer, they avowedly do not on Montague's say so. Contrast this situation with singular terms such as 'Nick'. A sentence such as (2.5) has a referential and non-referential reading. However, on the referential reading the expression 'Nick' can be said to refer or denote an individual directly. The notion of 'refer' at work in the context 'the expression alpha refers' has to do, in such a model theoretic account, with whether an expression in a language can refer directly to an object by virtue of the F assignment alone.

In the case of the non-referential readings of (2.21), (2.25) & (2.5) the semantic object that is the subject of the proposition is an intensional one. Thus the belief in both cases is <u>about</u> the characterisation of the <u>meaning</u> of the expression, hence the <u>de dicto</u> label.

Moreover, the expressions 'the alpha', 'a alpha', 'alpha', are not themselves referential or non-referential. It is the semantic objects, the values of expressions, that are referential or non-referential.

All of the scopal analyses involving belief contexts extend directly to multiply embedded sentences. This allows Montague to deal with iterated opaque contexts.

## <u>SECTION TWO</u> <u>EXTENDING THE SCOPE OF SCOPE</u>

### 1 Scope and Responsibility

The wide scope/narrow scope distinctions examined in the previous sections have been extensively used by logicians and linguists to account for a wide range of semantic phenomena. In doing so, they have gone beyond what

Montague himself claimed. However, many regard the use of scope in the analyses of different semantic phenomena as conclusive evidence of the explanatory power of the logical analysis of language.

In discussing the wide scope reading of a sentence such as (2.1) Dowty, Wall and Peters (1981) describe this reading as

(2.1) John believes Mr Universe swims

> the one in which the name [Mr Universe] is the 'speaker's description' of the person in question. The other reading...is sometimes described as the one in which [Mr Universe] is 'John's description' of the person in question. (Dowty et al. 1981:166)

What is at issue here is where the expression originates; from the speaker (eg the attributer of the belief) or John (the attributee). Determining who is responsible for the use of a 'form of words' is at the root of what I will call the attibuter/attributee distinction. This distinction is to be found in Hintikka (1969), Hasegawa (1972), Fodor (1970), Johanson (1976), Partee (1979) and Hellan (1981). In all of the cited work the phenomenon is analysed scopally.

> One phenomena presumably calling for a [scopal] analysis is the difference between what we may call a speaker's being responsible for the use of a certain expression and a participant's being so

responsible (Hellan 1980:48)

This distinction appears to hold across many classes of nominal in 'belief' contexts as well as in other opaque contexts. Thus in sentence (2.29) the relative scope of constituents is used to explain the various interpretations this sentence ('said' is treated in this case as an opaque verb).

(2.29) Jim said that he had seen my girlfriend.

Sentence (2.29) can either report Jim's having said something such as "I saw your girlfriend" or report something like "I saw Jo Miles" where the speaker of (2.29) identifies Jo Miles as 'my girlfriend'. The ambiguity is clearly shown by the two ways of continuing (2.29). The difference of interpretation centres on whether the description is the responsibility of the attributer (the speaker) or the attributee.

(2.30) She said she would ring me up tonight.
(2.31) Luckily, he didn't know that or he would have said something embarrassing.

Similar ambiguity is present in (2.32), where Jim might or might not realise that I live next door to his supposed spy.

(2.32) Jim thinks my next door neighbour is a spy.

Such examples show how in certain kinds of embedded sentences the lexical material relating to noun-phrases in the embedded sentence may be semantically either a part of the embedded sentence or a part of a higher sentence. This very naturally translates into a scope difference of the noun-phrase relative to the opaque operator of the super-ordinate sentence(s).

A related ambiguity is found in (2.33). This may conceivably be interpreted as Karl's having uttered a contradictory sentence such as "I didn't kiss the girl I kissed".

(2.33) Karl says that he didn't kiss the girl he kissed

It is more likely to involve a sentence which Karl uttered such as "I didn't kiss Moira", reported by a person who is convinced that Karl really did kiss Moira. Clearly, exactly the same scope phenomenon can be appealed to for an explanation of these ambiguities. If the definite noun-phrase is inside the scope of 'says' we have the contradictory reading, if it is outside the scope we have the non-contradictory reading. Again the noun-phrase in question varies its scope relative to an opaque operator.

Examples below show how the attributer/attributee ambiguity extends to all three classes of nominal we are interested in. Taking proper names first, in (2.34) the description 'Samuel Clemens' may be one the attributee would not recognise, since we can imagine that the description originates from a speaker who is better informed about literary figures than John. Nevertheless, John may well believe that 'Mark Twain is a great writer'.

(2.34) John believes Samuel Clemens is a great writer.

Now consider the second class of nominals, definite descriptions, imagine that (2.35) was uttered by the Prime Minister of Great Britain in 1941. We might reasonably suppose that the 'responsibility' for the description 'the vilest man in Europe', lies with the individual Winston Churchill rather than one of Hitler's closest ministers. A wide scope interpretation of (2.35) would provide a means of representing this reading.

(2.35) Goering believes the vilest man in Europe is infallible

(2.36) Churchill believes the vilest man in Europe is dangerous

In the case of (2.36) uttered by the Goering we might suppose there were good grounds for understanding the description as originating with the attributee ( ie Churchill)

Finally, (2.37) can be construed in such a way that the indefinite expression is understood as originating from the 'attributer' of 'attributee'. Imagine a context in which John has no idea that a certain individual is informing against him. The speaker of (2.37) might well use the expression 'an informer' which would in no way 'line up' with what John believes about some particular individual. But now imagine a situation where John has arrived at the conclusion that certain unspecified persons, who are supplying him with confidential information, can be trusted. In this case we would say that the expression 'an informer' is legitimately one which John would assent to in describing these various people.

(2.37) John believes an informer is trustworthy

The scopal analysis of 'expressive responsibility' is summed up by Fodor

> linguists have assumed, and rightly I think, that the difference between the opaque and transparent reading of a sentence [narrow scope versus wide scope] is that the former expresses some relationship between the subject of the opaque verb and the descriptive content of the noun-phrase in question. They also seem to have assumed that although on the transparent [wide scope] reading the usual relationship between a speaker and a description he uses holds, this is not so for the opaque reading; on the opaque reading the speaker is merely taking over the description from the subject of the opaque verb, saying what would count, in

> his opinion, as a description of the object in question from the point of view of that subject...The assumption that the source of the description, or the responsibility for it, is always either the speaker (on the transparent reading) or the subject of the opaque verb (on the opaque reading) is embodied in the proposed representations [scopal] that we have been considering. (Fodor 1976:248)

## 2 Scope and the Specific Non-Specific distinction

As well as the issue of responsibility for nominal expressions, a further 'semantic' distinction has been 'explained' in terms of scopal variation of nominals with respect to belief contexts.

It has been alleged that indefinite noun-phrases occurring in opaque contexts exhibit a semantic property known as 'specificity'. The property of specificity seems at first straightforward. The ambiguity in (2.38) has been discussed in, among others, Baker (1966), Bach (1968), Dahl (1970), Dean (1968), Kasher & Gabbay (1976), Kroch (1979), Ioup (1977), Jackendoff (1972) and Lyons (1977). The distinction centres on the two ways represented by (2.39) and (2.40) that (2.38) can be continued.

(2.38) John wants to buy a car.
(2.39) He will buy it tomorrow.
(2.40) He will buy one tomorrow.
(2.41) Which car does John want to buy?

The continuation (2.39) corresponds to a reading in which the indefinite noun-phrase in (2.38) is understood specifically ; whilst in (2.40) the reading of the indefinite noun-phrase in (2.38) is non-specific . Notice also that the question (2.41) is only appropriate in the case of the specific reading of the corresponding assertion.

Associating specificity in indefinites with scope variations has been proposed repeatedly (cf for example Fodor 1970, Baker 1966, Bach 1968, Ioup 1977, Kroch 1979). Thus in a sentence such as (2.25) the analysis tree (2-VII) and logical translation (2.27) would correspond to the specific, wide-scope reading.

(2.25) John believes a Cretan lies.

A reading which is paraphrased as 'there exists a particular individual Cretan such that John believes him to be a liar'. The narrow scope analysis of (2.25) (see analysis tree (2-VI) and logical translation (2.26)) is paraphrased as 'John believes that there is some Cretan or other who lies'.

It is claimed that a scopal analysis of specificity must be employed when sentences such as (2.42) are considered.

(2.42) Mary believed that John wanted to see a film.

A feature analysis (noun-phrase [+specific] or [-specific]) is inadequate to capture all the possible readings of (2.42). It is claimed (2.42) is three ways ambiguous, as can be seen by continuing the sentence in one of three ways.

(2.43) Because John can relax watching one.
(2.44) But Mary doesn't know which one it might be.
(2.45) So they are going to see 'Cabaret' tonight.

The scopal proposals agree that the ambiguities do not result from the ambiguity of the indefinite noun-phrase, nor from the context, but stem from the semantic relationship between the noun-phrase and the rest of the sentence. Fodor, for example, argues for a type of logical representation where the indefinite is represented by something akin to an existential quantifier manifesting scope interactions with other elements in the sentence. The scopal account is claimed to offer the most adequate formal analysis of specificity. The scope possibilities of indefinites are seen to explain why a sentence like (2.42) has three interpretations. These interpretations correspond to the ordering possibilities of the existentially quantified noun-phrase with respect to the two opaque operators 'believes' and 'wants'. We can represent these possibilities in the quasi-logical frames (2.46)-(2.48).

(2.46) Mary believes ( John wants Ex ( John see x )).
(2.47) Mary believes Ex ( John wants ( John see x )).
(2.48) Ex ( Mary believes ( John wants ( John see x )).

It is claimed that it is not possible to explain such ambiguities except by means of the notion of scope, because we find a systematic relationship between the number of interpretations and the number of embedded opaque contexts. So (2.49) has four interpretations corresponding to the four orderings of the existential operator with the three opaque operators 'claims', 'said', and 'wanted'. Continuations that support each interpretation are given below together with the relevant operator orderings.

(2.49) Atlee claims Churchill said Bevan wanted to support a Communist.

(2.50) Because the Communists stood a better chance in the Clyde.
(2.51) Atlee claims ( Churchill said ( Bevan wanted Ex (Bevan support x ))).

(2.52) But Bevan wouldn't tell Churchill who.
(2.53) Atlee claims ( Churchill said Ex ( Bevan wanted (Bevan support x ))).

(2.54) Churchill wouldn't tell him who Bevan favoured.
(2.55) Atlee claims Ex ( Churchill said ( Bevan wanted (Bevan support x ))).

(2.56) It transpires that it is John Mclean.
(2.57) Ex ( Atlee claims ( Churchill said ( Bevan wanted (Bevan support x ))).

## 3 Scope and the Referential Attributive distinction

It is natural to ask whether definite descriptions exhibit a similar kind of scope ambiguity to the one detailed above. We might suppose that (2.58) does exhibit such an ambiguity.

(2.58) John believes the soldier who ordered the attack is brave

(2.59) Which soldier does John believe to be brave?

(2.60) John believes a soldier to be brave

This sentence can be taken to mean that John believes of some individual that that person is brave. Or it can describe a belief John has 'whoever the individual who ordered the attack, that individual must have been brave'. However the distinction is not exactly the same as in the case of indefinite expressions. The question (2.59) is both appropriate and answerable for either reading of (2.58) (contrast with question (2.41) applied to both readings of (2.38)). In fact both readings of (2.58) seem to entail the 'specific' reading of the corresponding indefinite (2.60).

The distinction has therefore been articulated in terms of whether or not a particular individual is held by the attributee to have some property, and whether, in addition, the attributee has a means of knowing who the individual was. It is not at issue that one particular individual is supposed to be involved.

> According to one of the readings of sentence (i), which I shall call the 'attributive' reading, John does not have any particular boy in mind, but simply wants to talk to whoever failed the exam.
>
> (i) John wants to talk to the boy who failed the exam
>
> (Fodor 1970:131)

On the other reading, the 'referential' reading, John does have a particular boy in mind as the boy he wants to talk to, and this boy he has in mind is the boy who failed the exam. The difference between the referential and attributive readings of sentence (i) is a matter of whether or not John has any particular boy in mind _as the boy who failed the exam_. The attributive reading of (i)

> implies that there is only one boy who failed the exam, and there can therefore be no question of John's deciding which boy who failed the exam he wants to talk to, but only of John's knowing or not knowing which boy failed the exam. (Fodor 1970:132) (Footnote 2.11).

Fodor in using the terms referential and attributive is adopting the terminology originally coined by Donnellan (1966). Donellan's widely quoted distinction is made in a way that does not actually refer to definite descriptions containing definite articles. Also his examples do not contain explicit opaque operators.

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Footnote 2.11). Notice that the term 'referential' is being used differently to the way Montague employs it.

However, if we consider what Donnellan says it is easy to see that the distinction is essentially the same as the one we have drawn in the last few pages.

> Suppose first we came upon poor Smith foully murdered. From the brutal manner of the killing and the fact that Smith was the most lovable person in the world, we might exclaim 'Smith's murderer is insane'. I will assume, to make it a simple case, that in a quite ordinary sense we do not know who murdered Smith (though this is not essential to the case). This, I shall say, is an attributive use of the definite description.
>
> The contrast with such a use of the sentence is one of those situations in which we realise whom we have in mind when we speak of Smith's murderer and, most importantly, to know that it is this person about whom we are going to say something...This I shall say, is a referential use of the definite description. (Donnellan 1966:285)

It is I think reasonable to suppose that the definite description 'Smith's murderer' is synonymous with the phrase 'the murderer of Smith'. The fact Donnellan's example is not tied to an explicit opaque context is more interesting. Donnellan regards the distinction he has drawn as a pragmatic and not a semantic one. In particular he does not regard it as scopal. Thus a sentence like (2.61), is not ambiguous in itself, but can be used in two different ways.

(2.61) The murderer of Smith is insane.

We might say following Levinson (1983:60) that it is an utterance which is potentially ambiguous between these two usages. These remarks notwithstanding Fodor (1970) argues for an analysis of the referential/attributive distinction in scopal terms.

> the referential/attributive distinction is a matter of scope relationships, and...the readings should be distinguished formally in terms of the position of some operator which determines the scope of the noun-phrase. (Fodor 1970:137)

As evidence in support of Fodor's claim consider, in a sentence like (2.62), the relationship between the number of possible readings this sentence may have, and the number of embedded clauses with opaque operators which the quantified definite noun-phrase can interact with. Again we find a systematic relationship between the number of embedded sentences containing opaque operators and the number of possible readings.

(2.62) Jill thinks John believes the murderer of Smith is insane

(2.63) (iota x) Jill thinks John believes (the murderer of Smith):.x.: is insane (Footnote 2.12)

(2.64) Jill thinks (iota x) John believes (the murderer of Smith):.x.: is insane

(2.65) Jill thinks John believes (iota x) (the murderer of Smith):.x.: is insane

Thus (2.62) can be taken to mean three things depending,

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Footnote 2.12. I am using the 'iota' operator as 'short-hand' for the fuller Russellian notation. It possesses exactly the same semantic truth conditions.

it is claimed, on the scope of the definite description. On one reading, which we might represent using the quasi-logical formula (2.63), Jill has in mind the individual who murdered Smith and thinks that John believes him to be insane. On the reading represented by (2.64) Jill thinks that whoever murdered Smith is such that John believes him to be insane. And finally (2.65) represents the reading in which Jill simply believes that John believes whoever murdered Smith to have been insane.

Of course, we may still need convincing that Donellan's distinction, as he himself drew it, can be carried over into opaque contexts. The necessary evidence is perhaps secured when we consider that a sentence such as (2.66) may have been actually uttered by someone (Footnote 2.13). Suppose John uttered (2.66), now on Donnellan's own admission (2.66) can be made to assert two things, so presumably John might have have been thinking either of two things in uttering the sentence. What appears to be a distinction between uses of a phrase in a transparent, non-opaque context like (2.66) is actually a matter of whether the speaker has a particular person in mind or not. Such a situation could

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Footnote 2.13. Some semanticists (cf for example Saarinen) would argue that issues to do with occasions and acts of utterance are of no concern to formal semanticists. They are interested only in the truth conditions of sentences. This is an important and contentious point which I take up later in the thesis.

be captured by (2.67). However, (2.67) still contains an ambiguous expression, the definite description 'Smith's murderer'. This is hardly surprising since presumably (2.67) is uttered by someone as well. Suppose that I were that person, we can represent the position by insisting that a 'performative' surrounds the representation of (2.67). We then have a way of distinguishing our various possible readings in terms of something like (2.68). This is three ways ambiguous and seems to connect non-explicit opaque performatives with explicit opaque verbs such as 'believes', 'thinks', etc.

(2.66) Smith's murderer is insane

(2.67) John thinks Smith's murderer is insane

(2.68) I say to you John thinks Smith's murderer is insane

Partee (1972), as well as connecting the Donnellan examples with referential/attributive distinctions in opaque contexts, also remarks on the close equivalence of this distinction in definites with specificity in indefinites.

Finally it should be mentioned that 'proper names' can manifest referential/attributive ambiguities when considered in certain contexts. In (2.69), clearly the individual has been named but never found. Now imagine someone uttering (2.69), effectively giving (2.70).

Given the state of affairs that exist in the actual world, representation (2.71) best captures the attributive reading of (2.70). However, this is a matter of contingent fact, and we could imagine that the utterer of 2.69 did in fact know the identity of the killer. Such a situation would then best be captured by (2.72).

(2.69) Jack the Ripper was insane

(2.70) I say to you Jack the Ripper was insane

(2.71) I say to you (iota x) (Jack the Ripper):.x.: was insane

(2.72) (iota x)I say to you (Jack the Ripper):.x.: was insane

Taken together these last sections indicates a number of different ways scopal insights have been used to explain alleged semantic distinctions in belief-contexts (see Table 2.6). This clutch of scopally based semantic insights seems very impressive. In addition there is Montague's own attempt to solve various substitution problems He attempts to effect this through his formalisation of the Fregean distinction of sense and reference, along with rules to determine when the one or other of these semantic values was in play. Together these achievements might convince us of the value and power of the Formalist programme.

One final point to note. The issue of who is responsible for a particular descriptive expression, what they might mean be it etc. could be seen as related to the problem of deciding when discourse is about an object and when it is about a meaning or description.
Similarly, we can ask to what extent do the specific/non-specific or attributive/referential dichotomies relate to claims that expressions can be about either their own senses/meanings or their simple extensions? There seems to be a considerable amount of overlap- perhaps it is little wonder that a common logical mechanism should be thought to underly these various phenomena. The issue of what is common to these referential phenomena and whether intensions and scope provides an adequate account is the topic of the next chapter.

TABLE 2.6 (Footnote 2.14)

| Cat of Exp | Semantic Distinction | Scope Position |
|---|---|---|
| P Names | Reference, Referential_M, | Wide |
| | Extensional, De Re, | " |
| | Attributer's responsibility | " |
| | Referential_D | " |
| Def Desc. | Reference, Referential_M, | " |
| | Extensional, De Re, | " |
| | Attributer's responsibility | " |
| | Referential_D | " |
| Ind Exp. | Reference, Referential_M, | " |
| | Extensional, De Re, | " |
| | Attributer's responsibility | " |
| | Referential_D | " |
| | Specific | " |
| P Names | Sense, Non-Referential_M, | Narrow |
| | Extensional, De Dicto, | " |
| | Attributee's responsibility | " |
| | Attributive_D | " |
| Def Desc. | Sense, Non-Referential_M, | " |
| | Intensional, De Dicto, | " |
| | Attributee's responsibility | " |
| | Attributive_D | " |
| Ind Exp. | Sense, Non-Referential_M, | " |
| | Intensional, De Dicto, | " |
| | Attributee's responsibility | " |
| | Attributive_D | " |
| | Non-Specific | " |

Footnote 2.14. The terms 'Referential_M' and 'Non-Referential_M' refer to Montague's use of the terms 'referential' and 'non-referential'. The terms 'Referential_D' and 'Attributive_D' are the terms Donnellan uses for his ambiguity in definites.

# CHAPTER THREE OVERWHELMING SCOPE AND UNDERWHELMING CONTEXT

## SECTION ONE PARADOXES OF SCOPE

Can scope be made to carry all of the semantic distinctions cited in the last chapter? In this section I intend to show that it cannot.

In the previous chapter I tried to draw the various semantic distinctions as clearly and as unambiguously as I could. This is, in a sense, to distort how things are. There has been, and remains, great confusion about the precise nature of distinctions such as 'specific' versus 'non-specific', 'referential' versus 'attributive' etc.

For example, apropos 'specificity', it is common to find the following kinds of statements

> I am aware that what is precisely meant by specific and non-specific [...] is a little obscure. (Lyons 1977:191)

> The 'specific'/'non-specific' contrast [...] These expressions have a very confused history in the linguistic literature. They have been used in several overlapping ways. (Heny 1981:liv fn34)

This lack of consensus arises because of different views about how distinctions in sentences such as (3.1) and (3.2) should be drawn. These views in turn are the product of two very different sorts of emphasis. The first emphasizes the truth conditions of sentences. The second, highlights the states of knowledge and understanding of language which speakers and hearers possess.

(3.1) John believes a policeman committed the crime
(3.2) John believes the murderer is insane
(3.3) John seeks a unicorn

For those who claim that the kinds of ambiguity present in sentences like (3.1) & (3.2) are scopal in origin there is a commitment to explaining the phenomena in terms of the different truth conditions the sentences may have. These truth conditions are dependent on actual or possible states of affairs in the world. The relationship of expressions in a language to states of affairs in the world determines the truth values of sentences in a language. In this account we do not make any mention of the mental states of the speakers and hearers of language.

It is in this spirit that we find Dowty et al. explaining how Montague would have talked about 'specificity' (they use sentence (3.3) to illustrate the 'specificity' phenomenon). They point out two different ways one can think about a sentence like (3.3).

1. what goes on in a person's mind when he decides to seek for something or other

> (and what beliefs may lead him to seek something) and
>
> 2. what relation can be said to obtain among (non-linguistic and non-mental) objects, and in particular, what the second of the two objects in this relation is, when the sentence 'John seeks a unicorn' is true.
>
> Model theoretic semantics is only concerned with the second of these two questions. Dowty et al 1981:249 fn 13

This highlights one of Montague's chief concerns- namely, the discovery of the appropriate ontology for a theory of meaning, a commitment to the discovery and elucidation of 'non-linguistic' and 'non-mental' semantic objects. These objects are the values that expressions in a language can take on. In Montague's account they include various set theoretic objects, total functions of certain sorts and truth values. All of these objects are quite independent of the intentional belief states of language users.

This treatment of sentences and their meanings as comprising a separate, objective ontological realm is very Fregean in spirit. There exists a similar motivation in the desire to decouple the language user from language itself, for example, distinguishing sentences as abstract objects from occasions of use. Saarinen writes in connection with sentences like (3.2)

> the referential attributive distinction is not a semantic ambiguity [...] a semantic

> ambiguity is a property of sentences
> (rather than utterances) (Saarinen 1980:2)

Returning to Montague, the de re/de dicto distinction he makes, and which I described in the last chapter, is a distinction between the kinds of semantic object that expressions in a language can be <u>about</u>. This <u>aboutness</u> is no product of a language user's intentions, the relation of <u>aboutness</u> is secured by our objective theory of meaning which relates expressions in the language to objects in the world. Thus in (3.2) there are two sorts of object that the definite description could be <u>about</u>. On a wide scope reading it would be about an 'extension', in this case an individual. Whilst on the narrow scope reading the definite description would be about an 'intension', this intension is not an individual, but is a set-theoretic entity that can be used for accessing individuals at particular indices.

Here again we have made no use of cognitive notions such as what an individual thought he was referring to, or what he intended to convey by the use of particular expressions. Ontology and psychology have been kept quite separate.

But we saw in the last chapter a number of examples where the formal apparatus of truth conditional semantics was being used to draw 'psychological' distinctions.

Distinctions having to do with the cognitive states of language users.

1 Where does Responsibility lie?

Take, for example, the question of 'responsibility' for the use of an expression. We saw on page 75 that scope has been used to explain the various possibilities which arise in determining 'expressive responsibility' in sentences like (3.4). It seems quite natural, in such cases, to enquire after peoples' intentions, states of knowledge etc. when using or reporting such sentences.

(3.4) Goering thinks the bravest man in Germany
      planted the bomb

We might ask who is responsible for the use of definite description in (3.4)? Is it the attributer (whoever reported (3.4)) or the attributee (Goering himself)? These two possibilities might be represented by the logical schemas (3.5) and (3.6). In (3.5) the definite description has narrow scope indicating that responsibility for its use was the attributee's, whilst in (3.6) the wide scope reading indicates that the use of this definite description was the responsibility of the attributer or utterer of (3.4). We would, using our knowledge of the actual world and its history, probably suppose that (3.6) is the most likely interpretation for

(3.4).

(3.4) Goering thinks the bravest man in Germany
      planted the bomb
(3.5) thinks(g,^iota x(bravest_man_in_Germany(x)
      & planted_bomb(x)))
(3.6) iota x(bravest_man_in_Germany(x)
      & thinks(g,^planted_bomb(x)))

But (3.6) is also the 'de re' reading of (3.4), and as such is supposed to have nothing to do with modes of description of expressions themselves. The 'de re' interpretation relates the attributer to a certain sort of semantic object and nothing more.

We might suggest that since 'responsibility' has to do with the 'mode of description' an intension would serve as a more appropriate object for the attributer to be related to in the scenario sketched above. If the attributer could be related to an intensional object then we might be able to make more sense out of the proposal to use logical scope to explain the phenomenon of 'expressive responsibility'. To this end we might consider, in line with our proposals on page 90, the introduction of a 'performative verb'. This seems reasonable, in the scenario above the attributer will utter (3.4). This idea could be generalised, so all sentences would be understood as embedded under opaque performative operators. If we adopt this suggestion there are three schemas for utterances like (3.4), ie (3.7)-

(3.9).

```
(3.4) Goering thinks the bravest man in Germany
      planted the bomb
(3.7) SAYS (sp,^thinks(g,^iota x(bravest_man_in_Germany(x)
       & planted_bomb(x)))
(3.8) SAYS (sp,^iota x(bravest_man_in_Germany(x)
       & thinks(g,^planted_bomb(x)))
(3.9) iota x(bravest_man_in_Germany(x)
       & SAYS (sp,^thinks(g,^planted_bomb(x)))
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In (3.7) the description is the attributee's responsibility, in (3.8) it is the attributer's responsibility and in (3.9) we have the genuinely 'de re' interpretation in which the responsibility for a mode of description is not at issue at all.

The problem with this analysis is that it still tries to use one set of machinery to explain two very different sorts of phenomena. The 'de re/de dicto' distinction raises issues to do with semantic ontology and 'absolute external truth conditions'. The idea of 'expressive responsibility' raises questions about how speakers and hearers <u>understand</u> the ways we identify and describe the objects of discourse, and how this understanding relates to the states of knowledge which processors have at any moment in time.

This is demonstrated if we consider (3.4) a little more carefully. On its 'de dicto' analyses, (3.7) for the attributee and (3.8) for the attributer, the formal theory of truth demands that there is an unequivocal answer to the question 'who is the bravest man in Germany?'. There has to be an objective answer to the question of whether the expression 'the bravest man in Germany' is true of a certain object at any index, otherwise the formal intension of the expression cannot be constructed. This answer will depend on the various independent, extensional characterisations of the basic expressions which constitute this complex description. These semantic values are not up for negotiation, they lay outside the conventions and interferences of individual cognitive processors.

What we have said in the last paragraph is very different to what we want to say about the nature of 'expressive responsibility'. We view expressive responsibility as a notion that goes beyond the mere detail of whether X or Y used an expression. Rather, expressive responsibility is the realisation that speakers use expressions which other members of the speech community recognise as originating from that speaker. One consequence of this is that members in the speech community need not assent to, or judge as appropriate, these expressions. Expressions such as 'brave', 'traitor', 'informer' etc. are particularly good examples of terms whose appropriateness can only be judged within the framework of a particular Belief System's intentions (its goals, desires, needs, wishes etc).

In summary, assessing the truth conditions of (3.7) and (3.8) requires appeal to meanings which are objectively fixed, this runs counter to a full notion of 'responsibility'. It is an example of the general problem that arises when objective truth conditional meanings confront our linguistic practice. A problem that is rooted in the contrast between an anti-psychologistic versus a psychologistic view of meaning.

## 2 On being Specific

The clash referred to above is at the bottom of the confusion over what is meant by 'specificity'. The only definite thing to emerge out of a careful reading of the literature is that sentence (3.10) may be carried on in two ways, represented by (3.11) and (3.12).

(3.10) John wants to marry a Swede
(3.11) He'll propose to her tomorrow
(3.12) He's yet to find one who will have him

The distinction has been drawn in a number of ways. A linguist who has related it to questions of discourse and what is in the speaker or hearer's mind is Lyons (1977). He talks about specificity only after having defined reference in cognitive terms.

> according to the view of reference adopted here, when we ask 'What does the

> expression x refer to?', we are asking the same question as 'What is the speaker referring to by means of x (in uttering such-and-such a sentence)?' (Lyons 1977:177)

> The point is that, once any information at all has been supplied about an indefinite referent, it can then be treated by the participants as an individual that is known to them both and is identifiable within the universe of discourse by means of a definite referring expression. It is not a necessary condition of successful reference that the speaker or hearer should be able to identify the individual being referred to in any sense of identification other than this (Lyons 1977:189)

He illustrates the specific, non-specific distinction using sentence (3.13)

(3.13) Every evening at six o clock a heron flies over the chalet.

(3.14) It nests in the grounds of the chateau.

This sentence contains an indefinite noun-phrase, which under one interpretation, Lyons claims, can be understood to refer to a specific, though unidentifiable, individual . The continuation sentence (3.14) is seen to support such an interpretation. On this account it is no part of specificity that one should be able to go out into the world and identify the heron. The speaker probably couldn't do this any way. Indeed it doesn't matter on this account if the imagined state of affairs is false. There could be a number of herons flying over the chalet and nesting in the grounds of the Chateau. What is important is that the speech act was intended specifically and could succeed as a speech act, as a referential act, regardless of what holds.

A rather different view of specificity is held by those scholars who draw the distinction in terms of what holds true in the world, and how sentences relate to these states of affairs.

Jackendoff (1972) talks of the distinction in terms of what the noun-phrase does or would identify in the world. He writes apropos of sentence (3.15)

(3.15) John wants to catch a fish.

> On one reading there is a particular fish that John wants to catch (the specific reading). On the other reading (the non-specific reading)....there will be a fish to point to just in case John succeeds in catching one (Jackendoff 1972:279)

Often scholars seem to rely on both absolute truth conditions and cognitive states to explain the context of specificity. Kasher & Gabbay (1976) in an article entitled 'On the semantics and pragmatics of specific and non-specific indefinite expressions' claim that

> the difference between the specific and non-specific readings involves a difference of truth conditions. Consider [3.16]
>
> [3.16] John talked with a Swede

> Assume that I can describe some Swedes in a predicative identificatory way, and some Swedes I can't describe in this way. Assume one of the latter talked to John but none of the former [....] Now, on its non-specific reading [3.16] is true in a context of my uttering, if John talked to someone who is a native of Sweden. Hence [3.16] on that reading is true under the circumstances described above. On the other hand [3.16] on its specific reading is true, in my context of uttering it, if John talked with some Swede who I am able to describe in a predicative identificatory way. Under the above described circumstances John talked with none of the latter Swedes and thus [3.16] on its specific reading, is false, under these circumstances. (Kasher & Gabbay 1976: )

They also assert a little earlier in the article that they are using a cognitive notion of reference.

> we should like to stress that our criterion for specificity is the existence of a speech act of reference in the context of utterance (Ibid)

Taking these two quotes together we see that the authors regard 'specificity' as comprising, in part what the speaker intended, in part, what the speaker is able to do (his state of informedness) and, lastly, what is the case in the world.

What does seem incontrovertible is that if we once allow the full involvement of a processor's intentions, his state of informedness, his knowledge about the 'belief states' of other processors etc., we open up an enormous range of possibilities for the actual interpretation of the expressions in our linguistic practices.

There are those who argue that such an involvement of individual cognitive states takes us beyond the realm of semantics and into pragmatic issues. However, I will endeavour to show that a theory of "truth" and "reference" cannot be isolated from a theory of the cognitive states of language users.

For now let us "play" according to the formalist's rules. Firstly, we should note that the examples used by both Lyons and Kasher & Gabbay do not contain verbs that are traditionally regarded as inducing opaque contexts. As a consequence it is not immediately clear how the 'specificity analysis' suggested on page 89 can be used at all in these cases. One move is to once again introduce an implicit performative verb into such sentences. The performative provides the operator with which the indefinite can interact, cf for example 3.17 and 3.18.

(3.16) John talked with a Swede
(3.17) SAYS (sp,^(Ex(swede(x) & talked(j,x))))
(3.18) Ex(swede(x) & SAYS (sp,^(talked(j,x))))

But notice that, using an intensional formal system, 'specificity' is 'semantically' indistinguishable from the de dicto/de re distinction of Montague's. This "intensional" characterisation of 'specificity' implies that on the 'specific' reading the speaker is <u>related</u> to an extensional object and in the 'non-specific' reading to an intensional object. Specificity so construed is not concerned with what speakers or hearers <u>intend</u> by means of their use of certain expressions.

Nevertheless, let us construe 'specificity' in the way Jackendoff suggests, in terms of what the noun-phrase does or would identify in the world. Playing by the formalist's rules we can run into problems.

Using truth conditional semantics and scope to articulate specificity, Ioup (1977) claims to have demonstrated certain 'paradoxes of scope'. She claims that a sentence like (3.19) is interpretable in four ways- supported, she claims, by continuation sentences such as (3.20)-(3.23). These four interpretations are the result of two different ambiguities. One is the ambiguity possible in the relative ordering of the quantifiers 'every' and 'a', ie 'V...E...' versus 'E...V...'- what I will refer to as the 'combinatoric ambiguity'. The other is the ambiguity inherent in our understanding of the indefinite noun phrase as specific or non-specific- I will term this the 'specificity ambiguity'.

The essential point in Ioup's argument is that a linear arrangement of quantifiers, indicating the relative scopes of the quantified expressions, can only capture three out of the four interpretations. To understand her claims we have to understand the constraints these various semantic ambiguities place on the representational capacity of logic.

(3.19) Every villager believes that a witch blighted their cows
(3.20) They know who she is and are trying to catch her
(3.21) They know who they are and are trying to catch them
(3.22) If they ever discover who they are the villagers will burn them
(3.23) They all agree it must have been the same one, and if they ever find her they will burn her.

Table 3.1 shows the linear order constraints that the various ambiguities impose on the operators. If we look at the combinatoric ambiguity- a wide scope reading of the universal quantifier relative to the existential requires that the universal quantifier has widest scope, it must in any case stand outside the scope of 'believes', whilst the position of the existential operator is unconstrained within the scope of the universal. The only constraint to represent in this case is 'Vy..Bel'. If we consider the other possibility in the combinatoric ambiguity, where the existential is given wider scope, then two constraints are imposed, namely- 'Ex..Vy' and 'Vy..Bel'. It so happens that these two constraints can be consistently obeyed. If we now consider the interaction of the specificity ambiguity with the combinatoric one we have additional constraints to accommodate. The question is can all the alleged interpretations be consistently represented using the scope of operators.

Continuation (3.20) is an interpretation of (3.19) in which we imagine a situation where all the villagers are in collective agreement as to the particular individual responsible. The relevant quantifier and opaque operator must satisfy the constraints indicated in the first row of Table 3.1- indeed these constraints can be simultaneously satisfied.

Table 3.1

| Interpretation | Constraints on the linear ordering of operators | |
|---|---|---|
| | Combinatoric | Specificity |
| cont by 3.20 | Vy..Bel<br>Ex..Vy | Ex..Bel |
| cont by 3.21 | Vy..Bel<br>Vy..Ex | Ex..Bel |
| cont by 3.22 | Vy..Bel<br>Vy..Ex | Bel..Ex |
| cont by 3.23 | Vy..Bel<br>Ex..Vy | Bel..Ex |

Continuation (3.21) is an interpretation of (3.19) where each individual villager has his own particular idea about which 'specific' witch it was that blighted the cows. This reading is accommodated by the application of the consistent set of constraints represented in the second row of 3.1. The next case is continuation (3.22) where (3.19) is understood in the following way. Each villager has a belief that some witch or other, not specifically characterised, blighted the cows. Once again a consistent set of constraints exist- shown in the third row of Table 3.1. The next continuation (3.23) is a reading of (3.19) in which all the villagers together are seen to have beliefs which relate them all to the same non-specific characterisation of the indefinite noun phrase. Now if such an interpretation is possible (Geach's so called 'intentional identity' (Geach 1967)) then there is no linear ordering of operators that can represent it. This reading requires a wide scope reading of the existential relative to the universal for the combinatoric ambiguity, since the universal does not interact with the opaque context it must be represented outside it. However, if the indefinite is to be given a non-specific interpretation the particular quantifier must occur within the scope of the opaque operator. We are left with an irresolvable problem. We cannot do both jobs at once using the same logical machinery. We cannot satisfy all of the constraints simultaneously.

Now there has been some dispute as to whether (3.23) is a genuine reading of (3.19)

> it is predicted (correctly, we believe)
> that in example [3.24] it is impossible
> for 'a fish' to have a de dicto reading
> and at the same time have wider scope than
> 'every man' (Dowty et al 1981:210)

(3.24) Every man believes that a fish walks

In this quote, from a part of their book where they are dealing with specificity, they use Montague's own terms de re and de dicto synonymously with the terms specific and non-specific. Presumably on their account what is at stake is the kind of object that each villager stands in a belief relation to. It seems, therefore, quite possible in terms of semantic ontology that they should each be in a belief relation to the same semantic object- namely, an intension.

So (3.23) seems a perfectly plausible reading of (3.19) in Montague's own terms. Alternatively, if we think for a moment what a cognitive explanation of this reading involves, it still seems plausible. We imagine a situation where all the villagers are agreed on the kind of witch which must have cast the spell. Perhaps because of some particular feature of the blight, lets say, it is believed that the witch must be the same one that has been causing havoc in surrounding areas. They have no way of actually identifying the individual. Thus according to some formulations of the specificity distinction we can say that the noun phrase is understood non-specifically. We might say, following Geach, that their beliefs are about an 'Intensionally Identical' object.

3 Compounding the paradoxes of scope

If we agree, despite my earlier objections, to use scope to account for 'responsibility' we can produce situations in conjunction with other 'scopal' phenomena, such as the combinatoric or specific ambiguities, where scope becomes hopelessly overburdened. It is possible that a sentence like (3.25) would now become eight ways interpretable! I am assuming that (3.25) is in fact embedded under an implicit performative 'SAYS' and that this operator always has widest scope.

(3.25) S SAYS Every villager wants to marry a witch

Sentence (3.25) has three ambiguities- the combinatoric one, the specific and the ambiguity of responsibility. Three ambiguities imply eight interpretations. Table 3.2 shows the various constraints that arise if each of these semantic dichotomies is represented in terms of the scope of logical operators.

Table 3.2

Constraints on the linear ordering of operators

| | Combinatoric | Specificity | Responsibility |
|---|---|---|---|
| i | Vy..Bel<br>Ex..Vy | Ex..Bel | W(x)..Bel |
| ii | Vy..Bel<br>Ex..Vy | Ex..Bel | Bel..W(x) |
| iii | Vy..Bel<br>Ex..Vy | Bel..Ex | W(x)..Bel |
| iv | Vy..Bel<br>Ex..Vy | Bel..Ex | Bel..W(x) |
| v | Vy..Bel<br>Vy..Ex | Ex..Bel | W(x)..Bel |
| vi | Vy..Bel<br>Vy..Ex | Ex..Bel | Bel..W(x) |
| vii | Vy..Bel<br>Vy..Ex | Bel..Ex | W(y)..Bel |
| viii | Vy..Bel<br>Vy..Ex | Bel..Ex | Bel..W(y) |

The constraints placed on the combinatoric and specificity ambiguities are the same as for (3.19) The ambiguity of responsibility revolves round the question of who is regarded as the originator of the predication 'witch' in (3.25). The logical representation I will describe allows that a quantifier and term need not stand immediately next to one another- although the term must be inside the scope of the quantifier. Although Montague does not use this formalism it is a more general one and allows the machinery of logic greater expressive power.

The two possibilities, represented in the third column of Table 3.2 , are that the non-logical constant 'witch' stands outside or inside the scope of 'wants'. In the wide scope reading responsibility lies with S, whilst in the narrow scope reading it lies with the villagers.

Of the eight possible combinations of ambiguities five are represented in a straightforward manner, namely- combinations i, ii, v, vi and viii. Logical representations for these interpretations are given in Table 3.3. Three combinations of ambiguities are problematic- iii, iv and vii in Table 3.2.

Table 3.3

| | |
|---|---|
| i | S SAYS [ExVy (witch(x) & [villager(y) -> wants(y,marry(x)])] |
| ii | S SAYS [ExVy (villager(y) -> wants(y,marry(x)& witch(x)))] |
| v | S SAYS [VyEx (witch(x) & [villager(y) -> wants(y,marry(x)])] |
| vi | S SAYS [VyEx (villager(y) -> wants(y,marry(x) & witch(x)))] |
| viii | S SAYS [Vy (villager(y) -> wants(x,Ex[marry(x) & witch(x)])] |

What are the problems with iii, iv and vii ?

Combinations iii and iv fail, in part, because if Ioup's paradox- we want to interpret the noun phrase 'a witch' non-specifically and simultaneously provide a wide scope reading for the existential quantifier in the combinatoric ambiguity.

But notice that iii fails for the additional reason that specificity and responsibility conflict. We need to place the predication 'witch(x)' outside the scope of 'wants' to indicate S's responsibility for the description- but the quantifier which is needed to bind the variable in 'witch(x)' is also required inside the scope of 'wants' for non-specificity. These two constraints cannot be jointly satisfied.

Combination vii is also interesting. A conflict between the combinatoric and specific ambiguities is not the problem here. It is one of responsibility interacting with specificity. If S is responsible for the term 'witch' it must be represented as standing outside the operator 'wants', but a non-specific interpretation of 'witch' requires it to be inside the scope of 'wants'.

But are the difficult combinations really possible interpretations of (3.25)? Consider the following continuations for (3.25):

(3.25) Every villager wants to marry a witch

(3.25)iii They all have the same ideal- though they'd never agree to my description of such a woman

(3.25)iv They all have the same ideal- and they realise the status they would achieve marrying such a woman

(3.25)v Every villager has his own ideal- one thing is for certain, they wouldn't like my description of the object of their desires

These continuations are aimed at interpreting the notion of specificity in terms of intensional identity. One could imagine alternative continuations if we were invited to construe non-specificity as a lack of the identificatory knowledge required to recognise an individual- to pick the individual out as satisfying the indefinite predication. These alternative continuations are given below:

(3.25)iii They don't know who she is- and they certainly don't know she is a witch

(3.25)iv They don't know who she is- but they do know the status they would acquire by marrying her

(3.25)v None of the villagers know the identity of the women they want- nor that they are witches.

The problem of whether such interpretations imply existence can be defused using Montague's approach- he drew his individuals from a set of possible individuals not all of whom have 'existence' predicated of them.

Nevertheless, we still face the paradoxes of scope that arise when specificity interacts with other 'scopally determined' phenomena.

## 4 The origin of specificity

Let us return now to considering specificity as a phenomenon in itself. We can distinguish two views as to the origin of the phenomenon; semantic and cognitive.

I am going to explore the notion of specificity as cognitive in nature; then return to the semantic analysis. Lyons argues that it is in an intention to be specific that the property of specificity arises in the first place. Let us consider what some of the criteria might be in the specificity of an indefinite.

In example (3.26) below it is quite possible that John knows a great deal about a particular work of art that has gone missing. He possesses very rich and detailed ways of 'predicatively identifying' this particular object. We would want to say in such a case that cognitively speaking John has a belief about a specific object. On the other hand, we can imagine a world in which he may have very little knowledge about the object, the only evidence he may have is the absence of a painting as indicated by a bright piece of untarnished wall.

(3.26) John believes that a painting is missing

Nevertheless, John has a belief about a quite specific object. He has a representation of this construct and he may talk to others about the missing object in quite definite terms. His understanding and communication manifests itself in such a way that we conclude John does hold a belief about a particular object.

This reveals an important feature of a cognitive analysis of the intention to be specific, the representation of the intended referent may be more or less detailed, more or less accurate- but is still a specific attempt, on the part of the speaker, to call to mind or recreate a particular representation in the mind(s) of his audience.

Now the feature alluded to above is a fundamental property of cognitive representations- representations are 'empirically incomplete'. Imagine a couple in a Gallery staring at a painting long and hard. Later one reports of the other (3.27)

(3.27) John has fallen in love with a Van Gogh

Now they have studied this painting with the utmost care and have formed very detailed representations of it. They can go on at length about its subject, manner of composition, brushwork etc. But of course if an exact facsimile of the painting were manufactured their descriptions and representations would be quite inappropriate to the job of determining which is the original. This is a key aspect of our knowledge of the world. Our linguistic specifications no matter how detailed and 'specific' are incomplete descriptions of already incomplete representations. Our perceptual representations under-determine the objects that give rise to them in the actual world, our language further under-determines these representations.

Related to the property of representational incompleteness is the fallibility of representations and their cognitive embodiments. Imagine our couple in the Gallery trying to find another painting they particularly want to see. They are given directions, (3.28), by a not very well-informed Gallery attendant who has, in turn, got the instructions from an even less well-informed colleague Harry. Now the indefinite description might serve perfectly well to locate the part of the Gallery and the painting they are after. It might serve despite the fact that the landmark picture adjacent to the one sought is not a Constable at all.

(3.28) Harry believes the painting you want is
next to an unmistakable Constable

This case illustrates that descriptions of objects which are in fact false from the vantage point of some better and greater authority, can still serve as perfectly good identificatory criteria. We will return to this point when we look at definite descriptions.

Cognitively understood 'specificity' is an aspect of "referential communication" which is grounded in the nature of mental representations. This allows us to account for other interesting uses of indefinites in language. Often in an utterance the notion of specificity is working on a number of levels- working at the level of what are sometimes called in the literature tokens and types (alternative terms are exemplars and stereotypes or prototypes).

In (3.29) John might be understood as asserting something about a particular car or else about a make of car, in the first case the object of reference is the perceptually present car, in the second case the perceptually present object serves only as an exemplar for a more abstract construct. In both interpretations 'intentional specificity' is present in the desire to evoke certain sorts of representations in the hearer.

(3.29) John says "That car is a lethal weapon"
to Nigel

By establishing topics and referents of discourse the speaker is ipso facto being specific. The nature of the 'specifically evoked' objects of discourse varies enormously. However when viewed in the context of discourse the concept of non-specificity disintegrates, in setting up the objects of discourse one is engaged in representational specificity.

How is specificity understood within formal semantic proposals? As I have said the intensional proposals equate specificity and non-specificity with de re and de dicto interpretations of expressions. As such the explanation for the specificity phenomenon in a sentence like (3.30) is through the relation of a subject to a certain sort of non-mental semantic object- an extension or intension. We gain no analysis of the 'mental specification' of the object of John's desire.

(3.30) John wants a book

However, this analysis gets things upside down. In the example above it is a mental state which decides whether John is concerned with a particular book on a particular shelf, a certain title, a certain genre of novel or whatever.

Only if intensions were psychologised so as to be the mental carriers of meaning would be able to reconcile intensions with representational specificity. Though we would still be left with the problem of distinguishing when reference was to extensions or intensions (psychologised say as tokens and types respectively)

Having argued against the standard intensional analysis it ought to be pointed out that many linguists do not use an intensional logic in talking about scope and specificity. Linguists who accept scopal accounts of specificity usually represent the possible interpretations using logical schema of the First Order

Calculus. But what is it about these logical schema that "explains" the concept of specificity?

(3.31) John wants to marry a Swede
(3.32) John wants (Ex(John marry x))
(3.33) Ex(John wants (John marry x))
(3.34) John wants there to be at least one person such that that person is Swedish and John marries her
(3.35) There is at least one person, a Swede such that John wants to marry her

In the First Order account of (3.31), without intensional machinery, (3.31) may be paraphrased as (3.34) or (3.35). The difference then between (3.32) and (3.33) and their respective paraphrases (3.34) & (3.35) is that in (3.33) there is a commitment to the existence of an object that John stands in a relation of 'wanting to marry', whilst in (3.32) he would like there to be such an object that he could marry. Such an object on this analysis will be drawn from individuals in the 'world'. Suppose we were to present John with all the female Swedes there were and at each turn he declined the lady. Would we say, when he had exhausted this extensional presentation, that (3.34) is false? This proposal seems to miss the point of John's utterance, he is referring to an 'intentional object', an object fulfilling an idiosyncratic set of wishes, desires, needs etc. He may carry this 'specific cognitive' recipe around never cashing it out extensionally.

It is claimed that we need a scopal analysis of specificity otherwise it is not

> possible to explain such ambiguities except by means of the notion of scope, because we find a systematic relationship between the number of interpretations and the number of embedded sentences (of the proper type) (Bach 1968:107)

So in sentences like (3.36) a featural analysis will not do.

(3.36) Bill thinks John wants to marry a Swede

I will show, in chapter five, that this claim is not true. I will not discuss this point further since my solution requires the introduction of machinery that is best presented later.

If we accept that 'specificity' is rooted, in so far as it exists at all, in the cognitive system then we are not able to use the model of specificity logic provides.

> The apparatus of extensionally interpreted predicate calculus (and its extensions that attempt to treat such intensional phenomena as tense and modality extensionally) is based on the idea that it is possible to give an account of the truth-conditional meaning of sentences in terms of the set relations of elements in a model. This idea can be seen as an idealized assumption of omniscience on the part of all users of the meta-language with regard to the domain of the object language. Such concepts as 'knowledge' and 'belief' are seen as problematic once sentences make explicit mention of them, but the propositional attitudes of the speakers and hearers of the object language toward the statements of that

> language have been idealised away [...] logic is seen to abstract away from all differences in knowledge and belief- the differences that are the very preconditions for the possibility of expository uses of language. (Stenning 1980: )

This analysis suggests that any phenomenon rooted in cognitive propositional attitudes is liable to be distorted by standard logical treatments. The next section presents another characteristic of definite nominals whose intentional nature renders a traditional logical analysis inappropriate.

## 5 The Referential Attributive distinction revisited

We saw in the last chapter how the referential attributive distinction has been handled scopally. However, in Donnellan's (1966a) original description of the phenomenon he argued that the distinction should not to be understood as <u>semantic</u> at all. It was not a phenomenon to be explained in terms of an absolute theory of truth and reference.

> in general whether or not a definite description is used referentially or attributively is a function of the speaker's intentions in a particular case. (Donnellan 1966a:297)

It is in the intention of the speaker to use the definite description in various ways that a referential and attributive distinction arises. The distinction is not, for Donnellan, an intrinsically syntactico-semantic ambiguity depending on the scopal possibilities of the quantified expressions.

It will be useful for the discussion that follows to distinguish two expressions due to Donnellan (1978) and Kripke (1977). They talk of 'speaker's reference' and 'semantic reference'. Speaker reference is what a speaker <u>intends</u> to <u>denote</u> by means of his use of an expression in language. Semantic reference is what, from an 'omniscient observers' (all knowing and all seeing) viewpoint, the expression does denote in formal absolute terms. The recursive formal semantic machinery of model theory, or any other system that fixes the semantic values of expressions in a language independent of processors, is interested in articulating the different truth conditions sentences have in terms of their semantic reference. There can only be, in the absolute space of truth conditions, appeal to the <u>absolute</u> semantic values that expressions in a language possess. This is required if we are to provide a correct and comprehensive system of entailments for the logic of the language.

Donnellan's (1966a) article argues that the referential use of a definite description does not depend on a 'denotationalist' theory of reference. Such a theory requires that referential use entails that the speaker is referring to whatever happens to be uniquely denoted by the definite description. But this secures semantic reference- which as we shall see is not necessarily identical speaker reference.

Let us remind ourselves how Donnellan draws the referential attributive distinction.

> A speaker who uses a definite description attributively in an assertion states something about whoever or whatever is the so-and-so. A speaker who uses a definite description referentially in an assertion on the other hand, uses the description to enable his audience to pick out whom or what he is talking about and states something about that person or thing. In the first case the definite description might be said to occur essentially, for the speaker wishes to assert something about whatever or whoever fits the description; but in the referential use the definite description is merely one tool for doing a certain job- calling attention to a person or thing- and in general any other device for doing the same job, another description or name, would do as well. In the attributive use, the attribute of being the so-and-so is all important, which it is not in the referential use. (Donnellan 1966a:285)

In the next passage Donnellan presents an example which, he claims, demonstrates that the referential attributive distinction is intentional in origin.

> That these two uses of the definite description in the same sentence are quite different can perhaps best be brought out by considering the consequences of the assumption that Smith had no murderer ( for example he in fact committed suicide). In both situations, in using the definite description "Smith's murderer", the speaker in some sense presupposes or implies that there is a murderer. But when we hypothesise that the presuppositions or

> implications are false, there are different results from the two uses. In both cases we have used the predicate 'is insane', but in the first case, if there is no murderer, there is no person of whom it could be correctly said that we attributed insanity to him. Such a person could be identified correctly only in case someone fitted the description used. But in the second case, where the definite description is simply a means of identifying the person we want to talk about it is quite possible for the correct identification to be made even though no one fits the description we used. We were speaking about Jones even though he is not in fact Smith's murderer and, in the circumstances imagined, it was his behaviour we were commenting upon. Jones might, for example, accuse us of saying false things of him in calling him insane and it would be no defence, I should think, that our description, "the murderer of Smith" failed to fit him. (Donnellan 1966a:285)

The passage above would seem to show that in the case of a referential use of the definite description one is able to 'refer' to an individual using a description which does not <u>denote</u> Jones in the strict semantic sense.

Of course, this situation was not mentioned in Fodor's scopal treatment of the referential and attributive readings of definites- it is fatal to her proposals.

Suppose Smith had committed suicide- then the definite description in my utterance (3.37) does not on the denotationalist account <u>denote</u> the object I <u>intended</u> to <u>refer to</u>.

(3.37) The murderer of Smith is insane

Standard model theoretic logic determines the content of quantified noun phrases in part by the function which assigns basic expressions of the language their denotations. The actual individual which satisfies the predicative terms in the definite description 'the murderer of Smith' will not be the one that will allow speaker reference and semantic reference to coincide (Footnote 3.1). On the formal account the utterer of (3.37) stands in a relation to an object denoted by terms other than 'murderer of Smith'. Formally, in the context described (3.37) will always be false.

We cannot, using a standard model theoretic account, produce an explanation of why (3.37) could be a 'successful referential speech act'.

The examples Fodor chooses are ones where speaker and semantic reference coincide, the coincidence seems to explain speakers successful reference but the "explanation" is parasitic on the "semantic reference" turning out to be the same as the speakers "intended reference".

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Footnote 3.1. This will be the case no matter what the assignment of values to variables

One might ask whether Fodor's scopal proposals are consistent in themselves- do they encounter paradoxes of the sort described for indefinite? Consider the sentence (3.38)

> (3.38) All the villagers know who the murderer of Smith is

On Fodor's account the referential reading requires that the definite description is outside the scope of the relevant opaque operator; whilst the attributive reading requires it to be inside.

Can we have combinatoric ambiguities involving 'iota x' and 'Vy'. Do the positional possibilities 'iota x...Vy' and 'Vy...iota x'yield intelligible interpretations.

It seems perfectly possible that in (3.38) each villager should be in agreement about who they think the murderer of Smith is. The other interpretation is one in which they each think the murderer is unique- having different ideas about who it is. Combinatoric ambiguity seems possible. possibility of interactions.

Do the combinatoric and referential ambiguities taken together produce problems for scopal representations?

The attributive reading requires the quantified noun phrase to be inside the scope of 'know'- a wide scope interpretation of the universal in the combinatoric ambiguity places the quantified expression outside the scope of the opaque operator. This interpretation of (3.38) is one we might gloss as- 'all the villagers believe that whoever he is the murder of Smith is insane'. It is an interpretation which cannot be represented if the scope of the definite is used to explain both phenomena.

Issues of "responsibility", "specificity" and "referentiality" all seem to involve knowledge- what speakers and hearers know about certain objects. We keep returning to the question of the cognitive states of people who use "referential expressions".

The absolute formal semantic position is straightforward- meanings are non-cognitive. The meanings of expressions are fixed independently of language users and these meanings are invariant. Moreover, the method of evaluating sentences as true of false relates sentences to objective states of affairs in the world. These are the central tenets of 'semantic reference'.

We have looked, in this section, at how formal semantics struggles to account for certain semantic phenomena within its own framework. In the next section we ask whether semantic reference is the right concept to start from when trying to understand reference in natural language. We also consider the problems which systems of formal semantics face when they attempt to provide theoris of inference for natural language- these problems are, once again, associated with the formal definition of meaning.

## SECTION TWO RADICAL OPACITY

The formal proposals, as to how proper names, definite descriptions and indefinite expressions _mean_ what they do, are both proscriptive and narrow. Frege alleges proper names and definite descriptions do _refer_ but indefinites do not. Montague argues that only proper names are capable of direct denotation or reference. Russell claimed that none of these three categories of noun phrase actually denote.

### 1 The context of reference

The role of context in determining the semantic values of expressions is particularly poorly dealt with in formal accounts of reference. It ought to be self-evident that a sentence like (3.39) devoid of any 'contextual embedding' has no truth value. The question of whether (3.39) is true or false does not even arise until we have provided a contextual embedding for (3.39).

(3.39) Barry is wearing a tie

Context determination is not a problem peculiar to proper names. In fact the putative analyses Russell and Montague give to definite and indefinite terms throws context, or the lack of it, into prominence again.

In (3.40) do we suppose that on a 'de re' reading the only way the definite description can be truthfully discharged is if there exists one and only one individual in the world that has the property of being a fish and also the property of swimming?

(3.40) The fish swims

This seems totally counter intuitive as an analysis of (3.40). It is clear that the 'one and only one' part of the Russell/Montague analysis must be relativised to a context of some sort.

> [(3.40)]...would probably never be intended by a speaker of English to imply that one fish exists in the entire world, but rather would be used when a certain fish is uniquely identifiable to the hearer in the immediate surroundings or at least in the context of the immediately preceding discourse. (Dowty et al 1981:197)

In such a case where the use of a definite description in a particular context results in the hearer's attention being directed in such a way that an individual is uniquely identifiable why should we not say that the definite description is a singular referring term?

Parity of argument suggests that in an appropriate context an indefinite expression may also be held to identify a unique individual, as in (3.41).

(3.41) A man Sam knew in Oxford has been appointed

Again we might reason that in such cases the indefinite was acting as a singular referential term (cf for example, Chastain 1975, Wilson 1978, Fodor & Sag 1982).

> indefinite descriptions should, therefore, be added to the list of expressions, since in many contexts they purport to refer and thus count as singular terms. (Chastain 1975:206)

Context seems to be the central concept here. What sort of contextual information is required to compute the semantic value of (3.39)-(3.41) and how does a term come to be embedded contextually? An obvious reply is through the use of that term by a language processor on a particular occasion. If contexts are crucial to the referring power of terms and <u>use</u> is crucial to context then we might suspect that <u>use</u> and reference are intimately connected. This, I will argue, is exactly right.

In formal semantics context has been articulated in terms of various spatio-temporal co-ordinates, occasionally throwing in extra elements such as previous discourse. Now formalists have recognised that this is a singularly impoverished view of context. Thus we find Lewis (1972) presenting a rather more extensive set of co-ordinates. These co-ordinates constitute the context against which the semantic values of expressions are to be evaluated.

> we must have several contextual co-ordinates corresponding to familiar sorts of dependence on features of context. (The world co-ordinate might itself be regarded as a feature of context, since different possible utterances of a sentence are located in different possible worlds). We must have a time co-ordinate in view of tensed sentences and such sentences as 'Today is Tuesday'; a place co-ordinate, in view of such sentences as 'Here there are tigers'; a speaker co-ordinate in view of such sentences as 'I am Porky'; an audience co-ordinate in view of such sentences as 'You are Porky'; an indicated-object co-ordinate in view of such sentences as 'That pig is Porky' or 'Those men are Communists'; and a previous discourse co-ordinate in view of such sentences as 'The aforementioned pig is Porky'. (Lewis 1972:175)

What is lacking in such contextual sets are elements to do with the internal states of language processors. To be fair to Lewis he does actually, in an appendix to his 1972 paper, allow the possibility of one intentional co-ordinate. The consequences of this are potentially dramatic for a formal programme, but this co-ordinate is seldom mentioned or referred to in the literature.

> and only door that now exists is open; nor does it mean that the one and only door near the place of utterance, or pointed at, or mentioned in previous discourse, is open. Rather it means that the one and only door among the objects that are somehow prominent on the occasion is open. An object may be prominent because it is nearby, or pointed at, or mentioned; but none of these is a necessary condition of contextual prominence. so perhaps we need a <u>prominent-objects co-ordinate</u>, a new contextual co-ordinate independent of the others. It will be determined, on a given occasion of utterance of a sentence, by <u>mental factors</u> such as the speakers expectations regarding the things he is likely to bring to the attention of his audience. (Lewis 1972:214)

Many scholars have reacted against the Formalists' exclusion of intentional states from accounts of reference. Morgan (1975) claims that we should view the speaker as generating the language he does in part as a means of directing his audience to infer certain things about the speakers intentional states. For example, in considering why a particular nominal form is used in a sentence Morgan claims we should consider the question

> What can we infer about the speaker's intentions from the fact that he has chosen this particular description, rather than any of the others which would call to mind the same referent? (Morgan 1975:442)

As an example consider the following situation. Sam might say to Robert something like (3.42). It is quite possible Robert knows the referent

| | | |
|---|---|---|
| (3.42) | Sam says to Robert | 'Louisa could get you some tablets'. |
| (3.43) | Sam says to Robert | 'As, Dr Steel, Louisa could get you some tablets'. |

of 'Louisa' in this context to be Sam's wife without knowing that she is a Doctor. However, if Sam appreciated this gap in Robert's knowledge a more 'co-operative' utterance might have been (3.43). Certainly the manner of description is dependent on Sam's estimation of the intentional state of his recipient.

> a theory of linguistic reference will have to be combined with a systematic account of certain intentional states of the speaker- his thoughts, beliefs, perceptions, and so on- which are, so to speak the immediate links connecting the singular terms he utters with their referents out in the world. (Chastain 1975:192)

Context construed in this way gives language its intentional character and is at the root of the many claims that reference is an intentional phenomenon (cf for example Strawson 1950, Grice 1968, 1975, Searle 1969, 1979, 1983, Chastain 1975, Lyons 1977, Grosz & Hendrix 1978, Nunberg 1978, Webber 1978, 1981, 1983, Allen 1979, 1983, Brown & Yule 1983).

In support of these claims lets look at some more referential acts.

Suppose I walk into my office and see two colleagues waiting for me, one utters (3.44). Now we all three know a lot of people by the name of 'Sam', in fact we probably each know quite different sets of Sams. What does this utterance rely on to get me to to successful referential uptake (a realization of who is being referred to)? It isn't particularly the time and place (3.44) was uttered, nor the simple fact that Gerry reported it to me, nor was it any previous discourse history. What it relied on was a shared corpus of background beliefs,

(3.44) Gerry says "Sam is wearing shoes today."
to Nigel

shared expectations, shared ideas about what is newsworthy, remarkable, unexpected etc. Why should (3.44) be remarkable? It so happens that in our little group it has been a noteworthy feature that a chap we all know, Sam, has for as long as we've known him not worn shoes. He pads about barefoot, convinced this is the natural, healthy condition for feet! Within our society this is rather unusual, not perhaps in the Outback of Australia, but certainly in the Northerly latitudes of Edinburgh. But is was not the spatio-temporal co-ordinates that allowed immediate uptake of reference. It was rather the 'co-ordination' of a number of intentional elements

(Footnote 3.2). In this context the particular predication made in (3.44) was sufficient to absolutely and uniquely identify an intended referent.

Similarly, consider a situation in which a group of academics are having lunch in the Refectory and observing their Head of Department and a colleague eating together at another table. Now in this context (3.45) succeeds as a unique act of reference, its success is secured via some complex intentional inferential work involving the appreciation of various authority structures and how they might be carried over by analogy into the current situation. The definite description may well have never been heard by the assembled audience before as applying to the intended referent, nevertheless as soon as it is used they all laugh heartily.

(3.45) Smith says "I see the Head Boy is at it again".
to Jones etc.

In such cases as (3.44) & (3.45) we have to describe what is going on in terms of the beliefs and attitudes of speakers and hearers. The success of these acts can best be understood in terms of the reciprocal recognition of intentions by language users. The speaker relies on his

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Footnote 3.2. It cannot be over emphasized that the possession of any knowledge or, more appropriately, beliefs by a processor is an intentional fact. And to appeal to them is to appeal to intentional elements.

audience being able to recall and reconstruct these appropriate intentions.

> the conditions of reference are satisfied in the light of a "total context", which includes the beliefs of the speaker and hearer (Nunberg 1978:34)

The introduction of intentions allows reference to operate against a rich and varied backdrop. In hearing (3.46) I might be completely confounded until a context is supplied- namely, a fast food restaurant where the needs and requirements o the workers lead to certain sorts of referential identification- idiosyncratic but perfectly comprehensible. (This example is due to Nunberg (1978)).

(3.46) The ham sandwich is sat over by the jukebox

The introduction of an intentional context into the referential relation brings with it other properties. Intentional states are fallible. We entertain mistaken beliefs, misconceptions of various sorts, including mistaken views about the beliefs of others. Intentional fallibility often manifests itself as various sorts of 'referential misconstrual'. It is ironic that an adequate 'theory of reference' needs to say something about referential failure as well as success. We also require an explanation of what might be happening in the kinds of dialogue exemplified in (3.47) and (3.48).

(3.47) A: Have you seen Steve's new car
B: I have, I'd like a convertible myself
A: But it isn't

(3.48) A: Have you been to the Pub on Buccleuch Street?
B: No but I heard it sells Real Ale
A: Oh you're thinking of Proctor's Bar

What we need is an account of reference as an act which involves processors whose estimations of each others intentional states are constantly changing. These processors are constantly operating on only partial and incomplete descriptions of total contexts.

## 2 Nominals and Polysemy

Context shows up a feature of language which I refer to as 'radical' or 'cognitive' opacity. To fix the meaning of terms we need to take into account the mental states of language users. Since we have no privileged access to the mental state of others we cannot establish as a necessary condition for language that our separate use of terms is identical.

We could ignore this subjectivity of meaning many formalists have done and just assert intensional equivalence across speakers. But this has no explanatory force- it gives us no account of how such equivalence comes to exist- it is established by fiat.

Formal semantics provided us with a formal specification of a formal problem- the problem of substitutibility and referential opacity. We have examined formal ways to deal with the problem. The indications are that opacity involves a general problem not appropriately described in formal terms at all. Problems of opacity and substitutibility are rooted in fact that meaning is negotiable between speakers and exists against a dynamic background of human behaviour.

We cannot substitute terms in a formal calculus and hope, thereby, to describe a fundamental property of natural language. The fact is that natural language terms are used 'analogical', 'metaphorically', on many levels simultaneously. In examining context we have seen the complex and rich background against which referential evaluation takes place. We shall now consider polysemy- this phenomenon shows the huge variety of referential evaluation which individual terms are susceptible.

Polysemy is quite distinct from another phenomenon often closely associated with it, homonymy. These two characteristics of certain words can best be illustrated by example. Take the word 'bank' used as a noun. There are two quite separate meanings for the word. It might refer to a certain sort of financial institution or else to a type of landscape feature associated with rivers etc. The word 'bank' is homonymous. Ambiguous when standing alone, but in context we perceive its two meanings, viz (3.49) & (3.50).

(3.49) The man cashed his cheque at the bank
(3.50) The men were fishing along the bank
(Footnote 3.3)

Polysemy is a rather more subtle property of words. Consider the lexical item 'chicken', this might be used to refer on one occasion to a kind of bird and on another to a kind of meat. Or again the word 'book' might refer to a particular object open in front of me now, or else a particular title, or else the general concept, cf for example (3.51)-(3.53).

(3.51) The book is on the shelf.

(3.52) The book was finally published by OUP.

(3.53) The book will survive the IT revolution.

Look at how the word 'radio' is used in (3.54)-(3.57) (after Nunberg 1978). In (3.54) it is used to refer to a physical object. In (3.55) it refers to a method of transmission. 'Radio' can also be used to refer to an industry as in (3.56). And a use like (3.57) where reference is to the quality of the product commonly transmitted over radio sets.

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Footnote 3.3. It is, of course, always possible for a suitably intricate context to over turn the preferred interpretation in cases such as (3.49) & (3.50)

(3.54) John bought the radio.

(3.55) They got the news by radio.

(3.56) He made a pile out of radio

(3.57) Radio has gone downhill since TV came in.

It is not obvious that we want to say that these are completely different meanings of the words 'chicken', 'book', 'radio' etc. We might say that these are different uses of the same word. It is this phenomenon that is known as polysemy, we are not faced with multiple words 'radio' in (3.54)-(3.57). We are faced with different applications of "meaning". What we have to question is whether meaning can be reconciled with the monolithic ascription of intensions to words. These 'facts' of language issue a direct challenge to the truth conditional semanticist. What kind of all embracing set theoretic notion of meaning can be constructed for words exhibiting such rich and varied sense.

> A newspaper copy and a newspaper company don't count as instances of the same kind of thing in anyone's ontology, nor do a plate of chicken wings and a chicken on the hoof. (Nunberg 1978:7)

Another interesting aspect if polysemy is the fact that a nominal can serve a number of referential functions simultaneously, invoking a number of effects in the hearer. Thus in (3.58) the hearer is expected to be able to use reference to a physical object to secure reference to a rather more abstract referent, a particular sort of institution. Similar examples can be found in (3.59)-(3.61). All are cases where

(3.58) The newspaper you are reading has come out against hanging

(3.59) The chair you are sitting on is commonly seen in Eighteenth Century interiors

(3.60) The disposable cup you are drinking from is an environmental pollutant

(3.61) The bullet entered the pancreas, which is a vital organ, and he died of his wounds

initial referential uptake is only part of the story, once a physical referent is secured the audience is expected to use this uptake as a 'sign post' to the more general, important and abstract intended referent.

The features of meaning presented in this section- the context in which reference must be evaluated, what reference is to etc.- present problems for a Formalist account of semantics. The problems may be seen as resulting from a wish to sanitize meaning, to remove it to a non-psychological objective realm where transparency and determinateness of sense together secure an absolute theory of meaning, truth and reference.

## 3 The problem of Logical Omniscience

The omission of the cognitive processor from formal theories of meaning and reference has worried cognitive scientists. For example Johnson-Laird writes:

> Logicians have only related language to models in various ways, psychologists have only related it to the mind. The real task is to show how language relates to the world through the agency of the mind. (Johnson-Laird 1981:1)

How then are we to relate intensions to a psychologically plausible theory of language understanding? Surprisingly, many practitioners of formal semantics are candid in their admission that:

> the model-theoretic intension of a word has in principle nothing whatsoever to do with what goes on in a person's head when he uses that word. (Dowty 1979:375)

Introducing a collection of Montague's work Thomason writes:

> According to Montague the syntax, semantics and pragmatics of natural language are branches of mathematics, not of psychology (Thomason 1974:3)

This straightforward disavowal of any interest in psychology and the cognitive system is one response open to scholars.

Other advocates of formal theories of meaning have been aware of the gulf between their theories and theories of a 'mentalistic' sort. Some have sought to bridge the gap. We shall look at these proposals using them, on the way, to highlight the substantial obstacles to the reconciliation of a Montague-type approach with psychology.

Barbara Partee (1979) places on record her concern to bring together these two views of semantics which she calls 'mathematical' (formal) and 'psychological'. In fact, she relates this concern directly back to some of the central issues exercising me in this thesis.

> I believe that we will not be able to find an adequate account of the semantics of propositional attitudes without a theory which reconciles the conflicting demands of these two kinds of views of what semantics is. (Partee 1979:1)

She goes on to note:

> the view that semantics is not psychology can [...] be reasonably ascribed to Frege (1919), and seems to be either implicit or explicit in the work of many linguists and philosophers. (Ibid:1)

The basic problem, in trying to bridge the gap from avowed anti-psychologism to psychologism, is that some of the idealisations the truth-conditional formalists make, seem incompatible with a view of semantics as psychology.

One of Montague's idealisations is that the intensions of sentences are propositions, and propositions are functions from possible worlds to truth values. Now a consequence of this view is that any logically valid sentence (one true in all possible worlds) will have the same intension as any other. This, together with the fact that Montague assumes that the objects of propositional attitudes are propositions, leads to some uncomfortable consequences.

Recall the modified logical schema for substitution of identical semantic values given in the last chapter, and restated here.

(3.62) alpha=beta-->(PHI<-->PHIalpha/beta), where
alpha does not stand within the scope
of ^,NECC,Past or Fut

(3.63) ^alpha=^beta-->(PHI<-->PHIalpha/beta)

These schema together with the other proposals cited in Montague's system generate the consequence that where P and Q have the same value, then as logical equivalents they are intersubstitutable everywhere.

So in Montague's system the inference from (3.64) to (3.65) is valid. (Footnote 3.3)

(3.64) John believes that two is even
(3.65) John believes that the square of
two is irrational

In fact the problem is more general than this, the propositions do not have to be logically valid for the problem of inferences of the form (3.66) to (3.67) to hold, they can be logically false or simply logically equivalent.

(3.66) John believes P
(3.67) John believes Q

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Footnote 3.3. Assuming the not implausible supposition that these statements of arithmetic are in fact logically valid.

The principle that allows these troublesome entailments, is a grave embarrassment to Montague. After all, one of his aims was to provide a logic which would block illicit inferences in intensional contexts.

> Montague's main aim was to give a completely successful analysis of logical consequence, or entailment, for ordinary language. (Bennett 1974:5)

Embarrassing entailments can be found in Montague's system outside of 'intensional' opacity inducing contexts. In standard possible world semantics any logically false sentence implies any sentence whatsoever, whilst any sentence implies a logically valid sentence. So that the inference moves (3.68) -> (3.69) and (3.70) -> (3.71), are both valid. This is a consequence of the standard way in which entailment is defined, a sentence A entails a sentence B if it is impossible that A is true and B is false.

(3.68) Two plus two equals five
(3.69) The room is made of green cheese
(3.70) The unicorn is running for President
(3.71) Two plus two equals four

Tautologies and contradictions are logically equivalent outside intensional contexts, (3.72) could perfectly well entail (3.73).

(3.72) Two plus two equals four
(3.73) Either it is raining or it is not raining

Given our very clear intuitions about the inadmissibility of such inferences, it remains a very substantial concern that a system principally designed to deal with the notion of inference in languages should allow such entailments.

Partee traces the root of the problem to the fact our judgements are embedded within propositional attitudes:

> propositional attitudes are psychological, and it is just these psychological limitations that make substitution of logical equivalents fail. (Partee 1979:8)

In the quote from Partee above I find it surprising that she speaks of our failure to draw inferences of the sort canvassed as limitations. Even a super-competent cognitive being would presumably not make inferences such as (3.70) -> (3.71).

## 4 Proper Names and Logical Omniscience

We have already noted that Montague's solution to the substitutability problems associated with proper names was to ignore them. Within his system we are left with the legitimacy of inferences such as (3.72) -> (3.73).

(3.72) John believes Samuel Clemens is Samuel Clemens
(3.73) John believes Samuel Clemens is Mark Twain

I should point out one drawback of both my

> treatment and that of Russell: one must either prohibit the existence of two genuine proper names of the same individual, (so that, say 'Samuel Clemens' would be allowed in the language, but the purported name phrase 'Mark Twain' would be replaced by the common noun phrase 'person called Mark Twain' [Footnote 3.4] or reconcile oneself to the unambiguous truth of such sentences as 'necessarily Samuel Clemens is Mark Twain'. (Montague 1970b:213)

Montague leaves us with the option of either denying certain apparent proper names the status of genuine proper names, or else accepting the view that proper names must be rigid designators (i.e. have the same denotations in all possible worlds).

Treating proper names as if they were rigid designators has been advocated by, for example, Kripke (1972). Part of the enthusiasm for Kripke's proposal has been its associated theory of 'proper name use'. This theory is seen to explain how people can 'use' proper names to refer to individuals they do not know personally and cannot identify using any first hand knowledge of the person or object named. This is the so-called 'causal theory of proper names', (Kripke 1972, Putnam 1973,1975, Donnellan 1974).

A rough statement of this theory might be

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Footnote 3.4. Recall that this is the move advocated by Russell who thought no actual surface-level 'proper name' of English was a genuine proper name but was, rather, a truncated description.

> the following. An initial baptism takes place. Here the object may be named by ostension, or the reference of the name fixed by a description. When the name is 'passed from link to link', the receiver of the name must, I think, intend when he hears it to use it with the same reference as the man from whom he heard it. (Kripke 1972:302)

When this dubbing or baptism takes place the individual is now called by the relevant name. The name has rigid designation because an individual is for Kripke, as Montague, a possible individual, and one essential requirement for a theory of language semantics is to be able to individuate or specify possible individuals across different possible worlds. Johnson-Laird wryly sums up the requirement:

> A formal semantics for propositional attitudes depends on the postulation of possible worlds and possible individuals to inhabit them [...] The question arises as to how the same individual is to be identified from one possible world to another - the problem of Trans-World Heir Lines, as Kaplan has dubbed it. (Johnson-Laird 1982:42)

Kripke thinks that nothing short of rigid designators will do. The particular case of proper names will be dealt with more fully in the section on denoting phrases.

For now let us note that such a view commits us to the necessity of identity statements containing proper names that name the same object. On this view sentences such as (3.76), (3.79) and (3.82), if the identities alleged are true, are necessarily true. This commits us to being able to infer (3.75) from (3.74), (3.78) from (3.77), (3.81) from (3.80) and so on. These seem, intuitively, an unreasonable set of inferences.

(3.74) Claudius believes that Cicero denounced Catiline
(3.75) Claudius believes that Tully denounced Catiline
(3.76) Cicero is Tully
(3.77) Beverly believes that Hesperus is Hesperus
(3.78) Beverly believes that Hesperus is Phosphorus
(3.79) Hesperus is Phosphorus
(3.80) Barbara wonders whether saltpetre is saltpetre
(3.81) Barbara wonders whether saltpetre is potassium nitrate
(3.82) Saltpetre is potassium nitrate

In addition identities such as (3.83) (after Johnson-Laird 1982), which on the rigid designator approach are necessary, fail to explain why the assertion contained in (3.84) is not equivalent to (3.85). We can imagine that (3.84) is true, whilst (3.85) looks as if it is false. Many contingent events, in the actual world contributed to the emergence of the character named by 'George Orwell'.

(3.83) George Orwell is Eric Blair
(3.84) If Eric Blair had not existed then George Orwell wouldn't have either
(3.85) If George Orwell had not existed then Eric Blair wouldn't have either

And Johnson-Laird points out another curious consequence of Kripke's baptismal and rigid designator views of proper names. As a question we know that (3.86) is sensible even though the two terms refer to the same object. But if the identity of proper names is necessary it looks as if (3.86) is equivalent to (3.87).

(3.86) Which was named first, Phosphorus or Hesperus?
(3.87) Which was named first, Phosphorus or Phosphorus?

Recent proposals in formal semantics (Kaplan (1977), Stalnaker (1978), Klein (1979) seek to remove the problems posed by these embarrassing entailments. Their common approach is to invoke the use of <u>context</u> in characterising meaning. Thus they define notions such as 'propositional concept' (Stalnaker), or 'character' (Kaplan), which contribute, if you will, to two stage intensions, ie functions from contexts of use to propositions which are in turn functions from possible worlds to truth values. We can contrast these notions with the standard characterisation of meaning, see Table 3.4 below.

Table 3.4

```
                      Fc
Context of use   |-----> Propositions
                               |
                               v

                              Fi
           Possible Worlds |-----> Truth Values

Fc = Character or Concept
Fi = Intension

Recent view: Meaning = Fc and Fi
Trad   view: Meaning = Fi
```

Using the idea of a 'rich' context, these proposals aim to show that two stage interpretations of meaning block the various embarrassing entailments and equivalences. For example, in the case of the actual world a speaker of (3.88) picks out the necessarily true proposition because for that utterer his cognitive state/context determines that the two terms are co-extensive. Whilst in the context of a world where the identity (3.88) was not known to hold, (3.88) would pick out the necessarily false proposition.

(3.88) Hesperus is Phosphorus

Now this whole approach has one very interesting feature: the contexts appealed to seem to involve the internal cognitive states of the speakers, hearers, holders etc. of propositions. These cognitive states are their belief worlds, embodying their <u>understanding</u> of terms etc. It is not clear whether each speaker is now locked inside his own 'language', defined by his solipsistic context. Character and concept seem to be idiosyncratic notions. Nevertheless, they begin to recognise the central position cognitive states play in the determination of extensions.

However, the intensions themselves are still objective external functions. And as such seem to be the objective aspect of meaning that humans are obliged to attempt to grasp in order to 'successfully' communicate.

Thus the problem of proper names and their intensions (constant functions picking out the same extension at all indices) leads us into the more general problem of the essential plausibility of intensions as possible psychological or cognitive elements.

## 5 Mental Procedures and Intensions

Intensions as formally defined are far too powerful if they are to serve as the representations of words which humans possess. Thus Partee (1979) writes:

> the psychological representation is probably more like an incomplete and possibly incorrect definite description or a partial algorithm for picking out the referent. (Partee 1979:6)

Dowty (1979) believes that the psychological representations of word meanings (he calls these representations "concepts") grossly underdetermine the formal intensions of words. An example, much used by Putnam, is a word like 'water'. People in using this word have little idea of the necessary and sufficient criteria (physical and chemical composition and the like) that fix the extension of such terms in all circumstances. Following Putnam we might suggest that what a person understands, when he uses such a word, is perhaps a set of more or less standard entailments. These do not circumscribe an intension completely, and may often be inaccurate.

How then to bring intensions more closely into correspondence with concepts? Johnson-Laird's recent suggestions have been radical and to the point. He argues that the only way to link formal intensional semantics to psychology is to relinquish the belief that meanings are non-mental entities. He proposes intensions as the very mental procedures which people operate with when they use and understand a word. He too notes that these mental procedures are often incomplete. He suggests we might conceive of them as constituting 'stereotypes'. These 'stereotypes', Johnson-Laird hopes, will serve as candidates for our mental 'effective intensions'. Why should this be? What are stereotypes?

> A stereotype is a special sort of intension, very different from the logician's idea of a set of necessary and

> sufficient conditions. It is essentially a partial function from possible worlds to extensions. Hence, what we possess in our minds simply fails to cover all the cases that nature presents us with - we may have no grounds or criteria for deciding whether a given entity is a piece of furniture, or whether one item is 'at' another. The lexicon is open. Its phylogeny reflects its ontogeny: its present status reflects the way it is learnt. If sufficient problematic cases occur, then an intension may be modified, or a more precise 'test' may be introduced, in order to legislate about the problematic cases. Natural Language tolerates these uncertainties because it is used primarily for communication, which is largely a matter of conveying what you intend to refer to and what properties you intend to designate, rather than conveying precise extensions. (Johnson-Laird 1982:29)

Johnson-Laird's account of "meaning" implies that our communicative acts are open to failure and indeterminacy of interpretation. We can of course entertain mistaken or inappropriate beliefs, beliefs which do not allow us to deal with all the situations we find ourselves in.

Barbara Partee (1981), in trying to psychologise intensions, suggests relativising intensions to individuals, effectively specifying a separate semantics for each of the members of the speech community. However, she leaves out any consideration as to how all these idiolects can be brought into a stable correspondence with one another. Like Johnson-Laird, Partee recognises that these individualised intensions will be partial intensions.

As these proposals stand I have no argument with the claim that the mental representations of words fall far short of idealised intensions. Nor do I disagree with the idea that stereotypes or prototypes might be a psychologically fruitful way of thinking about lexical representations, this has a long and respectable history (cf for example Bruner, Goodnow & Austin (1956), Berlin & Kay (1969), Rosch (1973,1977), Rosch et al (1976), Rummelhart & Ortony (1977)).

Having admitted this much I would still question characterising an effective mental procedure as a partial function from possible worlds to extensions. What exactly are the co-ordinates used in the possible worlds? What are the extensions which are mapped onto? Why are possible worlds invoked at all in the type of mental model theory Johnson-Laird suggests?

He suggests that particular instantiations of mental model can be thought of as possible ways of discharging the truth conditions of a sentence. In this respect they can be seen as doing the kind of job the modal logician required of possible worlds. Of course the logician's possible worlds are too rich a notion to put inside the head of speakers and hearers. But Isard (1978), Johnson-

Laird (1982, 1983) and others have suggested thinking about the construction of mental models as a constructive process. In this way we do not have to store all the possible instantiations of mental models, only rules for their construction. In just the same way we do not have all the integers explicitly represented in our heads but procedures for generating them. We have a generative capacity for model building.

This is all well and good but the problem still remains exactly what does it mean to say that the meaning of a word is a partial function from these worlds or models onto extensions. Are these extensions in the world or in the head?

Johnson-Laird suggests:

> Model-theoretic semantics maps the expressions of language into model structures, and in the case of natural language Montague (see Thomason 1974) and others have argued that these structures consist of 'possible worlds'. Such a semantics cannot be inserted directly into the mind, because there are infinitely many possible worlds. Both Partee (1979) and Johnson-Laird (1982) have struggled with this problem of a rapprochement between semantic theory and psychology [...] I have argued that there is a direct resolution of the problem: a mental model is a single representative sample from the set of models satisfying the assertion.(Johnson-Laird 1983:264)

> Lexical semantics presents no essential obstacle to our project of linking formal and psychological semantics. Intensions are knowable but very often they take the

> form of stereotypes. A stereotype is a special sort of intension [...] It is essentially a partial function from possible worlds to extensions. (Johnson-Laird 1982:29)

> If a discourse has complete truth conditions, it is true with respect to the world if and only if it has at least one mental model that can be mapped into the real world. If a discourse has only partial truth conditions [...] it is false with respect to the world if it has no mental model that can be mapped into the real world. If its truth conditions are not fixed or not known, then to use Russell's aphorism about mathematics, we never know what we are talking about, nor whether what we are saying is true. (Johnson-Laird 1983:442)

To realise Johnson-Laird's proposals that stereotypes are the effective mental representations of meanings, we need to understand quite explicitly what the components of the partial functions (stereotypes) are. For example, what are the possible worlds referred to? From the quotes it appears that they are particular mental models. Now the standard definition from model theoretic semantics provides the following type of structure:

M = < A.W.T.<.F >

where:

A is the set of objects/individuals in the model.

W is the number of possible worlds available to the model.

T is the set of time intervals at which the model is sampled.

< is a linear ordering of the set T. this establishes the directionality and sequence of time.

F is a function that assigns semantic values of the appropriate sort to each non-logical constant of the language relative to each pair <w.t> where w-in-set-W and t-in-set-T.

Johnson-Laird claims that mental models are particular instantiations from a range of possible models. instantiations containing representations of individuals and such like. Let us transport the model structure we defined above as part of the building blocks of mental models. The W. T and > co-ordinates can be thought of as instantiations of one of a possible number of mental models. A is the set of mental objects to be seen as populating the model. and F assigns our 'mentalese' or private language to elements out of the model.

So L.:M:. 'mentalese' can be given an interpretation or model

M.:M:. = < A.:M:..W.:M:..T.:M:..<.:M:..F.:M:. >

But this hasn't yet got us to the real world! One of the suggestions Johnson-Laird makes is to borrow an idea of Isard's (1978). which is:

> to argue that the two domains are 'equivalent with respect to a language'. that is, anything that can truly be said about one is true if the other. (Johnson-Laird 1982:32)

So now we have two models. one the mental model. the other 'reality'. What enables a mental model to function as a model of reality. is that the 'mapping' Johnson-Laird wants establishes a correspondence between models that can in principle make the same set of sentences in a language true. The language is not just private. but has two aspects, mentalistic and realistic. by virtue of the presumed equivalence of models with respect to a language. The formal constraint this places on the models is shown below in Table 3.5.

The fact the two models can stand in this relation is presumably a fact about the 'utility' or 'appropriateness' of our models qua the reality model.

Table 3.5

```
M.:R:. = < A.:R:..W.:R:..T.:R:..<.:R:..F.:R:. >    |
                                                   |--- L
M.:M:. = < A.:M:..W.:M:..T.:M:..<.:M:..F.:M:. >    |
```

M.:M:. and M.:R:. are co-ordinated or equivalent wrt to L

The condition to be satisfied is that for
any sentence PHI of L

```
if |[PHI]|.:M:..:M:. = 1 then |[PHI]|.:M:..:R:. = 1
AND
if |[PHI]|.:M:..:M:. = 0 then |[PHI]|.:M:..:R:. = 0
```

This kind of proposal still relies on an absolute notion of truth. It still appeals to there being determinate truth conditions in the way our models and meanings in these models work. Without truth conditions as Johnson-Laird says 'we never know what we are talking about'. What he is looking for is some guarantee of language success. He finds this in the relations of invariant and deterministic reference between language and models embodied in the language equivalence proposal. It is an old solution in a new guise. The key for success is the assumption that our mental models and reality can make the same sentences true.

And yet Johnson-Laird's own work suggests he is suspicious of such deterministic and invariant accounts of our meanings and representations.

> [...] a representation can be a representation of a real thing but it is not the real thing itself. Hence the nature of the mind and its perceptual

> system exert a decisive effect on the world we perceive [...] our view of the world is causally dependent both on the way the world is and on the way we are [...] our knowledge indeed depends on our biological make up as well as on things-in-themselves. (Johnson-Laird 1983:402-403)

What drives Johnson-Laird back into the arms of a formally inspired account of reference is the need for a strong theory of language success. An explanation of why it is that:

> somehow behind the scenes [...] the extensions of terms are fixed. (Johnson-Laird 1982:21)

This attempt to psychologise intensions seems not to provide an acceptable solution. The problem remains of how to account for communicative success- how does language secure the objects of reference- and at the same time reflect incomplete and non-deterministic linguistic procedures.

The original problem of opacity was articulated in formal systems. In certain contexts terms seemed to refer to structures that went beyond simple reference to objects. The problem was to account for these structure and still preserve semantic transparency and a formal theory of logical entailments.

Other approaches have attempted to square language success and the subjective. non-deterministic nature of intensions. They have in general appealed to the notion of a mental model. In the next chapter we will examine in detail the concept of a mental model. Can mental models provide a means of understanding the phenomenon of reference? Do they offer explanations for the associated opacity problems?

# CHAPTER FOUR LANGUAGE AND MENTAL MODELS- VIEWS FROM COGNITIVE SCIENCE

> What is needed to make psychological sense of propositional attitudes is. in my view. an extension of the notion of a mental model. a study of the semantics of such verbs as believe. and an analysis of certain aspects of referring expressions (Johnson-Laird 1982:48)

The rest of this thesis is an attempt to discharge the requirements outlined above. We have. in previous chapters, examined logical proposals which seek to account for a wide range of the semantic data associated with intensional contexts. culminating in the use of Montague's Intensional Logic. Montague's system involves the deployment of 'model theoretic' apparatus. Is the appeal contained in the above quote merely an exhortation to extend the notion of a model as used. for example. in Montague Semantics? I argued in the last chapter that there are real problems with such a view.

There exists a fundamental difference between the notion of 'models' as used in standard 'model theoretic' semantics and what we might call 'mental models' theory. The difference. in essence. is that mental models are. as the name implies, mental or cognitive in origin.

In mental model theory the relation between language and the world is absolutely dependent on, and mediated by, cognitive models. Mental models provide a way of understanding an organism's response to its environment. They offer an organism a representational ability, one which has evolved and developed so as to furnish the individual with information that is relevant to its needs whilst not completely at odds with its external environment.

The vital caveat in talking of mental models is that the processes of model construction do not furnish irrefragable knowledge. The model building apparatus provides representations that at best provide reliable and usable beliefs, and not veridical access to an objective reality.

This kind of argument is well developed in the work of the evolutionary epistemologists (cf for example Lorenz 1973, Vollmer 1975, Riedl 1979, Tennant 1982a, 1982b). They posit, as a basic requirement of cognitive systems, the possession of a 'Weltbildapparat' (world building apparatus). This apparatus generates representations of the organism's environment. The representations, in turn, are tailored to those aspects of the organism's interaction with its environment that are important for reproduction and survival.

The 'Weltbildapparat' results in what we can call a 'mental model'. Now of course within mental model theory access to the world is via representations. This introduces subjectivity. The problem for a theory of knowledge that takes mental models seriously, is to explain why they embody 'knowledge' that is reliable concerning the world outside our models.

As Tennant (1982a) has pointed out the problem may be summarised in this way. 'how can subjective conditions of thought have objective reality?' (1982a:3.2)

Evolutionary Epistemologists attempt to reply to this substantial worry in the following way. Firstly, they argue that successful advances in adaption (in terms of a Darwinian view of Evolution) correspond to an increase of information about the domain for which that adaption is significant. It follows that evolution may be characterised as an information increasing process. Secondly, cognitive structures, like other biological organs, evolve as a result of the process of natural selection. This suggests that cognitive structures should be reasonably well-adapted to those aspects of 'reality' that are of importance to the species concerned. A further consequence of this evolutionary line of argument is that there is no implausibility in supposing that certain items of information, or structures that result in information-gain. can be inborn. And so. the argument goes, certain cognitive propensities and structures can be innate (ontogenetically a priori) through having been slowly 'wired-in' by natural selection (phylogenetically a posteriori).

Such a position involves a very direct contact with the 'real world'. one of fundamental importance. The process of evolution affects organisms through the force of natural selection which constantly engineers organisms into successful accommodations with their environments.

In characterising organisms as possessed of 'world building' apparatus, and as involved in gathering and interpreting information we must heed an important caveat. The processes of information processing. interpretation and model building do not lead to veridical or irrefragable knowledge. There is contact with an external reality. and this 'reality' takes an active and consistent role in the dynamic relation of an organism with its environment. directly shaping its cognitive structures. But the consequent cognitive structures provide 'representations' and 'models' that at best furnish reliable beliefs and not veridical knowledge. This sounds familiar. and it is interesting that it should surface explicitly time and time again in the work of. for example. Lorenz. He draws a distinction between the actuality of cognitive systems as glaubensgewinnenden (belief-achieving). against the chimera of cognitive systems as erkenntnisgewinnenden (fact achieving).

Let's now consider under what conditions an organism would be constructing 'beliefs'. The organism needs to act to survive. To act it must process information. process it reasonably well and reasonably quickly. To do this it is likely that information processing strategies have developed that yield fast answers on 'degraded' input. It is not necessary for the survival of a species that it always gets the 'right' answer from its cognitive strategies, only that it responds appropriately more often than not. that its response is not at a chance level. One can imagine many such strategies that provide the organism with fast. computationally low-cost processing abilities. Reliability not irrefragability is the appropriate design criterion.

On this view understanding the structure and content of the cognitive system requires understanding the crucial interaction of organism and environment.

We also perceive a way of rendering truth and reference in a cognitive context, rooted in an assumed and theoretically required reality. Truth and reference become intentional notions because our representations are not irrefragable. nor do they need to be.

> We accord no sense to any conception of the world as it 'really' is. independently of our ways of perceiving. apprehending and organising it. (Tennant 1982b)

> Evolution in selecting our perceptual and intellectual abilities is not in the least interested in their capacity for truth but merely in whether or not they will help us to survive. (Olding 1983:7)

Mental models have been seen to have biological utility. But what of the view from other areas of Cognitive Science- and. in particular. how do these mental models relate to language? Let us consider some recent answers to this question. For expository purposes it is useful to classify these proposals according to the paradigms which inspired them. Figure 4.1 shows the classification of 'mental model' research I have used.

Figure 4.1

| Linguistics | Logic |
|---|---|
| Karttunen 1976 | Stenning 1977 |
| Jackendoff 1975 | Kamp 1981 |
| Fauconnier 1979 | Seuren 1982 |
| **Psychology** | **A.I.** |
| Johnson-Laird 1980 | Webber 1978a. Sidner 1978 |
| Sanford & Garrod 1981 | Kaplan 1979 |
| | Allen 1979 |
| | Grosz 1977 |

SECTION ONE LINGUISTICS AND MENTAL MODELS

Let us consider each area in turn. Karttunen proposes discourse models as part of the apparatus required by any linguistic theory capable of accounting for linguistic data. His description of a discourse model appeals to the notion of computational processes able to maintain a text history. Such a text history would contain. at least. 'discourse referents'. The 'discourse referents' are representations of the objects of discourse. i.e. what the discourse is about. The discourse model is incremented and updated as discourse proceeds.

> Consider a device designed to read a text in some natural language, interpret it and store the content in some manner. say. for the purpose of being able to answer some questions about it. To accomplish this task. the machine will have to fulfill at least the following requirements. It has to be able to build a file that consists of records of all the individuals. that is. events. objects. etc.. mentioned in the text and, for each individual. record what is said about it. (Karttunen 1976:364)

Karttunen is concerned to explore the possibility of using the properties of such discourse models to explain a number of problems and ambiguities usually treated in a structural or linguistic fashion. The linguistic nature of Karttunen's interests are made quite clear in the 'Discourse Referents' paper.

> Given an indefinite noun-phrase, under what circumstances is there supposed to be an individual described by this noun-phrase? This need not be understood as some sort of ontological question subject to philosophical speculation. In this paper I intend to approach it from an entirely linguistic point of view. (Ibid:365)

> We are going to examine case by case certain aspects of sentence structure that play a role in determining whether an indefinite noun-phrase establishes a discourse referent. (Ibid:387)

We can also see from these quotes that Karttunen regards sentences as containing instructions for the generation and interpretation of 'discourse model structures'. Karttunen has little to say concerning the representational nature of his discourse referents. However, he is at pains to square up his linguistic data with the semantic facts present in the putative truth-conditions of sentences. For example, the following quote suggests that Karttunen is persuaded that the 'discourse model generator' must be sensitive to the effects of intensional contexts on sentential truth values.

> it [the text-interpreting device] must distinguish what exists for the speaker from what exists for somebody else. (Ibid:372)

Although this passage suggests that assignments of truth to sentences may be made relative to other 'worlds' than the 'real one' he leaves untouched how this would fit together, and to what model the assignment of truth would finally make appeal.

Jackendoff's (1975) and Fauconnier's (1979) work are closely related. indeed Fauconnier acknowledges that Jackendoff's work inspired his own. Both are concerned to account for linguistic data within linguistic theory. However. both see the consequences of their work for other disciplines. and acknowledge the influence of other disciplines on their thinking.

Fauconnier's (1979) comments on mental models (he calls them 'mental spaces') illustrate what is perhaps the common theme running through all the mental model work to date. He talks of the 'topology of discourse processing' and of 'considering meaning as instructions for use'. A feature that might serve as a unifying theme. is that

> sentences contain [....] instructions for discourse processing; they can set up image spaces within the discourse. introduce new elements in such spaces [....] the sentence is a set of instructions for setting up and referring to the mental constructs which support the organisation of discourse. (Fauconnier 1979:5)

Fauconnier also supports, in line with my own remarks and Karttunen's. the view that these models are irredeemably subjective. He perceives the consequences of this subjectivity for the truth evaluation of sentences.

> The traditional approach to the problem of natural language logic [...] involves the notion of truth in real and possible worlds and the association of isolated sentences with representations akin to formulas of mathematical logic. The empirical linguistic evidence. however. suggests that truth conditions hold with respect to spaces. which are mental constructs produced by discourse. (Ibid:72)

Like Karttunen. Fauconnier suggests that many of the puzzles of natural language semantics might be the result of the various properties and mechanisms of discourse models.

The properties these mental spaces or models possess as representations seem to be taken over entirely from Jackendoff (1975). Jackendoff. in considering the nature of reference in various language contexts. appeals to the 'semantics of images'. The semantics of images distinguishes the actual referent and an image of that referent. Jackendoff is at pains to point out that in many contexts (eg belief contexts) what is at issue is not the actual referent itself but the image, how the image is described, whether it is supposed to be a "faithful representation" of the 'real referent' etc.

The appeal to the semantics of images and the notion of faithful representations is expanded by Jackendoff.

> The notion of a faithful representation must of course be explicated. A particular medium of imagery represents

> only certain aspects of the objects it purports to represent [...] Each medium has a set of conventions that define and delimit the nature of the correspondence between images in that medium and their purported referents. A faithful representation within a particular medium corresponds point by point with those aspects of its purported referent that are taken into account by the conventions of the medium. (Jackendoff 1975:55)

There are a number of interesting points in this passage. Jackendoff appeals to the idea of a 'set of conventions' that already determine how an image is to be interpreted as a representation of its referent. These conventions work by taking into account certain aspects of the purported referent and provide ways of mapping features of the image onto features of the referent. The notion of convention is of course intentional; conventions have to be recognised and shared by human beings. And certainly Jackendoff realises that these image conventions carry with them a familiar subjective qualification:

> The linguistic properties of all the media of imagery are fundamentally the same. grounded in the semantic (or cognitive) relation *x* *purports* to refer to y. (Ibid:60)

Such a relation is open to error. and if we extend the lesson of the semantics of imagery in language to cognitive representations in general we arrive at a position similar to the one I have argued for in previous chapters.

## SECTION TWO LOGIC AND MENTAL MODELS

Let us now turn to proposals which involve 'mental models' and which arise out of logical traditions. Each of these proposals posit 'intermediate' discourse representations. These structures stand between language and the 'verification domain' that determines the truth or falsity of the sentences in the language. In other respects the proposals are, as we shall see, interestingly varied.

Stenning's work (1977,1978,1980) attempts to explain the results of text generation or interpretation in terms of the strategies or heuristics a psychological subject uses.

> From a speaker's point of view these principles can be seen as principles of text construction - how to construct a text that will describe a given model. From a hearer's point of view they can be seen as principles of model construction - how to construct a model given a text. (Stenning 1978:193)

Such principles have predictive content. It is an interesting, and empirically testable psychological claim that, for example, we build textual descriptions under a constraint of 'Anaphoric Conservatism', a principle which states that:

> Old elements are not implicitly given new descriptions, or conversely, a new indefinite description heralds a new set of elements. (Stenning 1978)

In using the apparatus of formal semantics Stenning is helping himself to what he considers a useful tool. with the following important caveat. In appealing to logical calculi he asserts that the semantic assumptions of such systems are relevant to only certain sorts of discourse. Moreover. these particular sorts of discourse are an idealisation away from how human subjects normally communicate.

> I shall argue that we can make best sense of the relations between logical structure and discourse function if we treat logic as an abstract theory of one particular type of discourse (call it argumentation for the present) rather than the foundation of a general theory of all types of discourse.(Stenning 1980)

> Logic. I have argued. is the study of argumentation under the idealisation that the participants' knowledge of the object-language interpretation is complete and constant [...] Once this ideal state of equated extensional interpretation has been achieved, the meaning of predicates is completely fixed by their extension: but we could never arrive at such states unless we shared the procedures for applying each vocabulary item in each new interpretation. (Stenning 1980)

It is implicit in his writing that processors engaged in the interpretation and generation of language cannot avail themselves of omniscience. omniscience is not a feature of our communicative activity:

> Ostension might help iron out some ambiguities but if we don't share common ways of categorising what we're pointing at. pointing is not going to help. Although reference. and ostension. in particular. are common courts of appeal in

> this process of checking agreement on an initial interpretation. they are only courts. not legislatures so-to-speak. (Stenning 1980)

One of Stenning's conclusions is that a theory of reference cannot be secured by a formal theory of sense.

> To take extensionalism as the foundation of a theory of meaning is to make reference (or at least denotation) out of sense. and the result is to make it impossible to make sense of reference in types of discourse other than argumentation. (Stenning 1980)

Stenning sees the outlines of a solution to reference in language lying in our understanding of the different communicative functions of language and the various strategies and heuristics of referential activity. Seuren (1982.1983) also shares a concern for the cognitive processes which construct and maintain models of discourse. Seuren attempts to outline the various mechanisms that such 'discourse domains' utilize. Mechanisms that have to do with. for example; 'orientation'- the focusing of information relevant to the immediate needs of communication; 'referential maintenance' and 'incrementation'- processes involved in the orderly assimilation and integration of the objects of discourse into the discourse domains themselves.

In particular. Seuren sees these principles as contributing to the interpretation of utterances against a discourse context; utterances cannot be interpreted in themselves but only as component parts of a discourse domain. His detailed proposals amount to an ambitious attempt to use 'discourse domain principles' in explaining a wide range of linguistic behaviour from presupposition. through anaphora to intensional contexts.

Seuren's model does assume an absolute theory of truth and reference. In his view a discourse model is a cognitive model which relates to some verification domain (usually the real world). Relates in such a way that it contains representations which bear truth values with respect to the verification domain. The verification domain is a processor-independent model determining the relations of truth and reference for the discourse model.

The use of an external processor-independent model to discharge the truth conditions of discourse models is also a feature of Kamp's (1981) proposal. However. the 'discourse representations' do not. in themselves. have any semantic content at all since they are purely syntactic objects. His 'discourse representations' are ordered pairs consisting of a set of individual constants and occurrences of formulae of a language. Part of Kamp's formal definition of a Discourse Representation (DR) is given below

DEFINITION 1. Let D be an L-Discourse

1. A possible DR (discourse representation) of D is a pair <U.Con> with
   (i) U a subset of V the set of discourse referents
   (ii)Con is a set of occurrences in D of sentences of L'(U)
   (Kamp 1981:306)

Note that L'(U) is a language obtained from L by adding a subset U of V to the set of basic terms together with a set of sentences (those occurring in the discourse). Such a characterisation entails that DRs are syntactic objects. DRs are pairs of individual constants and sets of occurrences of sentences.

Strictly speaking. Kamp's DRs are intermediate structures between discourse and models. one presumes between discourse and the world. To provide a theory of truth for these DRs Kamp uses a two stage definition of truth. In fact his definition boils down to the addition of a further 'interpretation function'. In the construction of DRs new individual constants (discourse referents) are introduced. In order to interpret them (as they constitute an addition to the language L) we need an additional interpretation function. Recall that in standard model theory. to give an interpretation for L you give a model M=<A.F>. where A is a non-empty set and F assigns elements and sets of elements of A to the basic expression of L. To interpret the expanded language L'(U) with the additional syntactic elements U (the discourse referents) we need an additional interpretation function f. This provides a full model M' for the language L'(U), viz M'=<A,F,f,U>. As Reichgelt (1981) points out, Kamp's method for providing an interpretation of DRs is

> [...] in fact quite similar to a strategy used in Henkin-type completeness proofs where one expands the language to 'exemplify' existential formulas (cf Henkin (1949)) (Reichgelt 1981:10)

In so far as DRs are syntactic structures rather like the syntactic structures of language, and since truth and reference are fixed by assignment functions, Kamp is still adhering to a traditional absolute, objective theory of meaning for the actual expressions of language. He does not indicate that different processors, who presumably instantiate these DRs, have different assignment functions for the basic expressions of the language. However, Kamp's proposals do offer a dynamic and incremental model of DR construction.

## SECTION THREE PSYCHOLOGY AND MENTAL MODELS

Let us turn now to two proposals arising out of psychology. In both proposals discourse models are essential to the underlying theories of language generation and interpretation. We have already discussed at some length aspects of Johnson-Laird's work, but we have not yet referred to the work of Sanford and Garrod.

Johnson-Laird has over a number of years and in numerous articles (cf for example Johnson-Laird 1977, 1978, 1980, 1981, 1982, 1983, Johnson-Laird & Garnham 1980) argued that to understand language processing we are

> forced to postulate a crucial role for what we call mental models of discourse, or more simply, discourse models. A discourse model is a mental object that constitutes an individual's knowledge of a discourse. (Johnson-Laird & Garnham 1980:371)

I am in agreement with much of what Johnson-Laird has said about the nature, origin and need for mental models. In discussing his views, echoes of my discussion as to the nature of models and representations will be evident.

The need to postulate models has two main elements, firstly the utility and advantage they confer on the organism, secondly their ability to help account for a substantial amount of psychological data.

Johnson-Laird's endorsement of the advantage which mental models confer is unequivocal.

> It is now plausible to suppose that mental models play a central and unifying role in representing objects, states of affairs, sequences of events, the way the world is, and the social and psychological actions of daily life. They enable individuals to make inferences and predictions, to understand phenomena, to decide what action to take and to control its

> execution. and above all to experience events by proxy; they allow language to be used to create representations comparable to those deriving from direct acquaintance with the world; and they relate words to the world by way of conception and perception. (Johnson-Laird 1983:397)

> [mental models] can be used in much the same way that a navigator uses a map to avoid danger and to reach a desired destination in safety. The richer and more veridical the internal model. the greater will be the organisms chance of survival. (Ibid:402)

Once again we are confronted by the issue of the fallibility of representations and whether truth is in principle attainable for cognitive systems. What Johnson-Laird says above. together with his discussion of intensions and the use of model theory. might suggest he is adopting an absolutist theory of truth to provide semantic content for his models.

Johnson-Laird does sometimes talk as if this were an assumption in his work. It is most apparent in his 1983 work where he urges the adoption of Kamp's theory of truth for DRs. Kamp's is a theory which. as we have seen. is rooted in an absolutist theory of truth. reference and meaning.

> How then is truth to be defined with such a conception of a mental model? In my view. the way to proceed is to take advantage of Kamp's essential insight and to argue that a discourse is true if there is a proper embedding of at least one of its discourse models in the real world model. (Johnson-Laird 1983:372)

However, Johnson-Laird on many occasions does justice to the 'subjective nature' of our knowledge. The notion of veridicality mentioned in the (1983:402) quote is ameliorated by assertions that

> You may say that you perceive the world directly but in fact what you experience depends on a model of the world [...] all our knowledge of the world depends on our ability to construct models of it. Since this ability is a product of natural selection, our knowledge indeed depends on our biological make-up as well as on things-in-themselves. (Johnson-Laird 1983:402-403)

This has profound consequences for the way he is bound to view reference, a view not at all dissimilar to my own. A view that highlights intentions, that allows the possibility of successful communication transcending what, from a God's eye position, would be a literal failure of reference.

> Reference certainly requires representations that correspond to elements in the world, but it is a mistake to confuse reference with mere correspondence. The use of natural language to communicate depends on an intentional correspondence between a symbolic expression and a state of affairs [....] People, however, use linguistic expressions with the intention of picking out certain states of affairs. Successful communication may transcend literal failures of reference [....] because a listener may be able to recover a speaker's referential intentions. Human communication therefore depends on a tacit understanding that symbolic expressions can either correspond or fail to correspond to reality. (Ibid 1983:405)

However, even in this passage there is a tension between the use of absolute truth conditions and fallible approximations to them. The implication is that if only we had enough information equally shared, communication would become transparent and veridical. Whilst there is a perception of how intentions relativise all talk of truth conditions, there is at the same time a commitment to some larger theory of absolute truth underwriting our mental models. This tension is again evident in the passages below

> the mental model is constructed on the basis of the truth conditions of the propositions expressed by the sentences of the discourse. (Ibid 1983:407)

> the truth conditions of the proposition expressed by a sentence therefore depend on the meaning of the sentence, its context of utterance (as represented by the current mental model), and the implicit inferences that it triggers from background knowledge. (Ibid 1983:407)

The contexts which relativise truth conditions are, on Johnson-Laird's own admission, complex sets of considerations including intentional elements. It must be reiterated that, understood intentionally, the 'evaluation conditions' for a sentence such as (4.1) do not have to do with an exact particular state of affairs obtaining in the world. The sense in which (4.1) is 'true' depends on the interlocutor's needs. A recurrent theme in Johnson-Laird's writing is this conflict between truth-conditional theories of meaning and intentional constructivist views of meaning. The resulting tensions of this conflict are also a feature, as we shall see, of most AI approaches to discourse model building.

> (4.1) New York is a hundred miles from Boston

Why does Johnson-Laird require the Procrustean theory of truth for the semantics of his mental models? It may be that the method of instantiation of these models in the mind suggests such a theory of truth. Johnson-Laird argues that the apparatus of mental models should be regarded procedurally. In particular, mental models may be realised as computational algorithms

> [....] the essential character of mental models: they derive from a relatively small set of elements and recursive operations on these elements; their representational power depends on a further set of procedures for constructing and evaluating them. (Ibid 1983:429)

This computability constraint together with a wish to 'psychologise formal semantics' and subsequently to use its machinery in mental models, leads to the adoption of a standard theory of truth and reference. And yet set against this is Johnson-Laird's admiration for the work of Wittgenstein, work which suggests that truth and reference are not the appropriate foundation upon which to build a theory of meaning.

I will not at this stage present any of Johnson-Laird's detailed proposals concerning the architecture of mental models. Some of these will receive discussion when I present the elements of my Discourse Models.

What I will add is that Johnson-Laird presents compelling evidence for the deployment of the general concept of mental models. He cites work on inference and reasoning. memory and verbal recall. word and narrative understanding etc. all of which suggest the mediation of mental models in our cognitive processes (summarised in Johnson-Laird 1980a, 1983). Illustrative of these claims is the evidence that in narrative comprehension and recall a constructive rather than interpretive representation is implicated in the human processor (cf for example Bransford. Barclay & Franks 1972. Bransford & McCarrell 1975). An interpretive theory suggests that the representations constructed when. say. narrative is understood, are full analyses of the semantic content of the narrative. On this view each sentence is represented in some propositional form in which the meaning of each element and the interpretation of the whole preserves the original input structure. A constructive theory suggests that individuals build representations that go beyond the 'semantic content' of input in various ways. The evidence is quite strong that constructivism is at work in linguistic interpretation. This evidence supports a speculation Johnson-Laird advanced some years before the appearance of his more fully worked out theory of mental models.

> It is natural to wonder whether the sentence is the largest unit normally involved in the recall of language. It is possible that from the meanings of sentences in a connected discourse. the listener implicitly sets up a much abbreviated and not especially linguistic model of the narrative. and that recall is very much an active reconstruction based on what remains of this model. Where the model is incomplete. material may even be unwittingly invented to render memory more meaningful or more plausible - a process which has its parallel in the initial construction of the model. (Johnson-Laird 1970)

The promise of mental models seems large in psychological terms. Two researchers who have reason to agree are Sanford and Garrod. They regard much of the processing involved in the cognitive task of reading as being

> motivated by the attempt to discover some unique mental model of what the writer is talking about. (Sanford & Garrod 1981:8)

Notice that Sanford & Garrod are discussing text not spoken discourse. In general. their research has focused on text rather than spoken discourse because it provides a more structured and controllable domain for linguistic generation and interpretation. Nevertheless. the central elements in their account of mental models have a familiar look

> rather than simply describe text as a linguistic object. it therefore seems more appropriate to describe it as a set of instructions which tell the reader how to utilise the knowledge he already has [...] (Sanford & Garrod 1981:8)

> The basis on which discourse is produced and understood is essentially contractual. A writer wishes to convey an idea to his readers. In essence. this means that he must establish in the minds of his readers a situational model which is the same as (or closely similar to) the one in his own mind. He can then refer to this model as his discourse unfolds and be reasonably certain that what he says will be intelligible. (Ibid)

We discover in these quotes a processing view of language behaviour. regarding elements in language as instructions for discourse model manufacture. The quotes also advance a framework within which the reciprocal recognition of intentions lies at the heart of successful communication. This view. Sanford & Garrod argue. buys us a great deal

> If we accept that a discourse produces models of situations in the minds of the reader. and that readers are under some sort of psychological contract to relate all discourse to such models. then the various forms of inference can all be handled within this common framework. (Sanford & Garrod 1981:11)

Their ideas as presented in various articles (Garrod & Sanford 1978.1982. Sanford & Garrod 1981) centre on questions of inference, anaphora. focus. reference evaluation. memory partitioning and knowledge representation. They draw on insights from formal semantics, linguistics, artificial intelligence as well as psychology in an attempt to produce a workable, procedural account of text generation and interpretation.

Of particular relevance to this thesis are their ideas about reference and reference evaluation. They write:

> Problems of reference have two major aspects. For any entity which is mentioned in text, there must be some referring expression. Such expressions can take a variety of forms: for instance, pronouns, noun-phrases, both definite and indefinite, or even whole clauses. One of our concerns is to explore how these expressions could serve as processing directions, and so enable the reader to construct a unique configuration reflecting the relationships amongst the things mentioned in the text. Such an approach could be construed as an exercise in producing a procedural semantics of reference. The second aspect of the reference problem is the way in which the text as a whole seems to refer to recognisable events and episodes, of which the reader has general knowledge. The configuration of entities has to be mapped into general knowledge if the significance of the text is to be understood. (Sanford & Garrod 1981:159)

Inasmuch as Sanford & Garrod are attempting to account for psychological data they come to the problem of reference in natural language without any particular theory of truth and reference. In fact, the passage above suggests that they view expressions as 'referring expressions' to the extent that they lead to the establishment and maintenance of 'discourse tokens' or 'discourse entities'. elements inhabiting the discourse model and having no privileged special existence in the world.

Also the relation of reference does not have the absolute flavour that Johnson-Laird's own view implies. In the first place communicative exchange is a contractual affair. This means that 'efficient communication' requires co-operation. co-operation in turn requires reciprocal recognition and interpretation of each other's 'mental models'. This introduces a wide latitude for 'differential interpretation'; if we maintain models of one another's models. we may carry our own particular assumptions about word meaning. appropriateness of descriptions for particular objects etc. with us into these models. The opportunities for differential interpretation are huge. especially if there is no pre-ordained theory of meaning which fixes the extension of each term for each user of the language as being the same. In this respect Sanford and Garrod's work is amongst the most congenial to my own.

## SECTION FOUR ARTIFICIAL INTELLIGENCE AND MENTAL MODELS

Sanford and Garrod acknowledge how much of their own work is informed by work from Artificial Intelligence. It is appropriate now to look at the proposals originating from AI work which relate to mental models of discourse. Most of the AI work in this area which has a cognitive orientation adopts a strongly Intentionalist view of language.

> Linguistic behaviour is basically about communicative behaviour. [....] On the communicative view then. the job of a hearer is to somehow reconstruct a portion of the speaker's life - namely. those the speaker wishes to convey (call them the speaker's message. or communicative intent. or whatever) - and the job of the speaker is to somehow facilitate this reconstruction. (Berwick 1983:27)

As Berwick points out this view implies a simple. embryonic theory of language which has. at least. the major components indicated in Figure 4.2

Figure 4.2

```
 ------------------------------------------
|        Speaker                           |
|                                          |
| Intentions= {beliefs, needs,             |
|              goals etc.}                 |
| Expressed in If                          |
|__________________________________________|
               ||
               ||
  Utterance- Expressed in Ef
               ||
               ||
 ------------------------------------------
|        Hearer                            |
|                                          |
| Intentions= {beliefs, needs,             |
|              goals etc.}                 |
| Expressed in If                          |
|__________________________________________|
```

If = Internal formalism
Ef = External formalism

In this theory processors possess intentions, some of which are to 'share knowledge', 'inform', 'dispute', 'question' etc. It is further assumed that these rich intentional states are instantiated by some 'representational code' or 'language of thought' (cf for example Fodor 1975).

> The cornerstone of their research and almost all cognitively oriented Artificial Intelligence work generally [....] the assumption that mental processes are computational, where by computational one may take Fodor's definition of computation; operations defined over (mental) representations. (Berwick 1983:36)

The model of communication suggested in Figure 4.2 requires that a 'bridge' is established between speaker and hearer (the various processors in the discourse situation). The bridge is an utterance or set of utterances. These utterances comprise a system which the descriptive linguist is in the business of analysing. But what makes language work? Here again 'cognitively-oriented' Artificial Intelligence wears its intentional colours on its sleeve.

> A whole series of regularities [....] phonological. syntactic. semantic. pragmatic - intervene so as to dictate what can and cannot be counted as an utterance that properly conveys any intended message. It is the hearer's knowledge of these well-formedness requirements that permit the recovery of my intended message; similarly. it is my knowledge of these very same constraints ( and my knowledge that my listener knows about these constraints) that guides the exterior form that I produce. In brief. the hearer knows the rules of the game by which I produced my utterance. and uses these rules to infer inner form from exterior utterance. Shared knowledge makes further sharing possible [...] (Ibid:28)

The regularities of the language system work through their instantiation in us the language users. It looks then as if AI research will provide a useful set of concepts for the view of language and reference I am advocating. This is true. as I think will become apparent. only in part. Most of the work acknowledges the crucial importance of processors and their states in the theories of natural language understanding we build. but most work still assumes a fixed theory of meaning which will guarantee communicative coordination between systems. On this view a situation such as illustrated in Figure 4.2 works not because of an equal distribution of knowledge about our shared world but because of the assumption that the 'intensions' of the terms used in the speakers' and hearers' Ifs are the same. that is pick out the same extensions. This is, I think. where my own proposals depart from most of the AI work I am aware of.

To justify this claim let us look at some of the most recent and widely acclaimed of this AI work.

Very generally we might distinguish three themes in the work I am going to discuss here. The first exemplified by. for example. Webber 1978a. 1978b. 1978c. 1981. 1983), Grosz (1977. 1978. 1979. 1981) and Sidner (1978. 1979. 1983) is primarily concerned with providing mechanisms for the representation and manipulation of 'discourse structures' and the 'discourse entities' that populate them.

Webber's conception of a discourse model is simple and straightforward

> a discourse model may be described as the set of entities 'naturally evoked' by a discourse and linked together by the relations they participate in. (Webber 1978a:21)

In the same way that Kamp (1981) provides syntactic apparatus to construct discourse representations from the surface syntax (external form) of sentences. so too Webber seeks to provide a calculus to describe and represent the content of the models of discourse we are presumed to construct.

The formal calculus for describing and representing these models of discourse is a type of First Order Calculus with lambda abstraction. In effect. Webber's system places expressions of her formal language. which are translations out of surface strings of English. into pair-wise correspondence with some kind of internal and presumably mentalistic representation of the objects of discourse. Understood in this way the resemblance of Kamp's and Webber's work is all the more striking: the discourse entities 'naturally' evoked form a set of objects A. Webber's proposals aim to establish an interpretation for her logical formalism (LF) in terms of a mapping from discourse objects to formulas in the LF.

The rules and processes that support and determine this mapping form the substance of her ideas. In turn her formalism and rules for discourse object evaluation etc are much influenced by the need to account for the wide range of anaphora or abbreviated reference in language.

Any full theory of discourse models and discourse reference has to propose mechanisms by which the abbreviated references in the examples below are seen to work. that is relate back to a particular antecedent

(4.2) John went to the pub. He got very drunk.
(4.3) Bev gave Nigel a jumper. It didn't fit.
(4.4) Take a cup of flour, mix in some butter. Moisten it with milk and knead it into a dough.
(4.5) Mary became a violinist because she thought it a beautiful instrument.
(4.6) Few doctors smoke. They know it causes cancer.
(4.7) The wine is very good but it seems to have gone.
(4.8) Every young man's ambition is to appear suave. So he spends hours perfecting his image.
(4.9) A fox is a cunning animal. They live constantly on their wits.

In each case the antecedent of the various pronouns (anaphors) in the above examples are rather different sorts of object. In (4.2) reference both in the proper name 'John' and its associated anaphor 'he' is to a specific individual. presumably uniquely identifiable in the context of the utterance of (4.2). In (4.3) a particular object is at issue. this time introduced initially using an indefinite expression. In (4.4) subsequent abbreviated reference is back to an object that is undergoing constant modification and change. Example (4.5) offers a case where the initial indefinite predication allows recovery via the pronoun 'it' of the 'concept' of a particular kind of instrument. In (4.6) subsequent reference is back to a set of doctors which could be construed as the complement of the set originally mentioned! In (4.7) reference is back to a rather indefinite amount of wine. In (4.8) and (4.9) the pronouns in the second sentences refer back to 'a prototypical' element and a 'generic' class respectively. The range of types of antecedent. and through them. referents available in natural language can be seen to be very large indeed.

> What my research has been directed at then is (1) a definition of what text makes available for anaphora that can accommodate the kinds of examples presented and also be amenable to a computational treatment and (2) within that computational treatment. a characterisation of features of a representational formalism (or set of formalisms) that would most effectively support the procedures. (Webber 1983:334)

We need a formalism equivalent to the job. We also require a formalism that can draw the kinds of semantic distinction we have looked at extensively already. Namely. the ambiguity present in sentences like (4.10).

(4.10) Three boys ate a pizza.

Webber's formalism. based as it is on a logical calculus. uses scope to make the various distinctions which different interpretations of (4.10) require (Footnote 4.1). In discharging these requirements Webber is

---

Footnote 4.1. The two interpretations of this sentence are represented in Webber's formalismusing thelogical schemas (1) and (2) below.

(1) ?m(v:SET(boy))[(Ey:pizza)& ate v.y & |v|=3]

sensitive to the general context of mental model construction within which her work is placed.

> My assumption is that one objective of discourse is to communicate a model: the speaker has a model of some situation which for one reason or another. s/he wishes to communicate to a listener. Thus the ensuing discourse is. at one level. an attempt by the speaker to direct the listener in synthesising a similar model. (In this sense I am equating 'understanding' with 'synthesising an appropriate model'.) (Webber 1978a:21)

In the context of these models Webber sees a wide range of nominal expressions as appropriate in evoking or 'referring' to discourse objects.

> When the speaker wants to refer to an entity in his or her discourse model. s/he may do so with a definite pronoun [...] Alternatively. the speaker may refer to an entity in his or her discourse model by constructing a description of it in terms of some or all of its known properties and/or relations (eg. 'a red balloon'. 'Mary's mother'. etc.). The speaker may or may not assume that the entity has a counterpart in the listener's discourse model. (Webber 1978a:22)

---

(2) ?m(u:SET(?m(v:boy[(Ey:pizza)& ate v.y])))[|u|=3]

She has introduced a new operator SET which is capable of scopal variation. The first reading (collective interpretation) in which all the boys ate the same pizza. has a logical representation which uses the SET operator to form a set. a set of boys. having cardinality three. and which as a set has the property of 'eating a pizza'. The second reading (distributive interpretation) is one in which each boy had at least one pizza each. In this reading the SET operator forms a set of boys each eating a pizza. the cardinality of this set is fixed in the formula as three.

Reference for Webber is always modulo the evocation or accessing of a discourse entity. Discourse entities are fundamental in the act of referring.

> A discourse entity inhabits a speaker's discourse model and represents something the speaker has referred to. A speaker refers to something by utterances that either evoke (if first reference) or access (if subsequent reference) its corresponding discourse entity. (Webber 1983:335)

Webber's introduction of discourse models to establish a vital link between language and the world is reminiscent of Johnson-Laird's approach.

Webber also considers how 'reference' can be achieved by other than linguistic means to evoke or access discourse entities. Discourse entities may be evoked into a listener's model either (1) linguistically from explicit discourse; (2) perceptually. from the immediate spatio-temporal environment and context; and (3) inferentially. reasoning from the existence of other discourse entities. Just how intentional Webber regards these methods of evocation is revealed when she writes:

> the discourse itself provides explicit descriptions. These may reflect things like the speaker's knowledge and attitudes (eg 'a rock' as opposed to 'a fine grained porphyry'). the speaker's beliefs about the listener's knowledge, the speaker's intention [....] an entity may be evoked into the speaker or listener's discourse model as a result of what s/he perceives. How it is described will depend upon how

s/he classifies that perception linguistically. Webber 1978a:23-24

The discourse entities themselves are regarded by Webber as 'conceptual coathooks' on which to hang descriptions of the entity's real world or hypothetical world correspondent. They act in a sense almost like Russell's logically proper names. devoid in themselves of descriptive content. serving as points about which descriptions can adhere.

What of the level of representation of the discourse objects themselves? In her work with Bobrow (Bobrow & Webber 1980a. 1980b. 1981). a knowledge representation language KL-ONE (based in part on Brachman's semantic network proposals 1978. 1979) is used to represent knowledge of the objects of discourse. Webber's logical formalism can then be seen as a method of describing parts of the underlying level of knowledge representation. the knowledge base itself.

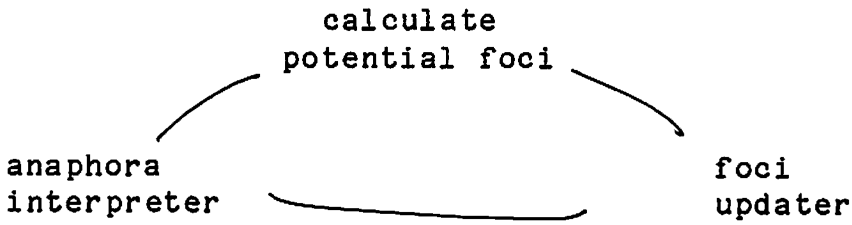
The next question is how do these representations work as representations of objects in the world? How does the logical formalism that Webber uses to represent the discourse objects obtain its own semantics? There is little discussion of these points in her work. The logical appearance of her LF suggests a standard theory of truth. reference and meaning. However. Webber's recognition of the intentional component of reference, along with comments she makes about the negotiation of 'terms of reference' between cognitive systems. all suggest that an absolutist view of reference is not in accord with the spirit of her research.

Grosz' and Sidner's work has much in common with Webber's. Grosz and Sidner are concerned to provide an account of how 'focus operates in discourse'. in particular. how focus aids the interpretation of anaphors. The mechanisms of focus would seem to be closely related to the manipulation of discourse entities over the life time of a discourse.

Both Grosz's and Sidner regard focus as a mechanism for establishing a focus space (what Reichman 1978 calls a context space). Such spaces are the subset of a speaker's total knowledge that is relevant to a part of discourse. The question then is how does the process of focus work?

Sidner proposes a 'focus algorithm' responsible for the implementation of focus. The algorithm consists of three interacting processes which function in a cycle for each sentence of a discourse. The relationship of these processes is given below in Figure 4.3. The first process chooses foci based on what the speaker initially says. An interpretation process uses this set of foci together with rules of anaphora interpretation to resolve the various anaphors in the sentence. The third process updates the foci if necessary and highlights one of these foci as the current focus of the discourse so far.

Figure 4.3
The focus cycle in Sidner's algorithm




Sidner illustrates how this cycle operates on the piece of discourse below:

1. Last week there were some nice strawberries in the refrigerator
2. They came from our food co-op and were unusually fresh
3. I went to use them for dinner. but someone had eaten them all
4. Later I discovered it was Mark who had eaten them
5. Mark has a hollow leg. and it's impossible to keep food around when his stomach needs filling

> Suppose the first focusing process initially guesses that strawberries are the focus in 1. Next a pronoun interpreter would apply a rule that says 'A pronoun that can be replaced by the focus phrase. with the resulting phrase remaining syntactically acceptable. co-specifies with the focus. unless some pragmatic knowledge rules out that co-specifier'. to determine that strawberries can replace they in 2 with no syntactic failure. An inference process. governed by the pronoun interpreter could confirm that strawberries can come from food co-ops and can be fresh; that is that no contradiction in general knowledge results. Finally. a third process can confirm strawberries as the focus since it

> has been re-mentioned and because other objects mentioned in 1. the refrigerator and the previous week, were not discussed in 2. (Sidner 1983:279)

It is interesting that on this view anaphora helps constrain both the focus and the potential foci serving as antecedents for the anaphors. Initial focus is postulated on the basis of a number of different sorts of information. For example. syntactic form might be used; particular forms are closely associated with topic foregrounding (ie focus highlighting). The sentences (4.11)-(4.13) below use clefting. pseudo-clefting. there insertion as highlighting devices.

| | | |
|---|---|---|
| (4.11) | It was Barry who admired the waitress. | CLEFT |
| (4.12) | What Barry admired was Radio 3 | PSEUDO CLEFT |
| (4.13) | There was a programme which did strange things to the computer | THERE INSERTION |

Where no clear focus prediction is possible Sidner's algorithm resorts to a case analysis of the sentence (cf for example Fillmore 1968. Jackendoff 1972) in order to provide role fillers as potential foci. one of which will be subsequently selected.

The discourse elements themselves. which provide candidates for focus. are structured out of semantic knowledge networks. These networks have properties found in various AI knowledge representation formalisms such as

KL-ONE (Brachman 1978) and KRL (Bobrow and Winograd 1977).

Sidner. like Webber. is careful to recognise the intentional nature of the referential relation in language. But she conveniently avoids the difficult question of how it is that her discourse entities succeed as representations of real world objects. There is no explicit theory of meaning in Sidner's proposals.

> What is the relation of specifications to the real world? One might like to claim that a reference relation exists between specified cognitive elements and objects in the world, but since referring is what people do with words. this relation is problematic for cognitive elements. Instead. specifications will be said to represent the objects referred to. that is, they bear a well-structured correspondence to objects in the world. (Sidner 1983:269)

Grosz's work centres on many of the same issues as Sidner's. The most significant difference is that Grosz restricts her research into discourse which occurs in task-oriented dialogues. This results in mechanisms for changing focus that are not directly governed by the syntax of the discourse or the semantics of particular words in the discourse as in Sidner's work. Grosz's mechanisms of focus change are driven by close attention to the 'structure of the task' to which the dialogue is directed.

Mechanisms are required for updating the

> focus representation. because. as a dialogue progresses. the objects and actions that are relevant to the conversation. and therefore in the participants' focus of attention. change. Procedures are described for deciding where and how to shift focus in task-oriented dialogues. ie. in dialogues in which the participants are co-operating in a shared task. These procedures are guided by a representation of the task being performed. (Grosz 1977:iii)

Her recognition of the importance of intentional contexts in semantic evaluation and her use of rich knowledge networks to represent the objects of focus (discourse objects). means that she is in substantial concord with much of Webber's and Sidner's work.

In respect of the first point we find her writing with Hendrix:

> The interpretation of an expression depends on who is doing the interpreting; speaker and hearer are considered as distinct interpreters (or processors) each with their own conception of the world [...] The state of these processors. their condition at a given time plays a crucial role in the analysis of the interpretation of an utterance. (Grosz & Hendrix 1978)

Apropos her use of semantic nets. Grosz makes use of the partitioned network formalism developed by Hendrix (1975a.b). In so far as these formalisms represent the objects of knowledge which processors have. it is not clear whether Grosz is stuck with a uniform assignment of knowledge structures to all individual processors. Such a uniform assignment of the same structures would ensure that processors have effectively the same intensions for the same concepts. I suspect that she is probably more aware than most of the problems this would raise despite providing a nice. neat. univocal connection of knowledge structures throughout processors to the same set of objects in the world. In her 1979 article she writes that a crucial limitation on all natural language systems constructed to date is that

> The knowledge and beliefs of all participants in a discourse are assumed to be identical. (Grosz 1979:17)

The limitation of which she speaks is made explicit in the next piece of work I want to consider. that of Kaplan (1978. 1979. 1983). He implements a completely extensional semantics for his natural language understanding system. Far from seeing this as a 'limitation' Kaplan regards this approach as well-suited to his particular needs. Kaplan is concerned to construct an efficient database query language. a language capable of being used to question a database clearly and unambiguously. To allow a fully extensional language to succeed as a database query language Kaplan adopts a simple solution. Rather than complicating the language to account for the complexities of the world. he simplifies the world to suit the language.

He boils down the complex world of intentions to the single goal of asking questions. asking questions about a world of objects defined exclusively as property sets. Berwick captures the extensional flavour of Kaplan's proposals rather well; - the world Kaplan's system can converse about is a database:

> we could define such a database as a triple <X.D:.i.I.:.U>. X is a finite set of objects like 'John'.'Mary'. 'Computer Science 101'. I is a finite set of attributes used to index the domain D such as 'sex'. 'Grade'. or 'year'. U is a function defined over attributes and their values that retrieves the set of objects that have a particular value of a specified attribute. eg U(sex. male) will return the subset of X that has the attribute 'sex' with the value 'male'- John etc. The crucial point is that a database is defined so that it has a quintessentially extensional semantics- what U returns is a set of objects. A question asked of a database. a database query. is then simply some sequence of calls to the interpretation function U. (Berwick 1983:63)

In so far as the database includes clean. unproblematic. extensional characterisations of objects the problems of polysemy. vagueness etc. are avoided. The other simplification is in the impoverished theory of action and belief that his approach uses. The intentions of agents consist solely in trying to find out the answers to queries about a database.

The work of Allen (1979.1983). Allen & Perrault (1980). Cohen (1978). Perrault. Allen & Cohen (1978), Perrault & Allen (1980). Perrault & Cohen (1981) exemplifies a much more serious and realistic approach to the question of analysing intention in language. The unifying theme is the belief that we cannot fully understand either the generation or interpretation of language without understanding the complex intentions that underlie the use of language.

A point made right at the beginning of my thesis and embodied in the Principle of Context was that discourse involves separate agents with differing views of the world. Therefore language processors must be able to handle and represent the beliefs and knowledge of other people. Included in a model a processor builds is a view of the other processors' models. Processors have models of the models of other processors.

Work in developing AI planning systems. of which Allen and his colleagues' work are all examples. has to recognise that intelligent agents (whether artefactual or natural) must be endowed with reasoning and inference procedures. able to handle and distinguish separate agents' beliefs and knowledge. Furthermore. they must be able to operate on incomplete and sometimes inconsistent information. The agents have to ascribe intentions.

beliefs, and goals to other agents to explain behaviour. particularly linguistic behaviour.

The plan-based approach to natural language understanding found in Allen et al and elsewhere (cf for example Bruce 1978. 1980. 1981a. 1981b. Wilensky 1978) is geared to a dynamic evaluation of the underlying intentions behind 'speech acts'. Since Allen and his colleagues' work is a computational formulation of speech act theory. we ought to take a look at the general concepts behind speech act theory itself. Such a review is perhaps overdue since the theory has traditionally been closely associated with Intentionalist views of meaning.

Three philosophers are responsible for the development of modern speech act theories. Austin (1962. 1970). Grice (1957. 1967. 1968. 1975.1978) and Searle (1969. 1975. 1979. 1983). These philosophers have all noted the relationship between meaning and intention. For example. Grice (1957) presents his formulation of meaning as:

> 'S meant something by X' is (roughly) equivalent to 'S intended the utterance of X to produce some effect in an addressee by means of the recognition of this intention'. Grice 1957:385

Austin was one of the first philosophers to question the generally received notion that the meaning of an utterance was exhausted by its truth conditions. Austin noted that many utterances occasioned the performance of actions. Many of these actions resulted from the presence of explicit performative verbs. ie 'promise'. 'warn'. 'regret' etc. Sentences such as (4.14)-(4.16) when uttered in appropriate contexts allowed the utterer to perform certain acts.

(4.14) I promise I will come to the party
(4.15) I warn you not to touch that wire
(4.16) John regrets the pain he has caused you

As utterances (4.14)-(4.16) may succeed or fail to achieve or perform the relevant actions. Someone might touch the wire despite the warning of (4.15). Nevertheless we cannot talk of utterances (4.14)-(4.16) as being true or false. Such predicates are not appropriate to these performative utterances.

Austin's work led to a view that all utterances could be viewed as actions. actions termed 'speech acts'. Austin classified these acts into three types; locutionary acts, illocutionary acts and perlocutionary acts.

In uttering (4.15) we can identify these various acts. The very act of saying (4.15) performs a locutionary act. a relatively uninteresting act from our point of view. It is the remaining two classes of act that will preoccupy us. As a speaker of (4.15) I intend to effect a change in what I think will be your future behaviour. I attempt to effect such change via the performance of the illocutionary act of warning. The actual effect of this utterance may be to amuse you. perhaps because you think the danger is exaggerated, or you know what I do not. that the electricity is off etc. The actual effect of my uttering (4.15) in a certain context is a perlocutionary act. Of particular interest is an analysis and understanding of the necessary and sufficient conditions for the successful performance of an illocutionary act such as contained in (4.15). Searle's work is relevant here through what he refers to as 'felicity' conditions for the performance of speech acts.

Suppose I want to perform the illocutionary act of making a request. and so suppose I utter (4.17).

(4.17) Help me lift the projector

The felicity conditions for such an act to succeed will include various 'preparatory' conditions:

where H is hearer. S myself the speaker

(i) H is able to do the act
(ii) S believes that H is able to do the act
(iii) It is not obvious to S and H that H will do it of his own accord

To this we might add a 'sincerity' condition:

(iv) S wants H to do the act

This kind of analysis of the preconditions underlying a speech act. the necessary steps involved in executing it. is good material for translation into 'planning procedures' and 'protocols'. The planning aspect of intentional speech acts is forcefully described by Allen:

> Underlying this model of conversation is the assumption that the participants in dialogue are rational human beings who are co-operating [Footnote 4.2] to help each other. In particular. each is continually 'executing' processes to
> 1 Achieve goals based upon what he believes
> 2 Adopt goals of other agents as his own
> 3 Infer goals of other agents
> 4 Predict the future behaviour of other agents
>
> Consider two agents. A and H. in conversation. Each knows that the other is executing these processes. and both know that each other knows. In particular. when A speaks to H. any inferences that H makes by executing these processes based solely on what A said and on what H believes A knows about H's beliefs and processes. may be taken (by H) as intended to be communicated by A. (Allen 1979:79)

Footnote 4.2. Grice's work is concerned to outline rules of co-operative conversational behaviours- co-calledconversa-

This is exactly the point I have made elsewhere about the reciprocal recognition of intentions. Because we are equipped as 'rational belief systems' with similar problem solving strategies and maxims for speech act construction. we can achieve our communicative ends with relative success. We can do this even where beliefs about the domain of discourse are unevenly shared.

Actually achieving some measure of wider informedness is one of the top level intentional goals of communication. As I have written elsewhere:

> The intention of an utterance is the attempt to bring about some change by affecting the models of situations which addressees have in their heads. Indeed this intention to discover. contrast or change models of what people believe can be seen as the mainspring of linguistic communication. Of course language can state the obvious. almost gratuitously describing the way the world is. But so often our linguistic behaviour is concerned to communicate new facts. elicit new information. We engage in a constant process of modifying our own and other peoples' views of the world. (Shadbolt 1983:66)

Automating the process of plan formation in the generation of speech acts, and automating plan deduction in the interpretation of speech acts, is the main aim of Allen's work. To illustrate the close connection between planning and linguistic acts consider an agent A asking a

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tional maxims.

question of another agent B, say (4.18)

(4.18) What time does the language lecture start?

We may assume that A has a top level goal of wanting to attend the lecture. We can understand A's uttering (4.18) as an attempt to remove an 'obstacle' that inhibits achievement of the top level goal (ie A doesn't know what time to turn up). Now this obstacle can be viewed as a subgoal that needs to be achieved (ie the time found out). moreover it is a subgoal that cannot be satisfied without assistance. It is one of Allen's claims that many instances of helpful behaviour on the part of an audience to questions such as (4.18) arise because the observing agent recognises an obstacle in the other agent's plan and acts to remove the obstacle.

Thus in our example A asks a question of B which B then answers. A has a top level goal. A creates a plan (plan construction) that involves asking B a question whose answer provides some information necessary to achieving the goal. A can be viewed in (4.18) as executing a plan - by performing an action - the speech act of questioning. In interpreting (4.18) B attempts to infer what A 's goal could have been. this is 'plan inference'. The inferred top level goal will include a number of subgoals and it is B 's recognition that some of these are not achievable without his assistance. and which therefore represent obstacles to A. that leads to his recognition of the force and requirement of (4.18).

In building and designing such planning systems Allen and his colleagues realise that they are dealing with systems which have to co-operate with different sets of initial beliefs. But these beliefs are to do with what states of affairs S knows about. what states of affairs S thinks H knows about. what states of affairs S thinks are recognised as mutually shared (ie S thinks H thinks S knows, and which S thinks H thinks S thinks H thinks). As such they utilise logics of belief. wants and actions which make reference to propositions describing states of affairs. For example. the logical schema representing an agent S's belief that some other agent A knows that P is true is (4.19). This implies that S believes A believes P. but also that S believes P as well.

(4.19) BELIEVES(S.P & BELIEVES(A.P))

What is generally left aside are the grounds for assuming that the proposition 'P' comprises elements whose meanings are the same for each agent. Relativising propositions in this radical sense would. of course. have dramatic effects on the grounds for the licenced inference of one set of propositions from another.

Interestingly Berwick acknowledges this problem but does not seem to realise its full implications. Intensions as formally and objectively defined as equivalent for all speakers cannot do as a model of human communication.

> Allen's model centers on the causal connection between human actions and the world. It involves in an essential way what the speaker or hearer wants or intends. On different occasions depending on the belief. desires and party allegiance of the agents involved. one and the same set of formal objects (hence objects with the same properties. hence same extensions) could have different intensions. (Berwick 1983:33)

Whilst it is no longer clear what the relationship is between these sorts of intensions and extensions, it is certainly not the one defined by, for example, Montague semantics.

This is not to diminish this planning work. It is a substantial achievement to get the logic of belief and action detailed enough to explain how a speaker might construct (4.18) as an effective question and have the hearer interpret it as such.

(4.20) Is paracetamol dangerous?

My point is that our task becomes more difficult, or approximates reality more closely, when the terms that constitute the question are liable to have different intensions for S and A. yet still have sufficiently much in common for (4.20) to work as a communicative act.

A significant part of explaining how (4.20) works. when asked of a GP by. for example. a frightened housewife. consists in the GP's assessment of how to judge the meaning of the terms used by the housewife in (4.20), modulo the needs. desires etc. of his patient relative again to his own detailed and extensive knowledge of the objects involved and their 'properties'.

It is this additional aspect. dropping the assumption of the equivalence of intensions. that marks off my research from the work discussed here.

Having reviewed at some length the roles mental models have played in cognitive science research I want now to turn to my own application of models to the question of reference in 'opaque contexts'.

# CHAPTER FIVE PROCESSORS. REFERENCE AND MODELS- A SYSTEM OF REFERENTIAL DESCRIPTION

It might be worth presenting a resume of the main points I have tried to establish with regard to reference and language processors.

When a processor is involved in generating or interpreting a piece of natural language a model is built based on the states of affairs described through the language. The construction of these models is a major component in our understanding of language.

Plainly. discourse involves separate agents with differing views of the world. Language processors must be able to represent the beliefs and knowledge of other people. Included in a model a processor builds is a view of the models of other processors'.

All issues involving reference must involve language processors. Linguistic expressions in themselves do not refer. A linguistic expression lacks reference unless it is invested with reference through a particular speaker's use of it.

Reference depends on two things the importance of which it is impossible to exaggerate. Firstly. the context of utterance; the notion of context I have elaborated on at some length. it includes. at least. the time. the place. the speaker. the immediate focus of interest. the current histories and states of the speaker and addressees. Intimately connected with context (indeed an intrinsic part of it) is the intentional state of language processors.

Intentions are the driving force behind communication. both in the construction and interpretation of linguistic acts.

> When I take a noise or a mark on a piece of paper to be an instance of linguistic communication. as a message. one of the things I must assume is that the noise or mark was produced by a being or beings more or less like myself and produced with certain kinds of INTENTIONS. (Searle 1969)

Intended meaning relies. in part. on the following beliefs for the speaker and hearer; beliefs about the current situation. beliefs about each others beliefs and goals, beliefs about the context of discussion. and even beliefs about their mutual beliefs. (For example. the mutual beliefs of A and B would be those beliefs that A and B both believe and furthermore that they both believe that they both believe. and they believe that they both believe that they both believe etc.)

Scholars from psychology. A.I., linguistics and philosophy. all admit the central importance of intention in understanding behaviour in general and linguistic behaviour in particular. For example. the American philosopher Dennett (1978) regards intentionality as the fundamental concept behind certain sorts of systems. He argues that intenSional referential phenomena inevitably arise out of language-using IntenTional Systems. The connection is so close for Dennett that he talks of intenTional linguistic contexts and idioms (1978:3).

I have tried to show that this view of Dennett's is correct. By assuming beliefs in other systems to which we have no privileged or veridical access we encounter all the problems of referential opacity. Consequently. in utterances such as (5.1) whoever is referred to by 'he'. may not know of the object he has the belief about. that it is a pendulum-bob, or he may think it exists when in fact it doesn't etc. (Footnote 5.1)

(5.1) Nigel says to Sam    He believes the pendulum-bob is moving

The point I am seeking to establish is that referential

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Footnote 5.1. Artificial Intelligence systems already exhibit a degree of intensionality. The Mecho project at Edinburgh University consists of a set of programs some of which represent the micro-world (applied mechanics) the system 'knows' about. Objects in the micro-world are represented as sets of descriptions. In such a system. if a description is used to talk about an object and the system does not know of the object under this description. we find ourselves confronted by the type of opacity phenomena. including intenSionality. arise out of intenTional acts. The Intentional acts themselves issue from Intentional Systems that operate in complex contexts. these contexts include internal as well as external states.

Two further points need to be made. Firstly I have argued that traditional logical attempts to solve and explain intenSional and referential puzzles fail because the Theory of Meaning embodied in such approaches does not allow for an intenTional dimension to language. It does not allow for users who may hold beliefs whose contents cannot be guaranteed equivalent. Secondly. the logical proposals do not reflect the manner in which intenTional systems are connected to the world. The models that organisms support are the product of a complex interaction. there is no single correspondence theory of truth that can adequately capture our embedding in that external reality.

By modifying certain basic assumptions. it may be possible that the logical proposals could be 'fixed up' At the very least. we can claim that the logical proposals which I have examined fail to highlight crucial

problem exemplified in (5-1). Bien (1976.1980) has discussed the emergence of these sorts of opacity problems in connection with the evaluation of expressions within computational systems.

features of intensional phenomena.

The task now is to present a system of referential description that embodies the various points I have made. and which allows us to lay out an utterance's referential possibilities.

## SECTION ONE THE PROCESSOR-CENTRIC MODEL

### 1 Components of the Model

The diagram in Figure 5.1 represents what I have called the Processor-Centric (P-C) standpoint. It is a division of the language processor into functionally convenient components. The partitioning is determined by the two considerations mentioned above; that it should embody the various conjectures about language and its processing discussed in the last section. the representation should be capable of displaying the referential possibilities of natural language.

FIGURE 5.1

MAIN COMPONENTS OF THE PROCESSOR-CENTRIC REPRESENTATION

```
 ____________________________________________
|           General Processor State          |
|    ______________________________________  |
|   |       Processor's Epistemic          | |
|   |       Model (EM)                     | |
|   |                                      | |
|   |______________________________________| |
|    ______________________________________  |
|   |       Processor's Discourse          | |
|   |       Model (DM)                     | |
|   |                                      | |
|   |______________________________________| |
|____________________________________________|
```

The representation distinguishes as part of a language user (or what we might call the General Processor State), two functionally distinct areas; the Epistemic Model (EM), and the Discourse Model (DM).

Let us look first at the role of the Discourse Model (DM). It is here that a processor constructs a model of the elements introduced in a discourse. This will constitute. in part. his understanding of a piece of discourse. Discourse as it occurs has a 'public aspect'. The various linguistic elements used. are. under normal conditions. presumed to be available to all participants in a particular discourse.

The discourse model. will be populated with elements representing the objects referred to in discourse. These elements I have called Discourse Objects (DOs). The discourse objects themselves can be viewed as 'loci'. The 'locus' is well established in A.I Knowledge Engineering, and intuitively serves as the 'representational object' about which properties can adhere. Webber (1983) for example talks of 'discourse entities' or 'discourse objects' as

> a 'conceptual coathook' (a term coined by William Woods) on which to hang descriptions of the entity's real world or hypothetical world correspondent. As soon as a discourse entity is evoked it gets a description. Over the course of the text, the descriptions it receives are derived from both the content of the speaker's utterances and their position within discourse (Webber 1983:337)

Loci. in this respect. fulfill a similar function to Russell's Logically Proper Names. They are radically simple ways of accessing information. the locus is empty of descriptive content. Discourse objects in my descriptive system will be symbolised using subscripted labels, eg. such as 'do1'. 'do2'.....,'don' etc. The information associated with discourse objects will be laid out in a format to be described a little later.

So far I have kept DOs divorced from any information other than that explicitly introduced in discourse. Of course. discourse does not. and cannot, proceed in isolation from the general or specific 'background' knowledge a processor has. In fact the early stages of discourse are often explicitly directed toward the retrieval and activation of relevant background knowledge from the 'long term Knowledge base' (cf for example. Garrod and Sandford 1982).

I have confined to the DM information explicitly contained in discourse. Any other information relevant to the interpretation of these discourse objects I confine to what I have called Epistemic Models (EMs). In the EM an object of knowledge can be individuated as a locus (an Epistemic Object EO). Information from many sources attaches to these EOs. Epistemic Objects are distinguished using a similar notation to that used for discourse objects. ie 'eo1'. 'eo2'......,'eon' etc. Once more the radically simple nature of these EO loci allows us to access their associated knowledge without descriptive commitment.

Talk of EOs raises questions about how knowledge is to be represented, how the 'knowledge bases' are to be partitioned etc. These questions are familiar topics in Philosophical Epistemology. Cognitive Psychology and Artificial Intelligence. Without getting sidetracked into a lengthy discussion on 'knowledge representation' we can make some obvious and important points.

The knowledge which will contribute to the content of EOs is open to revision and change. Knowledge may be gained and enter EMs from various sources. different modalities and mediums etc. Some of the knowledge we possess is relatively long term and stable. other knowledge is more short lived. more transitory. Most psychologists theorise different types of knowledge store. We find. for example. Long Term Memory for the long term knowledge. Short Term Memory for more short lived information etc. None of this is contentious. some sort of distinction between long term and short term knowledge stores. together with a differentiation of their respective contents. can be found in virtually all theories of human cognition (cf for example. Waugh & Norman 1965. Kintsch 1970. Baddeley & Patterson 1971. Craik & Lockhart 1972).

No detailed theory of the structure of knowledge bases and their contents can suppose that the various components of the system are independent and autonomous of the results of other components. For example. as discourse proceeds. settings change. This requires that different long term knowledge needs to be 'activated'. whilst knowledge currently active may be placed in the background. Information assimilated from the discourse itself may eventually be consolidated in the longer term knowledge structures. Dynamic interaction and activation of knowledge is a feature of most recent models of memory. attention and semantic representation (cf for example. Underwood 1976. Chafe 1979. 1972. 1974. 1976, Prince 1981. Sanford & Garrod 1981).

However having mentioned these rather obvious points. I am not about to embody in my system any detailed claims about how to represent long, medium and short term knowledge. Neither will I propose mechanisms for the activation of knowledge.

Even with this large set of disclaimers one can still impose interesting requirements on the nature of Epistemic and Discourse Models, and on the objects they contain.

## 2 Partitioned Perspectives

One thing we must provide is a means by which a processor can represent perspectives. other than his own, on the objects known to. and discussed by. discourse participants. This is the requirement that any sophisticated intentional system should be able to model. as part of its own knowledge. the knowledge it believes other agents to have.

For example. I might know a great deal about the philosopher Socrates. Suppose I also believe that Bill knows very little about this individual. except perhaps that he was a Greek philosopher. In addition. I might believe that Bill does not know that I have such comprehensive knowledge of Socrates. These various beliefs all form different perspectives on the same individual represented in my 'knowledge base'. Since I am concerned with those objects of knowledge individuated in referential acts. I will need different perspectives on the contents of any EM. These I will represent using the convention shown in Figure 5.2 (Footnote 5.2).

FIGURE 5.2

MULTIPLE PERSPECTIVES ON EPISTEMIC AND DISCOURSE OBJECTS

```
 ________________________________________________________________
|                                                                |
|     Nigel's Active EM _____________________                    |
|     |                                      |                   |
|     |        eo1| nep     [...] |          |                   |
|     |           | n/bep   [...] |          |                   |
|     |           | n/b/nep[...] |           |                   |
|     |                                      |                   |
|     |______________________________________|                   |
|                                                                |
|     Nigel's DM ____________________________                    |
|     |                                      |                   |
|     |        do1| ndp     [...] |          |                   |
|     |           | n/bdp   [...] |          |                   |
|     |           | n/b/ndp[...] |           |                   |
|     |                                      |                   |
|     |  ____________________________________|                   |
|________________________________________________________________|
```

Notice that Nigel's EM in Figure 5.2 is referred to as 'Nigel's Active EM'. This serves to remind us that not all EM knowledge is equally activated at any point in

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Footnote 5.2. Partitioning knowledge to represent different perspectives is proposed elsewhere in the literature (Perrault and Cohen 1981. Clark and Marshall 1981). However. the partitioning is not used to account for the range of phenomena to which I apply it.

language production or interpretation. The active EM will contain those most salient objects involved in the current stage of discourse.

We are to understand the EO representation in the following way. The EO representing Socrates is identified as 'eo1'. there are three active perspectives shown associated with this object- namely. Nigel's view of the object. 'nep' (Nigel's Epistemic Perspective). Nigel's view of Bill's view of the object. 'n/bep'. and Nigel's view of Bill's view of Nigel's view of the object. 'n/b/nep'. The square brackets following the perspective labels represent the contents of this particular perspective (not as yet detailed).

A similar representational device is observed in Figure 5.2 for DOs. This represents the intuition that whilst a discourse itself is public. the interpretation a processor places on how a discourse object is being understood, (for example. which EO it is associated with) may differ according to which perspective he is considering. The need for multiple perspectives in discourse models will be apparent in later sections when we consider various forms of referential misconstrual. The brackets following the abbreviated perspective labels will contain an indication of which EO the DO is to be associated with. as well as a representation of the information explicitly mentioned by each discourse participant.

Note that three embedded perspectives on either EOs or DOs represents a particularly interesting case of multiple perspectives. The three perspectives given in Figure 5.2 for 'eo1'. establish conditions of 'subjective mutual belief' (Footnote 5.3).

For example. I believe the object Socrates is 'mutually known' to Bill and myself if the following epistemic perspectives exist for the relevant EO; my own perspective on the object. my view of Bill's view of the object. my view of Bill's view of my view of the object. Notice. however. that this only secures the following - I believe Bill knows of an object known to me. I also believe that he believes I know of this object. Whilst these perspectives can in principle be indefinitely embedded, leading to a series such as nep, n/bep. n/b/nep, n/b/n/bep. n/b/n/b/nep. ...... three perspectives serve to establish a 'pragmatic halt'. This pragmatic halt is a consequence of the fact that if I believe Bill knows of an object. and I think he knows I

Footnote 5.3. I have used the term 'subjective mutual belief' rather than the more usual term 'mutual belief' to highlight the fact that. from a P-C standpoint. what is believed to be mutually known is yet another case of subjective belief. Wherever the phrase 'mutually known' is encountered this qualification should be noted.

know about that object. then I can proceed in referential discourse on the assumption that in terms of the distribution of knowledge about what objects can serve as a common pool of potential discourse objects. Bill and I are similarly informed.

Artificial Intelligence has shown that there are many ways mutual knowledge may be implemented in knowledge-based systems (cf for example. Allen 1979. 1983. Perrault & Cohen 1981. Steel 1984). In such Knowledge Based Systems one could check against a data base in which mutual knowledge is explicitly stored. or the mutual knowledge could be generated dynamically in some type of proof system. This is not of immediate concern to our project which merely aims to represent. in a perspicuous way. a processor's view of what is mutually known.

It should be pointed out that it is possible that an EO be known to a particular processor only through his views of other peoples perspectives on that object. Epistemic objects on which a processor has an immediate perspective we will call 'directly instantiated'. EOs which are only known to him via his views of other processor's beliefs about these objects. we will call 'indirectly instantiated'. Clearly both indirectly and directly instantiated EOs form all those objects a processor knows something about.

## 3 Representing the Objects of Knowledge and Discourse

The range of types of object which can serve as 'Intentional Referents' which are accessible as EOs is huge. Cases of polysemy. such as those given on pages 141 et seq.. demonstrate the ability of expressions to 'refer' to different 'types' of object.

In some cases nominals seem to be operating simultaneously at different levels in a typology of objects.

(5.2) The chair you are sitting on is commonly seen in Eighteenth Century Interiors.

One possible account of this phenomenon is that whilst only one DO has been introduced. it serves as a means of retrieving two EOs. One of which is an object with spatio-temporal co-ordinates. weight. an individual history etc. The other is an abstract characterisation of a type of object. embodying information extensible to all members of the type.

The interesting feature of types is the way that these abstract characterisations can be used in an extensional or token-like way. A processor's intentions can intervene to create a new level at which properties and objects can be inaugurated and treated as individual discrete tokens. This is the extensional consequence of organising knowledge around any discrete locus. The aggregation of knowledge can be seen as constituting an object/individual in its own right. A favourite example of mine comes from a POP2 programming manual.

(5.3) Take the result and place it
on the stack

Nowhere in the hardware of the machine does it make sense to look for either of the two referents introduced via the DOs in (5.3). The stack in POP2 is, typically, a functional concept far removed from the actual electronic hardware of the computer which supports the POP2 language. The path which leads from certain semi-conductor states to high level computer languages has many intervening levels of description. Each level relies on objects, states and processes being interpreted at another level as different kinds of objects, states and processes (Footnote 5.4). In so far as a level of description is useful we can and do talk about the objects, states and processes that comprise it in a perfectly extensional way. We do not worry if an object, such as a stack, at one level of description lacks an

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Footnote 5.4. See Smith (1982) for excellent discussion of the issues of levels of interpretation in understanding the semantics of programming languages.

obvious correlation with a particular individual state at a lower level of description (Footnote 5.5).

Another aspect of the flexibility of nominal interpretation is the abstraction of a previously instantiated token- moving from a token to a type. One can take any object no matter how 'solidly instantiated'. and move up a level from talking about it as an object to talking about its constitutive criteria. cf (5.4) for example.

(5.4) He is not the Barry I once knew

As processors we move easily from talk of objects as 'tokens'. through to talk of objects of ever more abstract 'types'. We also treat these abstract 'types' as just another sort of 'token'. How ought a descriptive system concerned to detail the states of knowledge relevant to referential communication. model this feature of our linguistic practice?

From the point of view of DOs one possibility is to claim that since no significant syntactic or grammatical distinctions are apparent in nominals used as 'types' and nominals used as 'tokens'. then no distinction in DOs

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Footnote 5.5. For example the physical size and location of the stack may for reasons of efficiency be changed at a lower level without any apparent change in the higher level object's properties.

should be made. In the system I present. none is made.

What of the objects of knowledge themselves? One response is to ignore this source of linguistic variety and assume an epistemology in which the only objects of knowledge are 'tokens' in a single level object typology. This approach is taken. as we have seen. by Kaplan (1978.1979.1983). Grosz (1977.1981) and many others.

Another approach is to implement a level of 'prototypical knowledge'. Minsky's FRAME proposals (1974). and Bobrow and Winograd's KRL system (1977a.1977b) can be viewed as such implementations. Frames themselves are objects of knowledge- they are abstractions serving as general schemas from which individual instances of the frame type can be generated. Using this approach we can think of an EO either as a frame or the result of instantiating a frame. Both are legitimate objects of knowledge. Thus we can think of a concept such as our knowledge of what constitutes a car as being a frame. When the frame is instantiated, that is its attributes take on values. we have an example of the concept. In this case. for example. an individual car with a registration number, recoded mileage and so on.

To represent this feature of language. and the knowledge structures which support it. EMs will contain two sorts of EO. I will assume that EOs are either types or tokens; either frames or instances of frames (Footnote 5.6)

I will now introduce simplified notations which represent the informational content of EOs and DOs. Let me stress from the outset that this notation reflects no commitment to any particular form of knowledge representation. Any formalism would suffice which was capable of representing the properties. qualities and attributes of the objects of our knowledge. I will associate with EO sets of pairs, each pair consisting of an 'attribute' and its associated 'value'. Thus one attribute might appear as A2. whilst a value for this attribute might be LARGE. The attribute A2 corresponds intuitively to the concept of SIZE. I have used non-descriptive labels for the attribute component of the attribute value pair so as to suggest that this information is not to be thought of as part of 'Internal English'. The attribute value pairs, as represented here. provide a short hand for the kind of information that is active at a certain moment in a processor's perspective on an object. Moreover. the attribute value structures are not meant to suggest that this is the only. or indeed a likely. way in which knowledge is

Footnote 5.6. This is something of a simplification- we can have many-tiered hierarchies of types and tokens. However. the basic feature of types and tokens is represented.

organised. Information constituting. for example. the value LARGE of an attribute SIZE is likely to be embodied in complex cognitive procedures. These procedures will consist of criteria sensitive to context. These criteria amount to our rules of use for the properties. qualities and attributes that constitute our knowledge of objects themselves. For example. part our criteria for the concept LARGE applied to any object. once contextualised for the type of object in question. might be the amount of the perceptual field it fills at a certain distance. or even. when the object is unseen. the sound it makes as it falls over!

I also need a means of representing the difference between types and tokens. To represent the difference between these two sorts of EO I will reserve the first two attributes of the EO knowledge structure; the value associated with the first attribute (A0) will indicate whether the EO is a type or a token. whilst the value of the second will indicate the concept of which the EO is either the schema or an instance. An example of this type of representation is shown below

```
.eo [ <A0.type>.<A1.car> ]
.eo [ <A0.token>,<A1.car> ]
```

When the types or tokens which occur in EMs are associated with DOs then we can always talk of 'referential specificity'. a term I introduced in an earlier chapter. Discourse objects point back to particular and specific collocations of knowledge- these collocations. whether types or tokens. are particular EOs

Figure 5.3 illustrates how an EO and its related perspectives are associated with 'knowledge' about the object. In this case the EO represents a token. 'eo3' is a partial representation of the information I will have to activate in my EM prior to uttering (5.5). Only information which will be directly involved in the utterance is shown as part of the structure of 'eo3'.

(5.5) Nigel says   I discovered Barry is twenty six
      to Bill

FIGURE 5.3

ACTIVATED EPISTEMIC TOKEN OBJECT FORMING PART OF
AN ACTIVE EPISTEMIC MODEL

```
 Nigel's Active EM _____________________________________________
|                                                               |
|  eo3| nep     [<AO.TO>.<A1.MAN>.<A2.BARRY>.<A3.26>] |         |
|     | n/bep  [   :        :         :       <A3.28>] |        |
|     | n/b/nep[   :        :         :           :   ] |       |
|                                                               |
|_______________________________________________________________|
```

It is reasonable to suppose that utterances such as (5.5) are based. in part. on my perception of incongruences of information between myself and Bill. If we look at Figure 5.3 the representation reveals the case in which I have one view of Barry's age whilst I believe Bill to have another. I do. however. expect us both to know the individual Barry by the proper name 'Barry'. Thus although in the representation there is no explicit set of intentions that prompt a processor to say anything in the first place. informational differences (embodied as perspectival differences) are partly responsible for 'energising' communicative acts.

Notice that some attribute value pairs present in nep are not shown explicitly in n/bep or n/b/nep. I adopt the convention of showing three perspectives on an EO to indicate that it is 'subjectively mutually known'. but I only note attribute value pairs to a depth at which significant differences are found between that level and the one immediately above. Consequently. Figure 5.5 also embodies the assumption that I believe Bill to believe that I agree with him as to Barry's age. If I was unsure of Bill's view of my view about this attribute value pair the representation would be

n/b/nep[<A0.TO><A1.MAN><A2.BARRY>.<A3.?>].

We should note that there are really two sorts of ignorance about potential values etc, I may not know what value Bill associates with an attribute. or there is a stronger epistemological case where I know for certain that Bill does not know the value of some attribute. To avoid ambiguity in the notation the later case of 'understood ignorance' is represented as '??'.

Before leaving the issue of the contents of Eos it should be noted that the processors involved in discourse will themselves be represented as EOs in the knowledge bases. Thus a perspective. say a/bep on an object, is really part of the structure of the EO representing b. Any perspectives a processor has of another processor's view of an object implies an EO for that other processor.

Thus in Figure 5.3 the EO which we maintain of b is implied but not shown. There are occasions when explicit reference to EOs of this sort is a useful device within PC representation.

Let us now consider how the contents of the DOs are represented. The content of a DO is that information explicitly introduced by a processor in discourse. These contents are associated with relevant discourse perspectives. ie my understanding of who has said what about an object. my understanding of a fellow interlocutor's understanding of who has said what about an object etc.

The contents actually associated with DOs are not full lexical strings, but rather those ascriptions. predications and descriptions. made of objects in the lifetime of a discourse. The choice of exactly what parts of any utterance to represent as explicitly attached to DOs is difficult. Especially since the evidence suggests that surface forms are not the manner in which information is stored in models of discourse (cf for example. Bransford. Barclay & Franks 1972. Bransford & McCarrell 1975).

Figure 5.4 below represents the contents of a DO I might establish in response to my own utterance of (5-5). The DM and its objects serve as an indication of the history of a discourse. Information from the DM is constantly being compared to what is known in the EM. relevant adjustments in the EMs are subsequently made. The DO. 'do3'. indicates my view of the separate discourse participants' views of who said what about that object of discourse.

FIGURE 5.4

DISCOURSE OBJECT FORMING PART OF A DISCOURSE MODEL
AFTER UTTERANCE OF (5-5)

```
 Nigel's DM ___________________________________________
|                                                      |
|                                                      |
|     do3| ndp     [eo3.[ndc]] |                       |
|        | n/bdp   [ :     :  ] |                       |
|        | n/b/ndp[ :     :  ] |                       |
|                                                      |
|______________________________________________________|
```

where
ndc={barry.nep}
{twenty six.nep}

In Figure 5.4 the DO. 'do3'. is shown as containing various perspectives. My perspective on this object is shown as 'npd' (Nigel's Discourse Perspective), my perspective of Bill's perspective on the DO is shown as 'n/bdp' (Nigel's view of Bill's Discourse Perspective) etc. Following these perspectival indicators there is an indication of which EO the DO is derived from. This information is then followed by a list containing my view of who has said what about a DO, and which perspective this contribution can be regarded as having originated from. In this particular case there has, so far, only been one contribution, represented as 'ndc' (Nigel's Discourse Contribution). Associated with 'ndc' are the salient predications/ascriptions made by myself of the object and the epistemic perspective out of which it is presumed the descriptions have been lexicalised. This information is something of a reduplication of information already contained in the EM. The representation of 'ndc' in Figure 5.4 shows that I have made two 'predications', or 'ascriptions' of the DO 'do3'- namely, 'barry' and 'twenty six'. Both of these ascriptions are assumed to have originated out of Nigel's Epistemic Perspective 'nep' on 'eo3' (the EO itself contains the more detailed considerations concerning which of these ascriptions are held to be 'mutually known').

Note that a similar convention is adopted to that governing embedded epistemic perspectives. ie if there is no assumed difference between my view of the discourse. 'npd'. and my view of Bill's view of the discourse. 'n/bdp'. the contents are not replicated at the lower embedded level.

## 4 Quantification in the PC Model

The problem of representing quantified nominals in 'mental models' such as the PC system is a serious one. Any 'mental model' approach. which seeks to be psychologically plausible. faces the problem of representing. in finite models. nominals such as 'all the stars in the galaxy'. 'all the prime numbers' etc. Proposals which seek to establish how DOs are established find themselves overwhelmed if such expressions are seen to introduce a separate DO for each element of classes like 'stars in the galaxy'. 'prime numbers' etc. There are. fortunately. a number of ways in which quantified nominals could be accommodated within a PC framework.

One approach. which we might term 'type exemplification'. suggests that part of the knowledge activated. when certain nominals are used. includes a means of generating inductively a particular member out of what is potentially a very large. perhaps infinite.

set. For example. consider (5.6).

(5.6) A to B  Think of a number, multiply
              it by twelve

Rather than suppose that people have to carry an infinite number of EOs about with them. each of which represents one of the natural numbers, it seems more reasonable to suppose that concepts like the integers are stored as inductive rule schemas- these can be thought of as EO types for integers. Such a schema allows us to generate any member in the series as needed- to generate a token from a type. On hearing (5.6). a single DO is introduced and associated in the first instance. not with a particular number. but with the type EO which allows number generation.

Notice that this gives us a way of importing universality to nominals such as indefinites which would not receive such treatments on logical accounts. What of explicit universal quantifiers? How are they to be understood as instructions for model construction and model search?

We could adopt the view outlined above. Accordingly we would have to claim that despite appearances to the contrary nominals like 'every number', 'all men'. introduce a single DO into discourse. This is a DO which is associated with a certain sort of EO- namely. a type.

Any ascription is now an ascription made of a DO associated with a type EO. This is an EO capable of modification which affects the entire class of objects which can be 'generated out' of the schema. Thus an assertion such as (5.7) bears on the level of knowledge which is the schema for generating the primes themselves.

(5.7) A to B  Every prime must have a root which is real

In a similar way an utterance such as (5.8) could be understood as a comment about the instigator's view of the 'mandatory' properties which he ascribes to a particular sort of object. Thus (5.9) and (5.10) have the same force as (5.8). in all cases reference is to DOs which are associated with a type characterisation.

(5.8) A to B  Every tiger is fierce
(5.9) A to B  A tiger is fierce
(5.10) A to B  The tiger is fierce

These proposals appear to work reasonably well for universal and individual terms. It is less immediately clear how examples such as (5.11) are to be treated.

(5.11) A to B  Some tigers are fierce

One approach suggested in a series of articles by Johnson-Laird (cf for example Johnson-Laird 1975a. Johnson-Laird & Steedman 1978. Johnson-Laird & Bara 1982). His proposals were originally meant to account for the data derived form subjects performing syllogistic inference tasks.

In syllogisms such as (5.12) Johnson-Laird models the two premises by setting up a 'tableau' of tokens. Each token is seen to represent an individual from the classes mentioned. A mental model or tableau for the first premise is shown in Figure 5.5. The second premise extends and revises the tableau to that shown in Figure 5.6.

```
(5.12)  All vicars are gardeners
        All gardeners are vegetarians
        All vicars are vegetarians
```

FIGURE 5.5
TOKEN TABLEAU CONSTRUCTED IN RESPONSE
TO FIRST PREMISE OF (5.12)

```
vicar  =  gardener
vicar  =  gardener
vicar  =  gardener
         (gardener)
         (gardener)
```

FIGURE 5.6
TOKEN TABLEAU CONSTRUCTED IN RESPONSE
TO FIRST & SECOND PREMISES OF (5.12)

```
vicar  =  gardener  =  vegetarian
vicar  =  gardener  =  vegetarian
vicar  =  gardener  =  vegetarian
         (gardener) = (vegetarian)
         (gardener) = (vegetarian)
                      (vegetarian)
```

The tokens in parentheses are introduced as possible individuals. since although it is possible that from the first premise the sets of vicars and gardeners are equal.

the first premise is also consistent with the situation in which 'vicars' are a subset of 'gardeners'. This is the possibility which is captured by the additional bracketed elements. The second premise extends the model. again it is possible that the sets of gardeners and vegetarians are equivalent. or that there are more vegetarians than gardeners. With such straightforward models a simple inspection of the model can provide conclusions such as 'All vicars are vegetarians'.

A similar approach to quantified discourse objects could be adopted within the PC model. Tableaus could be up in the DMs and EMs to represent the content of the quantifiers. This could be done explicitly as in Figure 5.7 in response to an utterance such as (5.15). Or through EM perspectives on the EO representing Bill as in Figure 5.8.

(5.15 ) Robert to Sam   All the villagers love Bill

FIGURE 5-7 EXPLICIT REPRESENTATION OF A SET OF TOKENS ESTABLISHING A TABLEAU FOR QUANTIFIED INFORMATION IN (5-13)

```
 ______________________________________________________
|                                                      |
|  Robert's EM_______________________________________  |
|  |                                               |   |
|  | .eo8  .eo9                           .eo5     |   |
|  |                                               |   |
|  | .eo10 .eo11                                   |   |
|  |_______________________________________________|   |
|                                                      |
|  Robert's DM_______________________________________  |
|  |                                               |   |
|  | .do1       .do2                      .do5     |   |
|  |                                               |   |
|  | .do3       .do4                               |   |
|  | ______________________________________________|   |
|______________________________________________________|
```

```
where eo8-eo11 have structure
 | rep     [<A0.TOKEN><A1.VILLAGER>]|
 | rep     [<A3.LOVES BILL>]        |
 | r/sep  [        :                |
 | r/s/rep[        :          -     |

where eo5 has structure
 | rep     [<A0.TOKEN><A1.MAN>]|
 | r/sep  [        :           |
 | r/s/rep[        :           |



and do1-do4 have structure (where eon
is a separate eo out of the EM)
 | rdp     [eon.[rdc]] |
 | r/sdp  [ :    :  ] |
 | r/s/rdp[ :    :  ] |

rdc={villager.rep}.{loves Bill.rep}

and do5 has structure
 | rdp     [eo5.[rdc]] |
 | r/sdp  [ :    :  ] |
 | r/s/rdp[ :    :  ] |

sdc={Bill.rep}
```

FIGURE 5.8 REPRESENTATION OF (5-13) USING MULTIPLE PERSPECTIVES TO REPRESENT UNIVERSAL QUANTIFIER

```
Robert's EM ____________________________________________
|                                                        |
|.eo5|rep     [<A0.TOKEN>.<A1.MAN>.<A2.BILL>]          | |
|    |r/sep   [    :          :        :               | |
|    |r/s/rep[    :          :        :               | |
|    |                                                 | |
|    |r/v1ep [    :          :        :    <A3.v1 LOVES>]| |
|    |                                                 | |
|    |r/v2ep [    :          :        :    <A3.v2 LOVES>]| |
|    |                                                 | |
|    |r/v3ep [    :          :        :    <A3.v3 LOVES>]| |
|    |                                                 | |
|    |r/v4ep [    :          :        :    <A3.v4 LOVES>]| |
|________________________________________________________|
```

This gives us a rudimentary system for the representation of quantified expressions. We have type instantiation for universal and generic knowledge, and token tableau for universal as well as other combinatoric possibilities.

## 5 Modelling a Referential Exchange

We need to show how the various elements in the descriptive system link up, how the EM, EOs, DM and DOs are related to one another. A good way of doing this is to present an example of the system in use. The aim of this system is to display the possibilities of interpretation open to processor's in their referential acts. How then would the system cope with the canonical case of 'alleged successful reference' in (5-14)? (Footnote 5.7)

(5.14) Sam to Robert  Barry is ill

First, we should note that the PC system highlights a fact to which I have previously alluded; there are two sorts of intensional context. Language always has one type present, the second only occurs if certain lexical items are present. I have called the first implicit intensional contexts and the second explicit intensional contexts.

In explicit intensional contexts an intensional operator occurs as a lexical item in the linguistic string. These constitute the so-called 'classic' intensional contexts discussed at length already in this thesis. Explicit intensional operators can be seen in utterances (5.15), (5.16) & (5.17). In these examples they occur with a second type of intensional operator. This is the covert or implicit intensional context, what others have referred to as the 'performatives'. In the system presented here natural language use always involves implicit intensional operators, thus creating a total blanket of intensionality over language.

---

Footnote 5.7. The term 'alleged' is, as a hope to show, entirely appropriate.

Implicit intensional contexts arise out of the fact that all 'natural' language has an origin. It is generated by someone. This amounts to the covert intensional operator 'X says that "..."'. 'X writes that "..."' etc. Natural language also has a destination. It has percipients. This supplies another covert intensional context, 'Y hears that "..."'. 'Y reads that "..."' etc. Examples (5.15). (5.16) and (5.17) all exhibit these implicit as well as the explicit intensional operators, whilst (5.18) presents us with a case in which only the implicit intensional context is present.

| | | |
|---|---|---|
| (5.15) | Sam says to Nigel | Robert says your girlfriend just rang |
| (5.16) | Sam says to Nigel | Robert thinks he saw your girlfriend |
| (5.17) | Sam says to Nigel | Robert wants to invite your girlfriend out |
| (5.18) | Sam says to Nigel | Your girlfriend just rang |

Our descriptions have to be indexed from a point of origin to a point of percipience to make clear who said what to who. In this respect all language, by virtue of having been generated and needing to be interpreted, has opaque possibilities.

Implicit operators present no problems for logical representations as long as performative analyses are used. The PC model. however. presents us with an immediate performative analysis of language.

Let us return to the case of reference in (5.14). In referential acts I will term the person who first performs an act of reference with a particular discourse object the 'instigator' of the referential act; the person to whom it is directed will be the 'interpreter'. First consider the matter from the point of view of Sam the instigator of the referential act. After uttering (5.14) we will assume that he thinks his referential act successful. Thus. he thinks his interpreter has construed the proper name in a uniquely referring way. So although Sam and his interpreter may know a number of Barrys the occasion of his utterance is such that Sam believes the name selects a unique individual. and does so in such a way that Sam believes his partner and himself are not thinking of different objects.

(5.14) Sam says Barry is ill
to Robert

Let us suppose the context of utterance of (5.14) was of the following sort. Sam walks past Barry's office and sees Robert sitting waiting there. Part of the intentional story behind an utterance like (5.14) may be explained in terms of plan generation and recognition.

Robert has a goal. to see Barry. Sam recognises that this is a likely goal of Robert's. Now Sam possesses information which will violate a precondition of Robert's goal being achieved- namely. the information that Barry is ill. Finally. Sam will rely on Robert's ability to recognise his contribution as one which is relevant to the goal Robert currently entertains. Whilst this rich plan generation and plan recognition is not represented in the descriptive system. part of the information necessary for it to proceed is provided. This consists of Sam's beliefs that; Barry is ill. and that Robert does not know that Barry is ill. This difference is encoded and represented as a perspective difference on a 'mutually known' object.

Figure 5.9 provides a processor-centric representation embodying this perceived difference of informedness. It is assumed in all the Figures that follow in this example that the first two attributes of the EO representing Barry have the values [<AO.TYPE>.<A1.MAN>].

FIGURE 5.9
PROCESSOR CENTRIC REPRESENTATION OF SAM
PRIOR TO UTTERANCE OF (5.14)

```
 ---------------------------------------------------------------
|                                                               |
|  Sam's Activated EM ________________________________________  |
|  |                                                        |   |
|  |    .eo7| sep     [<A2.BARRY>.<A3.ILL>      ]|          |   |
|  |        | s/rep   [<A2.BARRY>.<A3.WELL>]     |          |   |
|  |        | s/r/sep[        :          :      ]|          |   |
|  |                                                        |   |
|  |________________________________________________________|   |
|                                                               |
|  Sam's DM ___________________________________________________ |
|  |                                                        |   |
|  |                                                        |   |
|  |                                                        |   |
|  |                                                        |   |
|  |                                                        |   |
|  |________________________________________________________|   |
| ______________________________________________________________|
```

After uttering (5.14). Sam's Processor Centric representation is modified as shown in Figure 5.10. A discourse object has been introduced into discourse for the first time. in effect an act of discourse object creation has occurred. This DO. 'do1'. is the discourse manifestation of the EO. 'eo7'. Discourse object creation will involve a process of identifier lexicalisation. a way of identifying 'eo7' which is believed by Sam to be a mutually known way if identifying the individual in question (Footnote 5.8).

A referential identifier. such as 'Barry'. succeeds as a means of signaling discourse object introduction by relying. in part. on syntactical/grammatical conventions governing its position within discourse. in part. on intonational conventions (cf for example. Halliday 1967).

The process by which a particular lexicalisation is chosen for an EO is bound to be complex Presumably an EO can be described in terms of many of its properties. At the very least. to succeed as a referential device for a discourse interpreter. the referential instigator must believe that a particular property. which he selects as the referential device. is mutually known to instigator and interpreter.

After the utterance of (5.14). we represent .in Figure 5.10. the DO. 'do1'. inheriting the object relevant information contained in the utterance. This information is indexed for its contributer and 'perspective of origin'. It is assumed by Sam at this stage that his discourse participant will adopt his view of the DO introduced.

Footnote 5.8. The information used to lexicalise an identifier 'Barry' is represented as <A2.BARRY>. It was pointed out that this representation is not to be thought of as English. What allows us to relate the elements 'BARRY' and 'Barry'? I am relying on the assumption that part of our knowledge of concepts does include. at some level. information about how concepts may be realised as elements in our public language. Thus the information in the EO represented as BARRY is that information in the 'internal mental formalism' that will be realised as 'Barry' in the external formalism of English.

FIGURE 5.10
PROCESSOR CENTRIC REPRESENTATION OF SAM AFTER UTTERANCE OF (5.14)

```
 ________________________________________________________
|                                                        |
|  Sam's Activated EM ___________________________        |
|  |                                             |       |
|  | .eo7| sep    [<A2.BARRY>.<A3.ILL> ]|        |       |
|  |     | s/rep  [<A2.BARRY>.<A3.WELL>]|        |       |
|  |     | s/r/sep[      :         :   ]|        |       |
|  |                                             |       |
|  | ____________________________________________|       |
|                                                        |
|  Sam's DM _____________________________________        |
|  |                                             |       |
|  |     .do1| sdp    [eo7.[sdc]] |              |       |
|  |         | s/rdp  [ :    :  ] |              |       |
|  |         | s/r/sdp[ :    :  ] |              |       |
|  |                                             |       |
|  |_____________________________________________|       |
|________________________________________________________|
```

where
sdc={barry.sep}.{ill.sep}

We are modelling alleged successful reference - Sam's belief that he has evoked in Robert's mind a knowledge structure representing an object which he wants to introduce in discourse. What effect can Sam suppose this introduction of a discourse object (with the properties ascribed to it) will have on his discourse partner?

A possible final P-C representation of Sam after (5.14) is shown in Figure 5.11. This shows that a modification of the 's/rep' perspective on 'eo7' has taken place. The modification represents Sam's belief that Robert has treated Sam's contribution in (5.14) as sincere and authoritative.

FIGURE 5.11

```
 ______________________________________________________
|                                                      |
|  Sam's Activated EM ________________________________ |
|  |                                               |   |
|  | .eo7| sep    [<A2.BARRY>.<A3.ILL> ] |         |   |
|  |     | s/rep  [        :        :    ] |         |   |
|  |     | s/r/sep[        :        :    ] |         |   |
|  |                                               |   |
|  |_______________________________________________|   |
|                                                      |
|  Sam's DM __________________________________________ |
|  |                                               |   |
|  |     .do1| sdp    [eo7.[sdc]] |                |   |
|  |         | s/rdp  [ :     :  ] |                |   |
|  |         | s/r/sdp[ :     :  ] |                |   |
|  |                                               |   |
|  |_______________________________________________|   |
| _____________________________________________________|
```

where

sdc={barry.sep}.{ill.sep}

The system will allow us to represent a more cautious approach by Sam. A 'conservative modification' involves moving from the 'eo1' configuration in Figure 5.10 to that shown in Figure 5.12. Sam is not sure what effect his utterance has had on Robert's perspective on 'eo1'. but at the very least he can modify the s/r/sep perspective on 'eo7' (Footnote 5.9).

FIGURE 5.12

```
Sam's Activated EM __ __.___      __ __.______
|                                               |
|     .eo7| sep     [<A2.BARRY>.<A3.ILL> ]|     |
|         | s/rep   [<A2.BARRY>.<A3. ? > ]|     |
|         | s/r/sep[<A2.BARRY>.<A3.ILL> ]|      |
|                                               |
| ______________________________________________|
```

Let us now turn to the interpreter of (5-14) and consider his referential interpretation in the light of a P-C representation? Let us suppose that the interpreter also believes successful reference to have occurred. This means that Robert. in the context described for (5-14). has had evoked in his mind a representation of an object which he believes Sam intended to refer to. The stages by which the interpreter arrives at this condition are as follows.

On hearing (5-14). the first state represented is one in which Robert recognises the introduction of a DO. The DO will have associated with it various ascriptions. these are collectively labeled 'sdc'. ie Sam's

---

Footnote 5.9. To guarantee even this one would have to presume something like a felicity condition of 'sincerity'. It should also be noted that there are two choices open at a lower level again. ie 's/r/s/rep' could have the configuration [<A2.BARRY>.<A3,ILL>]. or [<A2.BARRY>.<A3.?>]. Although this does mean that a perspective not shown 's/r/s/rep' is different than 's/r/sep' the pattern established by considering yet deeper levels settles down to a choice between ..../rep [<A2.BARRY>.<A3.ILL>]. or ..../rep[<A2.BARRY>.<A3.?>].

Descriptive Contribution. Robert assumes these ascriptions to have arisen out of Sam's epistemic perspective on an as yet unlocated object of knowledge. This first stage then is represented in Figure 5.13. Notice that the condition of not yet having located an object of knowledge to associate with the discourse entity is shown in the P-C representation as an unspecified EO token. 'eo?'. associated with the newly established DO. 'do1'.

FIGURE 5.13
PROCESSOR CENTRIC REPRESENTATION OF ROBERT IMMEDIATELY AFTER HEARING (5.14)

```
 _________________________________________________
|                                                 |
|  Robert's EM ____________________________       |
|  |                                        |     |
|  |                                        |     |
|  |                                        |     |
|  |________________________________________|     |
|                                                 |
|  Robert's DM ____________________________       |
|  |                                        |     |
|  |     .do1| rdp     [eo?.[sdc]] |        |     |
|  |         | r/sdp   [ :     :  ] |        |     |
|  |         | r/s/rdp[ :     :  ] |        |     |
|  |________________________________________|     |
|_________________________________________________|
```

where
sdc={barry.r/sep}.{ill.r/sep}

The second stage of referential interpretation requires using information derived from the discourse and intentional context to locate an appropriate object of knowledge. in P-C terms to find an EO to associate with the DO 'do1'. Both processors are aware of the situative context. that Robert has the likely goal of waiting for the occupant of the room etc. This type of inferential capability will obviously aid Robert in the search of his Knowledge bases. Figure 5.14 represents the state where Robert has selected an object of knowledge to associate with the newly introduced discourse object. This condition is represented as an EO. 'eo8'. serving as the associate of the DO 'do1'.

FIGURE 5.14

```
 ------------------------------------------------------------
|                                                            |
|  Robert's EM ----------------------------------------      |
|  |                                                  |      |
|  | .eo8| rep     [<A2.BARRY>.<A3.WELL>] |           |      |
|  |     | r/sep   [        :            :] |          |      |
|  |     | r/s/rep[        :            :] |           |      |
|  |                                                  |      |
|  |--------------------------------------------------|      |
|                                                            |
|  Robert's DM ----------------------------------------      |
|  |                                                  |      |
|  |      .do1| rdp     [eo8.[sdc]] |                 |      |
|  |          | r/sdp   [ :     :  ] |                |      |
|  |          | r/s/rdp[ :     :  ] |                 |      |
|  |                                                  |      |
|  |--------------------------------------------------|      |
|------------------------------------------------------------|
```

where
sdc={barry.r/sep}.{ill.r/sep}

Finally there arises the question of what modification Robert should make to his knowledge in the light of Sam's discourse contribution. There are a number of possibilities assuming Robert takes Sam's contribution to be sincere. The possibilities revolve round whether Robert regards Sam as authoritative and whether Robert believes that Sam believes there is mutual recognition of his authority. Some of these possibilities. at least in terms of the consequences for the EO perspectives. are shown in Figures 5.15-5.18.

Figure 5.15 shows a case where Robert believes that Sam is authoritative and believes that Sam believes that Robert will treat him as such. Figure 5.16 shows the case where Robert believes Sam as authoritative but is unsure as to whether Sam believes that Robert will treat him as such. Figure 5.17 is the case where Robert does not believe Sam's information as authoritative but thinks that Sam will believe that Robert will regard it as such. Figure 5.18 shows a situation where Robert does not believe Sam's information. and he is not sure how Sam thinks his contribution will be taken. There are even more possibilities than these four. for example. Sam's utterance may simply cast doubt on Robert's 'rep' perspective of 'eo8' without directly changing it to another definite value.

Figure 5.15
POSSIBLE MODIFICATION OF ROBERT'S EM
AFTER INTERPRETATION OF (5.14)

```
Robert's Active EM __________             _____
|                                              |
|     .eo8| rep     [<A2.BARRY>.<A3.ILL >] |   |
|         | r/sep   [     :          :   ] |   |
|         | r/s/rep[      :          :   ] |   |
|                                              |
| _____________________  _____________________ |
```

Figure 5.16
POSSIBLE MODIFICATION OF ROBERT'S EM
AFTER INTERPRETATION OF (5.14)

```
Robert's Active EM _____ _      ______________
|                                              |
|     .eo8| rep     [<A2.BARRY>.<A3.ILL >] |   |
|         | r/sep   [<A2.BARRY>.<A3.ILL >] |   |
|         | r/s/rep[<A2.BARRY>.<A3. ?  >] |    |
|                                              |
| ________________________  _________________ _|
```

Figure 5.17
POSSIBLE MODIFICATION OF ROBERT'S EM
AFTER INTERPRETATION OF (5.14)

```
Robert's Active EM ______________     __
|                                              |
|     .eo8| rep     [<A2.BARRY>.<A3.WELL>] |   |
|         | r/sep   [<A2.BARRY>.<A3.ILL >] |   |
|         | r/s/rep[      :          :   ] |   |
|                                              |
| _________________________             __     |
```

Figure 5.18
POSSIBLE MODIFICATION OF ROBERT'S EM
AFTER INTERPRETATION OF (5.14)

```
Robert's Active EM_______________________________
|                                                 |
|     .eo8| rep     [<A2.BARRY>,<A3.WELL>] |      |
|         | r/sep   [<A2.BARRY>,<A3.ILL >] |      |
|         | r/s/rep[<A2.BARRY>,<A3. ?  >]  |      |
|                                                 |
|_________________________________________________|
```

In this section I have outlined the main elements of the P-C descriptive system. In describing the system we looked at a 'straightforward' case of referential communication. But what of some of the classic semantic problems of reference? What can the descriptive system contribute to these areas?

## SECTION TWO MODELLING ASPECTS OF REFERENCE

### 1 Modelling Ascriptive Responsibility

One very important feature of the PC system is its ability to represent the processor perspectives out of which descriptions of objects are held to originate. This problem. discussed in chapters two and three, is the problem of expressive or 'ascriptive' responsibility.

Language, such as that contained in (5.19), presents a number of problems for logical accounts of reference (Footnote 5.10)

(5.19) A says to B — The man drinking water is ill
B says to A — The man drinking water is drinking gin and he is drunk

First of all how does one represent responsibility for a description? Intensional logic can distinguish, as we have seen, the types of semantic object a participant is related to. However, it does not simultaneously determine ascriptive responsibility.

A second problem is to explain how the descriptions used to 'refer' to objects, are able to refer at all, when different processors dispute the truth of the descriptions. If a description is false of an object, then it cannot serve logically as a means of uniquely identifying or naming that object. Consequently, as Perrault & Cohen (1981) point out, we find statements of the following sort stipulating the necessary conditions for successful reference.

> A necessary condition for the successful performance of a definite reference by a speaker S using a description D in a context C is that S believes that D is

---

Footnote 5.10. Example (5.19) is a freely adapted version of the problem first raised in Donnellan (1966). Interesting discussions of such examples can also be found in Perrault & Cohen (1981), and Clark & Marshall (1981).

fulfilled in C. (Footnote 5.11) (Perrault & Cohen 1981)

We can demonstrate quite easily that the above requirement is neither sufficient nor necessary. Consider the following situation. A and B are at a party. They watch together as water and gin are poured into two identical glasses and given to women C and D respectively. Now suppose that unbeknownst to B, A sees C and D exchange glasses. Later A utters (5.20) to B.

(5.20) A says to B The woman with the gin is Louisa

There is no doubt that A successfully referred to D even though D was not drinking gin, nor did A believe D was drinking gin, but A believes that B believed she was, and A believed that B believed that A believed she was.

The PC descriptive system captures some of the critical states which A is likely to entertain in his execution of a 'successful' referential act. Figure 5.19 represents A's state before seeing the exchange of drinks. Figure 5.20 is A's state after witnessing the exchange of glasses and realising that B has not seen the event. We will assume throughout this example that the attribute value AO in all the EOs is <AO.TOKEN>.

Footnote 5.11. As Perrault and Cohen use the term we may understand 'context' as something like the set of entities 'known' to speaker and hearer, and 'D is fulfilled in C' means that exactly one entity in C satisfies D.

Figure 5.19
PROCESSOR CENTRIC REPRESENTATION OF A PRIOR TO WITNESSING EXCHANGE OF GLASSES

```
 ____________________________________________________________________
|                                                                    |
|  A's activated EM_______________________________________________   |
|  |                                                              |  |
|  | .eo1| aep     [<A1.WOMAN>,<A2.HAS WATER>] |                  |  |
|  |     | a/bep   [      :               :     ] |               |  |
|  |     | a/b/aep[      :               :     ] |                |  |
|  |                                                              |  |
|  |                                                              |  |
|  | .eo2| aep     [<A1.WOMAN>,<A2.HAS GIN>,<A3.LOUISA>] |        |  |
|  |     | a/bep   [<A1.WOMAN>,<A2.HAS GIN>,<A3.    ?   >] |       |  |
|  |     | a/b/aep[      :               :           :    ] |     |  |
|  |______________________________________________________________|  |
|                                                                    |
|  A's DM__________________________________________________________  |
|  |                                                              |  |
|  |                                                              |  |
|  |______________________________________________________________|  |
|____________________________________________________________________|
```

Figure 5.20
PROCESSOR CENTRIC REPRESENTATION OF A AFTER UTTERANCE OF (5.20)

```
 ____________________________________________________________________
|                                                                    |
|                                                                    |
|  A's activated EM_______________________________________________   |
|  |                                                              |  |
|  |.eo1| aep     [<A1.WOMAN>,<A2.HAS GIN   >] |                   |  |
|  |    | a/bep   [<A1.WOMAN>,<A2.HAS WATER>] |                    |  |
|  |    | a/b/aep[      :               :     ] |                  |  |
|  |                                                              |  |
|  |                                                              |  |
|  |.eo2| aep     [<A1.WOMAN>,<A2.HAS WATER>,<A3.LOUISA>] ||      |  |
|  |    | a/bep   [<A1.WOMAN>,<A2.HAS GIN   >,<A3.LOUISA>] ||      |  |
|  |    | a/b/aep[      :               :               :] ||     |  |
|  |______________________________________________________________|  |
|                                                                    |
|  A's DM__________________________________________________________  |
|  |                                                              |  |
|  |        | adp     [eo2.[adc]] |                               |  |
|  |        | a/bdp   [ :    :    ] |                             |  |
|  |        | a/b/adp[ :    :    ] |                              |  |
|  |______________________________________________________________|  |
|                                                                    |
|____________________________________________________________________|
```

where

```
     adp[adc]={the woman drinking gin,a/bep}
              {louisa,aep}
   a/bdp[adc]={the woman drinking gin,aep}
              {louisa,aep}
```

A's representation of C, ie 'eo1', could not have been what A was seeking to evoke, since A does not believe that B could recognise 'the woman with the gin' as referring to C. Note also that if A presumes successful referential uptake by B neither A nor B's belief. about who the woman with the gin is, need be revised. The only area where A might be 'faulted' is in violating conversational maxims, ie not correcting B's presupposition about the object of interest as displayed in the perspectives 'a/bep' and 'a/b/aep' on 'eo1' and 'eo2'. Example (5.20) shows that understanding which perspective processors regard as the origin of descriptions is an important feature in explaining how certain sorts of referential uptake occur.

A problem related to the one just discussed is that illustrated by our first example in this section- (5.19), where two mutually exclusive descriptions are being used by separate processors to designate the same individual.

| | | |
|---|---|---|
| (5.19) | A says to B | The man drinking water is ill |
| | B says to A | The man drinking water is drinking gin and he is drunk |

The problem is that in logic there is no account of how contradictory descriptions of an object may 'refer'.

The processor centric representations, however, are able to offer a series of 'snapshots' of different perspectives on our representations of objects. This allows us to chart a processor's view of ascriptive responsibility throughout discourse. In the system presented language originates out of processor perspectives. Moreover, multiple, and even contradictory descriptions of objects can be represented within one processor as long as the perspectival partitioning and segregation of these beliefs is maintained.

The descriptive machinery extends quite naturally to deal with ascriptive responsibility involving multiple processors. Take for example utterance (5.21).

| | | |
|---|---|---|
| (5.21) | A says to B | John said he saw the informer |
| (5.22) | A says to B | Bill said John said he saw the informer |

In the first case we have to determine who is responsible for the expression 'the informer'; ascriptive responsibility can either be A's, or John's. These two possibilities would be represented in A's DM as Figures 5.21 or 5.22 (where 'do1' is the DO introduced by the nominal 'John', and 'do2' is the DO introduced by the description 'the informer'). In Figure 5.21 the perspectival origin hence the responsibility for the terms of description of 'do1' and 'do2' are both from 'aep'. In other words A is taking responsibility for describing an object in these terms. A is also assuming that his interlocutor has this view of the ascriptive origin of these terms.

In Figure 5.22 responsibility for the mode of description of 'do1' is A's, but for 'do2' responsibility is held by A to be his view of John's mode of description, indicated by 'a/jep'. A assumes in this representation that his interlocutor has a similar view as to the placement of ascriptive responsibility. Notice that an additional perspective has arisen because of the use of an 'explicit' intensional operator, 'said'. The effect of such operators is to open up the possibility of relating discourse material back to perspectives other than just the two discourse participants. In this case the additional perspective is 'a/jep'.

Figure 5.21
PART OF A POSSIBLE PROCESSOR CENTRIC
REPRESENTATION FOR A AFTER AN UTTERANCE OF (5.21)

```
 ____________________________________________________________
|                                                            |
|                                                            |
|  A's DM_____________________________________________       |
|  |                                                   |     |
|  |  .do1| adp      [eo1.[adc]] |                     |     |
|  |      | a/bdp    [ :     :  ] |                     |     |
|  |      | a/b/adp  [ :     :  ] |                     |     |
|  |                                                   |     |
|  |  .do2| adp      [eo2.[adc]] |                     |     |
|  |      | a/bdp    [ :     :  ] |                     |     |
|  |      | a/b/adp  [ :     :  ] |                     |     |
|  |___________________________________________________|     |
|                                                            |
|____________________________________________________________|
```

where
do1| adc |={john.aep}

do2| adc |={informer.aep}

Figure 5.22
PART OF A POSSIBLE PROCESSOR CENTRIC
REPRESENTATION FOR A AFTER AN UTTERANCE OF (5.21)

```
 ____________________________________________________________
|                                                            |
|                                                            |
|  A's DM_____________________________________________       |
|  |                                                   |     |
|  |  .do1| adp      [eo1.[adc]] |                     |     |
|  |      | a/bdp    [ :     :  ] |                     |     |
|  |      | a/b/adp  [ :     :  ] |                     |     |
|  |                                                   |     |
|  |  .do2| adp      [eo2.[adc]] |                     |     |
|  |      | a/bdp    [ :     :  ] |                     |     |
|  |      | a/b/adp  [ :     :  ] |                     |     |
|  |___________________________________________________|     |
|                                                            |
|____________________________________________________________|
```

where
do1| adc |={john.aep}

do2| adc |={informer.a/jep}

In utterance (5.22) ascriptive responsibility can rest with either A, Bill or John.

The question of ascriptive responsibility actually comprises two elements. The first concerns the perspective of origin of the mode of description. The second has to do with the perspectives that may be inherited by a description. In other words who would know or would assent to the object under this description or that predication? In the simplest case, we can suggest that the origin for a description is taken to be the immediate discourse participant who is the referential instigator. Propagation is then assumed to proceed to all other processor perspectives either overtly or covertly mentioned in the relevant part of the discourse.

Of course, much more complex possibilities than this may be envisaged. The origin of a description may be placed in a perspective other than the referential instigator. Propagation may be restricted to only some of the implicated processors. The processor-centric representations, through the use of perspectives and differential attribute value lists, is able to represent the straightforward, as well as the more complex cases of expressive responsibility.

## 2 Modelling Specificity

The semantic phenomenon of specificity revolves round the various ways sentences such as (5.23) and (5.24) can be understood.

(5.23) John wants to buy a car
(5.24) John wants to marry a Swede

We have seen that there is considerable disagreement over what specificity is. Some argue it is a type/token distinction; a distinction between individuals and generic classes. Others argue that it is a matter of having the necessary information to identify a relevant individual.

No matter what view is taken some formalists have argued, as we saw in Chapter 2. that specificity is scopal in origin. On such a view indefinite expressions are not marked with a specific or non-specific feature. It must be scopal. they argue. because we find a systematic relationship between the number of interpretations and the number of embedded sentences.

Nevertheless, a natural way within our PC model of representing one version of the specificity dichotomy is to use the distinction between EO types and tokens. A non-specific reading of the nominal 'a car' in (5.23) is to be understood as a reference to an EO which is a type.

The specific reading is the interpretation where the relevant DO introduced by 'a car' is associated with an EO which is a token.

This approach is essentially featural. Nominals can be associated with two sorts of value - types or tokens. Let us use the PC model to represent (5.23). Imagine a scenario where the object in question, a car, has been indirectly instantiated- S's only view of the object is through a conversation he has had with John about it. It is a feature of the basic architecture of the PC model that it can capture the range of possibilities present in such a context. Figure 5.23 represents a possible configuration of S's EM after uttering (5.23). The configuration represents the straightforward case where S thinks all the relevant individuals have the same view about the object of John's desires - namely, that he wants a particular, specific car. S's assumption of unanimity is reflected in the fact that only a single EO is evoked and it has the relevant processor perspectives.

FIGURE 5.23

```
 ___ S's Epistemic Model_________________________________
|                                                        |
|                                                        |
| .eo2| S/jep   [<AO.TOKEN>,<A1.CAR>,<A2.WANTS JOHN>]|   |
|     |                                              |   |
|     | S/H/jep[   |          |        |            ]|   |
|                                                        |
|________________________________________________________|
```

There could be more complex situations than the one described. Different individuals might come to have different beliefs about the object of John's wants. For example, suppose S comes to believe that H believes something different than S intended through the use of the indefinite nominal.

Consider discourses (5.25)-(5.28) regarded as continuations to (5.23) - these indicate the range of beliefs about the object of John's wants which S and H may entertain. It is an important feature of the PC model that it should be able to describe these sorts dynamic belief change - that it should be able to represent the range of interpretations to which the indefinite is susceptible. Figures (5.23)-(5.26) represent the relevant EM which S must have immediately after each of H's replies in continuations (5.25)-(5.28) respectively. Thus the effects of H's reply in (5.25) are represented in Figure 5.23, the effects (5.26) are embodied in Figure 5.24, (5.27) in Figure 5.25, and (5.28) in Figure 5.26.

(5.23) S to H   John wants to buy a car

(5.25) H to S   Which one?
       S to H   One his neighbour is selling

(5.26) H to S   He doesn't have a particular one in mind then?
       S to H   No

(5.27) H to S   Which one?
       S to H   He doesn't have a particular one in mind

(5.28) H to S   He doesn't have a particular one in mind then?
       S to H   He does, it's one his neighbour is selling

FIGURE 5.24

PART OF S's EM AFTER H's UTTERANCE IN (5.26)

```
 ___ S's Epistemic Model ______________________________
|                                                      |
|                                                      |
| .eo1| S/jep  [<AO.TYPE >,<A1.CAR>,<A2.WANTS JOHN>]|  |
|     |                                             |  |
|     | S/H/jep[    |           |        |          |  |
|                                                      |
|______________________________________________________|
```

FIGURE 5.25

PART OF S's EM AFTER H's UTTERANCE IN (5.27)

```
 ___ S's Epistemic Model ______________________________
|                                                      |
|                                                      |
| .eo2| S/jep  [<AO.TYPE >,<A1.CAR>,<A2.WANTS JOHN>]|  |
|                                                      |
| .eo1| S/H/jep[<AO.TOKEN>,<A1.CAR>,<A2.WANTS JOHN>]|  |
|                                                      |
|______________________________________________________|
```

FIGURE 5.26

PART OF S's EM AFTER H's UTTERANCE IN (5.28)

```
 ___ S's Epistemic Model_______________________________________
|                                                              |
|                                                              |
| .eo1| S/jep   [<A0.TOKEN>,<A1.CAR>,<A2.WANTS JOHN>]|         |
|                                                              |
| .eo2| S/H/jep[<A0.TYPE >,<A1.CAR>,<A2.WANTS JOHN>]|          |
|                                                              |
|______________________________________________________________|
```

It is interesting that this style of analysis suggests a rather different way in which logic could attempt to model such situations. We could have the logic model the various belief states that different processors maintain in the contexts described. To do this we need a logical means of representing the partitioned perspectives. One such representation is given below

```
          1            2
thinks( S, wants( John, x))
&                     1           2
thinks( S, thinks( H, wants( John, x)))
```

This logical schema represents a schema for S's belief about what John wants, and what S believes H believes John wants. Now remembering we are modelling the beliefs of a particular individual the existential can be placed at either the positions marked 1 or the positions marked 2. We are now able to model, using this logic of beliefs, the four possibilities captured in the PC Figures (5.23)-(5.26). Formulae (5.29)-(5.32) correspond to interpretations for S's beliefs after H's reply in continuations (5.25)-(5.28) respectively.

```
(5.29)    thinks(S.Ex(car(x) & wants(John.x)))
        & thinks(S.thinks(H.Ey(car(y) & wants(John.y))))
        & x=y

(5.30)    thinks(S.wants(John.Ex(car(x))))
        & thinks(S.thinks(H.wants(John.Ey(car(y)))))
        & x=y

(5.31     thinks(S.wants(John.Ex(car(x))))
        & thinks(S.thinks(H.Ey(car(y) & wants(John.y))))

(5.32     thinks(S.Ex(car(x) & wants(John.x)))
        & thinks(S.thinks(H.wants(John.Ey(car(y)))))
```

We have captured the possibilities by having the logic model beliefs- this is quite a different enterprise than having it represent the possibilities of construal from the surface form of sentences. The logic is modelling partitions using predication. If this partitioning is the foundation of ascriptive responsibility then the logical machinery used is no longer scopal. It, effectively, only uses two positions of the indefinite together with partitions- a bivalent treatment just like bivalent features. This is clearly seen if we consider (5.33).

(5.33) S to H Bill believes John wants a car

(5.34) S to H Though he doesn't know
he already has one marked out

The range of different interpretations for (5.33) can be obtained by constructing partitions for the relevant individuals and then having the indefinite placed inside or outside the scope of the most deeply embedded operator 'wants'. Thus suppose we have a context in which S knows John to have a particular car in mind whilst Bill doesn't think he has- assuming S believes H to be in accord with his own perspective a continuation such as (5.34) suggests a PC representation for S's EM as in Figure (5.27). This can be represented using a partitioned belief logic as in (5.35)

FIGURE 5.27

PART OF S's EM AFTER UTTERANCE OF (5.34) AS A CONTINUATION OF (5.33)

```
 ___ S's Epistemic Model____________________________________
|                                                            |
|                                                            |
| .eo1| S/jep  [<A0.TOKEN>,<A1.CAR>,<A2.WANTS JOHN>]|        |
|     | S/H/jep[    :           :          :         ]|      |
|                                                            |
| .eo2| S/B/jep[<A0.TYPE>,<A1.CAR>,<A2.WANTS JOHN>]|         |
|     | S/H/B/jep[ :           :          :         ]|       |
|                                                            |
|____________________________________________________________|
```

```
(5.35)     thinks(S.Ex(car(x) & wants(John,x)))
         & thinks(S.thinks(H.Ey(car(y) & wants(John,y))))
         & x=y

           thinks(S.thinks(Bill,wants(John,Ez(car(z)))))
         & thinks(S.thinks(H.thinks(Bill,wants(John,Ew(car(w))))))
         & z=w
```

There is an alternative way of understanding the specific non-specific dichotomy- that is in terms of the amount of predicative information associated with the indefinite.

If there is sufficient information then we have a specific reading- otherwise it is non-specific. This difference is bound to be difficult to characterise. But whatever the degree of information required to secure specificity if it is regarded as a semantic dichotomy then a +spec or -spec feature associated with token EOs will secure the range of interpretations required. The machinery of partitioned perspectives operates on the bivalent values of + spec or - spec attached to tokens. Whatever account of the specificity phenomenon we choose. we can be assured of being able to capture the required range of interpretations.

## 3 Modelling Referentiality

The referential attributive distinction was originally analysed by Donnellan in terms of the intentions of speakers. The attributive use centred on the fact that the content of the definite description was an essential property of whatever object. if one existed at all. satisfied the description.

This 'essentialist' view of the attributive could be regarded as characterising a type of object. The meaning of the constitutive terms in the description are seen to provide a characterisation for a type of object. The singular fact about the definite is that only one object can instantiate the type at any particular instant. Thus whilst there is only ever one referent satisfying the description in (5.36), there is a procedure which allows us to determine that at different times different objects instantiate the description.

(5.36) A to B The League Champions look set for another title

The referential reading of the definite is one in which the description is one of many that could have been applied- it served merely as a means of identifying a token.

Such a view of the referential attributive dichotomy could be represented in two sorts of EO exemplified below.

eo¦ Aep [<A0.TYPE>,<A1.MURDERER OF SMITH>] ¦

eo¦ Aep [<A0.TOKEN>,<A1.MAN>,<A2.MURDERER OF SMITH>] ¦

There is an alternative view of the referential attributive ambiguity. It centres on whether or not a particular individual is held by the attributee of the definite to have some property, and whether, in addition, the attributee has a means of knowing who the individual was (Fodor 1970:131). In the first case we have the attributive sense of a definite description in the second the referential. Such an account could be accommodated by postulating two token EOs- the difference being represented in the value of an attribute- an attribute taking the values REF or ATT. These attribute values indicate whether the EO contains sufficient information to secure an identification of the individual of whom the definite description holds

As with the analysis of specificity within the PC framework we have a choice of interpreting the nature of the referential attributive dichotomy. And as with specificity the mechanism of partitioned perspectives together with a bivalent representation of the dichotomy allows us to represent the range of interpretations that any logical scopal account could capture.

Consider an utterance of (5.37). I will assume. for this analysis, a featural account of the referential ambiguity using the values REF and ATT on on attribute slot. Figures 5.28 and 5.29 show part of an EM which S could maintain after uttering (5.37). In both cases the EO is indirectly instantiated- S knows of John's view of the definite only through Jill's view of John. In Figure 5.29 we see that Jill believes John is using the definite description in its referential sense whilst in Figure 5.28 she believes he is using it attributively.

(5.37) S to H Jill thinks John believes the murderer of Smith is insane

FIGURE 5.28

PART OF S's EM AFTER UTTERANCE OF (5.37)

```
 ___ S's Epistemic Model ______________________________________
|                                                              |
|                                                              |
| .eo1| S/Jill/jep  [<A0.TOK>,<A1.MAN>,<A2.M OF S><A3.ATT>]||
|     | S/H/Jill/jep[   :          :        :        :   >]||
|                                                              |
|                                                              |
|______________________________________________________________|
```

FIGURE 5.29

PART OF S's EM AFTER UTTERANCE OF (5.37)

```
 ___ S's Epistemic Model ______________________________________
|                                                              |
|                                                              |
| .eo1| S/Jill/jep  [<A0.TOK>,<A1.MAN>,<A2.M OF S><A3.REF>]||
|     | S/H/Jill/jep[   :          :        :        :   >]||
|                                                              |
|                                                              |
|______________________________________________________________|
```

We can imagine alternative scenarios where S knows John to be using the definite in a way incompatible with Jill' views. We can represent such situations by invoking an additional perspective as shown in Figure 5.30.

FIGURE 5.30

PART OF S's EM AFTER UTTERANCE OF ()

```
 ___ S's Epistemic Model_______________________________________________
|                                                                      |
|                                                                      |
| .eo1| S/jep  [<A0.TOK>,<A1.MAN>,<A2.M OF S><A3.REF>            ]|   |
|     | S/H/jep[    :            :            :           :      ]|   |
|     |                                                           |   |
|     | S/Jill/jep  [<A0.TOK>,<A1.MAN>,<A2.M OF S><A3.ATT>]       |   |
|     | S/H/Jill/jep[    :            :            :       :   >]  |   |
|                                                                      |
|                                                                      |
|______________________________________________________________________|
```

We should note that as with specificity a logic which modelled individuals' beliefs could cope with these readings without using the scope of the definite except in two positions- effectively using it to represent a bivalent interpretation of the noun phrase. Thus the formula (5.38) represents the content of the perspectives S/jep, S/Hjep, S/Jill/jep and S/H/Jill/jep found in Figure 5.30.

```
(5.35)    thinks(S.iotax(thinks(John,M of S(x) & insane(x))))
        & thinks(S.thinks(H.iotay(thinks(John,M of S(y)
          & insane(y)))))
        & x=y

          thinks(S.thinks(Jill,thinks(John.iotaw(M_of S(w)
          & insane(w)))))
        & thinks(S.thinks(H.thinks(Jill.thinks(John,
          iotaz(M_of S(z) & insane(z))))))
        & w=z
```

## 4 Modelling the Paradoxes

The apparatus of the PC model which we have developed will be applied to some of the interactions of semantic ambiguities we looked at in Section One of Chapter Three. We saw that such interactions taxed logically based scopal accounts. First consider the interaction of specificity with responsibility. exemplified in (5.39).

(5.39) S to H  John still wants to marry a witch

In the case of the above we are concerned particularly to get the reading where 'a witch' is non-specific but responsibility is S's. Traditional logical modelling of the surface form of sentences could not get this reading. Our PC representation would deal with (5.39) as shown in Figure 5.31. I assume that S has his own view about the non-specific indefinite and I have adopted a type based analysis of non-specificity.

FIGURE 5.31
A PC REPRESENTATION OF S AFTER UTTERANCE OF (5.39)

```
 ____________________________________________________________________
|
| S's EM______________________________________________________
| |                                                            |
| |  .eo4| Sep     [<A0.TY>,<A1.WITCH>,<A3,MARRY JOHN>] |      |
| |      | S/Hep   [    :        :           :          ] |    |
| |      | S/H/Sep[     :        :           :          ] |    |
| |      |                                                |    |
| |      | S/jep   [<A0.TY>,<A1.WOMAN>,<A3.MARRY JOHN>] |      |
| |      |                                                |    |
| |      | S/H/jep[<A0.TY>,<A1.WOMAN>,<A3.MARRY JOHN>] |       |
| |____________________________________________________________|
|
| S's DM_______________________________
| |                                    |
| |     .do1| Sdp     [eo4,[Sdc]] |    |
| |         | S/Hdp   [    :      ] |  |
| |         | S/H/Sdp[     |      ] |  |
| |____________________________________|
|
|____________________________________________________________________
```

where

do1 |Sdc| = {witch.sep}{marry John, sep}

This is a similar analysis to that given on page 272 et seq. for ascriptive responsibility. but we have, in addition, the specific non-specific ambiguity.

Let us consider now the additional complication of the combinatoric ambiguity interacting with specificity and responsibility. In a sentence such as (5.40) we find all of these semantic ambiguities.

(5.40) S to H  Every villager wants to marry a witch

Remember from Chapter Three that in a sentence such as (5.40) there are three sets of constraints which when taken together standard logical scope treatments have difficulty representing. These are shown below:

Constraints on the linear ordering of operators

| | Combinatoric | Specificity | Responsibility |
|---|---|---|---|
| i | Vy..Bel<br>Ex..Vy | Bel..Ex | W(x)..Bel |
| ii | Vy..Bel<br>Vy..Ex | Bel..Ex | W(y)..Bel |
| iii | Vy..Bel<br>Ex..Vy | Bel..Ex | Bel..W(x) |

We will adopt a type interpretation of the non-specific. We will represent the quantificational information as multiple processor perspectives (representing the villagers) related to the relevant EO associated with 'a witch'. Figure (5.32) is a PC representation using these conventions of the constraints embodied in (i) - namely, a non-specific interpretation of the indefinite. S assuming ascriptive responsibility. and a many to one interpretation of the combinatoric ambiguity.

FIGURE 5.32 A PC REPRESENTATION OF (5.40) EMBODYING CONSTRAINTS SHOWN IN (i)

```
 ______________________________________________________________
|                                                              |
| S's EM_____________________________________________________  |
| |                                                          | |
| |  .eo4| Sep        [<A0.TY>,<A1.WITCH>,<A3.M'Yeo1eo2eo3>]|| |
| |      |                                                  ]|| |
| |      | S/eo1ep    [<A0.TY>,<A1.WOMAN>,<A3.M'Yeo1        ]|| |
| |      | S/eo2ep    [    :         :        <A3.M'Yeo2    ]|| |
| |      | S/eo3ep    [    :         :        <A3.M'Yeo3    ]|| |
| |      |                                                   || |
| |      | S/H/eo1ep[<A0.TY>,<A1.WITCH>,<A3.M'Yeo1          ]|| |
| |      | S/H/eo2ep[<A0.TY>,<A1.WITCH>,<A3.M'Yeo2          ]|| |
| |      | S/H/eo1ep[<A0.TY>,<A1.WITCH>,<A3.M'Yeo3          ]|| |
| |                                                          | |
| |  .eo1         .eo2      .eo3                             | |
| |__________________________________________________________| |
|                                                              |
| S's DM___________________________________________________    |
| |                                                        |   |
| | .do4| Sdp     [eo4.[Sdc]] |  .do1| Sdp     [eo1.[Sdc]] ||   |
| |     | S/Hdp   [    :     ] |      | S/Hdp   [    :     ] ||   |
| |     | S/H/Sdp[     |     ] |      | S/H/Sdp[     |     ] ||   |
| |                                                        |   |
| |  .do2| Sdp     [eo2.[Sdc]] | .do3| Sdp     [eo3.[Sdc]] ||   |
| |      | S/Hdp   [    :    ] |     | S/Hdp   [    :     ] ||   |
| |      | S/H/Sdp[     |    ] |     | S/H/Sdp[     |     ] ||   |
| |________________________________________________________|   |
|                                                              |
|______________________________________________________________|
```

```
      where
              do4 |Sdc| = {witch.sep}

              do1 |Sdc| = {villager.sep}
              do2 |Sdc| = {villager.sep}
              do3 |Sdc| = {villager.sep}



      where  eo1-eo3 have structure
       eon |Sep      [A0.TO>,<A1.VILLAGER>,<A3.M'Y eo4>]|
           |S/Hep    [  :        :              :      ]|
           |S/H/Sep  [  :        :              :      ]|
```

The constraints in (ii) would simply instantiate a separate EO representing a separate type of witch for each villager. Figure (5.33) is the relevant part of S's EM for such a PC representation.

FIGURE 5.33
PART OF S's EM FOR (5.40) EMBODYING CONSTRAINTS IN (ii)

```
S's EM_______________________________________________________
|                                                            |
|  .eo4| Sep        [<AO.TY>,<A1.WITCH>,<A3.MARRY eo1>]|     |
|      | S/H/eo1ep[<AO.TY>,<A1.WITCH>,<A3.MARRY eo1>]|       |
|      | S/eo1ep   [<AO.TY>,<A1.WOMAN>,<A3.MARRY eo1>]|      |
|                                                            |
|  .eo5| Sep        [<AO.TY>,<A1.WITCH>,<A3.MARRY eo2>]|     |
|      | S/H/eo2ep[<AO.TY>,<A1.WITCH>,<A3.MARRY eo2>]|       |
|      | S/eo2ep   [<AO.TY>,<A1.WOMAN>,<A3.MARRY eo2>]|      |
|                                                            |
|  .eo6| Sep        [<AO.TY>,<A1.WITCH>,<A3.MARRY eo3>]|     |
|      | S/H/eo1ep[<AO.TY>,<A1.WITCH>,<A3.MARRY eo3>]|       |
|      | S/eo3ep   [<AO.TY>,<A1.WOMAN>,<A3.MARRY eo3>]|      |
|                                                            |
|  .eo1        .eo2     .eo3                                 |
|____________________________________________________________|

where  eo1-eo3 have structure
 eon |Sep      [AO.TO>,<A1.VILLAGER>,<A3.M'Y eo4>]|
     |S/Hep    [  :        :              :       ]|
     |S/H/Sep  [  :        :              :       ]|
```

Finally the constraints in (iii) would be represented as in Figure (5.32) except that the issue of ascriptive responsibility would not be raised- thus A1 for eo4 would be the value WITCH in all perspectives.

Were a logic of belief to use predication for partitioned perspectives. and individuate individuals as holding sets of beliefs then we would relieve logic of some of its paradoxes- but only at the cost of relieving scope of its explanatory function.

What of the referential attributive ambiguity interacting with other semantic ambiguities? In effect. we can use PC representations similar to those used for the semantic interactions of specificity. responsibility and the combinatoric ambiguity.

An example will serve to illustrate the point. Sentence (5.41), which we met in Chapter Three, has a possible interpretation where the definite is attributive and the universal has narrow scope relative to the definite. This is problematic on a standard scopal treatment.

(5.41) S to H  All the villagers know the murderer of Smith is insane

Figure 5.34 shows a possible configuration of S's EM after uttering (5.41). We see an EO represented attributively with a set of multiple perspectives. of villagers holding propositional attitudes which 'refer' to the same intentional object- the murderer of Smith. whoever he may be.

FIGURE 5.34

PART OF S's EM AFTER UTTERANCE OF (5.41)

```
 -__ S's Epistemic Model_____________________________________________
|                                                                    |
|                                                                    |
| .eo1| S/eo2ep      [<AO.TOK>,<A1.MAN>,<A2.M OF S><A3.ATT>]||
|     | S/eo3ep      [   :          :         :        :   >]||
|     | S/eo4ep      [   :          :         :        :   >]||
|     |                                                     | |
|     | S/H/S/eo2ep [    :          :         :        :   >]||
|     | S/H/S/eo3ep [    :          :         :        :   >]||
|     | S/H/S/eo4epp[    :          :         :        :   >]||
|                                                                    |
| .eo2          .eo3            .eo4                                 |
|____________________________________________________________________|
```

```
        where  eo2-eo4 have structure
         eon |Sep      [AO.TO>,<A1.VILLAGER>..]|
             |S/Hep    [  :        :           ]|
             |S/H/Sep [  :        :           ]|
```

The system presented in this chapter separates out 'specificity'. 'referentiality.. 'responsibility' and quantification. Each is dealt with using a separate mechanism; responsibility arises out of perspectival partitioning, specificity and referentiality is determined in the properties of EOs, quantification is dealt with. in a rudimentary manner. using type modification. token tableau instantiation. or where appropriate multiple processor perspectives.

It is obviously advantageous to evade the paradoxes of scope. and the methods outlined seem to offer a way out of the problems. Paradoxically. in advancing a model that puts beliefs centre-stage we have seen ways in which logical accounts could represent some of semantic phenomena we have been concerned with. But only at the expense of abandoning a general application of scope to these phenomena.

## 5 Radical Opacity within the PC Model

It should be apparent that the system presented here makes no direct use of objects in the world. How can we ever guarantee that our acts of intended reference have been successful? The short answer is that we cannot. Once we take the processors part we are shrouded in a cloak of intentionality. Language becomes in a certain sense 'radically opaque'. In a 1983 paper I wrote:

> As Intentional Systems who use language, build models and generate descriptions of the world, we encounter intensionality. There are no irrefragable Omniscient Observers able to look inside processors heads and determine with certainty what is true of them. their descriptions, their predications and the world. No veridical 'God's eye view' exists for cognitive processors. We as humans cannot stand outside ourselves as Intentional Systems. Everything we have is a constructed model of reality. a model our various modalities endeavour to construct.

But as I have constantly argued this is not a council of despair. We can, by appreciating the relationship of an intentional system to its environment, understand the large degree of concordance and 'success' in linguistic communication. We do have much in common, a common Fregean ground. A commonality based on a common phylogenetic history, shared cognitive structures, similar ontogenetic histories and experience.

This common ground cannot secure an invariant recipe for success and failure in language. Referential communication will always be a somewhat 'risky' business. Misconstrual is always a danger, sometimes a never realised one. In the next chapter I consider data from natural discourse which seeks to support this view. It is a view of communication as intrinsically opaque and liable to misconstrual. But it is communication supported by negotiation, requiring the reciprocal recognition by processors of each others intentional states. In particular the negotiation requires modelling the models which other processors' have. In so far as the system developed here is especially sensitive to multiple perspectives, the data also provides a good test of the systems ability to cast insight on the 'mechanics of reference'.

# CHAPTER SIX DEPLOYING THE MODEL- REFERENCE IN DISCOURSE

The model presented in the last chapter was used to describe the mechanics of simple referential acts. It was also used to help account for some of the associated phenomena of reference.

Key elements of the model included- structured objects of discourse and knowledge, processing areas for these objects, and the use of partitioned perspectives to represent multiple user views of these objects.

The model was able to capture aspects of 'successful reference', 'referential misconstrual', and 'referential repair'. It was able to pinpoint 'ascriptive responsibility', and distinguish the same discourse objects referring to different sorts of knowledge structure. The model helped us represent some of the possibilities of interpretation in opaque contexts which traditional logic had originally uncovered.

In the process of describing the model I made the point that it also highlighted the fact that we as language users are subject to the phenomonon of what I termed 'radical opacity'. If meaning and reference arise out of processors' beliefs and intentions we can never be certain that the same terms, employed by different processors, will be intensionally and extensionally equivalent. I suggested that radical opacity should be confronted head on and accepted as a fundamental fact of language. Radical opacity should not be regarded as an abberration to be side-stepped on occasion, nor as a nuisance for which special semantic machinery is required.

Radical opacity would seem to place at risk 'communicative success', indeed properly understood it changes our notion of what success is. The communicative risk which is a consequence of radical opacity has its roots in the intentionality of behaviour. Communicative risk arises out of three inter-related features of intentional systems:

1. The essentially idiosyncratic and subjective nature of the 'semantic criteria' associated by different processors with linguistic terms.

2. The possibility of misjudging the intentional states of other processors; their perspectives on objects, their understanding of linguistic expressions, and even of the top level intentional strategies and assumptions which other processors have in play.

3. Most of our concepts are incomplete. We do not have full specifications of the objects to which our representations correspond in the world. This is in part a consequence of the incompleteness of the <u>perceptual process</u>. This may be an

> unavoidable feature of any intentional system's knowledge of its environment.

In this chapter I will be looking at discourse data which highlights both the intentional aspects of language generation and interpretation, and the attendant riskiness of such processes. The first part will concentrate on the use by processors of their estimation of the knowledge states of their interlocutors. We will look at how this 'derivative knowledge' is used in performing referential acts. The second part of the chapter looks at examples of referential misconstrual and attempts to trace their origin back to intentional sources. Analysis of the data also uncovers some of the generative and interpretive strategies which processors use in various sorts of discourse reference. These strategies reflect the processor-centered and non-absolute nature of reference itself.

We can see this and the next chapter as further applications of the model developed so far. The referential phenomena which we will consider demonstrates the opacity of reference no less then traditional opacity problems.

## SECTION ONE THE DATA FOR INTENTIONALLY DERIVED REFERENCE

The data under consideration were collected from two populations, 16-year old Scottish secondary school children and Edinburgh University students (Footnote 6.1). Subjects worked in pairs . Participant A was provided with a map of an area containing a number of dangerous natural features and a route across the map which avoided these dangers. Participant A was told that it was his job to describe the route to Participant B so that B could mark the route on his map. Participant B's map contained most of the features on A's map, but not all. Moreover, his map also contained features which did not appear on A's map. They were told that the maps were drawn by two different explorers and so they were aware that there could be differences between the two maps. The two pairs of maps used to elicit the data are shown overleaf together with the instructions used.

There are several points to notice about the design of this task. Firstly, no single participant commands all the relevant knowledge. Although in some sense A is invested with authority, B has his own, sometimes incompatible, information. In the optimal case each participant ought to be sensitive not only to his own view of the world but also to his partner's view of how the world is. This of course makes it an ideal design for

Footnote 6.1. The opportunity to elicit some of this data in support of my own research was provided by SED Project JHH/190/1, under the direction of Dr Gillian Brown.

investigating the role of embedded perspectives in discourse reference.

A second feature of this design is that for participant A the route is known. This constrains an important intentional element- his focus of attention for the next move on the map. For B the route is unknown. His intentional focus strategy may be quite different, B may take in and refer to much larger areas of the map than A had intended him to take account of.

Thirdly, the properties of the map are, in general, unpredictable. Nothing can be assumed from one feature about its relation to other features. Of course, there are domains where certain features may be necessary, or required to be in certain relations to one another.

A fourth point concerns the considerable cognitive burden this task places on A and B. Participants should attempt not only to plan and execute, or interpret and follow, a set of instructions, but they should do so whilst attempting to accommodate each other's viewpoints.

Lastly I should mention that the subjects who undertook this task showed every sign of enjoying it and of wanting to perform it successfully.

Having outlined the nature of the task I will now discuss why this type of task should be thought to provide data which can cast light on the mechanisms of reference and of its linguistic manifestations in discourse.

The justification for devising and running such tasks is that they provide a way of eliciting 'controlled data'. One can control the task so as to elicit comparable data from many different subjects. This provides a set of linguistic profiles which can be compared one with another, checked over for similarities, regularities etc. A task such as the map task allows control of input, so that the analyst can discern the specific information which it may be presumed a participant has access to when he produces a particular utterance.

Also in this type of task one can be reasonably sure at the outset that the particular information relevant to the task is new to all the participants - that we are not witnessing the discourse as part of some longer term discourse between them.

The map task allows us to look at language spontaneously produced by the participants.

These 'methodological' features of controlled data elicitation allow us to look for regularities in language use, to relate these regularities to a model. The model aims to represent aspects of a discourse participant's state which are crucial to understanding acts of reference in discourse.

## SECTION TWO CONSTITUTING REFERENCE- THE USE OF EMBEDDED MODELS

Some of the knowledge relevant to this task is what a processor can see on his own map (specifying some of the content of his activated EM) (Footnote 6.2). These will include directly instantiated EOs representing various features on the map. Recall that a directly instantiated object is one on which a processor has an immediate or 'primary' perspective, ie for A his 'aep' perspective, for B his 'bep' perspective. One of the most striking first observations about the data is that 'discourse communication' does not draw its 'referential content' exclusively from primary epistemic perspectives.

Of course there are cases, exemplified in extracts 6.1-6.4, where a participant relies on the objects and

---

Footnote 6.2. This knowledge will have entered through the visual modality. Of course this knowledge may rely on or be augmented by all sorts of background information for interpretation as well as existing notions of how to go about describing and solving a problem.

their associated properties which they have in their primary EM perspectives. Objects which they further assume satisfy the condition of being 'mutually known'. For any object or feature, say the start in Map1, this is modelled by A's assuming a set of EO perspectives for the feature as shown in Figure 6.1. I should point out that in this and the next chapter I will assume objects on the map evoke token EOs in the EMs of participants.

FIGURE 6.1

```
Part of A's active EM___________________________
|                                                |
|.eo1| aep     [<A1,BOT RIGHT>,<A2,START>]|      |
|    | a/bep   [        :              :    ]|   |
|    | a/b/aep[        :              :    ]|   |
|                                                |
|________________________________________________|
```

The situation represented in Figure 6.1 would seem to be just the sort that underlies the assumption of the identity of maps, features and information that informs the initial utterances of extract 6.1-6.4 (Footnote 6.3).

Extract 6.1
Map 1 S1 & S2 Subjects from B'Muir School

1 A: right you go + through + the middle + between the middle in between the swamp and the palm trees
2 B: uhu
3 A: then + left turn left round the swamp + and go under the waterfall

---

Footnote 6.3. In the transcriptions a '+' symbol represents a pause of approximately 1 to 2 seconds duration, '++' a pause of 2 to 4 seconds duration.

Extract 6.2
Map 1 S5 & S6 Subjects from B'Muir School

1 A: Go down a bit from the palm trees + and go along + go up and round round the swamp + and go down and round the waterfall ++ go between the two mountains ++ and up and over the bridge ++ and then + keep going along and round ++ and then just keep going straight on till you get to the castle

Extract 6.3
Map 1 S11 & S12 Subjects from Edinburgh Univ.

1 A: start in the south east corner and go north west past palm beach and around the swamp
2 B: go + north west and past the swamp and around the swamp + how far ?
3 A: + well north past the swamp and around the swamp and go under the waterfall

Extract 6.4
Map 1 S17 & S18 Subjects from B'Muir School

1 A: just go + start from the bottom
2 B: whereabout ?
3 A: go up + palm beach
4 B: right
5 A: then you just + go down from the waterfall
6 B: right

In fact in all these extracts A's assumptions of 'congruence' are confirmed and apparently shared by B (Footnote 6.4). This occurs despite the fact that in extracts 6.1 and 6.3 discourse has involved reference to a feature <u>the swamp</u> which B does not know about. It appears that some kind of bridging inference is being made that equates the <u>crocodile area</u> for B with A's <u>swamp</u>. However, this assumption, as we shall see, is by no means always made. The over-riding strategy adopted by the two processors and informing reference to discourse objects in these extracts seems to be an assumption of equivalence of the featural information they share, to assume that their perspectives are the same. This happens despite the clear initial instructions that they may expect differences between their maps.

Of course, A may not simply <u>assume</u> congruence of the maps. In extracts 6.5-6.8 we have evidence of A attempting to establish the content of B's EM; what EOs he has, what perspectives on these EOs. This requires A to be able to operate with embedded models. A's questions in all these extracts seem to contribute to the construction of a detailed appreciation of B's point of view. In terms of the P-C descriptive system this amounts to the construction by A of 'a/bep' perspectives on the EOs contained in A's EM.

Extract 6.5
Map 1 S13 & S14 Subjects from B'Muir School

1 A: have you got wee palm trees aye ?
2 B: uhu
3 A: right go just + a wee bit along to them
have you got a swamp ?
4 B: er
5 A: right well just go + have you got a waterfall ?

---

Footnote 6.4. Extract 6.2 is unusual in being a complete potted set of route instructions with no active participation by B.

Extract 6.6
Map 1 S23 & S24 Subjects from B'Muir School

1 A: have you got palm trees, palm beach on your map ?
2 B: aye
3 A: well start + about an inch down from the palm beach + and you go up + a couple of inches + have you got a swamp on your map ?

Extract 6.7
Map 1 S1 & S2 Subjects from Edinburgh Univ.

1 A: do you have a blue bay on your map Sandra ?
2 B: yes I do
3 A: bottom right hand corner of the map
4 B: yes
5 A: to the left of there is there a palm beach ?
6 B: yes
7 A: yes + right + erm + that means that there should should be approximately two inches of land + from + directly below palm beach to the coast again
8 B: erm yes
9 A: erm + there's + starting from there do you have a start marked ?
10 B: yes I do

Extract 6.8
Map 2 S7 & S8 Subjects from Edinburgh Univ.

1 A: do you have a starting point there ?
2 B: yeh my starting point is about half an an inch from the top
3 A: yeh
4 B: and about two inches from the right hand side
5 A: urm + have you got a volcano ?
6 B: yes I have
7 A: good + have you got a graveyard ?
8 B: yes ....

Consider extract 6.6, we can use our P-C descriptive system to model: aspects of A's likely state prior to his utterance of (1A), the introduction of a new object of discourse after A's utterance (1A), subsequent modifications which A might make to his knowledge structures in the light of B's reply (2B). Figures 6.2-6.4 show such progressive representations of A's states through 6.6. Similar representations could be constructed for all the interactions presented in extracts 6.5-6.6.

FIGURE 6.2
PROCESSOR CENTRIC REPRESENTATION OF PART OF
A's STATE PRIOR TO UTTERANCE (1A) OF 6.6

```
 ________________________________________________
|                                                |
|  Part of A'a Active EM_______________________  |
|  |                                          |  |
|  |.eo1| aep     [<A1,BO RHS>,<A2,P BEACH>]| |  |
|  |    | a/bep?                            | |  |
|  |    | a/b/aep?                          | |  |
|  |__________________________________________|  |
|                                                |
|  A's DM______________________________________  |
|  |                                          |  |
|  |                                          |  |
|  |                                          |  |
|  |                                          |  |
|  |__________________________________________|  |
|________________________________________________|
```

FIGURE 6.3
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (1A) OF 6.6

```
 ___________________________________________________
|                                                   |
|  Part of A'a Active EM__________________________  |
|  |                                             |  |
|  |.eo1| aep     [<A1,BO RHS>,<A2,P BEACH>]|    |  |
|  |    | a/bep?                            |    |  |
|  |    | a/b/aep?                          |    |  |
|  |_____________________________________________|  |
|                                                   |
|  A's DM_________________________________________  |
|  |                                             |  |
|  |     .do1| adp     [eo1,[adc]] |             |  |
|  |         | a/bdp  [eo?,  :  ] |              |  |
|  |         | a/b/adp[eo?,  :  ] |              |  |
|  |_____________________________________________|  |
|___________________________________________________|
```

where
adc={have you got palm beach ?,a/bep}

FIGURE 6.4
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (2B) OF 6.6

```
 ___________________________________________________
|                                                   |
|  Part of A'a Active EM__________________________  |
|  |                                             |  |
|  | .eo1| aep    [<A1,BO RHS>,<A2,P BEACH>]|    |  |
|  |     | a/bep  [<A1,  :   >,<A2,    :  >]|    |  |
|  |     | a/b/aep[<A1,  :   >,<A2,    :  >]|    |  |
|  |_____________________________________________|  |
|                                                   |
|  A's DM_________________________________________  |
|  |                                             |  |
|  |     .do1| adp     [eo1,[adc][bdc]] |        |  |
|  |         | a/bdp  [ :    :    :  ] |         |  |
|  |         | a/b/adp[ :    :    :  ] |         |  |
|  |_____________________________________________|  |
|___________________________________________________|
```

where
adc={have you got palm beach ?,a/bep}
bdc={yes,a/bep}

A number of points are raised by these P-C representations. In Figure 6.2, A's uncertainty about B's view of a particular EO, in this case 'eo1' representing the map feature Palm Beach, is quite radical. This is uncertainty not to do with the particular value of an attribute but with whether A has a feature at all. A '?' symbol in the perspectival perspectives themselves, ie embedded perspectives 'a/bep?' and 'a/b/aep?', represents uncertainty as to whether B has a feature at all.

Utterance (1A) is clearly designed to answer A's doubt. There are a number of noteworthy points in Figure 6.3. Firstly, the description 'Palm Beach' is represented as originating out of 'a/bep', how can this be when A is in doubt as to the contents of 'a/bep'? A's discourse contribution is of an interrogative kind and also mentions explicitly B's perspective, 'Have you got [....] on your map?'. We can think of (1A) as an hypothesis A is advancing about a possible perspectival configuration which B may have on an EO (if B has that object at all). A uses the description in an attempt to access B's view of 'eo1' if such a view exists. This is different than the case in which A uses a simple declarative form containing a description D but no explicit intensional operator, D can then be regarded as arising out of 'aep' (in this case it is assumed that equivalent modes of description are available at the perspectives 'a/bep', and 'a/b/aep').

In Figure 6.3 the DO introduced as 'do1' has two perspectives, 'a/bdc' and 'a/b/adc', which contain an associate EO symbol 'eo?'. This indicates that A is unsure with which, if any, of the potential EOs B can associate the DO (Footnote 6.5).

It might be thought that after (1A) A may assume that _B realises_ that A must have the object referred to as 'palm beach' even if he (B) does not. Thus A is licenced to make an immediate modification to his 'a/b/aep' perspective on 'eo1'. However, strictly speaking, A should make no such modification until he has some indication from B that B heard and/or understood what he said.

Moving on to Figure 6.4 we see that B's reply (2B) confirms to A that they do mutually share the object under discussion. Notice that A is represented as assuming that they share the same view about the location of 'eo1'. In fact this property has not been explicitly mentioned by A, but utterance (3A) suggests that an assumption of common location has been made. There is substantial evidence in the data that if a feature is discussed and some way of describing it is found to be mutually shared then much additional information is

Footnote 6.5. The case where B might have answered 'no' to A's query about a feature will be dealt later in this chapter.

assumed to be common. For example, if it is discovered that there are features on the two participants' maps which are called by the same name then their location, relative position to other objects, may well be assumed to be common also. This issue will be reconsidered when we look at the types of interpretive strategy which processors bring to this sort of task.

A final aspect of these extracts, and of this task, is whether or not third level perspectives such as 'a/b/aep' or 'b/a/bep' are ever used by the processors themselves. As they stand they might be regarded as a useful convention for indicating the tacit recognition of subjective mutual knowledge. But are the third level perspectives ever employed by the processors in this kind of communicative exchange? There is some evidence that they are? consider the co-operative responses to the questions posed in (1A) of 6.6, (5A) of 6.7 and (1A) of 6.6. It seems that in all cases the sensitive respondent realises that A is trying to construct a view of B's perspective. The consequence of this must be B's recognition that the perspective 'b/a/bep' is at stake. Direct evidence of the utility of these third level perspectives will be discussed in the next chapter when we consider how processors are able to cancel the presuppositions which their interlocutors have of their knowledge states.

I want to consider now a set of extracts where, in attempting to construct a model of B's viewpoint, A comes across differences between their maps. Extracts 6.9-6.12 all deal, for the sake of simplicity, with the same difference on Map 1 where A has a feature the *bridge* crossing the feature *Big River*. B has the *Big River* feature but does not have a *bridge* crossing it.

Extract 6.9
Map 1   S1 & S2 Subjects from Edinburgh Univ.

1 A: do you have + er a bridge crossing big river ?
2 B: no
3 A: to the top right hand side + do you have a big river
4 B: er sorry + yes I do have a big river + er there's no bridge
5 A: there is no bridge ++ you now have to cross the bridge + the bridge is + erm + I would say + two + and a half + two and a quarter inches up + the river + up river

Extract 6.10
Map 1   S9 & S10 Subjects from Edinburgh Univ.

1 A: ... do you have a bridge ?
2 B: no I don't
3 A: well there is a bridge + erm + if you + if you draw a line between lions den and the + and the + mountains
4 B: yeh
5 A: if you draw a horizontal line where it intersects the the river
6 B: yeh
7 A: that's about where the bridge is
8 B: ok

Extract 6.11
Map 1 S3 & S4 Subjects from B'Muir School

1 A: and then + go up about and over the bridge
2 B: I've not got a bridge I've got a lion's den and a wood
3 A: have you got a river ?

Extract 6.12
Map 1 S9 & S10 Subjects from B'Muir School

1 A: you go to the + the big river + and you go over a bridge ++ got that ? + have you got it yet ?
2 B: I've not got the bridge where's the bridge ?
3 A: at the big river
4 B: what part of the big river ?

How might we describe these interactions in terms of the P-C descriptive system? Configurations that prompt A to ask B questions such as (1A) in 6.9, or (1A) in 6.10 are those in which A is unsure whether B has certain features on his map. Whilst in (1A) of 6.11, A makes an assumption of the commonality of a feature only to have it discredited. How should we represent the detection of such differences by the participants?

Let's take extract 6.9 and concentrate on A's state after (2B) with respect to the bridge feature. What modification should he make to his EM? Figure 6.5 represents what is perhaps the most appropriate modification. B has no information of her own about the feature, she does not have the object on her map, her only knowledge is derivative from A's. But whilst B may not have any information derived from her primary perspective, simply by its introduction into discourse the feature has in some sense become a mutually shared object. This despite the fact that the perspectives 'a/bep', 'bep', and 'b/a/bep' are empty of content. (Footnote 6.6)

FIGURE 6.5
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (2B) OF 6.9

```
 Part of A'a Active EM
  .eo8| aep     [<A1,ON B RIV>,<A2,BRIDGE>]|
      | a/bep                              |
      | a/b/aep[<A1,ON B RIV>,<A2,BRIDGE>]|

 A's DM
      .do8| adp     [eo8,[adc][bdc]] |
          | a/bdp   [ :    :    :  ] |
          | a/b/adp[ :    :    :  ] |
```

where
adc={a bridge crossing big river ?,a/bep}
bdc={no,a/bep}

If we turn to plausible P-C representations for B herself

---

Footnote 6.6. Notice that a condition in which A believed B to have no knowledge of the <u>bridge</u> feature is quite different than the perspectival configuration which A has after (1A) when A must suppose that there is a new mutually known object of knowledge. In the first case the perspective on 'eo8' given below is all that could be present.

```
eo8 | aep [<A1,ON B RIV>,<A2,BRIDGE>] |
```

we see that immediately after hearing (1A) and on checking her EM she discovers there is no EO for her to associate the DO with, see Figure 6.6 (notice that there is no EO associate for the DO at this stage, represented as '_'). We might suppose that from this state she moves to instantiate an EO, she has knowledge of a new object, if only from a derivative perspective. This instantiation of a new EO is shown in Figure 6.7, it is a 'minimally mutually known' object, B is represented as having three perspectives on the object only one of which, 'b/aep', is the repository of the information B has about the object (Footnote 6.7).

---

Footnote 6.7. We can not always be certain about the assumed knowledge and beliefs which the route drawers have. This is because they often do not say much, and the language produced in this task is one of the most effective 'windows' into the intentional states of the processor.

FIGURE 6.6
PROCESSOR CENTRIC REPRESENTATION OF PART OF B's
STATE IMMEDIATELY AFTER UTTERANCE (1A) OF 6.9

```
 ____________________________________________________
|                                                    |
|  Part of B's Active EM________________________     |
|  |                                            |    |
|  |                                            |    |
|  |                                            |    |
|  |                                            |    |
|  |                                            |    |
|  |____________________________________________|    |
|                                                    |
|  B's DM_______________________________________     |
|  |                                            |    |
|  |     .do5| bdp     [ _ ,[adc]] |            |    |
|  |         | b/adp   [ :    :  ] |            |    |
|  |         | b/a/bdp[ :    :  ] |             |    |
|  |                                            |    |
|  |____________________________________________|    |
|____________________________________________________|
```

where
adc={a bridge crossing big river ?,b/a/bep}

FIGURE 6.7
PROCESSOR CENTRIC REPRESENTATION OF PART OF B's
STATE IMMEDIATELY AFTER UTTERANCE (2B) OF 6.9

```
 _______________________________________________________
|                                                       |
|  Part of B's Active EM_____________________________   |
|  |                                               |    |
|  | .eo3| bep                                  |  |    |
|  |     | b/aep  [<A1,ON B RIV>,<A2,BRIDGE>]|  |    |
|  |     | b/a/bep                              |  |    |
|  |                                               |    |
|  |_______________________________________________|    |
|                                                       |
|  B's DM____________________________________________   |
|  |                                               |    |
|  |      .do5| bdp    [eo3, [bdc][adc]] |         |    |
|  |          | b/adp  [ :    :    :   ] |         |    |
|  |          | b/a/bdp[ :    :    :   ] |         |    |
|  |                                               |    |
|  |_______________________________________________|    |
|_______________________________________________________|
```

where
adc={a bridge crossing big river ?,b/a/bep}
bdc={no,bep}

There is a need to say something about how the contents of direct primary perspectives can be formed when information about an object is obtained in a descriptive, derivative manner. In the last chapter I talked of the authority and sincerity assumptions which processors make about their fellow discourse participants. In all the cases I discussed not only were the objects of knowledge mutually known but each processor believed that his interlocutor had primary perspectives containing information about the objects. In the event that a processor, say A, believed that the authority and sincerity conditions held and made a novel ascription to an object, then A believed that a fellow discourse participant, say B, would adopt the modification so that it became part of the contents of his view of the object. In this way information was inherited from one perspective, say 'b/aep', to another, say 'bep'. Of course, this embodies a view about how we come by our knowledge of the world. In fact the problem is reminiscent of one faced by Russell and mentioned in chapter 1. He was convinced that all the knowledge which a person has is ultimately grounded in a Principle Acquaintance. This acquaintance must be direct. This raises for knowledge acquired through the say so of others (ie knowledge by Description). Such situations arise frequently in the extracts we will be examining. The problem is to decide when descriptively received information constitutes secure knowledge which the recipient adopts for his own. What are the grounds, either necessary or sufficient, for such indirect knowledge being promoted to the contents of a direct primary perspective? Russell found the problem intractable, I do not think I am better able to provide answers. However, there are a number of observations one can make about the kind of knowledge transfer involved in the task detailed here. In the map task, apart from A's say-so, there are certain features (such as the bridge on Map 1) which B is only descriptively acquainted with.

There are other features in which this type of situation is reversed for the two processors. Let us stipulate that in these cases whilst A or B can come to know of another object which they do not have, they do not and cannot form a direct perspective on it in the context of this task. This effectively side steps the whole issue of the grounds required to establish any content in primary perspectives. Since epistemologists cannot agree on the matter it would be inappropriate for me to lay down the relevant conditions. Against the charge that this is exactly what I did in the last chapter I can take a minimalist stand and argue that wherever a change in a primary perspective occurred for an interpreter then we could reanalyse the modification using the conservative or cautious modification of EMs outlined on page ***. This avoids any commitment to the conditions for changing the epistemological content of primary perspectives.

Three of the cited extracts, 6.9, 6.10 and 6.12, provide explicit evidence of the discourse participants moving beyond the initial detection of incongruence. Participant A in 6.9, 6.10 and B in 6.12 attempt to obtain more information about an object which they and their interlocutors now know they do not share. Aspects of the form of interactions involving incongruent features will be discussed in the next chapter.

In extracts 6.13-6.18 processors can be regarded as forming secondary perspectives on objects which they do not have marked on their own maps. Subsequently they use knowledge about these indirectly instantiated discourse referents in acts of referential communication.

In extract 6.13, obtained from university students, we can see that the part of the map they are discussing is one where participant A does not have a particular feature, a waterhole, whereas participant B does.

Extract 6.13
Map 2 S9 & S10 Subjects from Edinburgh Univ.

| | | |
|---|---|---|
| 1 | B: | I have a waterhole |
| 2 | A: | oh I have not got a waterhole + where ++ do you have a ruined village ? |
| 3 | B: | no |
| 4 | A: | no + erm |
| 5 | B: | is it ++ my waterhole is erm + between the graveyard and the volcano but a bit down |
| 6 | A: | er |
| 7 | B: | So I should just avoid it |
| 8 | A: | You want to go just above that |
| 9 | B: | OK, yes |
| 10 | A: | So your curve goes just above the waterhole |

In 6.13 we see that speaker A discovers from utterance (1B) the incongruency between their two maps. She informs B of this difference in utterance (2A), and asks a question to establish whether a further feature is shared. Eventually, after receiving information from B as to the whereabouts of the waterhole, A 'refers successfully' in two utterances to an object on which she

has information derived from only a secondary perspective, ie 'a/bep'. In the first instance we have the use, in utterance (8A), of a demonstrative pronoun. On the second occasion, (10A), reference is sustained by A's explicitly using the definite description 'the waterhole'. Participant A issues instructions as to how B should draw her route relative to this feature.

Extract 6.14 revolves round a discussion of the same part of Map 2 by another pair of university students. The extract opens with A and B discussing the various featural differences.

Extract 6.14
Map 2 S15 & S16 Subjects from Edinburgh Univ.

1 A: so you have a dead tree there as well
2 B: besides the ruined village
3 A: and where is your waterhole ?
4 B: my waterhole + it + its a + an oval waterhole + and the left edge of its oval bit is directly underneath the right hand gravestone + the last right hand gravestone + and about an inch down
5 A: OK + have you got an old temple marked ?
6 B: no
7 A: well I think it must be directly + well it must be quite ++ just underneath the + erm + waterhole in fact
8 B: near a stony desert ?

In utterance (1A) A attempts to get a clear understanding of what B has at a particular point and B responds with information in which she uses an already pre-established incongruent feature (a ruined village which A has but B does not) to act as a referential anchor for A's building a picture of the whereabouts of B's features. So utterance (2B) provides us with the first example, in this extract, of successful reference being achieved via information from a secondary perspective - namely, B's use of the definite description 'the ruined village' which has its origin in 'b/aep'. In utterance (3A) A attempts to discover where the waterhole is located (previously discovered by A to be present only on B's map). After B's careful description of its location relative to a mutually shared feature, the graveyard, A seems to indicate that she has placed the waterhole and now asks whether B has another feature the old temple. On discovering in (6B) that B does not have this feature A goes on to provide B with information about its location in terms of A's understanding of the location of B's feature the waterhole, an understanding which for A is derived entirely from the 'a/bep' perspective, and which allows A to use the definite description 'the waterhole' in (7A) as a successful referential device.

An interesting referential tactic is observed in extract 6.15. Again the extract exemplifies the dependency a participant may have on his understanding of other processors' information states in order to effect a successful referential act himself. At this point in Map 2 participant A has a ruined village, whereas participant B has a dead tree at the same place on her map.

Extract 6.15

Map 2 S1 & S2 Subjects from Edinburgh Univ.

| | | |
|---|---|---|
| 1 | A: | yes it is + do you have anything else between the graveyard and the crashed airplane? |
| 2 | B: | there is a dead tree near the graveyard |
| 3 | A: | erm + whereabouts is the dead tree? |
| 4 | B: | it's erm + to the left and below the graveyard |
| 5 | A: | to the left and below + erm + well that's where my ruined village is |
| 6 | B: | uhu |
| 7 | A: | so + erm + you want to go + between the ruined village and the graveyard |
| 8 | B: | uhu |
| 9 | A: | erm + and you want to go ++ erm ++ head ++ down towards the bottom right hand side of your page ++ erm ++ about ++ making a slight curve + to the right ++ so you're going between the dead tree and the graveyard |

The interesting thing about this extract is that participant A first co-locates her ruined village with participant B's dead tree in utterance (5A). She then uses information from her own primary perspective to refer to this position in utterance (7A) when she uses 'the ruined village'. Notice that B's utterance (6B), suggests that she has been able to interpret A's referential act even though from B's point of view the definite description arises out of a 'b/aep' perspective. Later in 6.15 A uses her perspective of participant B's perspective, this occurs in (9A) when A uses the definite description 'the dead tree'.

Moving on to Map 1 I have selected three extracts from our sixteen year old subjects which demonstrate a similar facility to that displayed by our older subjects in extracts 6.13-6.15.

Extract 6.16
Map 1 S13 & S14 Subjects from B'Muir School

1 A: Have you got wee palm trees aye?
2 B: uhu
3 A: right go just + a wee bit along to them + have you got a swamp ?
4 B: er
5 A: right just go + have you got a waterfall?
6 B: aye
7 A: go + between the palm trees and the waterfall
8 B: but I've got crocodiles
9 A: you've got what?
10 B: crocodiles
11 A: whereabout?
12 B: In between the waterfall and the palm trees
13 A: right + go in between the crocodiles and the palm trees

In utterance (13A) participant A refers to a feature using a description which originates from his understanding of participant B's map. This understanding involves an appreciation of what objects with what properties and descriptions each participant has, and placing this information in appropriate perspectival partitions. Participant A does not have crocodiles on his map. He first discovers in (8B) that B has crocodiles and then finds out their location. He then uses this data, supplied by B, to construct the definite description 'the crocodiles' to refer to a referent he has no direct access to.

Extracts 6.17 and 6.18 deal with the same part of Map 1. In each of the extracts 6.16-6.18 one could argue that there has been a collapse, by the two participants, of the features crocodiles and swamp into the same spatial location. After all these two features on Map 1 are certainly not semantically incompatible. Nevertheless, even if a reduction of two features into one spatial location has occurred, in all these extracts participant A uses a description derived from his perspective of B's view of the spatial location.

Extract 6.17
Map 1 S23 & S24 Subjects from B'Muir School

| | | |
|---|---|---|
| 1 | A: | ... have you got a swamp on your map ? |
| 2 | B: | crocodiles |
| 3 | A: | yeh well + you avoid the crocodiles + you go round them + go round in a circle + round them + so that + have you got a waterfall? |

Extract 6.18
Map 1 S21 & S22 Subjects from B'Muir School

| | | |
|---|---|---|
| 1 | A: | go + across + towards the swamp ++ and draw a line round the swamp |
| 2 | B: | swamp where about is the swamp ? |
| 3 | A: | on your left |
| 4 | B: | where the crocodiles are ? |
| 5 | A: | dunno + where's crocodiles ? |
| 6 | B: | left of palm beach |
| 7 | A: | aye + draw a + draw a line round the crocodiles |

Thus far the discourse interactions have been described without the explicit use of the P-C descriptive system, although the essential mechanism used in explaining these interactions, is that of perspectival partitions on the objects of our knowledge. A set of P-C representations is provided in Figures 6.8-917. They purport to model the instruction giver (participant A) for an extended version of the discourse contained in 6.13. This larger extract is given below as 6.13' (Footnote 6.8).

The P-C representations reveal the dynamic nature of referential generation and construal. One can represent a processor's growing appreciation of another processor's knowledge states. The P-C representations highlight the incremental nature of discourse; as discourse proceeds new objects are introduced, settings and foci are changed. If discourse is pulled back to earlier foci then the modes of description of these earlier discourse objects have to be recoverable. In all these respects the P-C descriptive system is able to represent referential activity.

Extract 6.13'
Map 2   S9 & S10 Subjects from Edinburgh Univ.

1 A: you have a start marked do you ?
2 B: uhu
3 A: just below the start mark you have a volcano + do you ?
4 B: uhu
5 A: right + erm + I want you to make a semi-circular curve + erm + downwards + er + just passing the volcano + er + about half a centimetre to its left ++ now do you have a graveyard ?
6 B: yes I do + so I make a semicircle towards the graveyard +
7 A: yes
8 B: would it be a wide one
9 A: erm + your + your semicircle wants to be + well erm + you want to go
10 B: do I go down and left ?
11 A: yes thats right + forming a semicircle + and stop it + erm just + half a centimetre to the right of the graveyard + OK
12 B: I have a waterhole
13 A: oh I have not got a waterhole + where ++ do you have a ruined village ?
14 B: no
15 A: no + erm
16 B: is it ++ my waterhole is erm + between the graveyard and the volcano but a bit down
17 A: er
18 B: so I should just avoid it
19 A: you want to go just above that
20 B: ok, yes
21 A: so your curve goes just above the waterhole

---

Footnote 6.8. The choice of extracts was determined by the degree to which the language used made explicit the likely states of the participant and his view of his interlocutor. I wanted an extract which left A's presuppositions and assumptions in little doubt. There is of course a methodological point at issue here, in deciding which P-C representations best capture A's state we are taking the stance of objective analysts, but we are not, of course, infallible in our ascription and subsequent description of these states.

In order that the Figures do not become inordinately large I have used the simple device of having the EO and DO labels populate the P-C area and then only expanding the EOs and DOs under the P-C areas if they are newly introduced or modified in some way.

FIGURE 6.8
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (1A) OF 6.13

```
 ___________________________________________
|                                           |
|  Part of A'a Active EM________________    |
|  |                                    |   |
|  | .eo1            .eo3               |   |
|  |                                    |   |
|  | .eo2            .eo5               |   |
|  |____________________________________|   |
|                                           |
|  A's DM_______________________________    |
|  |                                    |   |
|  | .do1                               |   |
|  |                                    |   |
|  |                                    |   |
|  |____________________________________|   |
|___________________________________________|

.eo1 |aep      [<A1,TOP LHS>,<A2,START>] |
     |a/bep?                             |
     |a/b/aep?                           |

.do1 |adp    [eo1,[adc]] |
     |a/bdp  [eo?,  :  ] |
     |a/b/adp[eo?,  :  ] |

   where
           adc={have you got a start ?,a/bep}
```

Notice in Figure 6.8 that a DO has been introduced by the act of referential instigation at (1A). This utterance indicates that A is checking whether or not B has the feature <u>start</u>. Until she gets some feedback A is not strictly entitled to make any modification to her EOs, not even the third level perspective on 'eo1' is modified at this stage.

FIGURE 6.9
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (2B) OF 6.13

```
 ________________________________________
|                                        |
|  Part of A'a Active EM_____________    |
|  |                                |    |
|  | .eo1            .eo3           |    |
|  |                                |    |
|  | .eo2            .eo5           |    |
|  |________________________________|    |
|                                        |
|  A's DM____________________________    |
|  |                                |    |
|  | .do1                           |    |
|  |                                |    |
|  |                                |    |
|  |________________________________|    |
|________________________________________|
```

```
.eo1 |aep      [<A1,TOP RHS>,<A2,START>] |
     |a/bep    [        :           :  ] |
     |a/b/aep  [        :           :  ] |

.do1 |adp     [eo1,[adc][bdc]] |
     |a/bdp   [eo1,  :     : ] |
     |a/b/adp[eo1,   :     : ] |

   where
            adc={have you got a start ?,a/bep}
            bdc={yes,a/bep}
```

B's response at (2B) confirms to A that B does have a feature described as 'start'. This enables information to be propagate to the two perspectives 'a/bep' and 'a/b/aep'. Notice that they also inherit information concerning the location of this feature. But no information about location has been mentioned, what licences this assumption about A's belief states? As

## INSTRUCTIONS FOR THE MAP TASK

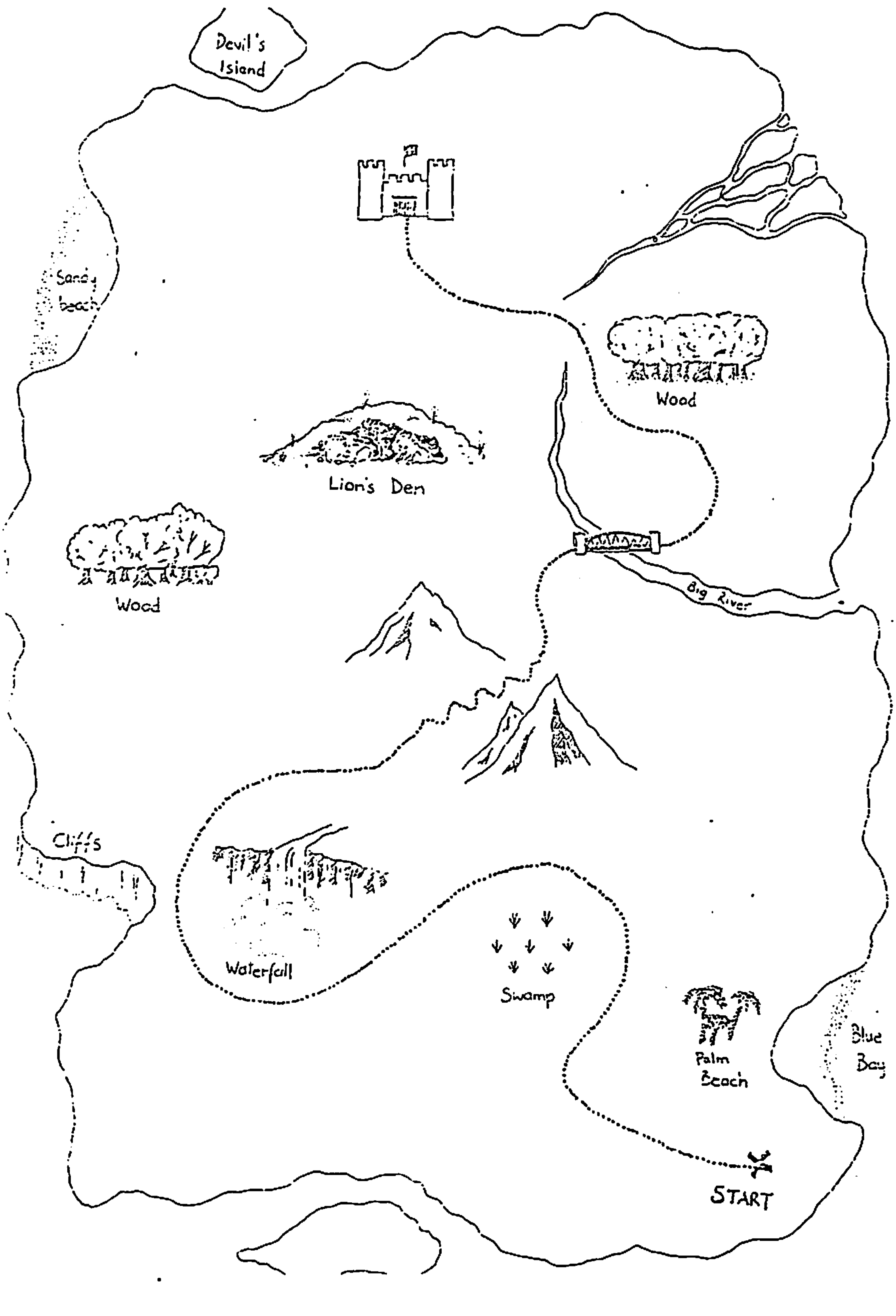
### INSTRUCTIONS GIVEN TO THE ROUTE DESCRIBER (A)

YOU AND YOUR PARTNER HAVE BOTH GOT A MAP OF THE SAME PLACE. YOU'VE GOT A ROUTE MARKED ON YOUR MAP. ITS THE ONLY SAFE ROUTE THROUGH ALL THE DANGERS. YOUR PARTNER HASN'T GOT A ROUTE MARKED ON THEIR MAP. YOUR JOB IS TO DESCRIBE THE ROUTE TO YOUR PARTNER SO THAT HE/SHE CAN MARK IT ON THEIR MAP. YOU HAVE TO DESCRIBE IT EXACTLY BECAUSE ITS THE ONLY SAFE ROUTE. THE MAPS HAVE BEEN DRAWN BY DIFFERENT EXPLORERS, SO THEY MIGHT NOT BE BOTH THE SAME. THERE COULD BE SOME DIFFERENCES.

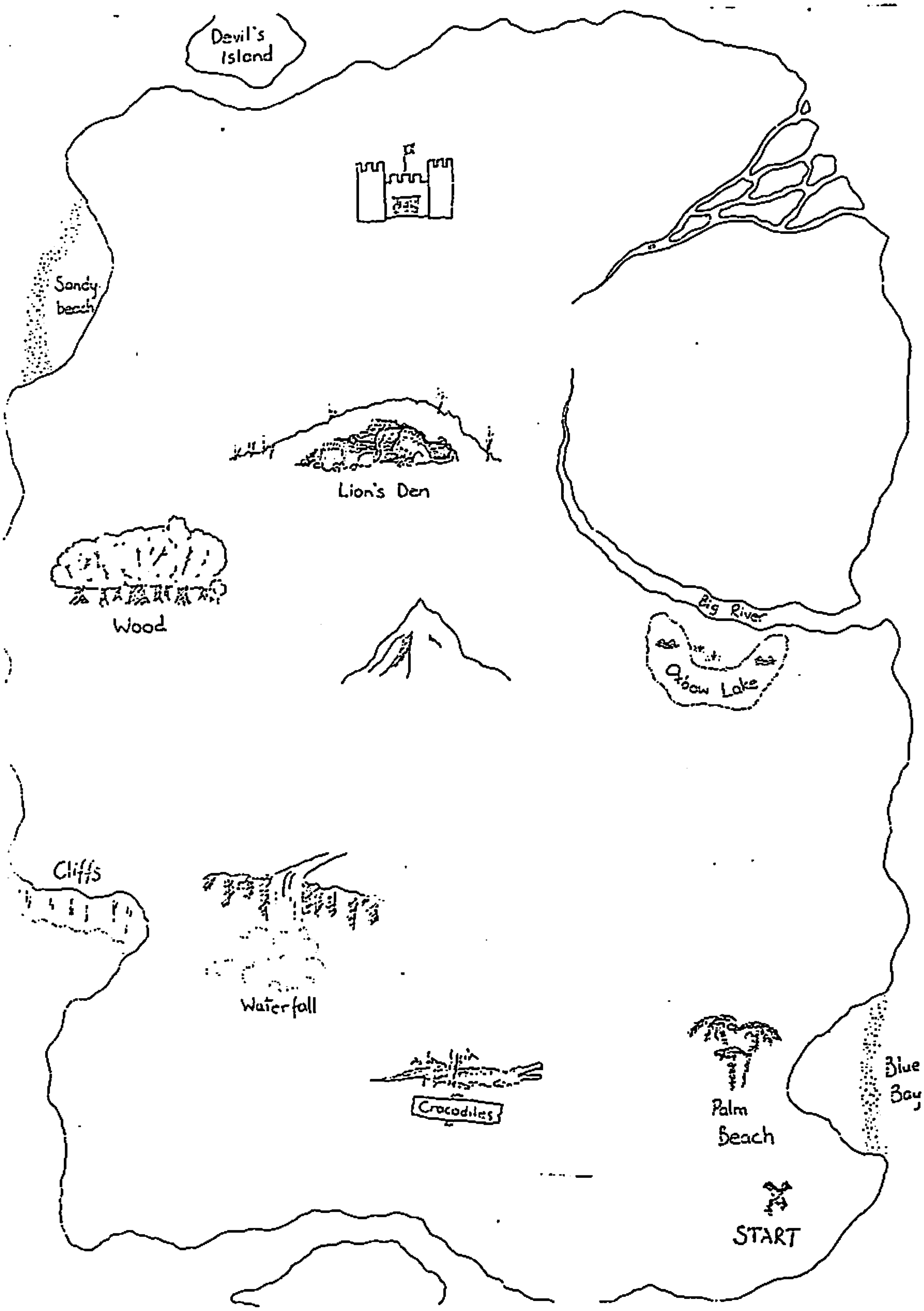
### INSTRUCTIONS GIVEN TO THE ROUTE DRAWER (B)

YOU AND YOUR PARTNER HAVE BOTH GOT A MAP OF THE SAME PLACE. HE/SHE HAS GOT A ROUTE MARKED ON HIS/HER MAP YOUR JOB IS TO FINISH UP WITH THAT ROUTE MARKED ON YOUR MAP. LISTEN TO WHAT HE/SHE SAYS AND ASK HIM/HER ANY QUESTIONS YOU WANT. YOU MUST DRAW IT EXACTLY. ITS THE ONLY SAFE ROUTE. THE MAPS HAVE BEEN DRAWN BY DIFFERENT EXPLORERS SO THEY MIGHT NOT BE THE SAME, THERE COULD BE SOME DIFFERENCES.

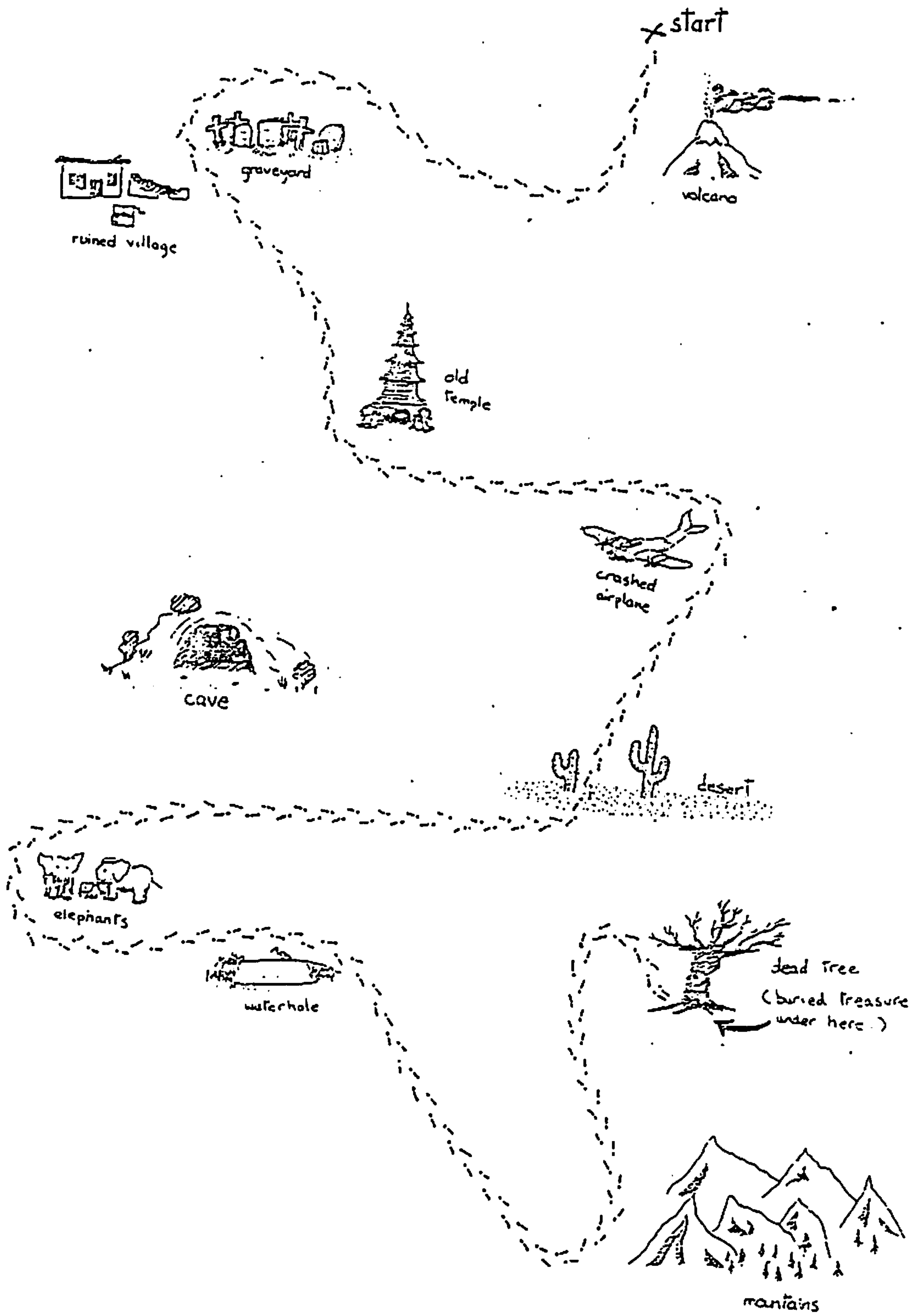
MAP 1 PARTICIPANT A (DESCRIBES ROUTE)



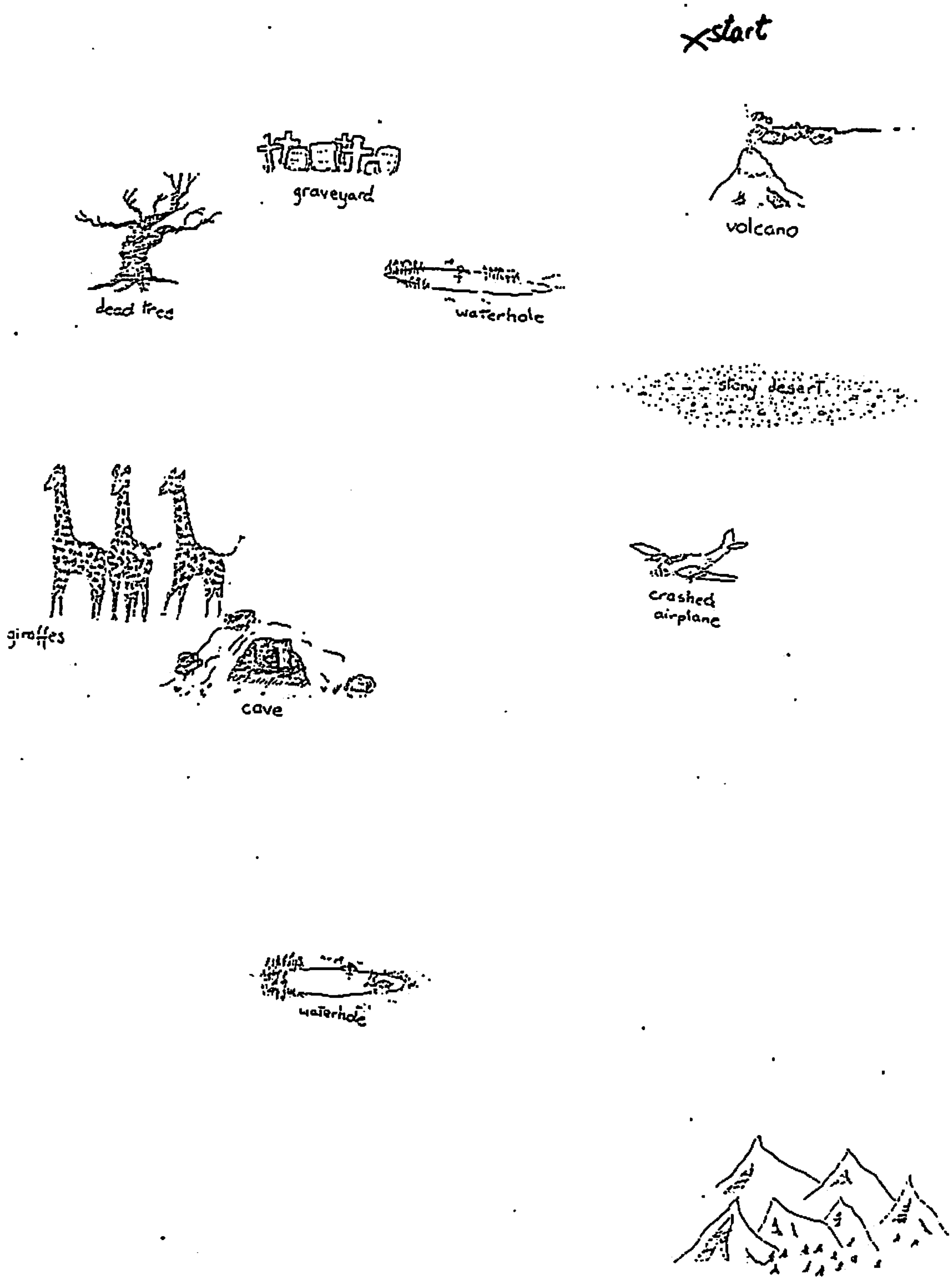
MAP 1 PARTICIPANT B (DRAWS ROUTE)



MAP 2 PARTICIPANT A (ROUTE GIVER)



MAP 2 PARTICIPANT B (ROUTE DRAWER)



analysts we are able to look at future discourse and determine what these later utterances imply for the earlier states of the processors. Since at (3A) A doesn't locate the start but begins describing the route relative to it, it seems that the assumption embodied in 6.9 is directly made by processor A.

FIGURE 6.10
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (3A) OF 6.13

```
 ______________________________________________
|                                              |
|  Part of A'a Active EM________________       |
|  |                                   |       |
|  | .eo1            .eo3              |       |
|  |                                   |       |
|  | .eo2            .eo5              |       |
|  |___________________________________|       |
|                                              |
|  A's DM_______________________________       |
|  |                                   |       |
|  | .do1                              |       |
|  |                                   |       |
|  | .do2                              |       |
|  |___________________________________|       |
|______________________________________________|
```

```
.eo2 |aep      [<A1,UNDER START>,<A2,VOLCANO>] |
     |a/bep?                                   |
     |a/b/aep?                                 |

.do2 |adp     [eo2,[adc]] |
     |a/bdp   [eo?,   :  ] |
     |a/b/adp[eo?,    :  ] |
```

where

adc={have you got a volcano ?,a/bep}

Figures 6.10 and 6.11 show a similar interaction to that represented in 6.8 and 6.6. In this case A actually does explicitly define a location for the feature volcano, although it is relative to start whose location, as we have seen, never was checked. So far from A's point of view the language in this extract is aimed at, and generated from,B's primary perspective. The checks, hypotheses and feedback, which constitute the various discourse contributions are associated with 'a/bep'.

FIGURE 6.11
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (4B) OF 6.13

```
 ________________________________________
|                                        |
|  Part of A'a Active EM______________   |
|  |                                  |  |
|  | .eo1            .eo3             |  |
|  |                                  |  |
|  | .eo2            .eo5             |  |
|  |__________________________________|  |
|                                        |
|  A's DM_____________________________   |
|  |                                  |  |
|  | .do1                             |  |
|  |                                  |  |
|  | .do2                             |  |
|  |__________________________________|  |
|________________________________________|

.eo2 |aep     [<A1,UNDER START>,<A2,VOLCANO>] |
     |a/bep   [          :              :   ] |
     |a/b/aep [          :              :   ] |

.do2 |adp    [eo2,[adc][bdc]] |
     |a/bdp  [eo2,  :     : ] |
     |a/b/adp[eo2,  :     : ] |

   where
           adc={have you got a volcano ?,a/bep}
           bdc={yes,a/bep}
```

FIGURE 6.12
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (5A) OF 6.13

```
 ____________________________________________
|                                            |
|  Part of A'a Active EM____________________ |
|  |                                       | |
|  | .eo1            .eo3                  | |
|  |                                       | |
|  | .eo2            .eo5                  | |
|  |_______________________________________| |
|                                            |
|  A's DM___________________________________ |
|  |                                       | |
|  | .do1            .do3                  | |
|  |                                       | |
|  | .do2                                  | |
|  |_______________________________________| |
|____________________________________________|

.eo3 |aep      [<A1,L OF VOLC>,<A2,G'YARD>] |
     |a/bep?                                |
     |a/b/aep?                              |

.do3 |adp     [eo3,[adc]] |
     |a/bdp   [eo?,   :  ] |
     |a/b/adp[eo?,    :  ] |

   where
          adc={have you got a graveyard ?,a/bep}
```

Once more the interaction represented in Figures 6.12 and 6.13 is identical in form to those in Figures 6.8-6.11: the introduction of a DO with the intention by A to discover if B has an existing object of knowledge to associate with the DO, and the subsequent confirmation by B that he has.

FIGURE 6.13
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (6B) OF 6.13

```
 ___________________________________________
|                                           |
|  Part of A'a Active EM__________________  |
|  |                                      | |
|  | .eo1            .eo3                 | |
|  |                                      | |
|  | .eo2            .eo5                 | |
|  |______________________________________| |
|                                           |
|  A's DM_________________________________  |
|  |                                      | |
|  | .do1            .do3                 | |
|  |                                      | |
|  | .do2                                 | |
|  |______________________________________| |
|___________________________________________|

.eo3 |aep      [<A1,L OF VOLC>,<A2,G'YARD>] |
     |a/bep    [        :               :    ] |
     |a/b/aep  [        :               :    ] |

.do3 |adp     [eo3,[adc][bdc]] |
     |a/bdp   [eo3,  :      : ] |
     |a/b/adp[eo3,   :      : ] |

   where
          adc={have you got a graveyard ?,a/bep}
          bdc={yes,a/bep}
```

After (6B) there occurs in extract 6.13' discussion about the shape of the line which is being drawn in as the route. Strictly speaking the route itself constitutes a feature, a feature which A has and which B is trying to duplicate. I have not included this feature, nor the discussions that revolve round it as a discourse object, in any of the task analyses. I have chosen instead to look at discourse reference relative to the less abstract, more concrete features.

FIGURE 6.14
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's
STATE IMMEDIATELY AFTER UTTERANCE (12B) OF 6.13

```
 ________________________________________________________
|                                                        |
|  Part of A'a Active EM________________________         |
|  |                                            |        |
|  | .eo1              .eo3              .eo4   |        |
|  |                                            |        |
|  | .eo2              .eo5                     |        |
|  |____________________________________________|        |
|                                                        |
|  A's DM_______________________________________         |
|  |                                            |        |
|  | .do1              .do3                     |        |
|  |                                            |        |
|  | .do2              .do4                     |        |
|  |____________________________________________|        |
|________________________________________________________|

.eo4 |aep                                         |
     |a/bep   [<A1,    ?      >,<A2,W'HOLE>]      |
     |a/b/aep?                                    |

.do4 |adp     [eo4,[bdc]] |
     |a/bdp  [eo4,    : ] |
     |a/b/adp[eo4,    : ] |

   where
           bdc={I have a waterhole,a/bep}
```

Figure 6.14 is of interest because we see that A has now discovered that B has a feature, a <u>waterhole</u>, which he does not have. Figure 6.14 is a representation of A after he has instantiated a new object of knowledge 'eo4' in response to the discourse object 'do4'. This EO has content only by virtue of B's descriptions, the only perspective containing information about 'eo4' is therefore 'a/bep'. Notice that I have not filled in a value for the location attribute of 'eo4'. Clearly if B has not mentioned its whereabouts, and A does not have the feature then A cannot make any detailed assumptions about its location.

FIGURE 6.15
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (13A) OF 6.13

```
 __________________________________________
|                                          |
|  Part of A'a Active EM______________     |
|  |                                  |    |
|  | .eo1          .eo3          .eo4 |    |
|  |                                  |    |
|  | .eo2          .eo5               |    |
|  |__________________________________|    |
|                                          |
|  A's DM_____________________________     |
|  |                                  |    |
|  | .do1          .do3          .do5 |    |
|  |                                  |    |
|  | .do2          .do4               |    |
|  |__________________________________|    |
|__________________________________________|

.eo4 |aep                                 |
     |a/bep   [<A1,    ?      >,<A2,W'HOLE>] |
     |a/b/aep                             |

.do4 |adp     [eo4,[bdc][adc]] |
     |a/bdp   [eo4,    :   :  ] |
     |a/b/adp[eo4,    :   :  ] |

   where
       do4 bdc={I have a waterhole,a/bep}
           adc={I have not got a waterhole,aep}

.eo5 |aep      [<A1,R UNDER G'YRD>,<A2,R.VILL>] |
     |a/bep?                                   |
     |a/b/aep?                                 |

.do5 |adp     [eo5,[adc]] |
     |a/bdp   [eo?,   :  ] |
     |a/b/adp[eo?,   :  ] |

   where
       do5 adc={have you got a ruined
                village ?,a/bep}
```

Notice also that in 6.14 'a/b/aep?' is unknown. A does not know whether B thinks A has the <u>waterhole</u> feature.

One of the functions of (13A) is to show B that A has not got the feature. Thus in 6.15 this perspective on 'eo4' is modified form 'a/b/aep?' to 'a/b/aep'. Utterance (13A) also contains a query about another feature, the <u>ruined village</u>. Figure 6.16 represents A's change of information state in response to B's utterance (14B) where he says that he does not have a referent for this most recently introduced discourse object.

FIGURE 6.16
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's
STATE IMMEDIATELY AFTER UTTERANCE (14B) OF 6.13

```
 _________________________________________________
|                                                 |
|  Part of A'a Active EM_________________         |
|  |                                     |        |
|  | .eo1             .eo3          .eo4 |        |
|  |                                     |        |
|  | .eo2             .eo5               |        |
|  |_____________________________________|        |
|                                                 |
|  A's DM________________________________         |
|  |                                     |        |
|  | .do1             .do3          .do5 |        |
|  |                                     |        |
|  | .do2             .do4               |        |
|  |_____________________________________|        |
|_________________________________________________|

.eo5 |aep     [<A1,R UNDER G'YRD>,<A2,R.VILL>] |
     |a/bep                                    |
     |a/b/aep [<A1,       ?      >,<A2,R.VILL>] |

.do5 |adp    [eo5,[adc]] |
     |a/bdp  [eo5,   :  ] |
     |a/b/adp[eo5,   :  ] |

   where
      adc={have you got a
           ruined village ?,a/bep}
      bdc={no,a/bep}
```

FIGURE 6.17
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's STATE IMMEDIATELY AFTER UTTERANCE (16B) OF 6.13

```
 _____________________________________________
|                                             |
|  Part of A'a Active EM______________________ |
|  |                                      |   |
|  | .eo1            .eo3           .eo4|   |
|  |                                      |   |
|  | .eo2            .eo5                 |   |
|  |______________________________________|   |
|                                             |
|  A's DM_____________________________        |
|  |                                      |   |
|  | .do1            .do3           .do5|   |
|  |                                      |   |
|  | .do2            .do4                 |   |
|  |______________________________________|   |
|_____________________________________________|

.eo4 |aep                                         |
     |a/bep   [<A1,TWIX G'Y & V>,<A2,W'HOLE>] |
     |a/b/aep                                     |

.do4 |adp     [eo4,[bdc][adc]] |
     |a/bdp   [eo4,    :   :  ] |
     |a/b/adp[eo4,    :   :  ] |

   where
        bdc={I have a waterhole,a/bep}
        adc={I have not got a waterhole,aep}
        bdc={my waterhole is between
             the graveyard
             and the volcano,a/bep}
```

Figure 6.17 shows A's modification to his 'eo4' structure on learning at (16B) of the location of the waterhole feature. Finally 6.18 represents A's use of his knowledge of an indirectly instantiated object to perform a referential act at (19A).

FIGURE 6.18
PROCESSOR CENTRIC REPRESENTATION OF PART OF A's
STATE IMMEDIATELY AFTER UTTERANCE (19A) OF 6.13

```
 ______________________________________________________
|                                                      |
|   Part of A'a Active EM___________________________   |
|   |                                              |   |
|   | .eo1               .eo3               .eo4   |   |
|   |                                              |   |
|   | .eo2               .eo5                      |   |
|   |______________________________________________|   |
|                                                      |
|   A's DM__________________________________________   |
|   |                                              |   |
|   | .do1               .do3               .do5   |   |
|   |                                              |   |
|   | .do2               .do4                      |   |
|   |______________________________________________|   |
|______________________________________________________|

.eo4 |aep                                         |
     |a/bep   [<A1,TWIX G'Y & V>,<A2,W'HOLE>]     |
     |a/b/aep                                     |

.do4 |adp     [eo4,[bdc][adc]] |
     |a/bdp   [eo4,    :   :  ] |
     |a/b/adp[eo4,     :   :  ] |

   where
        bdc={I have a waterhole,a/bep}
        adc={I have not got a waterhole,aep}
        bdc={my waterhole is between
             the graveyard
             and the volcano,a/bep}
        adc={I should just avoid it,a/bep}
```

In the extracts cited so far, and the P-C representations of them, I have confined myself to examples where what is at issue are the views each participant has of his partner's map. One dimension of the map task is not directly modelled in the P-C descriptive system, nevertheless it is crucial to understanding the kinds of referential exchange that go on. The dimension consists of the communicative _strategies_ that participants in this task call into play. It is to this feature of discourse reference that I look in the next section.

## SECTION THREE INTENTIONAL STRATEGIES IN DISCOURSE

What does one mean by a communicative strategy? We may illustrate by considering one of the most obvious and fundamental - the adoption of a co-operative strategy. Obviously a participant can choose to be fully co-operative - to pay attention to the task at hand, to make a maximum effort to generate or interpret a message, to integrate current messages with what is already known, to make further contributions which will be co-operative etc. But of course a participant may equally choose not to be co-operative in the ways outlined. Obviously the notion of co-operativeness forms something of a cline, we can speak of extremes of co-operativeness and unco-operativeness and of many possible states in between them.

It is important to realise that the effect of unco-operativeness can be produced _in spite of_ a participant having co-operative intentions. For example, a highly co-operative interpreter may be so absorbed with processing the first thing said by his partner that he may not hear or may ignore the next contribution.

Behaviour in the map task sometimes appears to be unco-operative even though the participant may have been keen to perform the task successfully. Extracts 6.19-6.22 present different cases of 'unco-operative' behaviour.

Extract 6.19

Map1 S19 & S20 Subjects from B'Muir School

1 A: .... you go up + between a swamp and the palm beach
2 B: eh ?
3 A: between a swamp and the palm beach + and you go round the swamp
4 B: what swamp ?
5 A: have you got a waterfall ?
6 B: aye
7 A: right
8 B: do you go past the crocodiles ?
9 A: go round the waterfall + near the cliffs + go round it that way round the waterfall + and up towards the mountains

Extract 6.20

Map1 S17 & S18 Subjects from B'Muir School

1 A: up the hill ++ and over the bridge
2 B: I've not got a bridge
3 A: and keep going up + and you reach the top

Extract 6.21

Map1 S13 & S14 Subjects from B'Muir School

1 A: right + you're going to have to cross the river
2 B: how ?
3 A: dinnae ken + any way you want ....

Extract 6.22

Map1 S9 & S10 Subjects from B'Muir School

1 A: just draw what I said + right you go over the big river + right
2 B: right over the big river right + there's not a bridge on it where's the bridge ?
3 A: dinnae ken
4 B: is it up from oxbow lake ?

In extract 6.19 participant B with utterance (2B) registers some problem, which is not specified, concerning his understanding of what was said. Participant A registers this and assumes that B did not hear the original message and co-operatively repeats what she has said before. Now B hears what A has said but is unable to produce an adequate drawing response so she asks, in utterance (4B), for more information. A ignores B's question, ignores it again at (7A), and ignores B's problem with a feature at (8B).

Again in extract 6.20 we have A acting as if he had not heard the question, or request from his fellow participant. In both 6.19 and 6.20 participant A actually ignores B's announcement of incompatible information.

Extracts 6.21 and 6.22 are slightly different, A responds to questions from B, demonstrating that the questions have been interpreted even though in both cases A's responses are less than helpful. In these cases A abdicates his responsibility as the authoritative route giver, A either regards himself as incapable of dealing with the problem or else is not prepared to undertake the task of solving it.

These cases of 'unco-operative' behaviour may arise out of the processing load that this complex cognitive task requires. This may manifest itself as an unwillingness by one participant to try and cope with the construction of a model of his interlocutor's point of view. Or else a participant may refuse to take on extra information which they are not able to accommodate at a particular moment. We might suppose that extract 6.23 evinces just such a situation, A's mention of a waterfall at (7A) is not attended to by B whose response, (8B), indicates that he is busy with an earlier part of the task.

Extract 6.23
Map1 S21 & S22 Subjects from B'Muir School

| | | |
|---|---|---|
| 1 | A: | .... draw a line round the swamp |
| 2 | B: | swamp + whereabouts is the swamp ? |
| 3 | A: | on your left |
| 4 | B: | where the crocodiles are ? |
| 5 | A: | dunno, where's crocodiles ? |
| 6 | B: | left of palm beach |
| 7 | A: | aye + draw a line round the crocodiles + is there a waterfall over the other side ? |
| 8 | B: | just + right just draw it round the + the crocodiles |

A high level intentional phenomenon such as 'co-operativeness' can be the product of very different sorts of underlying processor states. And of course inferring the intentional states of another processor is not an infallible enterprise, even for the discourse analyst armed with transcripts and all the knowledge relevant to the task.

Nevertheless evidence of the interpretive and generative intentional strategies in play can be seen in the data if we make a number of assumptions about a participant's goals and his processing constraints.

In discussing intentional strategies many cognitive scientists have distinguished what appears to be an overriding 'Principle of Parsimony', or more uncharitably 'Principle of Least Effort'. This is a behavioural principle which instructs processors to do no more processing than is necessary to achieve a goal. It is also assumed that goal satisfaction criteria are not fixed or invariant. In other words a processor is involved in determining what he regards as an adequate amount of success in goal achievement against the amount of processing that he is prepared to do or is able to do. The interaction of goals with available resources is reminiscent of the line taken by exponents of naturalistic epistemology. It is also the hallmark of recent approaches in the psychology of decision theory and problem solving (cf for example Kahneman & Tversky 1972, Tversky & Kahneman 1973, Slovic, Fischoff & Lichtenstein 1977). This psychological work has provided us with the concept of a 'heuristic' processing strategy. An heuristic is a procedure to determine a response to some input, the heuristic is not guaranteed to provide the <u>right</u> answer. Indeed heuristics imply that the notion of 'right response' is a product of thinking about behaviour in a normative and deterministic manner (of supposing that in any situation there is a correct way to behave). When talking about the application of an heuristic the best way to talk of the outcome is as an appropriate response given an interaction between the demands of the problem and the limitations of the processor.

What does this mean for communication in a task such as the one described in this chapter? Well we assume in looking at the data that what we are seeing is just the sort of interaction described in the last paragraph. The output is, in part, a balance between the amount of success a processor wants to achieve, or is able to achieve, with the amount of effort that he is either prepared or is able to put in. Obviously the sorts of heuristic strategy which will derive from a desire to achieve success will often conflict with principles such as Parsimony.

In terms of the map task what would it mean to talk of heuristic strategies of communication? The list below is not exhaustive, but provides an idea of the strategies it would make sense to postulate:

1. each participant assumes that their perspectives are equivalent, an assumption that information about features on the map is shared

2. participants do not modify knowledge structures until compelled to do so

3. if a knowledge structure is to be modified then modify it conservatively

4. never multiply structures unnecessarily, for example do not introduce new perspectives unless forced to

5. to secure reference minimally specify it, assume other information is shared if the manner of description is shared (ie if a feature is similarly named assume it is in the same location)

6. fill in details of objects as much as possible using background general information rather then requesting or discussing it explicitly

Together 1-6 can be seen as constituting the general Principle of Parsimony, 'do as little processing as you can get away with'. Balanced against this is the desire for success which is the requirement to do as much processing as necessary to achieve the goal criteria.

In looking at the map data we assume that processors are making on-line judgements as they communicate with one another which lead them to adopt particular communicative strategies at different stages in discourse. Language generation and interpretation is therefore assumed to be influenced by the kinds of intentional, heuristic strategy outlined. Moreover these strategies are liable to change as linguistic and para-linguistic information is sampled, tested and integrated into the growing construct which represents a processor's understanding of discourse.

Let me illustrate how appeal to these intentional strategies allows us to make sense of discourse in this task. I will look at two sets of heuristics which, as sets, constitute very different sorts of approach to the generation and interpretation of discourse in this task. One set of heuristics constitute what I have called a High Risk Communicative Posture, the second set give rise to what I have termed a Low Risk Communicative Posture.

In effect, the set of heuristics comprising the High Risk Posture amount to the Principle of Parsimony maximally applied, whilst the set comprising the Low Risk Posture are consistent with the goal requirement of a high degree of accuracy in the route replication.

These two sets of heuristics are not to be thought of as exclusive alternatives which processors must operate for the duration of a discourse. Successful communicators appear able to assess the current situation and apply both postures appropriately.

Let me first detail the sets of heuristics which comprise the two postures, then I will illustrate how they can be seen as applying in the data available. The High Risk heuristics for this task are really a task specific realisation of the heuristics 1-6 outlined above.

High Risk Posture

1.1 Minimal Difference - assume that your partner has the the same information about the map features as yourself

1.2 Minimal Specification - in the case of referential instigation, for example, minimally specify the new DO

1.3 Minimal Ontology - select as few objects as possible to relate the task to

1.4 Shared focus - assume that your partner shares your area of focus

1.5 Minimal Decentering - assume your information is secure, do not take on board incompatible information

1.6 Minimal Feedback - do not expect and do not provide feedback about each others discourse contributions

Low Risk Posture

2.1 Maximal Difference - do not assume that your partner has the same information about the map features as yourself

2.2 Maximal Specification - in the case of referential instigation, for example, provide as much information as possible so as to identify a new DO and establish its inter -relations with other mutually shared features. As a referential interpreter demand location of new DOs, check the meaning of orientation terms etc.

2.3 Generous Ontology - be prepared to introduce new DOs into discourse, be prepared to separate out what was previously assumed to be one common feature

2.4 Conservative Focus - move minimally away from the current focus, constantly check current focus of your partner

2.5 Decenter - construct a view of your partner's knowledge state, be prepared for it be be different

2.6 Maximal Feedback - provide constant information so that your partner is reminded of; the task goals, the state of your understanding of his contributions, the information you have on your map etc.

2.7 Hypothesis Formation - Constantly test your partner's representations, and hypothesise about what they might have on their map, what the next step in the task is etc.

We have already seen various aspects of these strategies at work in the extracts considered so far. Attempts to build models of a fellow participant would seem to require the operation of strategies such as 2.1, 2.3, 2.5 and 2.7. On the other hand some of the extracts contain what appear to be the deployment of high risk strategies such as 1.1, 1.3, and 1.5. For example, subjects S17 & S18 in extract 6.4 produce a performance of the task which can be classified as 'high risk'. We can also see in terms of the route which B produces how inadequate his performance is in comparison to the route A was trying to transmit, see Figure 6.19 over. If we look at an extended version of their discourse we can isolate a number of high risk strategies.

Extract 6.24
Map 1 S17 & S18 Subjects from B'Muir School

1 A: just go + start from the bottom
2 B: whereabout ?
3 A: go up + palm beach
4 B: right
5 A: then you just + go down from the waterfall
6 B: right
7 A: and up
8 B: right
9 A: up the hill + and over the bridge
10 B: I've not got a bridge
11 A: and keep going till you reach the top

In general both A and B minimally specify objects. They also use minimal ontologies, in particular, objects which the route would indicate to be relevant are not mentioned at all, eg in this extract A does not mention the swamp, the big river, the right hand set of woods, and B does not mention the crocodiles, the lion's den, the left hand set of woods. Also A provides only minimal consideration to B's problem at (2B) and completely ignores B's protest in utterance (10B); A's behaviour suggests he is minimally decentering and giving minimal attention to feedback from B.

The use of High Risk strategies by both participants is not limited to our school children. Extract 6.25 shows two university students operating High Risk strategies, again at considerable cost to the accuracy of the duplicated route, see Figure 6.20.

FIGURE 6.19a

MAP 1 PARTICIPANT A (ROUTE GIVER) SUBJECT 17

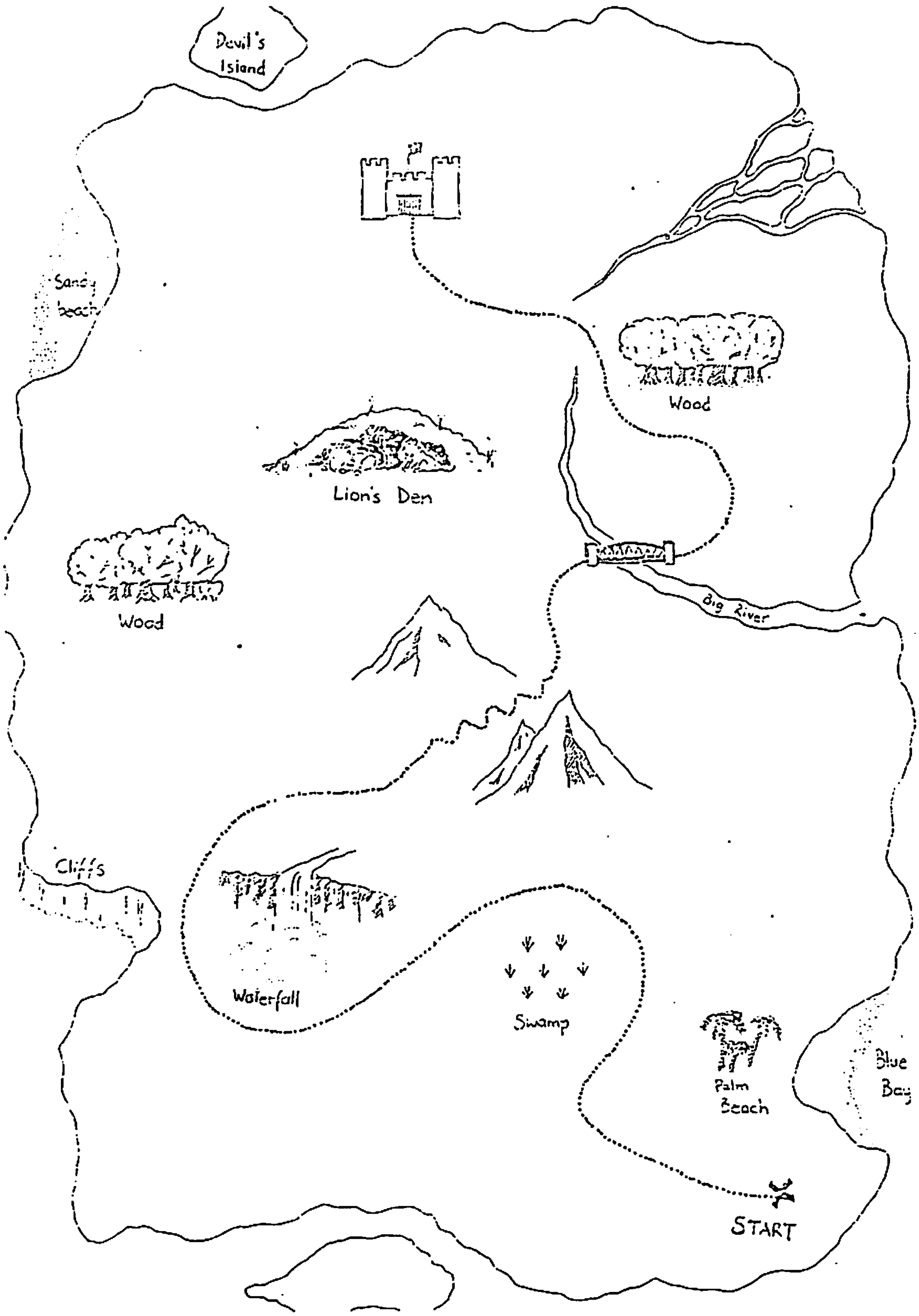


FIGURE 6.19b

MAP 1 PARTICIPANT B (ROUTE DRAWER) SUBJECT 18

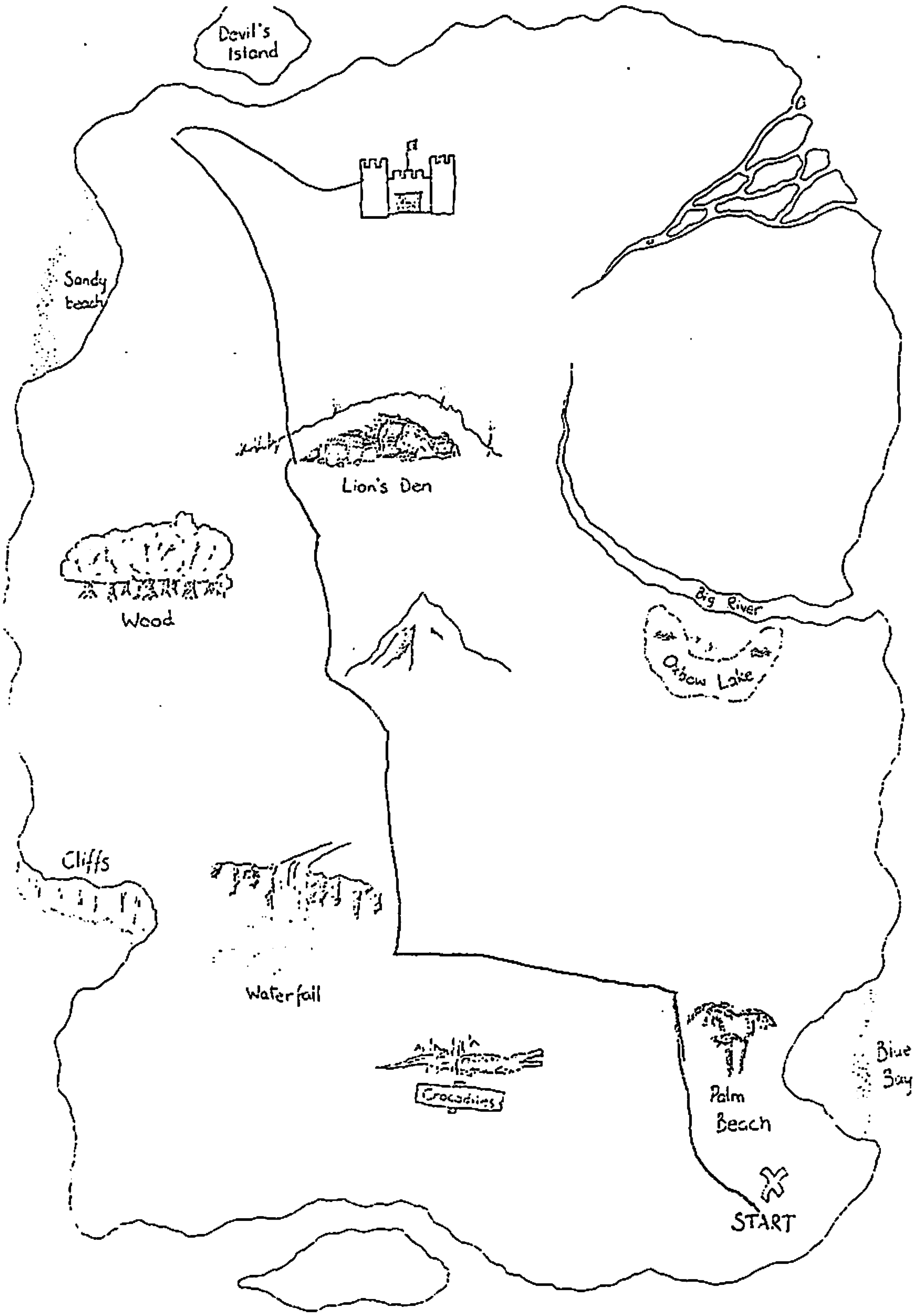


FIGURE 8.20a

MAP 1 PARTICIPANT A (ROUTE GIVER) SUBJECT 11

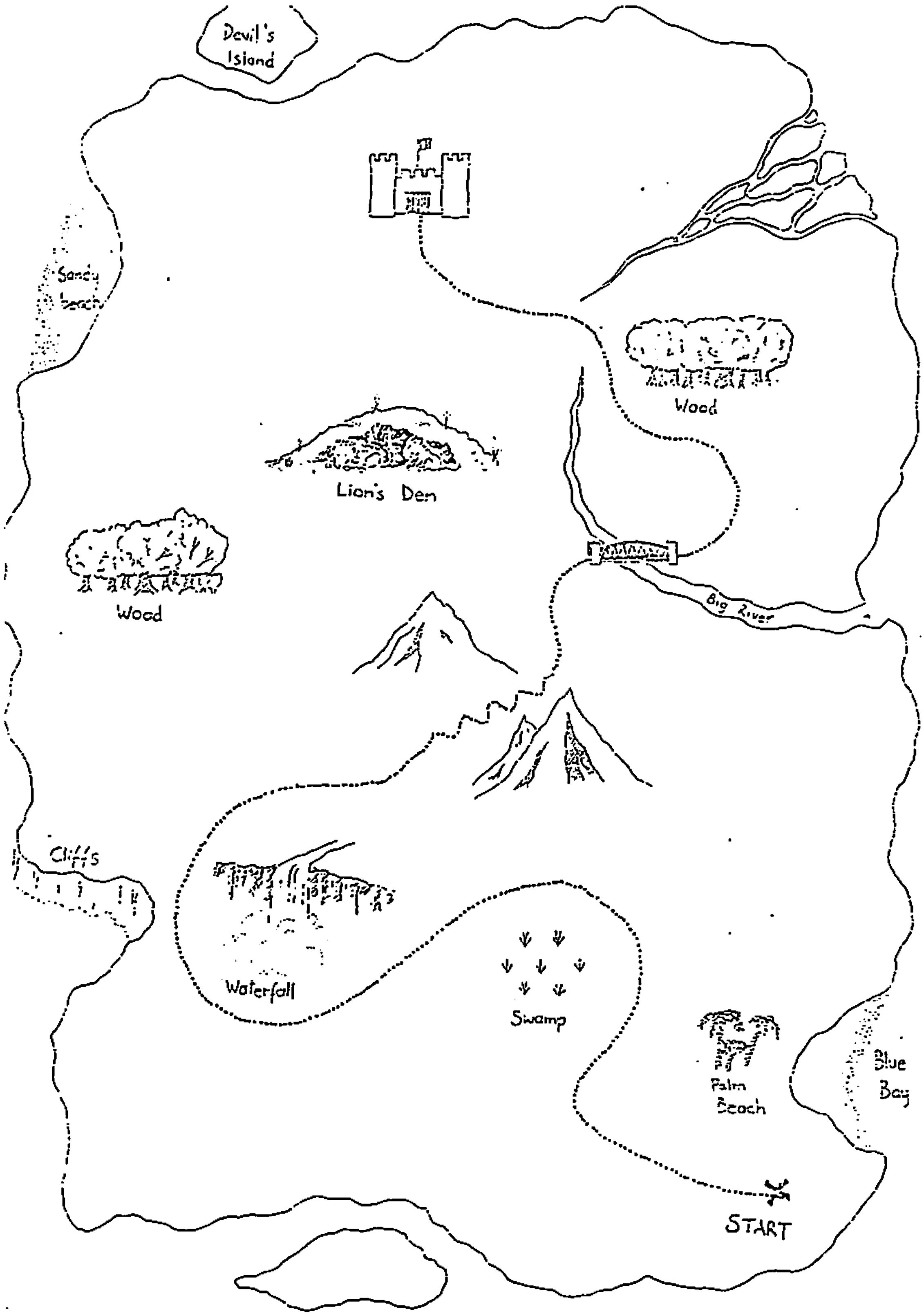
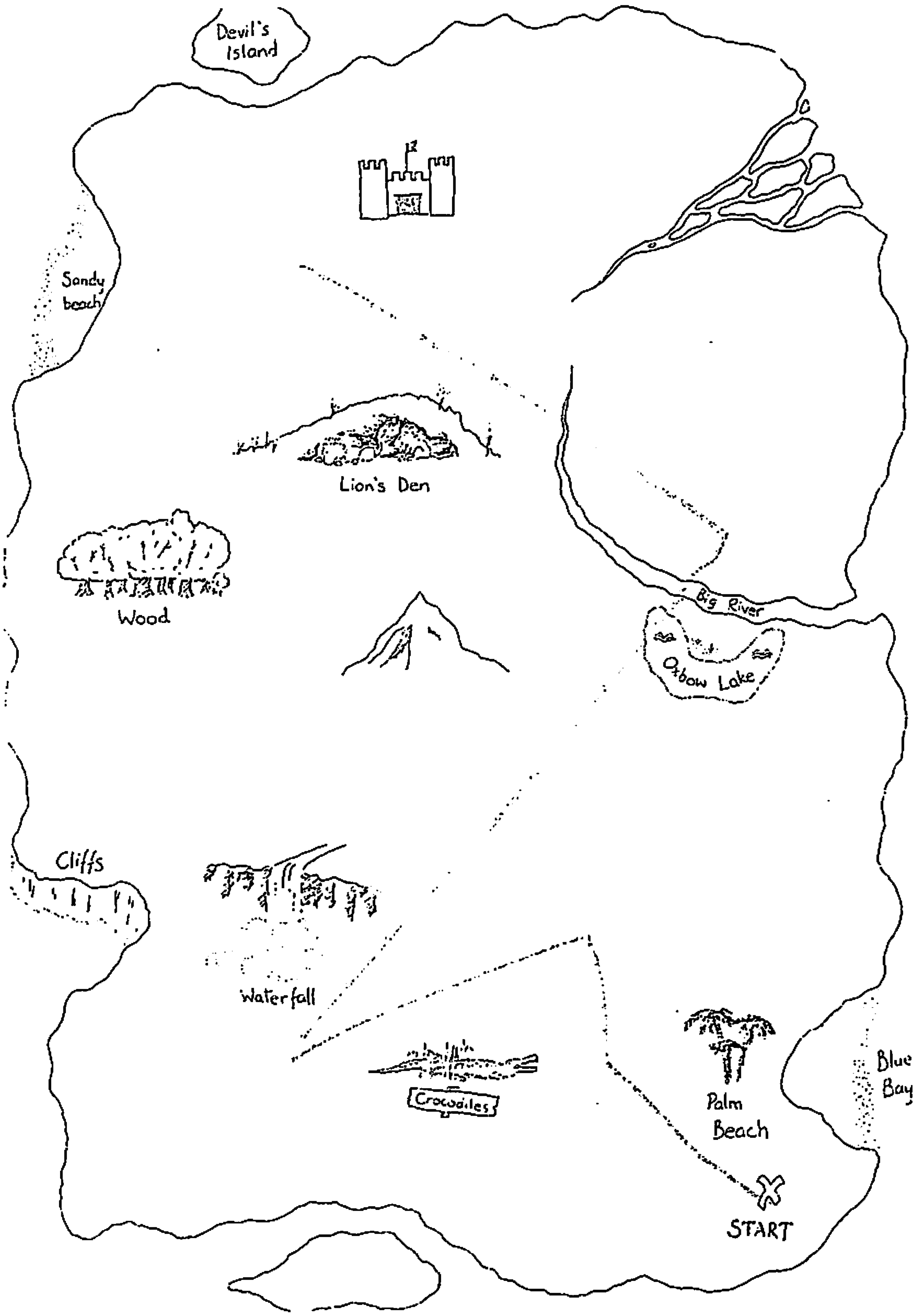


FIGURE 6.20b

MAP 1 PARTICIPANT B (ROUTE DRAWER) SUBJECT 12



Extract 6.25
Map 1 S11 & S12 Subjects from Edinburgh Univ.

1 A: .... and round the waterfall
2 B: round the bottom of the waterfall - OK
3 A: north east + until you get to the bridge, to the river
4 B: that's the big river half way there ?
5 A: yes
6 B: straight north east ?
7 A: erm yeh
8 B: yes OK
9 A: you cross the river
10 B: yeh
11 A: erm + north past the wood - er
12 B: wood + wood + oh yes I see it
13 A: yeh

Again despite B providing some feedback and checking A's instructions, notably at (2B), (4B) and (12B), both participants provide minimal specifications of features and of the route relative to the features. Moreover, features are omitted, features which could be regarded as crucial to accurate route construction, (for example the mountains are not mentioned). This behaviour together with an assumption of congruence leads them into a direct misconstrual of their referential acts in utterance (11A)-(13A), where A intends one set of woods and B's uptake is of another. More of this particular sort of problem later.

A good example of a Low Risk Posture is provided in the extended extract from subjects S7 and S8 below. This discussion concerns only a relatively small part of the route but its exhaustive nature secures an excellent duplication of the route by B, see Figure 6.21.

Extract 6.26
Map 1 S7 & S8 Subjects from Edinburgh Univ.

1 A: what in effect you are doing is curving up the side of the waterfall
2 B: yes
3 A: yeh + now just let me check if you have the next reference point + erm do you have mountains over +++ erm north east of the waterfall ?
4 B: uhu
5 A: and you also have mountains almost due north
6 B: no I have got woods due north
7 A: ah there should be two sets of mountains
8 B: well I have only got one
9 A: you have only got the one set right +++ well lets check which set you have got
10 B: have you got cliffs ?
11 A: yes I have got cliffs + yes OK er + if we go from the waterfall
12 B: erm + from the left hand side of the waterfall ?
13 A: from the left hand side of the waterfall ++ I think we have got different sets of mountains +++ wait a minute hold on ++ can I take you from the right hand side of the waterfall ?
14 B: well I have only just come from + round the bottom of the waterfall
15 A: yes + no sorry + I am just directing you + now don't dra anything yet + I'm just directing you to see if you have got the mountains
16 B: the mountains I have got are just to the right of the waterfall
17 A: well that is fine you have got one set
18 B: one set ?
19 A: well I have got two sets
20 B: you said one set was north east
21 A: right one set is sort of north east

Throughout this extract we see various Low Risk strategies in play. Throughout, A endeavours to decenter and build a model of B's viewpoint. This will enable him to engineer his route descriptions so as to be maximally useful for B. Examples of this sort of behaviour can be found in utterances (3A), (5A) and (9A). Such

FIGURE 6.21a

MAP 1 PARTICIPANT A (ROUTE GIVER) SUBJECT 7

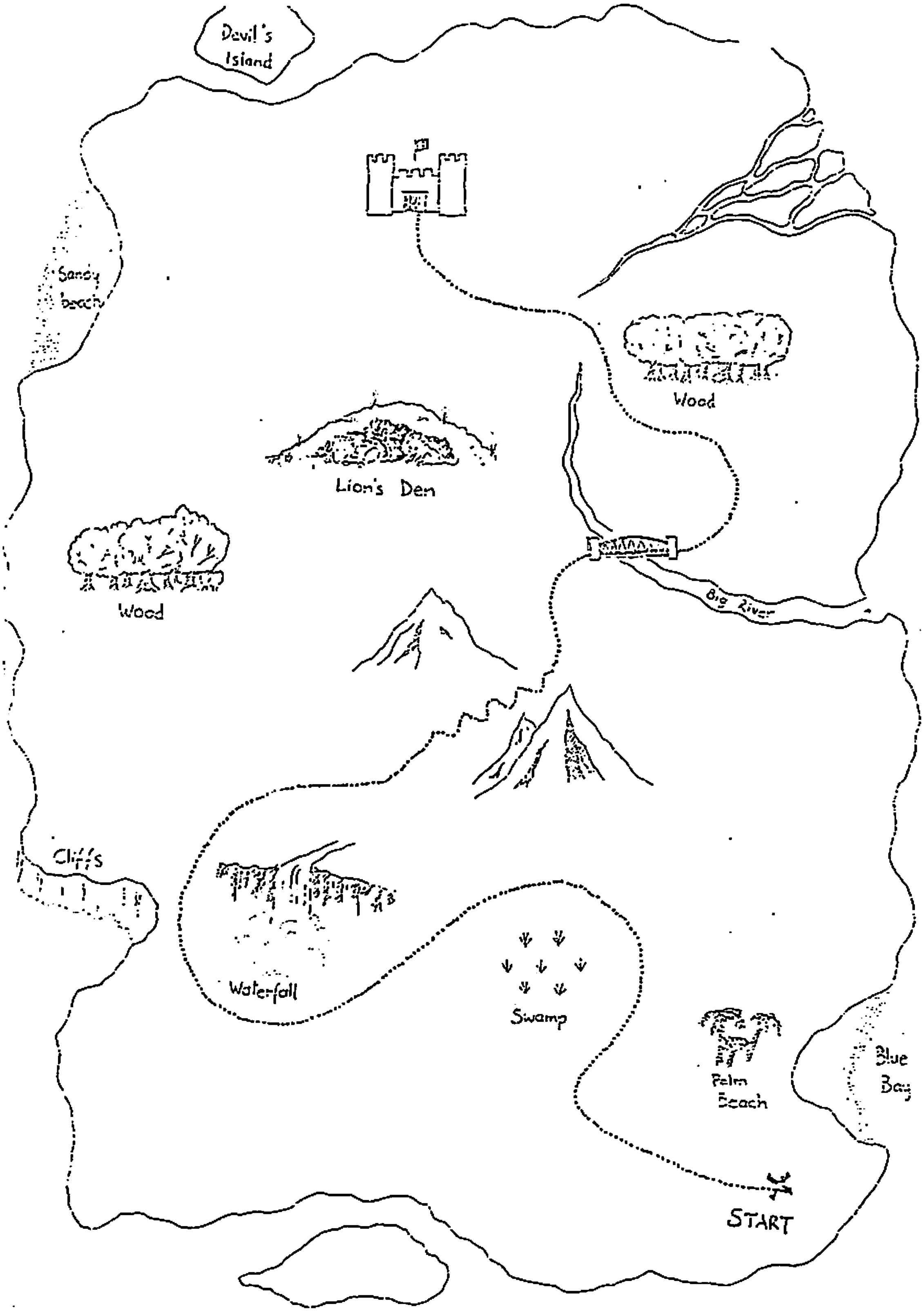
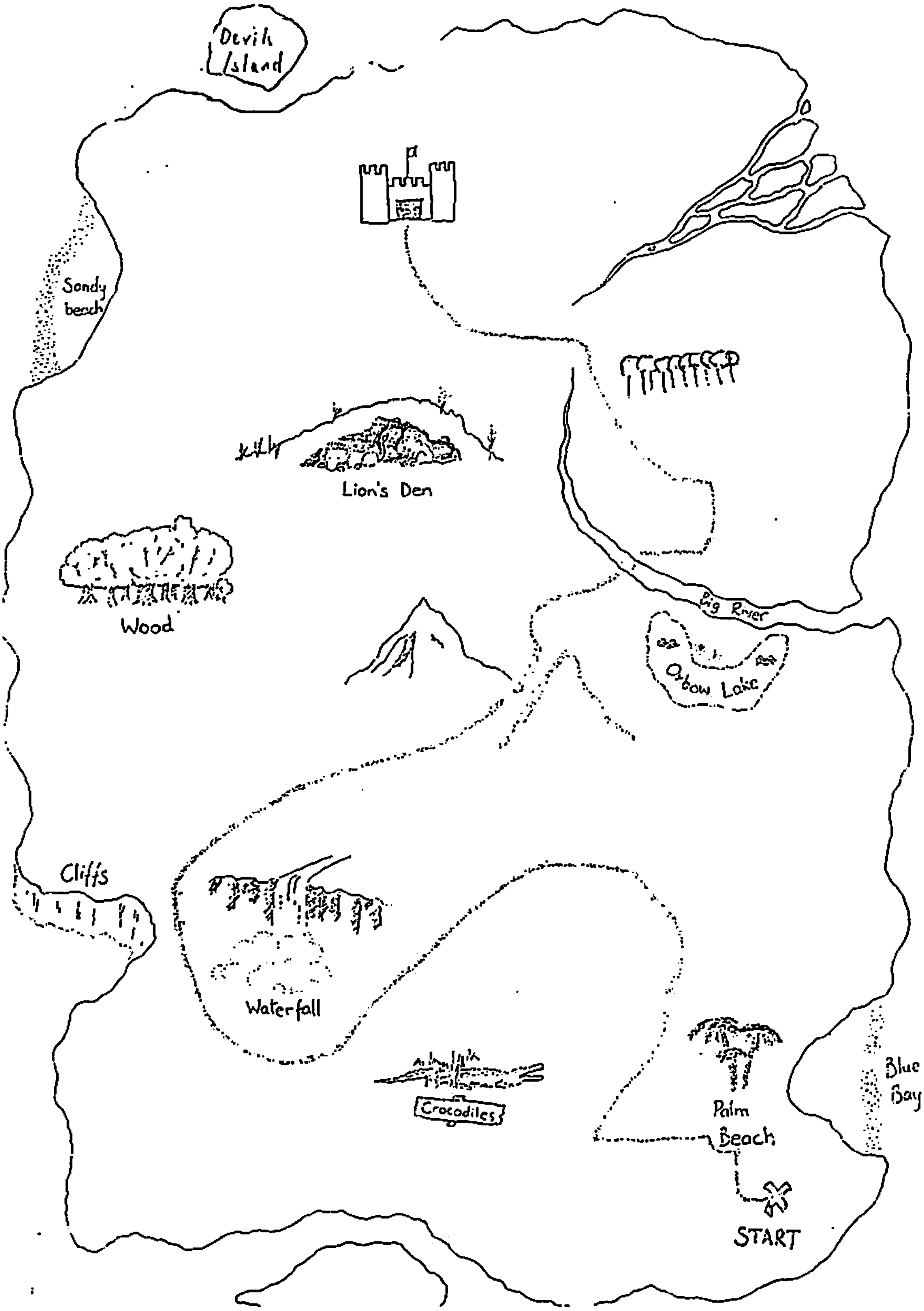


FIGURE 6.21b

MAP 1 PARTICIPANT B (ROUTE DRAWER) SUBJECT 8



contributions by A, together with B's responses, indicate that there is a clear appreciation of the incongruence of the two maps. We can also observe both participants operating a conservative focus strategy which is supplemented by detailed hypothesis formation. In particular, (13A) and (15A) serve to secure the current focus as well as establishing an immediate goal (which is to determine the content of part of each other's maps prior to B's drawing in the route). Both participants offer and receive detailed feedback, B's contributions at (6B), (8B), (12B), (20B) are all clear examples, and in some cases this feedback consists of accurate and detailed information about the features which B herself has, eg (16B).

Whilst such detailed Low Risk strategies often do yield good route duplications it would be wrong to think that an exclusively Low Risk Posture is necessarily best. The Low Risk Posture carries its own problems- for example, there are subjects who spend large amounts of time and effort specifying entities and their inter-relations in great detail before setting out to draw in the route. Unfortunately they then forget the agreed information, presumably because the processing and memory load is too great. Or again we find subjects who apply a strategy of maximal specification too rigorously. Extract 6.27 is from two subjects who seemed prepared to agree the identity of shared features only after a monumental amount of discussion. This usually led to problems about what had been agreed and established in the first place.

Extract 6.27
Map 2    S17 & S18 Subjects from Edinburgh Univ.

1 A: .... directly above the cactus you have a crashed plane
2 B: er right + erm + oh yes + er + I have a crashed plane marked here + can I + check this + my crashed plane is above it + it's in the base of the quadrant + top right hand imaginary quadrant of the erm picture + yes er + that sounds too high for me
3 A: er ?
4 B: because my cacti + my cacti + are about oh + I would say + about two inches at the moment or one and a half inches below the imaginary horizontal + er you know the half way line or the vertical dimension of this + er + sheet of paper

In general, however, the data reveals that processors adopt elements of High Risk and Low Risk Postures. The successful subjects, in terms of the accuracy of the reproduced routes and degree of referential concord, were those who displayed a flexible approach - adopting a High Risk strategy as long as they thought it would work but having the ability to switch to Low Risk ones when they deemed them necessary. Extract 6.28 demonstrates a mix of High and Low risk strategies.

Extract 6.28
Map 1 S19 & S20 Subjects from B'Muir School

1 A: go round the crocodile towards + the mountains + then round the + waterfall ++ up towards between the mountains ++ and across the bridge on the big river
2 B: what bridge on the big river ?
3 A: the river on the -
4 B: och aye
5 A: and you go + round towards the wood + but you cut off between + the tip of the + river and the woods ++ and then up towards the castle
6 B: I go up the top of the river + right
7 A: you go across the bridge right + up towards the wood + then go between the two rivers right + one at off the top of the right hand corner + and the river with the bridge on it + between that and then up towards the castle
8 B: say that again Karen
9 A: right you go across the bridge + and you go up towards a wood
10 B: wait a minute where's your bridge + I've not got a bridge
11 A: across the big river ++ you go across the big river
12 B: aye
13 A: then you go up
14 B: across it ?
15 A: uhu
16 B: right
17 A: then you go up towards the wood + but + then you go between the two rivers + one that comes in the top end at the corner
18 B: aye
19 A: and the big river
20 B: aye
21 A: and go up towards the castle
22 B: wait a minute what did you say about the woods ?
23 A: you just go + towards that but
24 B: doesn't matter I'm nowhere near the woods + right go on
25 A: and you go between the two rivers
26 B: aye
27 A: and then go straight up + just straight across to the castle
28 B: right I'm at the castle

If we look at extract 6.28 there are a number of interesting aspects to the discourse. For example, (2B) indicates that although B has interpreted A's contribution correctly she does not have a referent for 'bridge on the big river'. We can see A's response in terms of 'the river' as a way of indicating the most salient feature of what A assumes is B's big river/bridge package. B, at this point, presumably locates the river, and assumes that that will do as an identifying location and provides confirmatory feedback to A in (4B). In fact whilst both participants are co-operating they can both be charged with taking too much for granted. A assumes congruence of features, it is not clear that A realises that B does not have a bridge until considerably later in the discourse. B accepts only the most general characterisation to fix her next location point.

At (6B), B shows that she has paid attention to, and interpreted, the beginning of A's contribution (5A). A continues at (7A) with a set of well-specified directions, which include two references to the bridge (which B hasn't got) and also to the wood - (B has a wood but not in the area intended by A). B asks for a repetition of this complex set of instructions (8B) and A co-operates effectively and begins again with (9A), and once again mentions the two entities which B doesn't have. At (10B) we see B pay serious attention to a perceived incongruence, the lack of a bridge, B makes explicit this difference to A (notice that the problem with a wood is not yet mentioned). At (17A), A mentions a wood again, followed by a reference to two rivers both of which B has on her map. However, not until (22B) does B ask about the woods, apparently ignoring for as long as possible a feature which, as far as she can judge, can't relate to the task in hand, since it is not situated in the area she is currently focusing on.

This focusing aspect of the task is vital. An intentional aspect of A, his current focus, is constrained by the route on the map, so that A may not, in this case even notice the presence of a second set of woods on the left hand side of the map as a possible alternative referent for the uptake of his referential act. B's intentional focus state is not constrained in the same deterministic way. Although it is interesting that B is operating a conservative focus strategy. As a consequence B is not simply, in 6.28, recognising entities which A's expressions descriptively identify. Her attention is focused on where she is on her map- and in this case B's strategy seems to be to take in information which relates to where she is at the time when A begins to speak, to seize upon the first phrase which relates to that focal area, and then to try and identify the next move (cf for example B's response to

A's contributions at (5A) and (9A)).

We can see that application by B of a conservative focus strategy saved B from being misdirected, since she actually did misconstrue the intended referent of A's referential act at (17A).

The conservative focus strategy adopted by B in 6.28 is a feature of participants who are relatively successful in duplicating the route. They insist on securing the part of the representation which they are working on before they are prepared to move on to the next part of the route (cf for example (6B)). Other Low Risk strategies apparent in B's performance in 6.28 include demands for specification (cf for example (2B)), and requiring recapitulations (cf for example (8B)). However, B does resort to High Risk strategies, she minimally specifies (cf for example (12B) where she does not ask for the location of the bridge on the river), she sometimes ignores incompatible and incongruent information (cf for example (18B) where she ignores mention of the <u>wood</u>, and also (24B)).

Indeed it is interesting that the operation of one sort of Low Risk strategy, ie conservative focusing, can lead to a High Risk behaviour in another respect. Thus focus on the immediate route position in (18B) onwards, is one reason for B's ignoring incongruity at (24B).

To understand the processes at work in such referential exchanges one has to understand the intentional assumptions and strategies at work, one cannot rely on a link between expressions and features which is independent of the intentional states of processors. One of the consequences of this view is that different intentional assumptions should result in different referential uptakes.

In extracts 6.29-6.32 I have concentrated on interesting variations in the referential negotiation that occurred in an area of Map 1 already familiar to us from extract 6.26. In extract 6.29 B is operating relatively High Risk strategies; assuming minimal differences between maps, not using a particularly constrained focus strategy. This results in B's securing a referent for A's referential act (3A), but it is not the referent which A intended to be evoked. However, the operation of High Risk strategies results in the misconstrual not being detected and the task is completed to the satisfaction of both participants. Again the important point to notice is that A's use of the referring expression at (3A) cannot be said to refer to a feature at all on any logical account of the mechanics of reference - in the first place it is not a unique identifier. We can only account for what is clearly an <u>act of reference</u> and an <u>act of referential interpretation</u>

in terms of the communicative strategies, assumptions and states of knowledge in play at the time.

Extract 6.29
Map 1 S11 & S12 Subjects from Edinburgh Univ.

1 A: you cross the river
2 B: yes
3 A: um + north past the wood
4 B: wood + wood + oh yes I see it
5 A: yeh
6 B: now can you give me some more directions past the wood
7 A: sorry
8 B: where do I go from the river + north ?
9 A: yes but past the wood
10 B: oh dear I don't have to cross the river again do I ?
11 A: no
12 B: OK + so I'll head north west

In extract 6.30 a misconstrual of exactly the same sort as in 6.29 occurs. Again one can argue that the operation of High Risk strategies by A and B contribute to the misconstrual, a misconstrual that is never detected by the participants.

Extract 6.30
Map 1   S15 & S16 Subjects from B'Muir School

1 A: go over the bridge
2 B: right + right at the top of the big river + where it starts from + where do I go from there ?
3 A: round past the woods
4 B: what
5 A: have you got woods ?
6 B: yes + but I'm on top of the big river
7 A: you should be half way down it ++ go between the river and the trees
8 B: the river and the trees
9 A: at the top
10 B: where did you say I was to go between + the woods and the river ?
11 A: aye
12 B: OK .......

Lastly extracts 6.31 and 6.32 provide cases where low risk strategies actually reveal the incongruences between the maps, allowing the participants to gain accurate representations of each others' knowledge states and use this information in the construction of referential discourse.

In 6.31 B provides excellent feedback to A, at (4B), indicating that he cannot make sense of A's instructions which involve mention of the <u>woods</u> which as far as B can see are way removed from his current location.

Extract 6.31
Map 1 S1 & S2 Subjects from B'Muir School

1 A: go over the bridge
2 B: erm ?
3 A: then do a wee half circle + beneath the woods + after the bridge just continue it into a half circle + just below the woods
4 B: I'm not at the woods I'm at the river
5 A: aye but see where the wood is ?
6 B: uhu
7 A: the other woods + there's two woods
8 B: I've only got one
9 A: there's one on the right
10 B: no I've only got one
11 A: well there's a wood on the right
12 B: OK right
13 A: erm go through
14 B: no
15 A: the wood on the right is about an inch from the end of the island ken what I mean ?
16 B: uhu

To A's credit he realises that there is a potential ambiguity in his use of the referring expression in (5A) and points this out in (7A) (the left hand set of woods has been mentioned and introduced as a DO earlier in the task). B immediately interprets this as indicating an incongruence and signals this to A in (8B). From this point on there is no problem in the subsequent referential acts involving the expression 'the wood', A specifies its location and B signals that he understands A's point of view at (16B).

In 6.32 B suspects the possibility of multiple referents from A's initial introduction of a DO at (1A). B expresses this suspicion at (2B) and subsequent discourse seeks to establish the location of the intended referent of A's referential act in (1A).

Extract 6.32
Map 1 S13 & S14 Subjects from Edinburgh Univ.

1 A: .... have you got a wood just north of the river ?
2 B: a wood yes + but the wood is on + of course it could be a different wood the one I have is on the left
3 A: OK well + if you draw ++ the wood is on the left ?
4 B: yeh above the cliffs
5 A: oh well that is a different wood + I have got two woods
6 B: OK well whereabouts is this wood in relation to the lake + can I explain where the lake is
7 A: OK where is the lake

In these cases of discourse reference to ask for the referent of terms like 'wood' one has to take into account the intentions of the participants. Thus on A's map, unless we have recourse to his perception of intentional factors such as constrained focus being operational, there is no answer to the question of how he could refer unambiguously with terms like 'the wood' when he knows there are two referents available. From B's point of view how could he ever detect the possibility of ambiguity in A's use of a term, since this use can be seen as unique reference because for B there is only one referent.

## SECTION FOUR CONCLUDING REMARKS

This chapter has tried to establish a number of points. Firstly, in section three I tried to show how data elicited from a controlled task domain provides clear evidence that processors use information derived from the models they construct of the knowledge states of their interlocutors in order to generate and interpret acts of reference. The P-C system of description is able to capture the information states relevant to these sorts of derivative referential acts.

Throughout the data we see that discourse in general and referential communication in particular is conducted against a background of _intentional strategies_. In such 'referential interaction' processors set limits on the amount of information and detail they require for the identification of a shared feature.

We looked in section four at the kinds of strategy that might be implicated in the data from our map task. These strategies were, of course, intentionally derived, since they were cognitive in origin.

No system of referential description comes close to capturing the intentional complexity of the cognitive system. It would require, amongst other things, the embodiment of processes able to implement rich theories of decision and action. However, a processor centred approach does, at least, make us sensitive to the _role_ of intentional machinery in the mechanics of reference. Looking at things in a processor centred manner also suggests that opacity must be a feature of our interaction with the world and others in it. It is bound therefore to make us think about what is to count as success in communicative interactions.

Success for a processor is relative to his needs, goals, beliefs and strategies. I will call this sense of the word success its 'open texture' sense.

It would be wrong to think of this sense of success as being synonymous with 'the right answer'. Rather, the success a processor aims for will be an outcome which is appropriate given the structure of the problem and the information processing constraints of the cognitive system.

Processors aim at a degree of success consonant with their intentions. In the map task, as analysts there is some notion of objective success to be appealed to, let us call this the 'closed sense' of success. We can 'measure' the degree of closed success by looking, for example, at the route drawn by one of the participants and compare it with the one the other speaker has, or by viewing referential acts in the context of our 'Omniscient' knowledge of both maps. It is important to realise that this success is not available to the participating processors.

The map task is not special in this respect. Processors generally cannot judge communicative success by some appeal to a closed sense of success embodied in absolute states of affairs external to them. Rather in using language the processors involved judge by the criteria operational at a particular time whether communication has been successful. The criteria for identity and reference are constituted out of the intentions processors bring to the generation or interpretation of language.

In the next chapter I will be looking at some detailed aspects of referential behaviour in the map task. I will try to demonstrate that once again the multiple perspectives and dynamic modelling of informational states which the P-C descriptive system offers, yields real insights into the role and function of elements of our language.

## CHAPTER SEVEN DEPLOYING THE MODEL- REFERENCE AND DENOTING PHRASES

In this chapter I will present an analysis of the use of indefinite and definite phrases (what Russell called 'denoting phrases') in discourse. The analysis was inspired by the apparatus for referential description which was used in the last two chapters. The account given in this chapter of the semantics of the indefinite and definite stands in contrast to the formal one presented in chapters 1, 2, and 3. The analysis concentrates on the specific and referential use of the the indefinite and definite respectively. Thus I will be restricting myself to discussion of the indefinite article as it appears in the subcategorisation frame 'a + count noun' and in its indefinite plural form. Discussion of the definite article will be as it appears in the subcategorisation frame 'the + count noun'. I shall not consider the generic use of the definite or indefinite article, nor the predicative use of the indefinite.

This chapter attempts to show, contrary to the standard logical treatment, that we have to sometimes view indefinites and definites as full-blooded referring expressions. In the certain domains of use, it appears that the difference between the distribution of definite and indefinite forms has to do with the perception by processors of their interlocutor's knowlegde about the objects of discourse- it is nothing to do with notions of uniqueness in a model etc.

The apparatus of partitioned perspectives suggests a powerful and general account of indefinite and definite use. This account provides additional support for the utility of the PC model.

The first part of this chapter will consist of a resume of the most influential and established ideas concerning the semantics of definite and indefinite expressions. The second part of the chapter presents data which poses severe problems for these established views. The data seems amenable to analysis using the P-C descriptive system, indeed the result is a rather interesting analysis of the role of denoting phrases.

## SECTION ONE THE VIEW FROM FORMAL SEMANTICS - A RESUME

In earlier chapters we saw that formal semantics provides one particularly influential and univocal account of the semantics of definites and indefinites. Formal semantics

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Footnote 7.1. Exceptions, to a limited extent, are Frege's view of definite descriptions, and Fodor & Sag's (1982) claims about certain classes of indefinite expression.

generally (Footnote 7.1) assigns the indefinite article the semantics of the existential quantifier 'E', whilst the definite article is given a Russellian analysis. First Order glosses of these two views can be given as:

(7.1) '(Ex)F(x)' is understood as 'For at least one object, 'x', in the domain (or world) D, 'F(x)' is true'

(7.2) '(Ey)(F(y)&(x)(F(x)-->x=y))&G(y)' is understood as 'There is one and only one object, 'y', in the domain (or world) D, such that 'F(y)' and 'G(y)' are true'

As we have already seen in earlier chapters, a number of consequences follow from a quantificational interpretation of the articles.

1 The non-referring nature of definite and indefinite expressions

As a quantification over variables the quantified indefinite and definite expressions are not treated as referring expressions. Variables are not held to refer.

2 The cardinality of definite and indefinite expressions

The existential quantifier requires that at least one object satisfy the expression it quantifies. The definite determiner is analysed in such a way that one and only one object is held to satisfy the expression quantified into.

3 The scope principles of quantified definites and indefinites

The scope of quantifiers determines which variables the quantifier can bind.

The features outlined in 1-3 have been used to provide explanations for many semantic facts. For example, if we consider 1 and 2 jointly we can explain why sentence (7.3) is not false in situations where three students failed the exam.

(7.3) A student failed the exam
(7.4) (Ex)(student(y)&fail(y,(ix)(exam(x)))

The existential operator analysis of 'a' is seen to set conditions on the cardinality of the indefinite expression. It establishes the minimal case for what is to hold with respect to the satisfaction of the indefinite expression in order that the sentence be true. Moreover, if we _were_ to understand _a student_ as a full blooded referring expression, then on the truth-conditional view, (7.3) would have to amount to the claim that there was one, and only one, student who failed the exam. It is claimed that the existential operator analysis is in accord with our intuitions since we would want to resist the previously mentioned inference from (7.3).

Scope we have looked at extensively. It has been used to account for specificity in indefinite expressions, expressive responsibility, referential readings of definite expressions, and intensional/extensional ambiguities.

I have argued that, for example, both specificity and expressive responsibility are intentional phenomena, and that whatever scopal flavour there may be to some of these distinctions is a result of the possibility of descriptions/expressions originating out of embedded models.

A basic problem is that in the case of genuine referential expressions, the formal view has reference as a relation between referring expressions and the objects which they denote. Referring expressions are held to uniquely specify the individual objects in the world or model which the language is being interpreted over. Within this paradigm no status is accorded to the beliefs and intentions of speakers. There is no serious recognition of the fact that natural language consists of utterances produced by interlocuters with cognitive states and histories.

## SECTION TWO DEFINITES AND INDEFINITES - INTENTIONAL ACCOUNTS

Intentional views have a basic language-user orientation. They attempt to provide an account of what motivates a speaker to choose an indefinite or definite expression on a particular occasion of communication.
Unfortunately, such theories are no less susceptible to 'Imperialist pretensions'; assuming that a univocal

account is possible for the 'use' of these various expressions in all contexts.

## 1. FIRST AND SECOND MENTION

One well-established intentional view is that the occurrence of the indefinite or definite noun-phrase is determined by whether its use constitutes the first occasion of mention of the referent. Clark & Clark (1977) advance such a view:

> adults use the indefinite article to introduce new information [...] the first mention is usually marked by the use of the indefinite article and subsequent mentions have the definite one. (Clark & Clark 1977:368)

Psychologists have added a developmental aspect to this. Warden (1976) and Maratsos (1974,1976) found that children only gradually approach the adult model described above. This suggests that the conventions for using the indefinite and definite article in a story, for example, take some time to develop.

This 'first-second mention' model also appears in Prince (1981) and Kuno (1972). In a careful discussion of this and related issues, Dahl (1976) points out that it is rarely made clear what is held to constitute 'first and second mention'.

Dahl's criticism notwithstanding, Prince's (1981) model is a good example of an intentional theory of indefinite and definite use. It attempts to give a comprehensive account of the distribution of referential forms in discourse. She provides a taxonomy of the types of discourse entity introduction, she then maps these types onto particular referential forms. The four main categories of discourse entity introduction are listed in Table 7.1, together with the forms typically used in these situations. Notice that her claim as to when the indefinite form is used is a very strong one. Effectively, indefinites mark the introduction into discourse of brand new referents which are not in any way known to the hearer.

TABLE 7.1

| Mode of discourse entity introduction | Form of referential expression used |
|---|---|
| Brand New Entity - Speaker assumes it is not in any way previously known to the hearer | Typically 'a + noun' |
| Inferrable - Entities the speaker assumes will be inferrable by the hearer from general knowledge | Typically 'the + noun' |
| Evoked Situational - Entities which are salient in the environment in which the discourse is occurring | Typically 'the + noun' |
| Textual Situational - Entities which are salient in the context of the discourse itself, two types: | |
| Current - pronominal reference back to a discourse antecedent | Typically a pronominal form |
| Displaced - reference back to a discourse antecedent displaced from 'focus' | Typically 'the + noun' |

In data elicited by Brown & Yule (cited in Brown & Yule 1983) this model was seen to provide a good description of the observed distribution of 'referential forms'. In their experiment undergraduates worked in pairs, one undergraduate had a geometric diagram in front of him which the other could not see. The undergraduate with the diagram had to instruct his partner so that he could replicate the diagram on a sheet of paper he had in front of him. An analysis of the instructions revealed that the percentage of 'referring expressions' having a particular syntactic form when involved with a particular sort of discourse entity introduction was as shown in Table 7.2.

TABLE 7.2

| Form class | B. New | Inf'ble | Sit'nal | Cur. | Dis. |
|---|---|---|---|---|---|
| a + noun | 98% | - | - | - | - |
| the + noun | 2% | 100% | 58% | 24% | 100% |
| pronoun | - | - | 9% | 65% | - |
| ellipsis | - | - | 33% | 11% | - |

The fit of the data to the claims which Prince makes is rather impressive. Presumably it is because of this coincidence, and the fact that examples of this type of data come so easily to mind, that we are liable to accept the generalisations made in this model as true for English in all 'types of discourse'.

2. REFERENTIAL EXCLUSION

A rather different account is provided by Hawkins (1976,1978,1980). He argues that as a pre-requisite for indefinite expressions <u>to be used to refer</u> to an object, there must exist at least one more such object which the utterance can exclude. He cites examples such as (7.5)-(7.9) to illustrate his 'exclusion principle'.

(7.5) Fred lost a leg during the war
(7.6) Fred lost a nose during the war *
(7.7) I didn't buy the house, because a window was broken
(7.8) I didn't buy the house, because some windows were broken
(7.9) I didn't buy the house because a roof was leaking *

In (7.5) Fred originally had two legs and so it is possible to refer to one (the one he lost) which excludes the other one from the reference. Such an exclusion is not possible in (7.6) and to attempt to signal it with 'a' results in a marked reading. Similarly in (7.7)-(7.9) we know houses normally have several windows and only one roof. Hawkins argues:

> Both 'a window' and 'some windows' can refer to some only of the total number of windows in the house, while excluding others from the reference, but 'a roof' would necessarily be referring to all the roofs of the house, ie one only. Since the exclusion of at least one object from the reference cannot be satisfied within the pragmatic domain of interpretation (the parts of the house in question) 'a roof' cannot be understood as referring to the roof of the previously mentioned house. (Hawkins 1980:54-55)

Hawkins recruits the notion of 'inclusion' to explain the use of the definite article. The definite article acts as an instruction from speaker to hearer that the hearer should 'locate' the referent of the definite expression within one of a number of sets of objects which are again pragmatically defined on the basis of shared speaker-hearer knowledge and situational context. The hearer, according to Hawkins:

> [...] locates the referent in the sense that he understands that the object referred to is a member of the appropriate, pragmatically identifiable set. The definite description refers 'inclusively' to the totality of the objects (or mass) satisfying the referring predicates within the relevant pragmatic set. (Ibid:54)

## 3 DEFINITES, INDEFINITES AND UNIQUENESS

Venneman's (1975) account stands in direct contrast to Hawkin's view. Venneman argues that 'discourse subjects' can arise, or be given, (a) by general knowledge (including knowledge shared by just the interlocutors) or (b) the situative context of the discourse or (c) by the preceding part of the text of the discourse. If the discourse participant is relying on (c) as a way of getting discourse subjects into discourse models then the only way to get the discourse subject into the discourse initially is via:

> [...] an indefinite description (which presupposes the existence in the real or some possible world of the kind of phenomenon described by the predicate(s) used in the indefinite description). From the first mentioning on, the unique existence of the discourse subject introduced textually is presupposed, and the discourse subject will in the continued discourse be referred to by an individual name, a definite description, or a text-deictic expression, ie a pronoun. (Venneman 1975:316)

Venneman is sensitive to the part played by the knowledge which interlocutors bring to discourse in providing the source of discourse subjects. He also goes along with a 'first and second mention' model in order to determine when the indefinites and definites will occur. However, he is insistent that, no matter how a discourse subject is introduced, whether textually or not, once it has been introduced, the unique existence of the discourse subject in a world actual or possible is presupposed. It is hard to imagine how a particular referent might exist other than uniquely! Presumably, what is at issue is the existence of an object which uniquely satisfies the predicates used to refer to it in the text. Venneman's formal semantic background is apparent here. Within formal semantics, 'referring expressions' are interpreted as assertions that there is one and only one object which satisfies the predicates contained in the 'referring expression' itself. In this sense Venneman's claim is either trivial or misconceived. It is trivial because the prototypical relationship which underlies interpreted logical languages is the name/bearer relationship. It is a maxim in the logician's enterprise that the name/bearer relation should always be regimented in a logical language so that there is an unambiguous and unique relation of individual objects to names (cf for example Dummett 1981a). Venneman's point appears misconceived if we construe uniqueness as the commitment to the existence (in a world) of objects uniquely satisfying the predicates ascribed to them in a discourse. This is far too strong for the normal use of 'referring expressions' in language. Johnson-Laird & Garnham argue:

> Linguists and philosophers have often noted that a definite description can lead a listener to infer the existence of a unique entity if the description occurs in the absence of a prior identification of the entity. They have seldom noted that such a description often establishes uniqueness only with respect to the current discourse model. (Johnson-Laird & Garnham 1980:377)

In a sentence like (7.10) we do not want to be committed to the presupposition that there is one and only one man living next door to the speaker.

(7.10) The man who lives next door to me has bought a car

If uniqueness is relevant at all it is uniqueness in a discourse model rather than in reality which controls the use and interpretation of descriptions.

## SECTION THREE DENOTING PHRASES AND DISCOURSE

The claims made in the three views outlined are general across all types of discourse. Yet if we examine naturally occurring language there appear to be uses of definite and indefinite expressions which do not seem to be helpfully characterised in any of these accounts.

Brown (1983) cites a piece of conversation recorded between a young Scotswoman, A, and her elderly cousin, B, who she has not met for several years:

Extract 7.1

B : where I stayed was in Mea + was off Morningside Road
A : oh + yes + that's not far from Granpa's house
B : yes + just further on + in the bus + you know the Plaza + there was a Plaza + do you remember it + further on
A : erm
B : it was the next stop

To most of us it is fairly clear what is happening in this discourse fragment. Indeed we can appreciate how the various expressions relating to the _Plaza_ - 'the Plaza'- 'a Plaza'- 'it'- are being used by the instigator of the intentional act, and how the discourse object 'the Plaza' is introduced into their respective models of the conversation.

What would the views cited make of this data? The Formalist would have to deny that genuine reference had occurred at all in B's second utterance. And yet we do not feel happy with such a claim, surely A's subsequent puzzlement was more than a realisation that no referential act could in principle have occurred in the previous utterance!

We should also note that the first mention of the _plaza_ takes the form of a definite description, and the instigator appears to assume that her interpreter will know the object she thereby refers to. Moreover, even the subsequent use of the indefinite expression 'there was a Plaza' does not obviously suggest that the object the instigator is speaking of is unidentified, or expected to be unidentified by the interpreter.

What we as fellow linguistic processors suspect is that a change has occurred in the instigator's expectations, presuppositions, about what might be recovered from the background knowledge of her interlocutor. This change is difficult to characterise under any of the models available to us so far. Why does she use an indefinite expression after having used a definite expression first? An advocate of the first-second mention model might suggest it is because the instigator realises she has failed to follow the rule of first mention. I would suggest that few of us would think this provides an adequate account.

Is it then because she realises that the Plaza cannot in any way be known to her interlocutor? This claim would seem incongruous in the light of her next remark 'do you remember it?'.

Is the distribution of forms in this example occasioned by the fact that she finally applies an 'exclusion' principle because she thinks there may be a number of such objects the interpreter may know about and she is intent on excluding the one she has in mind from the rest? Again this does not look right.

What we might say is that none of the models considered so far seems to give a satisfactory account of what is going on in this particular context. How might we capture this kind of distribution, this kind of referential exchange?

## SECTION FOUR DENOTING PHRASES AND EMBEDDED PERSPECTIVES

The exchange in extract 7.1 seems to arise out of a change in the referential instigator's presuppositions about what might be available knowledge for her interlocutor. This is somewhat reminiscent of the situations which prevailed when participants were engaged in the map task. In fact the map task provides a controlled domain in which to attempt to equate the distribution of forms with the states of knowledge of the various participants.

Let us consider processor A's EM at the start of Map 1. Assuming that he first considers the feature start, there are a limited number of ways in which he can assume knowledge of this feature to be distributed between his primary perspective, 'aep', and his fellow participant's primary perspective, 'a/bep'. I am not at this stage going to consider third level perspectives; the model I want to propose is best approached by first looking at this simple two level system. The number of possible EO configurations is shown in Figures 7.1-7.4. As in the previous chapter I will assume that throughout the EOs are tokens.

FIGURE 7.1
POSSIBLE CONFIGURATION FOR PART OF A'S EM AT BEGINNING OF MAP 1

```
Part of A's active EM_______________________
|                                            |
|.eo1| aep    [<A1,BOT RIGHT>,<A2,START>]|   |
|    | a/bep  [       :             :    ]|   |
|                                            |
|                                            |
|____________________________________________|
```

FIGURE 7.2
POSSIBLE CONFIGURATION FOR PART OF A'S EM AT BEGINNING OF MAP 1

```
Part of A's active EM_______________________
|                                            |
|.eo1| aep    [<A1,BOT RIGHT>,<A2,START>]|   |
|    | a/bep                             |   |
|                                            |
|                                            |
|____________________________________________|
```

FIGURE 7.3
POSSIBLE CONFIGURATION FOR PART OF A'S
EM AT BEGINNING OF MAP 1

```
Part of A's active EM_________________________
|                                             |
|.eo1| aep    [<A1,BOT RIGHT>,<A2,START>]|    |
|    | a/bep?                            |    |
|                                             |
|                                             |
|_____________________________________________|
```

FIGURE 7.4
POSSIBLE CONFIGURATION FOR PART OF A'S
EM AT BEGINNING OF MAP 1

```
Part of A's active EM_________________________
|                                             |
|.eo1| aep                               |    |
|    | a/bep  [<A1,BOT RIGHT>,<A2,START>]|    |
|                                             |
|                                             |
|_____________________________________________|
```

Figure 7.1 represents the case where A believes that he and his fellow participant both have a feature <u>start</u> in a common location. Figure 7.2 represents the situation in which A has this feature, and he believes that B does not. Figure 7.3 is the case where A has a feature and he wonders whether B shares it. He is uncertain as to whether B has it. Finally, Figure 7.4 represents the case where A has discovered that B has a feature which he does not have (in fact this configuration does not hold for the feature <u>start</u> and the route giver in Map 1, but it can for other features).

These various P-C representations may, for the sake of space, be collapsed into basic configurations representing the absence or presence of information about a particular feature. This simplified notation is shown in Table 7.3.

TABLE 7.3

| | Perspect | Content | Perspect | Content |
|---|---|---|---|---|
| Figure 7.1 -> | aep | + | a/bep | + |
| Figure 7.2 -> | aep | + | a/bep | |
| Figure 7.3 -> | aep | + | a/bep | ? |
| Figure 7.4 -> | aep | | a/bep | + |

One may ask why all the possible configurations, which result from three values in two perspectives, are not shown. Each of the configurations shown in Table 7.4 is, for one reason or another, not possible in the context of this task.

TABLE 7.4

| Perspect | Content | Perspect | Content |
|---|---|---|---|
| aep | ? | a/bep | + |
| aep | | a/bep | |
| aep | ? | a/bep | ? |
| aep | ? | a/bep | |
| aep | | a/bep | ? |

The first of these additional configurations would correspond to the situation where A knows that B knows of a feature, but A himself is not sure of his own perspective on it. In the toy world of the map task we assume that A is able to decide whether or not he knows of an object. In actual practice it is possible to think someone else has definite knowledge about an object which you think you know about but cannot bring to mind.

We also accord no sense to the second configuration, which suggests that both A and B know that they have no information about an object and no derivative knowledge from any other source.

There is a problem in knowledge representation in distinguishing cases of knowledge of the absence of objects or features, and total ignorance of objects or features. If we take A's P-C point of view, A may come to realise that he has no perspective on a feature through derivative information he receives on the feature from B. This case is covered by the configuration (aeb a/aep +).

The third and fourth configurations are ruled out in the map task for the same reasons as the first configuration in 7.4. We assume that A cannot be unsure as to whether a feature is present on his own map or not.

The fifth configuration of Table 7.4 is ruled out on the grounds that A cannot be ignorant of a feature and then be in doubt as to that feature's presence in 'a/bep'.

Let us consider the role of the referential instigator and interpreter modulo these configurations. A referential instigator who makes first discourse reference to an object can be in any of the configurations shown in Table 7.5.

TABLE 7.5

| | Perspect | Content | Perspect | Content |
|---|---|---|---|---|
| i | Ins ep | + | Ins/Int ep | + |
| ii | Ins ep | + | Ins/Int ep | |
| iii | Ins ep | + | Ins/Int ep | ? |

The referential instigator (Ins) must have the object at a primary perspective. If he has derivative knowledge of an object from his partner, he cannot be the referential instigator. The first configuration, (i), is that in which the instigator assumes his interpreter has the object as well. Else he may, in advance of his act of reference, assume that the interpreter does not have the object, configuration (ii). Finally the instigator may be unsure about whether the interpreter has a contentful primary perspective on the object, configuration (iii).

As a referential interpreter a participant may be represented as in any of the configuration detailed in Table 7.6.

TABLE 7.6

| | Perspect | Content | Perspect | Content |
|---|---|---|---|---|
| i' | Int ep | + | Int/Ins ep | + |
| ii' | Int ep | | Int/Ins ep | + |

The interpreter can either think he shares the object introduced into discourse, as in (i'), or else he can believe he does not have it, as in (ii').

Let us now look at some of the data obtained from our subjects. As we saw in the last chapter, we can characterise the state of knowledge of a current speaker before his utterance by appeal to what he has on his map and the history of the discourse up to this point. What I shall do now is note the form of the expressions used in various 'knowledge configurations' where reference is made to new discourse objects or back to pre-established ones.

The extracts below are taken from our two populations of 16 year old Scottish Secondary school children and Edinburgh University students. The first set of extracts are typical of interchanges at two points on Map 1. The parts of Map 1 at issue will be familiar from chapter 8. At the bottom right hand corner of Map 1 there is a palm beach, and a waterfall at the bottom left hand corner. Both participants have these features marked. One of the participants (the instruction giver) has a _swamp_ lying between these two features, the other participant has _crocodiles_ marked. Also on Map 1 both participants have the feature _Big River_ but only the instruction giver has a _bridge_ marked across the _river_.

Extract 7.2
Map 1 S13 & S14 Subjects from B'Muir School

1 A: Have you got wee palm trees aye?
2 B: uhu
3 A: right go just + a wee bit along to them + have you got a swamp ?
4 B: er
5 A: right just go + have you got a waterfall?
6 B: aye
7 A: go + between the palmtrees and the waterfall
8 B: but I've got crocodiles
9 A: you've got what?
10 B: crocodiles
11 A: whereabout?
12 B: in between the waterfall and the palm trees
13 A: right + go in between the crocodiles and the palm trees

Extract 7.3
Map 1 S7 & S8 Subjects from Edinburgh Univ.

1 A: ok you are going to come about one inch below that palm beach
2 B: uhu
3 A: and ++ you are not quite horizontal you are taking a slight curve up towards the swamp + not obviously going into it
4 B: well sorry + I've not got a swamp
5 A: you have not got a swamp
6 B: no
7 A: ok
8 B: start again from the palm beach

Extract 7.4
Map 1    S21 & S22        Subjects from B'Muir School

1  A:  draw a curved line towards the bridge
2  B:  bridge?
3  A:  at the Big River
4  B:  there's not a bridge
5  A:  eh?
6  B:  there's not a bridge
7  A:  just draw a line + going across the river + the Big River
8  B:  anywhere on the river?
9  A:  aye

Extract 7.5
Map 1    S5 & S6        Subjects from Edinburgh Univ.

1  A:  ok so you're walking towards + have you got a bridge on your map that goes across the Big River?
2  B:  no
3  A:  well there is a bridge
4  B:  so I am + do I go near the lake before the Big River?
5  A:  a lake?
6  B:  oxbow lake
7  A:  well I don't have a lake + all I have is the Big River that nearly describes the tail of a rat
8  B:  ok + look I am on top of the waterfall now I am aiming between these two peaks sort of + pretty much straight forward
9  A:  yeh + you are going straight between the two peaks + ok
10 B:  yeh ok
11 A:  and you are describing a sort of a curvy line + you are not walking straight through
12 B:  ok is it a wiggly line ?
13 A:  yeh it is a wiggly line
14 B:  ok ++ and I am through the peaks and do I go straight on and I hit the bridge?

Looking at fragments of the cited extracts we can characterise the state of knowledge of a speaker the moment immediately before (or after) he produces an utterance and note the form of the expression he provides. Let's first consider participant A, the authoritative participant, as speaker in extract 7.2. The configurations and forms are distinguished as to whether this is an initial act of referential instigation (1), or of subsequent mention (2), the conditions for instigation and subsequent mention being well defined in this task.

Analysis of Extract 7.2
Map 1 S13 & S14 B'Muir

| | | aep | a/bep | form |
|---|---|---|---|---|
| 1 | A: .. you got wee palm trees aye? | + | ? | 1 ind pl |
| 2 | B: uhu | | | |
| 3 | A: .. you got a swamp ? | + | ? | 1 a + N |
| 4 | B: er | | | |
| 5 | A: .. you got a waterfall? | + | ? | 1 a + N |
| 6 | B: aye | | | |
| 7 | A: .. between the palmtrees | + | + | 2 the + N |
| | and the waterfall | + | + | 2 the + N |
| 8 | B: but I've got crocodiles | | | |
| 9 | A: you've got what? | | | |
| 10 | B: crocodiles | | | |
| 11 | A: whereabout? | | | |
| 12 | B: .. the waterfall and the palm trees | | | |
| 13 | A: .. the crocodiles and | | + | 2 the + N |
| | the palm trees | + | + | 2 the + N |

Consider now the fragments of extract 7.2 where B refers to discourse objects.

Analysis of Extract 7.2
Map 1 S13 & S14 B'Muir

| | | bep | b/aep | form |
|---|---|---|---|---|
| 8 | B: but I've got crocodiles | + | ? | 1 ind pl |
| 10 | B: crocodiles | + | ? | 2 ind pl |
| 12 | B: .. the waterfall and | + | + | 2 the + N |
| | the palm trees | + | + | 2 the + N |

Moving on, let us consider participant A in extract 7.3.

Analysis of Extract 7.3
Map 1 S7 & S8 Ed. Univ.

| | | aep | a/bep | form |
|---|---|---|---|---|
| 1 | A: ..that palm beach | + | + | 2 def |
| 2 | B: uhu | | | |
| 3 | A: ..up towards the swamp | + | + | 1 the + N |
| 4 | B: ..I've not got a swamp | | | |
| 5 | A: not got a swamp | + | | 2 a + N |
| 6 | B: no | | | |
| 7 | A: ok | | | |
| 8 | B: ..from the palm beach | | | |

And now consider the fragments of extract 7.3 where B is making reference to discourse objects.

Analysis of Extract 7.3
Map 1 S7 & S8 Ed. Univ.

| | | bep | b/aep | form |
|---|---|---|---|---|
| 4 | B: ..I've not got a swamp | | + | 2 a + N |
| 8 | B: ..from the palm beach | + | + | 2 a + N |

What might these two extracts suggest? Certainly the participants seem to be referring, despite the fact that Formalist doctrine does not allow <u>reference</u> to be the relation underpinning their use of the various indefinite and definite expressions in these extracts. The extracts also demonstrate that first and second mention is not equated with indefinite and definite forms respectively, cf for example extract 7.2 (10B), or extract 7.3 (3A) and (4B). Many of the indefinite expressions are not exclusive in the way Hawkins predicts; most of the features are unique in the map domain which constitutes the 'pragmatic domain of interpretation'.

If we look at the forms and the perspectival partitions, two patterns do emerge from these small fragments. One pattern applies to the referential instigator - where a configuration is implicated in the instigator's perspectives of:

$$\underset{+}{\text{Ins ep}} \quad \underset{?}{\text{Ins/Int ep}}$$

then an indefinite form is used, cf for example extract 7.2 (1A), (3A) and (5A) (Footnote 7.2). The other pattern is that where initial or subsequent reference takes place against an assumed configuration

$$\underset{+}{\text{P1 ep}} \quad \underset{+}{\text{P1/P2 ep}}$$

then a definite form is used, cf for example extract 7.2 (7A), (13A), and extract 7.3 (3A), (8B).

Let us look at analyses of extracts 7.4 and 7.5 to see if they help consolidate and clarify our understanding of the possible relation between epistemic perspectives and referential forms. Consider extract 7.4 from A and then B's point of view.

---

Footnote 7.2. The assumption of a configuration

Ins ep + Ins/Int ep ?

in utterances such as extract 7.2 (1A), (3A), (5A) is based on the very fact that interrogative forms are used.

Analysis of Extract 7.4
Map 1 S21 & S22 B'Muir

| | | aep | a/bep | form |
|---|---|---|---|---|
| 1 | A: ..towards the bridge | + | + | 1 the + N |
| 2 | B: bridge? | | | |
| 3 | A: at the Big River | + | + | 1 the + N |
| 4 | B: there's not a bridge | | | |
| 5 | A: eh? | | | |
| 6 | B: there's not a bridge | | | |
| 7 | A: ..across the river | + | + | 2 the + N |
| | + the Big River | + | + | 2 the + N |
| 8 | B: anywhere on the river? | | | |
| 9 | A: aye | | | |

Analysis of Extract 7.4
Map 1 S21 & S22 B'Muir

| | | bep | b/aep | form |
|---|---|---|---|---|
| 2 | B: bridge? | | + | 2 bare |
| 4 | B: there's not a bridge | | + | 2 a + N |
| 6 | B: there's not a bridge | | + | 2 a + N |
| 8 | B: anywhere on the river? | + | + | 2 the + N |

And now extract 7.5 from the two participants' points of view.

Analysis of Extract 7.5
Map 1 S5 & S6 Ed Univ

| | | aep | a/bep | form |
|---|---|---|---|---|
| 1 | A: ..you got a bridge | + | ? | 1 a + N |
| | ..across the Big River? | + | + | 2 the + N |
| 2 | B: no | | | |
| 3 | A: well there is a bridge | + | | 2 a + N |
| 4 | B: ..the lake before the Big River? | | | |
| 5 | A: a lake? | | + | 2 a + N |
| 6 | B: oxbow lake | | | |
| 7 | A: ..a lake + | | + | 2 a + N |
| | ..the Big River | + | + | 2 the + N |
| 8 | B: ..the waterfall ..these two peaks | | | |
| 9 | A: ..the two peaks + ok | + | + | 2 the + N |
| 10 | B: yeh ok | | | |
| 11 | A: ..straight through | | | |
| 12 | B: ok.. | | | |
| 13 | A: yeh.. | | | |
| 14 | B: ..the peaks ..the bridge? | | | |

Analysis of Extract 7.5
Map 1 S5 & S6 Ed Univ

| | | bep | b/aep | form |
|---|---|---|---|---|
| 4 | B: ..the lake before | + | + | 1 a + N |
| | the Big River? | + | + | 2 the + N |
| 6 | B: oxbow lake | | | |
| 8 | B: ..the waterfall | + | + | 2 the + N |
| | ..these two peaks | + | + | 2 the + N |
| 14 | B: ..the peaks | + | + | 2 the + N |
| | ..the bridge? | | + | 2 the + N |

Our first two patterns of configuration and form seem to be substantiated by these additional extracts. Recall that the remaining two level configurations for instigators and interpreters are (ii) and (ii') from Tables 7.5 and 7.6. These two configurations are given again in Table 7.7.

TABLE 7.7

| | Perspect | Content | Perspect | Content |
|---|---|---|---|---|
| ii | Ins ep | + | Ins/Int ep | |
| ii' | Int ep | | Int/Ins ep | + |

Let us consider (ii') first. Such a configuration can only operate as one which is relevant to a referential act which is an act of subsequent mention (some would use the term discourse anaphora). So far six out of the eight cases in which such a configuration is implicated involve the use of indefinite and bare nominals. This raises problems, as previously stated, for first and second mention accounts. These six cases, shown below, fall into two categories; situations where the interpreter is checking his understanding of the instigator's utterance, or else situations where we have explicit denial of presuppositions made by the instigator.

Part of Extract 7.5
Map 1 S5 & S6 Subjects from Edinburgh Univ.

4 B: so I am + do I go near the lake before the Big River?
5 A: a lake?

Part of Extract 7.4
Map 1 S21 & S22 Subjects from B'Muir School

1 A: draw a curved line towards the bridge
2 B: bridge?

Part of Extract 7.3
Map 1 S7 & S8 Subjects from Edinburgh Univ.

3 A: and ++ you are not quite horizontal you are taking a slight curve up towards the swamp + not obviously going into it
4 B: well sorry + I've not got a swamp

Part of Extract 7.5
Map 1 S5 & S6 Subjects from Edinburgh Univ.

4 B: so I am + do I go near the lake before the Big River?
5 A: a lake?
6 B: oxbow lake
7 A: well I don't have a lake + ...

Part of Extract 7.4
Map 1 S21 & S22 Subjects from B'Muir School

1 A: draw a curved line towards the bridge
2 B: bridge?
3 A: at the Big River
4 B: there's not a bridge
5 A: eh?
6 B: there's not a bridge

The denial of presupposition is particularly interesting because it requires the introduction of third level perspectives. Now there are only three possible configurations for three levels of perspective in the case of (ii'). These are shown in Table 7.8.

TABLE 7.8

| | Perspect Int ep | Perspect Int/Ins ep | Perspect Int/Ins/Int ep |
|---|---|---|---|
| iia' | | + | + |
| iib' | | + | ? |
| iic' | | + | |

From the interpreter's viewpoint (iic') represents the case in which the instigator has an accurate view of the interpreter's view of the absence of a feature from the interpreter's map. Configuration (iib') represents the situation in which the interpreter realises that the instigator is unsure about the interpreter's perspective (ie the interpreter's view of configuration (ii)). Lastly, (iia') represents the interpreter's belief that the instigator harbours an incorrect view as to the presence of an object on his map. To correct what the interpreter believes is a false presupposition which the instigator is making about him, the interpreter can be represented as attempting to change the perspectival configuration from (iia') to (iic').

There are another set of three level possibilities for the other two level interpreter configuration (i').

Again the interpreter's suspicion that the instigator harbours a misapprehension about his knowledge state can only be revealed in a three level analysis. These three possibilities are shown in Table 7.7.

TABLE 7.9

| | Perspect Int ep | Perspect Int/Ins ep | Perspect Int/Ins/Int ep |
|---|---|---|---|
| ia' | + | + | |
| ib' | + | + | ? |
| ic' | + | + | + |

The fragments just cited from extracts 7.3, 7.4 and 7.5 show the interpreter attempting to rectify the instigator's presuppositions in cases where the interpreter believes the instigator thinks the interpreter has features which he hasn't (in terms of our configurations moving from (iia') to (iic')). The analyses of the relevant extract fragments shows that in all cases indefinites are used.

Analysis of part of 7.3
Map 1 S7 & S8 Subjects from Edinburgh Univ.

| | A's config immed after 3A | | | |
|---|---|---|---|---|
| | Aep | A/Bep | A/B/Aep | Form |
| 3A: ..towards the swamp + | + | + | + | the + N |
| not obviously going into it | + | + | + | def pro |

| | B's config before 4B | | | |
|---|---|---|---|---|
| | Bep | B/Aep | B/A/Bep | Form |
| 4B: .. I've not got a swamp | | + | + | a + N |

Analysis of part of Extract 7.5

Map 1 S5 & S6 Subjects from Edinburgh Univ.

```
                                        B's config immed after 4B
                                        Bep B/Aep B/A/Bep Form
4B: .. I go near the lake                +      +        + the + N

                                        A's config before 7A
                                        Aep A/Bep A/B/Aep Form
7A: ..I don't have a lake                       +        + a + N
```

Analysis of part of Extract 7.4
Map 1 S21 & S22 Subjects from B'Muir School

```
                                        A's config immed after 1A
                                        Aep A/Bep A/B/Aep Form
1A: .. line towards the bridge           +      +        + the + N

                                        B's config before 4B
                                        Bep B/Aep B/A/Bep Form
4B: there's not a bridge                        +        + a + N
```

Extracts 7.6 and 7.7, cited below, show the type of presupposition correction involved when an interpreter attempts to indicate to the instigator that he has a feature which the instigator may think he has not got, in terms of our configurations moving from (ia') to (ic'). Again indefinites are used.

Extract 7.6
Map 2 S15 & S16 Subjects from Edinburgh Univ.

1 A: right well you're going + from north to south and there is a start marked in the top right hand corner + about two inches in from ++
2 B: yes + well + I've + I've got a start
3 A: you've got the start in the north + well we're heading in the south + now have you got marked a volcano?

Analysis of part of Extract 7.6
Map 2 S15 & S16 Subjects from Edinburgh Univ.

| | A's config immed after 1A | | | |
|---|---|---|---|---|
| | Aep | A/Bep | A/B/Aep | Form |
| 1A: .. is a start marked.. | + | | + | a + N |

| | B's config before 2B | | | |
|---|---|---|---|---|
| | Bep | B/Aep | B/A/Bep | Form |
| 2B: ..I've got a start.. | + | + | | a + N |

Extract 7.7
Map 1 S13 & S14 Subjects from Edinburgh Univ.

1 A: ok do you see right in the bottom right
hand corner of the map a blue bay with
a palm beach just ++
2 B: yeh
3 A: ok well below that palm beach about sort +
one inch in is a start cross
4 B: I already have a start marked
5 A: ok then left to the palm beach do
you have a swamp?
:
:
a B: where do I go from the start?
b A: so what you want to do is from the
starting point you bear...

Analysis of part of Extract 7.7
Map 1 S13 & S14 Subjects from Edinburgh Univ.

| | A's config immed after 3A | | | |
|---|---|---|---|---|
| | Aep | A/Bep | A/B/Aep | Form |
| 3A: .. is a start cross... | + | | + | a + N |

| | B's config before 4B | | | |
|---|---|---|---|---|
| | Bep | B/Aep | B/A/Bep | Form |
| 4B: ..I already have a start | + | + | | a + N |

We have seen from these extracts that in correcting an instigator's incorrect presupposition, an interpreter uses indefinites. When the instigator's view of the interpreter has been corrected, how does the interpreter subsequently refer to the object? What is the form of the referential expressions when configurations (ic') and (iic') are at stake? An extract which contains presupposition correction and subsequent mention by the interpreter is an extension of 7.3.

Part of Extract 7.3 with extensions
Map 1 S7 & S8 Subjects from Edinburgh Univ.

| | | |
|---|---|---|
| 3 | A: | and ++ you are not quite horizontal you are taking a slight curve up towards the swamp + not obviously going into it |
| 4 | B: | well sorry + I've not got a swamp |
| 5 | A: | you have not got a swamp |
| 6 | B: | no |
| | | : |
| | | : |
| a | B: | so I go to the palm beach |
| b | A: | no don't draw the route just now<br>I'm going to show you where the swamp is |
| c | B: | ok |
| d | A: | two inches across from the top of the tree at the palm beach |
| e | B: | ok is the swamp |
| f | A: | is the swamp and that swamp is about an inch square |
| | | : |
| i | A: | come up about one and a half inches to the left and curve right round ++ round about half an inch to the right of the swamp |
| ii | B: | so kind of above the palm beach then |
| iii | A: | yeh |
| iv | B: | how far up should I go? |
| v | A: | now take ++ a circle round the swamp staying about one inch from the edge |
| vi | B: | so I go round to the north of the swamp |

In extracts 7.5 and 7.4 the presupposed features are not mentioned after the interpreter's presuppositional denial. However, extract 7.8 shows another example of presuppositional denial where subsequent mention does occur.

Extract 7.8
Map 1    S3 & S4    Subjects from Edinburgh Univ.

1 A: because you are going to cross the bridge there
2 B: ok + well I don't have a bridge on mine
3 A: uhu
4 B: ok tell me where the bridge is
:
:
a A: you are going north east at the moment + we have to cross the river
b B: is the bridge I cross just there?
c A: yes that is what I am trying to tell you + where the bridge is you see
d B: ok well tell me again

In both these extracts after presuppositional correction, which in both cases is of the form (iia')->(iic'), the feature which the interpreter has learnt he doesn't have is referred to using definite forms, cf for example 7.3 (eB), (viB), 7.8 (4B), (bB).

Consider extracts 7.6 and 7.7 which, from the interpreter's point of view, move from configurations on the <u>start</u> feature of (ia') to (ic'). In both cases the interpreters correct what they perceive to be an erroneous presupposition: in 7.7, which is the only case of the interpreter making subsequent reference to the feature, a definite is used, (bB). It should be noted that the instigators in all the 'presuppositional correction' extracts also continue to use definite forms once they have taken 'on board' the interpreter's correction of their initial presupposition, cf for example 7.3 (bA), (fA), (iA), (vA), 7.6 (3A), and 7.7 (bA).

A three level analysis of the interpreter allows us to examine the form of referential expressions used if he replies to queries from the instigator with full referring expressions. In other words, we can look at the type of nominal which is used when associated with the perception by the interpreter of configurations (ib') or (iib'). Extracts 7.8-7.11 characterise such responses, responses which are quite rare since most commonly the response is just a 'yes'/'no' reply. We can see from the analyses that configuration (ib') is associated with extracts 7.8-7.12, whilst (iib') is associated with extracts 7.13-7.14.

Extract 7.9
Map 2 S15 & S16 Subjects from Edinburgh Univ.

1 A: ... have you got a waterhole
quite near there
by any chance?
2 B: yes I've got a waterhole...

Analysis-

B's (the interpreter's) perspect before 2B of 7.9

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| + | + | ? | a + N |

B's (the interpreter's) perspect after 2B of 7.9

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| + | + | + |

Extract 7.10

Map 1 S1 & S2 Subjects from Edinburgh Univ.

1 A: to the top right hand side + do you have a big river

2 B: er sorry + yes I do have a big river + er there's no bridge

Analysis-

B's (the interpreter's) perspec before 2B of 7.10

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| + | + | ? | a + N |

B's (the interpreter's) perspect after 2B of 7.10

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| + | + | + |

Extract 7.11

Map 2 S13 & S14 Subjects from Edinburgh Univ.

1 B: got what?

2 A: giraffes

3 B: but I have got some elephants

4 A: how about a cave?

5 B: yes there is a cave

Analysis-

B's (the interpreter's) perspect before 5B of 7.11

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| + | + | ? | a + N |

B's (the interpreter's) perspect after 5B of 7.11

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| + | + | + |

Extract 7.12
Map 1 S23 & S24 Subjects from B'Muir School

1 A: ... have you got a big river?
2 B: aye + got a big river up the way
3 A: you go across the bridge

Analysis-

B's (the interpreter's) perspect before 2B of 7.12

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| + | + | ? | a + N |

B's (the interpreter's) perspect after 2B of 7.12

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| + | + | + |

Extract 7.13
Map 2 S13 & S14 Subjects from Edinburgh Univ.

1 A: ...up round the graveyard
2 B: I go up above the graveyard
3 A: up above and round
4 B: ok + do you have a waterhole?
5 A: no I've not got a waterhole

Analysis-

A's (the interpreter's) perspect before 5A of 7.13

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| | + | ? | a + N |

A's (the interpreter's) perspect after 5A of 7.13

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| | + | |

Extract 7.14
Map 2 S5 & S6 Subjects from Edinburgh Univ.

1 A: ...can you see a desert? + it will be + its below the the airplane on the map
2 B: no I don't have a desert
3 A: ah + ok

Analysis-

B's (the interpreter's) perspect before 2B of 7.14

| Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|
| | + | ? | a + N |

B's (the interpreter's) perspect after 2B of 7.14

| Int ep | Int/Ins ep | Int/Ins/Int ep |
|---|---|---|
| | + | |

All of these responses are indefinite in form. Given the suggestion that both the (ib') and (ia') configurations evoke indefinites, this adds a couple of qualifications to the general pattern first observed in the two level analyses (which were chosen so as not to contain a third level perspective differing from the primary interpreter perspective). The rule for an interpreter's use of the indefinite is preserved in (ic'). Let me reiterate that what would be intractable exceptions to our analysis become suggestive new generalisations when third level perspectives are considered.

The extracts selected suggest a set of relations between configurations and forms that may be summarised in Table 7.7. If an interpreter perceives the configuration on the left as the perspectives he has on an object then the tendency will be to use the referential form shown on the right.

TABLE 7.10

Interpreter's use of referential forms

| | Int ep | Int/Ins ep | Int/Ins/Int ep | Form |
|---|---|---|---|---|
| ic' | + | + | + | definite |
| iic' | | + | | definite |
| ia' | + | + | | indefinite |
| iia' | | + | + | indefinite |
| ib' | + | + | ? | indefinite |
| iib' | | + | ? | indefinite |

Whilst all the evidence has come from isolated extracts, a complete analysis of the interpreter configurations in the map task data revealed that the percentage of occurrences of forms in each configurational class was as listed in Table 7.11.

TABLE 7.11

Percentage use of forms by interpreters

| Configuration | | | Indefinites | | | Definites | |
|---|---|---|---|---|---|---|---|
| | | | a+N | bare | ind pro | the+N | def pro |
| + | + | + | 3% | 2% | | 83% | 12% |
| | + | | 12% | 6% | | 74% | 8% |
| + | + | | 70% | | 4% | 26% | |
| | + | + | 68% | 10% | 4% | 10% | 8% |
| + | + | ? | 90% | 10% | | | |
| | + | ? | 56% | 15% | 15% | 4% | 10% |

The figures given in Table 7.11 are _prima facie_ evidence in support of the model of the relation between epistemological configurations and the production of referential forms given in Table 7.7. Whilst all the forms produced do not conform to the model's predictions the exceptions are a small proportion of the cases which do conform. Indeed in looking at regularities in discourse phenomena analysts often adopt the stance defended by Givon 1977.

> What is the communicative difference between a rule of 90% fidelity and one of 100% fidelity? In psychological terms, next to nothing. In communication, a system with 90% categorial fidelity is a highly efficient system. (Givon 1979)

Let us now look at the referential instigator in terms of a three level analysis. Given the possibilities of Table 7.5, there are a total of nine three level configurations for a referential instigator shown in Table 7.12.

TABLE 7.12

| | Perspect Ins ep | Perspect Ins/Int ep | Perspect Ins/Int/Ins ep |
|---|---|---|---|
| ia | + | + | + |
| ib | + | + | ? |
| ic | + | + | |
| iia | + | | + |
| iib | + | | ? |
| iic | + | | |
| iiia | + | ? | + |
| iiib | + | ? | ? |
| iiic | + | ? | |

We must distinguish in the case of the referential instigator, between initial introduction and subsequent mention. After referential instigation, presuming that the interpreter has heard aright, the instigator can assume that the third level perspective 'Ins/Int/Ins ep' must have content. The interpreter must realise the instigator has the object or he could not have introduced it into discourse in the context of this task.

After initial mention the instigator is restricted to the three possibilities represented in 7.12 as (ia), (iia) and (iiia), shown below together as Table 7.13.

TABLE 7.13

| | Perspect Ins ep | Perspect Ins/Int ep | Perspect Ins/Int/Ins ep |
|---|---|---|---|
| ia | + | + | + |
| iia | + | | + |
| iiia | + | ? | + |

Configuration (ia) represents the case where the instigator believes an object is mutually recognised to be shared. The extracts below are typical of how this subsequent mention configuration can arise. Notice it can arise out of various different initial mention conditions.

Extract 7.15
Instigator moves from '+ ? ?' to '+ + +'
Map 1 S23 & S24 Subjects from B'Muir School

1 A: ..have you got a waterfall?
2 B: uhu
3 A: you for round the waterfall
4 B: left or right or what?
5 A: eh + left round the waterfall + and
up + up about an inch + have you got
some mountains?
6 B: uhu
7 A: well you go in a straight line through
the mountains

Extract 7.16
Instigator moves from '+ + +' to '+ + +'
Map 1 S1 & S2 Subjects from B'Muir School

1 A: right you go + through + the middle +
between the middle in between the swamp
and the palm trees + right
2 B: uhu
3 A: then + left turn left round the swamp +
and go under the waterfall++
right and then right right round the waterfall
++ left turning left

Extract 7.6
Instigator moves from '+ ' to '+ + +'
Map 2 S15 & S16 Subjects from Edinburgh Univ.

1 A: right well you're going + from north to
south and there is a start marked in the
top right hand corner + about two inches
in from ++
2 B: yes + well + I've + I've got a start
3 A: you've got the start in the north + well
we're heading in the south + now have you
got marked a volcano?

Thus in maintaining reference to what are supposed to be mutually recognised shared objects the instigator makes use of definite forms.

An instigator may learn that the interpreter has not got a feature which he, the instigator, has got. Once configuration (iia) has been established through the interpreter's response to referential instigation, we find that once again the definite form predominates, cf for example the extended version of extract 7.3 (bA), (fA), (iA), (vA), and extract 7.8 (cA).

Lastly an instigator may, even after initial reference, remain unsure as to the presence or absence of the feature from his interpreter's map, ie configuration (iiia). The few occasions in this data where one can confidently assume such a configuration seem to involve the repetition of the form of the initial referential act, cf for example extracts 7.17 and 7.18 below.

Extract 7.17
Map 1 S15 & S16 Subjects form Edinburgh Univ.

1 A: do you have a swamp there?
2 B: you said a swamp?
3 A: yes have you got a swamp by +
left of the palm beach

Extract 7.18
Map 1 S17 & S18 Subjects from Edinburgh Univ.

1 A: ..and go on + across the bridge on the
big river
2 B: actually I don't have a bridge +
where would it be in relation to the lake?
3 A: you don't have the lake + well
4 B: no + but where would it be in relation
to the lake?

Table 7.14 below shows the percentage of different varieties of forms produced in the map data by the referential instigator at subsequent mention, in relation to the two main configurations observed, (ia) and (iia).

TABLE 7.14

Percentage use of forms by instigators on subsequent mention

| Configuration | | | Indefinites | | | Definites | |
|---|---|---|---|---|---|---|---|
| | | | a+N | bare | ind pro | the+N | def pro |
| + | + | + | 2% | 8% | | 74% | 16% |
| + | | + | 10% | 12% | | 66% | 12% |

Turning to the configurations an instigator may have immediately prior to referential instigation, we see that only five out of the nine possible configurations of Table 7.12 are possible in the map task. Configuration (iiia) and (iiic) are ruled out, they do not make much sense at a third level perspective. If the instigator is uncertain about his interpreter's primary perspective why should he, before instigation, know about the interpreter's view of himself the instigator. Altnough possibly (iiia) could make sense for certain obligatory features, ie the instigator does not know what his interpreter has but he does expect him to realise that he, the instigator, will have features such as start and finish. However, I will not follow up these configurations in this task. Configurations (iia) and (iib) seem odd for a similar reason to that given above.

Why should the instigator expect the interpreter not to have specific features but to realise that the instigator has (again the only exception might be the case of 'obligatory features'). This leaves us with the configurations laid out in Table 7.15.

TABLE 7.15

Possible configurations for the referential instigator prior to the act of instigation

| | Perspect Ins ep | Perspect Ins/Int ep | Perspect Ins/Int/Ins ep |
|---|---|---|---|
| ia | + | + | + |
| ib | + | + | ? |
| ic | + | + | |
| iic | + | | |
| iiib | + | ? | ? |

These configurations represent the following cases. In (ia) the instigator assumes that the object is mutually recognised as shared. This configuration is heavily implicated in strategies where the instigator plunges into route description without checking the congruence of the two maps. In such cases exemplified by extracts such as 7.16 the definite form is most in evidence.

A problem is that configurations (ib) and (ic) are difficult to detect. They correspond to situations where an instigator thinks he and his interpreter share an object, but in (ib) the instigator is unsure about whether the interpreter knows that the instigator has it, and in (ic) the instigator assumes that the interpreter does not believe that the instigator has it. Thus the problem with an extract such as 7.19, is that although the instigator at (1B) is directing his initial referential speech act to 'ins/int/ins ep', it is not immediately clear what assumptions the instigator is making about the level two perspective 'ins/int ep'.

Extract 7.19
Map 1 S15 & S16 Subjects from Edinburgh Univ.

| | | |
|---|---|---|
| 1 | B: | let me tell you what I have + I have a wood above + well above the waterfall |
| 2 | A: | uhu + and |
| 3 | B: | and I + er + have you got a lion's den? |
| 4 | A: | yes + yes + you should still be a good way down from the wood + turn towards + towards the mountains + you take the route over between the two mountains |
| 5 | B: | two mountains? |

Analysis-

| | | | | Bep | B/Aep | B/A/Bep |
|---|---|---|---|---|---|---|
| 1 | B: | ..I have a wood | 1 | + | * | ? |
| | | ..the waterfall | 2 | + | + | + |
| | | : | | | | |
| 3 | B | ..got a lion's den | 1 | + | ? | ? |
| | | | | Aep | A/Bep | A/B/Aep |
| 4 | A | ..the mountains | 1 | + | + | + |

Utterances such as (4A) in the imperative form seem to presuppose the existence of the object on the interpreter's map. So that a referential instigator who assumes the first two perspectives have content can effectively disregard the third level since an utterance like (4A) will have the effect of establishing content at the third level 'A/B/Aep'. Problems only really arise when the instigator explicitly directs his referential act to the third level perspective. Thus configuration (iic) and (iiib) are also tractable because there exists only one possible third level configuration with each of them. Examining the form of the speech act at instigation, as in (3B), allows us to determine that configuration (iiib) is implicated, or extract 7.6 (1A) which indicates that (iic) is present. In both these cases the indefinite form is used.

What about the configurations (ib) and (ic)? Perhaps the most useful generalisation is to look at the perspective to which an utterance is directed, if this looks to be explicitly a third level one, as in extract 7.19 (1B), then note the form of the expression.

Table 7.16 below notes the percentage of forms of expressions in various configurations.

TABLE 7.16

Percentage use of forms by instigators on initial mention

| Configuration | | | | Indefinites | | | Definites | |
|---|---|---|---|---|---|---|---|---|
| | | | | a+N | bare | ind pro | the+N | def pro |
| ia | + | + | + | 8% | | | 92% | |
| ib | + | + | ? | 82% | | | 18% | |
| ic | + | + | | | | | | |
| iic | + | | | 100% | | | | |
| iiib | + | ? | ? | 85% | | | 15% | |

Taking Tables 7.14 and 7.16 together, preferences for the adoption of referential forms in response to epistemic configuration seem to be as detailed in Table 7.17.

TABLE 7.17

Instigator's use of referential forms

| | Perspect Ins ep | Perspect Ins/Int ep | Perspect Ins/Int/Ins ep | |
|---|---|---|---|---|
| Initial Mention | | | | |
| ia | + | + | + | def |
| ib | + | + | ? | } indef |
| ic | + | + | | } |
| iic | + | | | indef |
| iib | + | ? | ? | indef |
| Subsequent Mention | | | | |
| ia | + | + | + | def |
| iia | + | | + | def |

SECTION FIVE CONCLUDING REMARKS

The set of generalisations proposed for the map task data gives us a new way of thinking about the factors governing the distribution of referential forms. The data examined suggests a model in which the factor constant over all uses of the indefinite expression is a participant's initial disposition not to assume symmetrical knowledge between himself and his interlocutor.

It is not assumed that the epistemological conditions of this task are carried over into all our discourse situations. The difference in the epistemological conditions between discourse tasks is one reason why the Prince model, discussed on page , accounts for the Brown and Yule data so well. In the geometric diagram drawing task the authoritative participant, the instructions giver, is able to assume pretty much an omniscient view. In the map task no participant commands all the relevant knowledge. Although the participant with the route is invested with authority - just as in the diagram drawing - the other participant has his own, sometimes incompatible information. Each participant has to be sensitive not only to his own view of the world but also to his interlocutor's. Also the properties of the objects in the diagram drawing task of Brown and Yule were well known; triangles have angles, circles have diameters, and so on. The properties of the objects in the maps are less well known and the relations between them cannot be predicted. The content of the map task has more inbuilt indeterminacy, and may therefore lead to greater doubt and caution, to different estimations as to the distribution of knowledge between discourse participants. What I am suggesting is that the different generalisations will emerge out of different tasks.

The data cited here do not constitute a rigorous experimental test of an effect of 'epistemological configurations' on the production of particular referential forms. The model used has suggested a set of possible generalisations for the referential forms found in particular sort of discourse data. Moreover the data would certainly prove embarrassing for other models of definite and indefinite distribution. There is a central reliance of the model on the estimation by referential processors of their interlocutors' belief states. Once more an intentional analysis seems required in a set of referential phenomena.

## CONCLUDING REMARKS

This thesis has been concerned with the question of how reference works in natural language. The phenomenon of referential opacity was taken as the starting point in this enquiry.

The most precise formulations of the problems surrounding referential opacity are to be found in Formal Semantics. It was therefore natural to first consider some Formal Semantic analyses of reference.

In all standard theories of Formal Semantics reference is a tightly defined, invariant relation. It is a relation established by *fiat*. Reference formally construed, is an objective and immutable relation between the basic expressions of a logical calculus and elements in the model over which the language is being interpreted. This view of reference is necessary in logical languages which require determinate theories of truth on which to build the recursive semantic structure of the calculus.

The facts of referential opacity, as we saw, threaten to deal a fatal blow to the enterprise of using logical languages to examine the semantic structure of natural languages.

Considerable effort and ingenuity went into the business of providing solutions for the class of problems generated by the so-called 'opacity operators' of natural languages.

We considered a number of formal responses to the problem of opacity. The first, the Fregean account, introduced the concept of a two-tier semantics. In Frege's semantics, expressions in a language could have as their semantic values not just objects, sets of individuals and the like, but also a second type of value - 'sense'. The sense of an expression could be construed as the 'meaning' of that expression inasmuch as a sense does what a meaning does. Given a spatio-temporal context a sense determines the extensions of expressions. But meanings themselves can sometimes be the object of reference, a meaning can be what we are talking about. Frege was insistent that this type of semantic value has to be objective and immutable. Senses were part of the objective furniture of the world. Only by placing meanings outside the head did Frege think we could secure a transparent semantics for language. Such transparency would enable the proper transmission of information about the objective content of human knowledge, for example mathematics logic, physics etc. Moreover, whilst substitutions of 'direct' co-referring expressions within opaque contexts might lead to unwanted inferences, the substitution of terms which had the same sense could not. As a programme this approach seemed promising enough. The next question was how to go about formally characterising the notion of sense?

Russell's answer was to suggest that we need not try, since he claimed that we only need a semantics based on the single concept of denotation. In addition Russell's Theory of Descriptions sought to explain many referential puzzles by demonstrating that true denotation was not a feature of the 'denoting phrases' and 'names' of natural language. It was Russell's belief that the puzzles of reference could be made to disappear from language through the application of logical analysis.

Nevertheless the wit of many Twentieth Century logicians was directed toward trying to produce a rigorous account of Fregean semantics. The formulation of sense as presented in Montague's work, is an interesting amalgam of Fregean and Russellian concepts. It provides a semantics which, on the one hand is fundamentally denotational and is grounded in basic extensions, whilst, on the other, it is capable of generating 'senses'. Certainly formal sense, or intension, filled the role of Fregean sense precisely because it provided a way of establishing, for any spatio-temporal context, the extension of an expression.

With the apparatus of Intensional Logic we considered the various analyses Montague proposed for opacity problems involving; proper names, definite descriptions and indefinite expressions. In addition, we reviewed scopal analyses of the referential phenomena of 'specificity', 'expressive responsibility' and 'referentiality'. I suggested that the mechanism of logical scope was being over-taxed. It is used to account for so many semantic distinctions that certain combinations of referential phenomena generate paradoxes of interpretation.

Two features of Formal treatments of reference mitigate against its use as a model of reference in natural language. The first is the exclusion from the account of any mention of the cognitive states of language users. The second feature, is the characterisation of the reference relation, it is characterised as absolute, objective and invariant. Both of these elements in the Formalists' view of reference may be appropriate in the 'closed system' domains of mathematics and logic. However they do no justice to the 'open texture' of natural language. Indeed properties like 'open texture' suggest that meaning in language just is dependent on cognitive criteria of identification and verification.

Attempting to take a different path than the Formalists I made use of cognitive states in the reanalysis of semantic distinctions such as 'specificity', 'expressive responsibility' and 'referentiality'.

A cognitive approach to semantics brings with it the assumption that the representations which constitute our understanding of terms, referential or otherwise, are both subjective and fallible. This introduces the prospect of the collapse of language as a means of transferring, eliciting or debating information. We can never guarantee that our representations refer to the same states of affairs in the world. Nor, as a corollary can we be sure that the same linguistic terms used by different processors are co-intensional.

However the slide into hopeless subjectivism is not an inevitable one. Insights recruited from Evolutionary Epistemology can offer a means of securing the 'success' of communication between intentional systems. The effective success of our communicative acts is the result of an accommodation between the demands of the communicative situation and the limitations of ourselves the language user. The Evolutionary Epistemologist also introduces the concept of a 'Weltbildapparat'; the ability of an organism to build models of their environment modulo their cognitive endowment. The use of Mental Models in Cognitive Science is discussed in an attempt to discern what is said about the interpretation and generation of language. It turns out that most Discourse Models do assume a form of intensional equivalence of terms between language users.

The constructive side of my thesis alleges a complex interaction of language user, language system and environment. None of these elements can be autonomous in our appreciation of the phenomenon of reference; environments contain language users, language users instantiate language systems.

The processor centered system of referential description developed in chapter five is an attempt to embody some of the features which, I have claimed, must figure in any account of referential behaviour. In particular, the system contains machinery to represent processors' beliefs about their own and other peoples' views of the potential objects of discourse reference.

Features of the system have been used to describe the semantic properties of 'specificity', 'expressive responsibility', 'referentiality' . The features used do not rely on the linear ordering of logical operators.

The descriptive system has also been applied to discourse data obtained from a controlled task. The nature of the task ensures that, initially, knowledge is distributed unevenly between the discourse participants. The referential behaviour of subjects performing the task was of particular interest. The data makes it clear, for example, apparent that processor's can and do use their beliefs about their fellow participant's perspectives so as construct effective referential expressions. We observe reference constituted out of the model a processor has of his interlocutor even when these beliefs are at odds with their own, or else are derived solely from the content of their partner's perspective on particular objects. On occasion referential acts are even directed toward, and maintained at, deeper levels of object perspective, for example A may use his belief of B's belief of A's belief about the discourse object.

We could discern in the referential behaviour produced by the task the influence of linguistic strategies of generation and interpretation. Once again these strategies are not invariant throughout discourse. One could also discern their modification through the influence of higher level cognitive goals and strategies, for example on-line estimations of how much 'success' for how much effort. In the last chapter the apparatus of 'partitioned perspectives' provided a way of accounting for the observed distribution of different referential forms in the data from our controlled task. Moreover, the data seems intractable for any other account of definite and indefinite use.

If we are not to spend time absorbed in the pursuit of which Waismann warns in the first quote of this thesis, we must not lose sight of what language is used for. Ordinary language was not designed for the transmission of the theorems of logic, nor the establishment of a Millennial theory of Natural Science; its purpose is to allow human beings to communicate with each other so that work can be done, transactions carried out, wishes expressed and satisfied, and so on. Formal views of language tend to impose unity and generality on the semantic heory underpinning a language. This finds ultimate expression in the Formalist's construal of the reference relation. It is no surprise then that referential opacity is a property of language which a Formalist must be rid of. Nevertheless it is a property of language which I believe cannot be avoided. Indeed it must not, for it is a fundamental consequence of the fact that we as cognitive systems instantiate language. Referential opacity should serve to reminds us of the processes by which reference is constituted in language.

## APPENDIX 1

The language presented here is essentially the Intensional Logic presented in Dowty et al (1983:155ff). which is a modified version of the Intensional Logic presented in Montague (1973).

### 1. The syntax of Li

The set of types of Li is determined by the rules 1-4 below

(1) e is a type
(2) t is a type
(3) If a and b are types. then <a.b> is a type
(4) If a is a type. then <s.a> is a type

A. The basic expressions of Li consist of non-logical constants and variables of all types. except s which is itself not a type.

(1) For each type a. the set of non-logical constants of type a. denoted Con:.a.:. contains constants c:.n.a.:. for each natural number n

(2) For each type a. the set of variables of type a. denoted Var:.a.:. contains variables v:.n.a.:. for each natural number n

B. Syntactic rules of formation of Li

The set of meaningful expressions of type a. denoted 'ME:.a.:'. for any type a is defined recursively via 1-16 below:

1. For each type a. every variable and every non-logical constant of type a is a member of ME:.a.:.

2. For any types a and b. if alpha-in-set-ME:.<a.b>.: and beta-in-set-ME:.a.:. then alpha(beta)-in-set-ME:.b.:

3. If PHI-in-set-ME:.t.:. then NOT(PHI)-in-set-ME:.t.:

4. If PHI and PSI-in-set-ME:.t.:. then (PHI&PSI)-in-set-ME:.t.:

5. If PHI and PSI-in-set-ME:.t.:. then (PHIvPSI)-in-set-ME:.t.:

6. If PHI and PSI-in-set-ME:.t.:. then (PHI-->PSI)-in-set-ME:.t.:

7. If PHI and PSI-in-set-ME:.t.:. then (PHI<-->PSI)-in-set-ME:.t.:

8. If PHI-in-set-ME:.t.: and u is a variable. of any type. then VuPHI-in-set-ME:.t.:

9. If PHI-in-set-ME:.t.: and u is a variable. of any type. then EuPHI-in-set-ME:.t.:

10. If alpha-in-set-ME:.a.: and u-in-set-Var:.b.:. then ?(alpha)-in-set-ME:.<b.a>.:

11. If alpha and beta are both in ME:.a.:. then alpha=beta-in-set-ME:.t.:

12. If PHI-in-set-ME:.t.:. then NECC(PHI)-in-set-ME:.t.:

13. If PHI-in-set-ME:.t.:. then Fut(PHI)-in-set-ME:.t.:

14. If PHI-in-set-ME:.t.:. then Past(PHI)-in-set-ME:.t.:

15. If alpha-in-set-ME:.a.:. then ^(alpha)-in-set-ME:.<s.a>.:

16. If alpha-in-set-ME:.<s.a>.:. then @(alpha)-in-set-ME:.a.:

2. The semantics of Li

For a non-empty set A (the domain of entities) a set of possible denotations of expressions of each type a is given by 1-4 below where a and b are any types (using the convention that 'D:.x.:' is the set of possible denotations for expressions of syntactic category x).

1. D:.e.: is A

2. D:.t.: is {0.1}

3. For any syntactic categories a and b D:.<a.b>.:=D:.b.:.:Da:.

4. D:.<s.a>.:=D:.a.:.:WxT:.

A model for Li is an ordered quintuple <A.W.T.<.F> where:

A is the set of objects/individuals in the model

W is the number of possible worlds available to the model

T is the set of time intervals at which the model is sampled

< is a linear ordering of the set T

The function F will assign to each non-logical constant of Li of type a a member of S:.a.:, where S:.a.: is the set of senses of type a defined as D:.<s.a>.:

An assignment of values to variables g assigns to each variable v:.n.a.: a denotation from the set D:.a.: for each type a and natural number n.

A. The semantic values of non-logical constants and variables

1. If alpha is a non-logical constant of Li. then |[alpha]|.:M,w.t.g:. = [F(alpha)](<w.t>] (i.e the semantic value of alpha at <w.t> is the result of applying the intension of alpha. supplied by F. to the argument <w.t>)

2. If alpha is a variable of Li. then |[alpha]|.:M,w.t.g:. = g(alpha)

B. Recursive semantic rules of formation determine of any expression alpha. the semantic value of alpha with respect to M. w-in-set-W. t-in-set-T and g as follows

1a. If alpha is a non-logical constant of Li. then |[alpha]|.:M,w.t.g:. = [F(alpha)](<w.t>] (i.e the semantic value of alpha at <w.t> is the result of applying the intension of alpha. supplied by F, to the argument <w.t>)

1b. If alpha is a variable of Li. then |[alpha]|.:M,w.t.g:. = g(alpha)

2. If alpha-in-set-ME:.<a.b>.: and beta-in-set-ME:.a.:, then |[alpha(beta)]|.:M.w.t.g:. = |[alpha]|M.w.t.g:.(|[beta]|.:M,w.t.g:.). (the results of applying the function |[alpha]|.:M,w.t,g:. to the argument |[beta]|.:M.w.t.g:.)

3. If PHI-in-set-ME:.t.: then |[NOT(PHI)]|.:M,w.t.g:. = 1 if and only if |[PHI]|.:M.w.t.g:. = 0; otherwise |[NOT(PHI)]|.:M.w.t.g:. = 0

4. If PHI-in-set-ME:.t.: and PSI-in-set-ME:.t.: then
|[PHI&PSI]|.:M.w.t.g:. = 1 if and only if both
|[PHI]|.:M.w.t.g:. = 1 and |[PSI]|.:M.w.t.g:. =1
otherwise |[PHI&PSI]|.:M.w.t.g:. = 0

5. If PHI-in-set-ME:.t.: and PSI-in-set-ME:.t.: then
|[PHIvPSI]|.:M.w.t.g:. = 1 if and only if either
|[PHI]|.:M.w.t.g:. = 1 or |[PSI]|.:M.w.t.g:. =1. or both;
otherwise |[PHIvPSI]|.:M.w.t.g:. = 0

6. If PHI-in-set-ME:.t.: and PSI-in-set-ME:.t.: then
|[PHI-->PSI]|.:M.w.t.g:. = 1 if and only if either
|[PHI]|.:M.w.t.g:. = 0 or |[PSI]|.:M.w.t.g:. =1;
otherwise |[PHI-->PSI]|.:M.w.t.g:. = 0

7. If PHI-in-set-ME:.t.: and PSI-in-set-ME:.t.: then
|[PHI<-->PSI]|.:M.w.t.g:. = 1 if and only if either.
|[PHI]|.:M.w.t.g:. = 1 and |[PSI]|.:M.w.t.g:. =1. or
|[PHI]|.:M.w.t.g:. = 0 and |[PSI]|.:M.w.t.g:. = 0.

8. If PHI-in-set-ME:.t.: and u is Var:.a.: then
|[VuPHI]|.:M.w.t.g:. = 1 if and only if
|[PHI]|.:M.w.t.g':. = 1 for all g' exactly like alpha
except possibly for the value assigned to u

9. If PHI-in-set-ME:.t.: and u is Var:.a.: then
|[EuPHI]|.:M.w.t.g:. = 1 if and only |[PHI]|.:M.w.t.g':.
= 1 for some exactly like g except possibly for the value
assigned to u

10.If alpha-in-set-ME:.a.: and u-in-set-Var:.b.:, then
|[?u(alpha)]|.:Mg:. is that function h with domain D:.b.:
such that for any object k in that domain,
h(k)=|[alpha]|.:M.g':. where g' is that value assignment
exactly like g with the possible difference that g'(u) is
the object k.

11.If alpha and beta are in ME:.a.:, then
|[alpha=beta]|.:M.w.t.g:. is 1 if and only if
|[alpha]|.:M.w.t.g:. is the same as |[beta]|.:M.w.t.g:.

12.If PHI-in-set-ME:.t.:, then |[NECC(PHI)]|.:M.w.t.g:.
is 1 if and only if |[PHI]|.:M.w'.t'.g:. is 1 for all
<w'.t'> in WxT

13.If PHI-in-set-ME:.t.:. then |[Fut(PHI)]|.:M.w.t.g:. is
1 if and only if |[PHI]|.:M.w.t'.g:. is 1 for some t' in
T such t<t'

14.If PHI-in-set-ME:.t.:. then |[Past(PHI)]|.:M.w.t.g:.
is 1 if and only if |[PHI]|.:M.w.t'.g:. is 1 for some t'
in T such t'<t

15.If alpha-in-set-ME:.a.:, then |[^alpha]|.:M,w.t.g:. is that function h with domain WxT such that for all <w'.t'> in WxT. h(<w'.t'>) is |[alpha]|.:M,w'.t'.g:.

16.If alpha-in-set-ME:.<s.a>.: then |[@alpha]|.:M.w.t.g:. is |[alpha]|.:M,w.t.g:.(<w.t>)

C. The following truth definitions are established for formulas of Li relative to M

1. For any expression PHI-in-set-ME:.t.: of Li. then PHI is true with respect to M and to <w.t> if and only if |[PHI]|.:M,w.t.g:. = 1 for all g assignments.

2. If alpha is any expression. then the intension of alpha with respect to M and g. denoted ^|[alpha]|.:M,g:. is that function h with domain WxT such that for all <w.t> in WxT, h(<w.t>) is |[alpha]|.:M.w.t.g:.

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