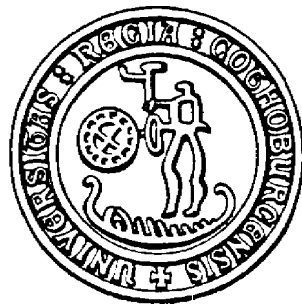# ON THE SEMANTICS
OF PROPOSITIONAL
ATTITUDE REPORTS

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ABSTRACT

This is a study on the truth-conditional semantics of propositional attitude attribution statements. It is suggested that attitude contents should be characterized in terms of abstract concepts, which are connected by way of a number of basic logical relations derived from a version of Quinean predicate-functor logic. This allows us to handle all logical relationships definable by first-order predicate calculus in a way that does not exploit variable-like entities. Individual, predicate, and propositional concepts are recognized. These concepts provide the relata of various mental attitude relations and may denote (or may fail to denote) other kinds of object. The resulting framework is itself formalized in first-order predicate calculus. This proposal is intended to give an account that is to a high degree independent of any particular view of the metaphysical, psychological or epistemological status of propositional attitude reports. An overview of different kinds of propositional and other conceptual attitude report constructions in English is given and it is suggested how the framework proposed can be applied to them.

CONTENTS

PREFACE

The present book is a revised and—I hope—improved version of my doctoral dissertation, which was publicly defended (and approved of) on December 17, 1994. All errors I know of have been corrected and a substantial amount of dispensable material has been removed. I have also made a few minor modifications of content and structure.

1

INTRODUCTION

1.1 Language and Propositional Attitudes

This thesis is concerned with the question of how statements about **propositional attitudes** (e.g. belief, knowledge, desire, hope, regret, and intention) should be accommodated within a truth-conditional semantics. These attitudes are allegedly *propositional* in the sense of having contents to which the distinction between truth and falsity is applicable. (As we will see, there are many ways of giving a more precise account of this.) Propositional attitudes are held by cognitive agents and the grammatical subject of a propositional attitude attribution sentence typically refers to a cognitive agent. There is a class of verbs which occur in such sentences and they commonly enter into constructions with a *that*-clause that characterizes a possible content of a propositional attitude. (There are also propositional attitude attribution sentences with a different syntax.) Propositional attitude attribution sentences and in particular their *that*-clause complements exhibit a deviant semantic behaviour. (For instance, codesignative referring expressions are not generally interchangeable *salva veritate* [i.e. with the truth value of a matrix sentence *ceteris paribus* unchanged].) Because of this, they have attracted the attention of many semanticists. Innumerable accounts of their semantics have been given and their analysis remain a controversial issue in philosophy and in linguistics. An overview of the situation and a (partially) new (but highly eclectic) account of their semantics will be given on the pages to follow.

This chapter will set down the aims of this study and will give an outline of this thesis, but first I shall make a few comments on why propositional attitude reports may be interesting.

1.2   The Importance of Propositional Attitude Reports

Propositional attitude reports provide many examples of semantic phenomena whose analysis is far from self-evident and that seem to pose difficulties to almost any kind of semantic theory. As they are also quite common, a crucial aspect of any semantic theory is the ways in which it can accommodate sentences of this kind. Semanticists (philosphers and linguists) have suggested many different solutions to the problems they pose. The semantic analysis of propositional attitude reports is also closely linked to the philosophical-conceptual analysis of propositional attitudes and the mental states which embody them.

Concepts relating to propositional attitudes are also important because of the role they play in our understanding of ourselves and of other human beings. A few remarks should be sufficient to remind us of their vital importance.

Rationality is often taken to be a distinctly human trait and it seems that "to have propositional attitudes is to be a rational creature" (Davidson, [1982, p. 475–476]). An ordinary person views himself as possessing intentions, beliefs, and desires and interprets other rational creatures by finding the same kinds of mental states in them. This kind of psychology gives a kind of high-level account af the causality behind human action and thereby supports various schemes for describing, explaining, predicting, and evaluating human behaviour.

Concepts relating to propositional attitudes are indispensable when it comes to viewing human behaviour as purposive action. Ordinary moral evaluation would also be impossible without them. Discourse about propositional attitudes consequently reflect very important aspects of the understanding people have of each other and a semantic analysis of propositional attitude reports will highlight basic assumptions behind ordinary "folk psychology".

1.3   Goals

The aim of the present work is to give an account of the semantics of propositional attitude reports in terms of their truth conditions. The approach is one that favours simplicity and economy of the formal framework, and it remains within the confines of first-order predicate logic. It is intended to be applicable in a systematic fashion to all kinds of discourse about propositional attitudes, but this point is argued only in relation to English. I also intend to show that the system of abstract content elements that is posited in this account is also useful in the analysis of other kinds

of intensional discourse.

It should be stressed that an account of this kind necessarily defines its subject matter in a normative way. It is assumed that propositional attitude discourse is defined by being intended to conform to certain publicly recognized normative principles and the aim is to give an account of utterances that actually conform to these norms. To the extent that these norms are controversial, so is the definition of the subject matter of this thesis.

The present approach is claimed to be exhaustive with regard to the analysis of the contents ascribed to propositional attitudes, but only contents that can be rendered in first-order predicate calculus will be considered.

Two important aspects of propositional attitude attribution semantics are mentioned only in passing: The problem of how the strength of propositional attitudes should be accommodated is not addressed and little is said about the temporal dynamics of attitude states and attitude-related events. The present work does not pretend to give an exhaustive treatment of these two issues.

1.4 Outline of the Thesis

The remaining chapters of this work are organized as follows: Chapter 2 discusses some fundamental assumptions behind truth-conditional treatments of semantics and the methodology upon which they rest. Most approaches to propositional attitude attribution semantics belong to this tradition and—I think—virtually all of them share most of the tenets of this methodology. Chapter 3 is an overview of various approaches to propositional attitudes and theories about how sentences are used as reports about propositional attitudes. In Chapter 4, a first-order framework for the analysis of propositional attitude reports is outlined. It describes how propositional content may be characterized in terms of concepts and a small number of basic logico-conceptual relations holding between concepts. Chapter 5 applies the apparatus introduced in Chapter 4 to different kinds of semantic problems arising in relation to propositional attitude attribution sentences, in particular, in relation to *that*-clause complements. In Chapter 6, the perspective is broadened: An overview of English sentential constructions that call for an analysis in terms of Chapter 4 concepts is given and their treatments are spelled out in some detail. A short recapitulation and evaluation of the work presented here form the substance of the concluding seventh chapter of the thesis.

2

TRUTH-CONDITIONAL SEMANTICS

2.1   Introduction

In this chapter I will discuss the methodology of truth-conditional semantics and some philosophical aspects of it. A semantic analysis of this kind is couched within a version of propositional attitude psychology. As the present study is concerned with propositional attitude reports, this means that many of the claims made in this thesis apply reflexively also to the statements of a truth-conditional semantics. It also means that the present chapter will form an account of a special case of propositional attitude interpretation, and that it therefore will recapitulate many themes which will be discussed from a more general point of view elsewhere in the thesis. The present chapter will however mainly be oriented towards the justification of the analytical procedures employed in this work, whereas the thesis as a whole is intended to be more neutrally descriptive. I will begin by discussing certain philosophical aspects of a study like this one. Then I will turn to more specifically linguistic issues and try to clarify and defend the general picture of language assumed in this thesis and the modes of justifying the claims set forth in it.

2.2   Truth

A rational inquiry, like the present study, is guided by the aim to reach only true conclusions. Truth will also be a central concept in this study from the point of view of its subject matter, as truth obviously is one of the key concepts in

truth-conditional semantics. The notion of "truth" has been much discussed in the philosophical literature. A brief discussion of my own stance may clarify the background views against which the present treatment of propositional attitude reports is best understood.

Many philosophers have seen as their task to lay some kind of foundation of rational inquiry. Most of them have considered defining truth and/or setting down some principles for determining what is actually true a crucial part of this enterprise. Such a theory forms a *first* philosophy, in the sense that it is taken to provide the primary and unshakeable guidelines for further inquiry. Descartes and the logical positivists may be quoted as typical examples of this trend.

This kind of approach is however marred by a difficulty stressed by philosophers like Frege, Moore and Wittgenstein. In order to rationally justify any claims concerning the concept of "truth" we must appeal to certain ideas that we already take to be true. Any rational discourse or chain of reasoning must be guided by principles involving a truth concept. As Frege noted, this means that we cannot capture the content of the concept of truth by giving a definition of it. He argues as follows in his article *Der Gedanke* [1918] (English translation [1984, p. 353]):

> [A]ny [...] attempt to define truth [...] breaks down. For in a definition certain characteristics would have to be specified. And in application to any particular case the question would always arise whether it were *true* that the characteristics were present. So we should be going round in a circle. So it seems likely that the content of the word 'true' is *sui generis* and indefinable.

What Frege stresses is that the concept of truth cannot be introduced by way of definition, as a definition can be grasped only by someone who possesses this concept. The concept of truth is one of the most basic ones and it is involved in the very principles defining rational thought.[1] Interpretation of thought and talk requires, Davidson (cf. Section 2.7.2) has argued, that the interpreted party is assumed to abide by certain principles of rationality defined in terms of truth. This means that concept of truth is fused into the very conceptual foundation of meaningful discourse and cognition.

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[1] Frege's argument does not show that a definition of truth must be circular or lead to an infinite regress (as Carruthers [1982] interprets Frege as trying and failing to prove). Rather, it shows that a definition cannot introduce the concept, because someone who does not already possess a concept of truth cannot grasp what a definition is.

Moore [1899, p. 181] raises an objection to the correspondence theory of truth that might be viewed as a version of Frege's argument:

> It is […] impossible that truth should depend on a relation to existents or to an existent, since the proposition by which it is so defined must itself be true, and the truth of this can certainly not be established, without a vicious circle, by exhibiting its dependence upon an existent.

Moore's argument is more epistemologically oriented than Frege's. In order to justify a proposed definition of truth, we must be able to judge that it is true, or likely to be true, and to do this we must already possess a concept of truth or else enter into an epistemologically vicious circle.[2] Any argument must appeal to premisses whose truth is not called into question. We must therefore hold certain beliefs without having any justification for them. As Wittgenstein [1974, § 253] puts it: "At the foundation of well-founded belief lies belief that is not founded." It is conceptually impossible to step outside of one's own belief system and compare it to what lies outside (because the comparison itself would presuppose that beliefs about this outside was formed). Wittgenstein [1974, § 155] describes the situation in this way:

> All testing, all confirmation and disconfirmation of a hypothesis takes place already within a system. And this system is not a more or less arbitrary and doubtful point of departure for all our arguments: no, it belongs to the essence of what we call an argument. The system is not so much the point of departure, as the element in which arguments have their life.

This situation obtains when we evaluate our views from within in the tradition of Cartesian epistemology (Descartes [1641]). However, it is also possible to view these matters in a more naturalistic way, by investigating the relations between what happens in the minds of people and in the world outside. However, such an inquiry presupposes that we to some degree trust our senses and abilities to reason. In such

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[2] Moore's argument also suggests that there is an ontologically problematic circle that is generated by a correspondence theory of truth. If we take C to be the relation of correspondence that constitutes truth, a proposition p is true if and only if p is C-related to an existent e, but then the proposition that $C(p, e)$, p_2, must be C-related to an existent e_2, and the proposition that $C(p_2, e_2)$, p_3, must be C-related to an existent e_3, and so on. A correspondence theory of truth seems to be forced to assume a very rich inventory of existents to serve as the relata of the correspondence relation. (We will return to this problem in Section 3.10.)

a context, notions of truth and rational justification belonging to an object domain are not, at least for the kinds of reasons mentioned above, impossible to define (cf. Russell [1922, p. xxii]).

These observations must inform our view of scientific methodology. We cannot rationally pretend to question all our views at the same time. An hypothesis can only be evaluated against the background of views that we, for the moment, are forced to take for granted. We increase our knowledge not by building a construction on a solid foundation. Rather, knowledge develops by a continuous process of restructuring our belief systems. No item is, to quote Quine, "immune to revision" [1951, p. 43] in the long run, but at every moment most of the system has to remain unquestioned.

2.3   Ontology

A crucial aspect of a theory is which kinds of entities it recognizes, or, in other words, which *ontology* it assumes. Different areas of inquiry make very different claims in this respect. Modern physics, for instance, only recognizes the existence of certain very small objects and very basic kinds of relations among them. Larger objects and more complicated relationships must be seen as being composed of these simple elements, or disappear from sight entirely. Ordinary common sense discourse seems to quantify over entities of many kinds. It may therefore be taken to assume a very rich ontology, in which we find, for instance, a very rich inventory of abstract objects (properties, words, possibilities etc.). This everyday ontology is quite vague and vacillating. A more scientific inquiry should be more precise with regard to ontology. It is thereby led to take some kind of stance towards the objects apparently referred to in everyday talk.

The natural sciences have often been taken as the model of rational inquiry, partly because of their very tangible success. (They have endowed the human race with powers almost undreamed of only a few decades ago.) This has led many people to view physics as the foundational science, which should define the basic ontology: Other areas of inquiry should frame their theories in a way that makes it possible to reduce the claims they make to claims about the things that physics recognize. This is the basic idea behind the program of *Unified Science* (cf. Carnap [1938]): Physics lays the foundation. Chemistry deals with certain kinds of molecular physical processes. Biology is concerned with complicated chemical processes (organisms) and sociology with the interaction of several organisms of a certain kind (human beings).

Many linguists are attracted by ideas of this kind. Chomsky, to take a salient example, considers linguistics to be the study of a particular faculty of the mind and writes:

> [W]e may think of a person's knowledge of a particular language as a state of the mind, realized in some arrangement of physical mechanisms. (Chomsky [1986, p. 40].)
>
> [T]he abstract study of states of the language faculty should formulate properties to be explained by the theory of the brain and is likely to be indispensable in the search for mechanisms. To the extent that such connections can be established, the study of mind—in particular of I-language [i.e. of language as an internalized mental system]—will be assimilated to the mainstream of the natural sciences. (Chomsky [1986, p. 39].)

This vision is no doubt theoretically fascinating, but at present there is no brain science capable of bridging the gap between mentalist linguistics and brain physics. The view that such a bridge is necessary is, I think, sometimes the expression of a certain unnecessary lack of self-assuredness on the part of linguistics. It is felt that unless an explicit bridge between the concepts involved in linguistic theories and those figuring in the natural sciences is provided, the intellectual respectability of linguistic theories is doubtful. I think this view is unwarranted. Linguists have been able to investigate language from many points of view and to produce theories open to rational and critical evaluation without advancing hypotheses that can be reduced to physicalist statements. (At least, no method of reduction has ever been known to exist.) So, a rational inquiry does not need to be assimilated "to the mainstream of the natural sciences". Of course, physical considerations will sometimes play a role in linguistic argumentation. For instance, a finite brain may only host a finite system of representations and this may be relevant in relation to how we conceive of language-related knowledge.

I think that we should recognize the possibility of there being many irreducibly different ways of describing reality. This possibility is not incompatible with a monist metaphysics, as is suggested by the view of the relationship between physicalist and mentalist theories (among which we find most of the theories proposed by linguists) that is defended by Davidson [1970], [1993a] who labels his position **anomalous monism**,[3] and by Fodor [1976, p. 12–19], who talks about **token**

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[3] This position is discussed and described as **non-reductive physicalism** by Rorty in an article by

physicalism. These positions are *monistic* in the sense that mental characteristics are taken to be *supervenient* upon physical characteristics, which means that any distinction made in mentalist terms in any concrete case always corresponds to one that can be made in physicalist terms, but *not vice versa*. For instance, everything that is an event according to a mentalist theory may also be given a physicalist description, but physical events that do not correspond to anything that can be described in mentalist terms may occur.

This view can be said to be nominalist with regard to mental particulars and universals: They only exist in virtue of our ways of speaking or thinking about human beings. Davidson's and Fodor's views are *anomalous* in the sense of assuming that there are no law-like principles that relate mentalistic descriptions to physicalistic ones. The term "token physicalism" also reflects this idea. Every mental token event or state is also a physical event or state, but the *types*, i.e. the predicates of a mentalist theory cannot be defined in physicalist terms. This kind of view will allow us to admit the mutual irreducibility of physicalist and mentalist descriptions of things without committing us to a corresponding metaphysical dualism. The two kinds of theories (and languages) represent different ways of describing the same reality.

For a linguist working in the tradition of truth-conditional semantics, questions of ontology enter the picture from two sides. First, in connection with the general theory that is formulated and this is the way in which ontology is relevant to any inquiry. Secondly, an ontology is stipulated when the truth conditions of natural language statements are analyzed, as a set of truth conditions assume that there is a certain domain of objects over which quantification ranges.

The point of departure of truth-conditional semantics are certain notions and intuitions that essentially belong to the perspective of the language user. Many of these are admittedly refined and redefined in semantics, to the degree that naive common-sensical reasoning has lead many a student of semantics astray. Nevertheless, truth-conditional semantics assumes that there are utterances, composed of words, that these words refer to things and that many utterances typically are true or false. From the point of view of the natural sciences, linguistic behaviour has to be seen as a product of enormously complicated physical processes. Most of the linguistic intuitions of ordinary language users would have no place in this picture.

On the one hand there is the intuitive everyday human perspective on human life, in which people think, feel, speak and set out to do things, and, on the other hand, the natural sciences, which only allow us to view people as arbitrarily delimited

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that name [1991].

aggregates of interacting matter. (There are intermediate points of view and different ones too.) For the moment human knowledge has not advanced far enough as to be able to clarify in detail how the two perspectives relate to each other, i.e. how human behaviour as intuitively understood by human beings is a product of physical (chemical) processes. An account of this kind, if possible at all, would be extremely complex and its modes of explanation would probably be of little use in ordinary social intercourse. Ordinary everyday intentional psychology gives a lucid, simple, and useful picture of the activities of human beings and some causal mechanisms involved in them, even if it employs notions that cannot be assimilated to those involved in a purely physicalist perspective.

Truth-conditional semantics is best seen, I think, as a theory built on top of everyday mentalist psychology. (However, it is possible to view linguistic structures correlated with truth-conditions in a purely abstract manner. This is often done in logic.) Most truth-conditional theories also depend upon the use of set-theory. In this way sets are included in the ontology and sets are a kind of abstract particulars quite foreign to everyday discourse.

2.4   Goals of Linguistics

The aim of linguistics (the science of language) is to elucidate, at least partially, the processes involved in linguistic (language-related) behaviour. This idea presupposes the common-sensical intuition that linguistic behaviour in one way or another is a naturally defined subspecies of human behaviour. The terms "linguistic" and "language" are quite vague, but there appears to be clear instances both of linguistic and non-linguistic behaviour (as well as more controversial intermediate cases). It is far from easy to say what regulates the application of these terms. They represent notions belonging to a complex picture of human life. Important aspects of this conception are that people possess minds containing representations of their environment, that they intend to do things, that they actively bring about changes in the minds of others, and that their own mental representations are formed in causal interaction with their environment. The two most important features of linguistic behaviour are, I think, that it is communicative and that it relies on a language system. It is communicative in the sense that it consists of actions intended to change the overt behaviour and/or the mental states of other people. A language system is a crucial factor behind linguistic communication, which relies on shared knowledge of established grammatical and word-oriented practice. This knowledge

is typically tied to a particular natural language. The language system is constituted by a system of assumptions about the *normal* use of the elements of language. It is in this sense a system of normative beliefs. They do not dictate how language is to be used, but in linguistic communication they are most of the time relied on by the participants.

Successful ordinary linguistic behaviour presupposes several kinds of knowledge and ability: general knowledge about the things talked about, general social competence, an ability to correlate one's linguistic actions with whatever non-linguistic activity one is engaged in (for instance, to talk while walking), and knowledge about the language being used. Knowledge of a particular language is consequently only one of several mental resources necessary for language use. For instance, a person who learns that Frege was born in 1848 can hardly be held to acquire any new linguistic knowledge, but his discourse-related abilities are extended: If he is an ordinary speaker of English, he has thereby learned the correct answer the question "When was Frege born?".

Considerations of this kind have prompted many linguists to draw a distinction between languages as systems and language use.[4] The idea behind such distinctions is that language use is a product both of linguistic knowledge and other factors, such as more common knowledge, the mood of speakers, of various events in their bodies, causal influence from the environment etc. Distinctions of this kind are theoretically difficult: It is far from easy to delimit the language system from other mental systems, but anyone who intends to describe language without describing the human mind as a whole and thinks this is meaningful is committed to some distinction between (a) language and the rest of the mind. However, the question of the theoretical basis for this distinction is controversial and the question of how (a) language is best delimited must take also the other aspects into consideration. The best notion of language is the one that supports and is supported by a theory of the mind that is holistically optimal from the point of view of evidential support, simplicity, and economy.

2.5   Linguistic Analysis

Utterances form one of the most important kinds of linguistic particulars. Linguistic theory involves making clear the relation that obtains between these and the language

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[4] The two most famous examples of this are de Saussure's [1915, p. 23–35] distinction between **langue** and **parole**, and Chomsky's [1965] between **competence** and **performance**.

system. The analysis of utterances proceeds from hypotheses about the structure of the language system, and these hypotheses derive their support from other data concerning these utterances. In this context, a number of intuitively discerned modes of description are usually recognized. The most physicalistic one represents an utterance as as a spatio-temporally located stretch of acoustic energy. A purely acoustic account of an utterance does not involve any linguistic analysis as it is applicable to any kind of sound signal and as it may be performed without taking hypotheses about the language user and/or language system into consideration. (To be meaningful to a linguist, such an analysis must however be designed to reveal acoustic features that are relevant to language.)

A morpho-syntactic account, by contrast, clearly depends upon assumptions about a language system involving an inventory of morphemes and modes of combining them. Such an account will describe an utterance as a string of morpheme (type of minimal meaningful units) instances and and tell us how these morpheme instances fit into a pattern of syntactic relationships (forming words, phrases, clauses, sentences etc.). There are many theories making very different claims concerning what should in more detail be said about morpho-syntax. Several of these posit several levels (e.g. surface and deep structure) of syntactic representation. In this study, syntactic issues will not be of much concern. It will rely on a surface-oriented analysis in terms of quite traditional grammatical relations and categories (as indeed most linguistic theories do). It should therefore be seen as presupposing a syntactic theory in which the relevant grammatical notions can be defined.

Semantics can be seen as another mode of description concerned with what utterances or the expression types they instantiate "mean" and it is recognized by all linguistic theories, even if there is little general consensus concerning the details of semantic analysis. A semantic account of an utterance does not necessarily articulate an utterance in the way a morpho-syntactic account does, as its semantics (its "meaning") may be conceived of holophrastically, i.e. correlated with an utterance as a whole, without directly claiming anything about the items out of which the utterance is composed. The often very indirect connection between semantics and the concrete physical features of an utterance may partly explain the conceptual difficulties troubling some linguists when it comes to semantics. I will follow one of the more important traditions and assume that there is an interesting notion of "meaning" that allows us to characterize meanings in terms of truth conditions. We will shortly return to this notion of meaning.

2.6   Language as a System

An inescapable assumption about language use is that there is a language system, which involves a lexicon, i.e. a set of morphemes and larger linguistic units, defined in terms of their phonematic shape and their grammatical and semantic properties, a compositional semantics, i.e. an inventory of modes of combining lexical units into larger units. (Grammar may be seen as an aspect of the combinatorial semantics.) These modes involve constraints on both form and semantical properties. It can also be argued that we should assume that an inventory of pragmatic principles belongs to a language system. These would handle various aspects of discourse organization, rhetorical devices etc. (Assumptions about a phonology are not directly pertinent to the issues of the present work, but many linguists would consider it a crucial part of a language system.)

The language system defines (more or less fuzzily) a set of possible expression types. Concrete utterances may be seen as instances of these expression types having a certain spatio-temporal location (cf. Strawson [1950b]). By identifying an utterance as an instance of a sentence type, its relation to a language system is made explicit. The analysis of utterances consequently proceeds in light of the analyst's notion of the language system, which represents constraints and expectations concerning the structure and meaning of utterances. Representing a common stock of elements out of which utterances are composed, it further allows us to relate different utterances to each other.

We should note the normative orientation of language systems. One way of understanding what language users are doing is to view them as trying to conform to certain mutually known linguistic constraints. Sometimes they fail and sometimes they try to communicate without recourse to these constraints, but in most cases they orient their verbal behaviour towards these constraints and intend it to be understood in light of them.

We may adopt a notion of intention allowing that language users often are not actively aware of their intentions. An analysis of such intentions is a kind of rational reconstruction of what is going on. Intentions are made explicit when we view the actions of a speaker as the product of active and fine-grained deliberations which explicitly consider all kinds of relevant information. Linguistic theory may be said to view language users as automatic systems and the central issue is: What kinds of information structures and capabilities of information processing must the language users be assumed to possess in order to be able to correlate their input (i.e. the kind of information about the environment they are assumed to be able to access) and

their output (their behaviour) in the way they do.

2.7   Truth-Conditional Analysis

A truth-conditional analysis of the kind outlined in this book is informed by a quite narrow conception of semantics. Many aspects of language use which intuitively pertain to the meaning of utterances are therefore excluded from consideration in a truth-conditional semantics.

An important tenet of truth-conditional approaches to semantics is that their notions of meaning abide by what Davidson calls **the principle of the autonomy of meaning** (Davidson [1984, p. 274]), which says that there is a high degree of independence between what a language user may intend to achieve by an utterance and the truth-conditional content of this utterance:[5] Truth-conditionally equivalent utterances may be made with very different intentions. And two utterances with different truth-conditional contents can serve the same purpose. For instance, an utterance of "I am hungry" (whose truth conditions will tell us that it is true if and only if the speaker is hungry at the time of utterance) may be made with the intention of getting the addressee to realize that the speaker thinks that it is time to go to a restaurant, but it may also be made with the intention of getting the addressee to realize that the speaker wants the addressee to prepare food for him. The former intention could also be carried out by means of an utterance like "I think that we should try to find a restaurant now".

Our ability to apprehend a kind of meaning that is abstract in this way is part of what makes language into a useful tool. This supports the idea is that there is a kind of meaning (BTC-meaning as explained in Section 2.7.4) which is governed by constraints that are determined by the words and their arrangement in a way that allows language users to apprehend this meaning also when they encounter hitherto unencountered strings of words and to be guided by this apprehension to an understanding of other aspects of the intentions behind an utterance. This kind of systematic semantics presupposes that many semantic constraints are comparatively stable and insensitive to contextual variation: "Language is the instrument it is because the same expression, with semantic features (meaning) unchanged, can serve countless purposes" (Davidson [1968, p. 108]). One of the most basic features of a language is that its semantic resources are reusable in this way.

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[5] A notion of meaning that did not support some such kind of independence would imply that every utterance would have a unique meaning.

Consequently, a truth-conditional semantics does not try to account for everything that is accomplished by means of language and leaves out of consideration how utterances with a certain truth-conditional content may bring about tangible effects. A fundamental assumption and motivation behind truth-conditional treatments of language is that the ways in which people use language crucially depend *both* on the truth-conditional properties they associate with linguistic expressions and on extra-linguistic beliefs and intentions. A truth-conditional semantics is consequently a component in a more general account of the mechanisms behind language use. Truth-conditional concepts of "meaning" are consequently narrower than many other notions of "meaning". Many aspects of meaning, as more broadly conceived, can hardly be captured by truth conditions. I think truth conditions are best conceived of as something that we discern in terms of the intentions of a language user.[6] An utterance is made with certain intentions, some of which are linguistic in the sense that they are defined in meta-linguistic terms. For instance, an utterance may be made with the intention that the addressee is to apprehend it as a sequence of instances of certain word types. Utterances are typically also accompanied by intentions which are non-linguistic in the sense that they are not defined in meta-linguistic terms. A speaker may, for instance, ask a person to pass him the salt, with the intention that the salt is to be within his reach within a few seconds. (The salt being within his reach is a state of affairs not apprehended in meta-linguistic terms.) Some of the intentions behind most utterances are, as Grice [1957], [1969], [1975] has pointed out, intended to be recognized by the addressee, and the speaker typically intends that it is the addressee's recognition of them that is to cause him to react to the utterance (cf. Bunt [1990]).

These intentions behind an utterance (or any other act) may be (partially) ordered by relations of means to ends. For instance, a language user may make an utterance with the following kind of intentions: (i) that the addressee (A) will recognize the utterance as being composed of a string of certain lexical items; (ii) that A will associate certain truth conditions with it; (iii) that A will realize that the utterance carries a certain force (e.g. that it is an assertion, a question, a suggestion, a joke, a linguistic example, or whatever); (iv) that A will form a particular belief; (v) that A is to do something; and (vi) that A will recognize all or some of these intentions (i)–(vi) of the speaker. (Lying, by contrast, involves that the speaker

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[6] This idea is a central one in the philosophy of Davidson, cf. papers like [1986], [1984], [1978]. Grice is perhaps the most prominent proponent of the view that language use should be explained terms of the intentions of the users of language and their mutual recognition of these intentions. It has been developed in several articles by Grice, such as [1957], [1969], and [1975].

intends some of his intentions *not* to be recognized.) A more concrete example conforming to this scheme could be the following: A speaker (S) says "It's cold here" with the following intentions (the list is not complete): (i) the addressee (A) will recognize that the utterance consists of instances of four English words and that they are intended to be used in accordance with a certain established practice (for instance, that "here" refers to the place where the utterance is made); (ii) that A will recognize that the utterance is intended to be true if and only if it is made in a chilly environment; (iii) that A will understand it as an assertion, (iv) that A will form the beliefs that S actually thinks it is cold, that S wants A to know this, that S has some instrumental reason for wanting this, that S wants A to do something that will increase the temperature, and that S wants A to close a window, and that S expects A to actually do this (and so on); (v) that A will close the window; and (vi) that all of these intentions will be recognized by A. Everyday common-sensical discourse would potentially consider any of these intentions as pertinent to the "meaning" of an utterance. A general theory about the intentions with which utterances are made and how they are determined would have to consider almost any kind of human belief and reasoning.

Truth-conditional approaches to semantics try to restrict their attention to only one kind of communication-related intention. The idea is that there is a truth-conditional notion of meaning (to be characterized in more detail shortly) that may fruitfully elucidate certain crucial aspects of language use. (Let us call it **basic truth-conditional meaning**, to be abbreviated **BTC-meaning**.) It may be that communication in certain cases do not involve BTC-meaning, but, it may be assumed that in many typical and significant cases it does. By introducing the notion of BTC-meaning we will be able to make a distinction between BTC-meaning-related intentions and other intentions behind an utterance. The latter concern effects of an utterance that may depend upon a wide range of non-linguistic factors, such as the beliefs, desires, intentions, physical environment and other conditions of the parties involved in a discourse. A comprehensive theoretical account of all of these factors and their influence on communication and behaviour in general is perhaps not even possible and would, in any case, involve much more than might reasonably be expected from an inquiry trying to restrict its attention to language. A truth-conditional semantics rests upon the assumption that a rather narrow conception of meaning may fruitfully be employed to explain various features of language use.

2.7.1 The Justification of Semantic Analyses

A theory about the truth-conditional content (as relativized to a speaker and a time) of the sentences of a language is a part of a general interpretational theory about the propositional attitudes of an interpreted party. If we accept a physicalist metaphysics, or at least a physicalist view of perception, we have to recognize the fact that such interpretations are justified by reference to perceptible features of physical states of affairs. Available evidence consists of data about the behaviour of people and about the environment in which it occurs. The details of the processes and the mental resources involved in the formation of adequate beliefs about propositional attitudes and the modes of reasoning exploited in public justificational discourse are to a large extent unknown.

Propositional attitude interpretation may be compared to the formation and testing of a theory according to a hypothetico-deductive scheme. At least, this is one way of conceptualizing interpretation: The "data" consists of observations of the outward behaviour of the interpreted party and the theory will be a collection of hypotheses about his mental states framed in the terms of propositional attitude psychology. The theory also contains principles of a more general kind that give content to the universally applicable concepts of this psychology (such as *belief*, *intention*, *truth*, and *reference*). This idea is the point of departure for Davidson's [1973] analysis of **radical interpretation** (which is highly influenced by Quine's [1960b] discussions of **radical translation**).

Radical interpretation occurs when an interpreter tries to understand a person on the basis of perceptually available evidence.[7] (Quine's case of radical translation is rather concerned with the compilation of a translation manual under the same circumstances.) The radical interpreter is assumed to know the language and general principles of propositional attitude psychology, but not anything about the mental idiosyncrasies of the interpreted party. Situations of more or less radical interpretation are common. We meet people we have never heard of, see what they do, hear what they say, and soon come to understand their language and some of their beliefs, desires and intentions.

Quine and Davidson stress the holistic nature of interpretation: Hypotheses concerning the meaning of sentences and those concerning the beliefs of interpreted party can only be evaluated together. Linguistic meaning and propositional attitudes can only be made sense of as elements in a coherent network, tied to the world

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[7] It is radical in the sense of proceeding from the evidential root (Latin: *radix*).

and to each other in accordance with certain general principles. These principles provide the point of departure for a process of interpretation, and are *a priori* in the sense that they are presupposed rather than discovered in the course of actual attitude interpretation. They concern, for instance, the relations between beliefs and utterances, the relations between beliefs and what actually is the case, between intentions and how they are carried out, logical constraints, and relations between different kinds of mental attitudes.

2.7.2   The Principle of Charity

It seems that ascriptions of more finely structured beliefs, desires, and intentions can only be justified if it assumed that the interpreted party uses a language which is equally finely structured. Utterance-related data are consequently very important in interpretation. A sincere declarative utterance expresses a *belief*. Which belief is expressed depends upon the *meaning* of the utterance. Both what the interpreted party means by his sentences and what he believes are circumstances that are revealed by an interpretation and not known prior to it. There is hardly any *a priori* constraint on this. Human languages are arbitrary systems of signs, and a sentence can mean anything and consequently be used to express any belief.

This suggests that there must be some other kind of *a priori* principle that will allow an interpreter to justify hypotheses about the beliefs and the meanings of an interpreted party on the basis of utterance-related evidence. Quine and Davidson argues that there is such a principle, namely what is called **the principle of charity**.[8] The idea behind it is that interpretation must start from the assumption that certain beliefs of the interpreted party are true. If utterances are taken to express true beliefs, the external observable world will provide the evidence that may allow an interpreter to say what they mean. Their meaning cannot reside in anything except their actual correspondence with the world. Exactly how the principle of charity should be formulated is a subtle issue, but it says that the beliefs of an interpreted party are largely true.

Similarly, the logical structure of sentences and the corresponding beliefs is identified on the basis of their being subject to the *a priori* constraints associated

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[8] See, for instance, the following articles by Davidson [1967], [1973] [1974a], [1974b], [1982], [1983], [1990a]. Also cf. Vermazen [1982] and Malpas [1988]. Critical discussions are found in Foley and Fumerton [1985] (against anti-sceptical arguments derived from the principle of charity by Davidson [1983]) and in Warmbrōd [1991]. The term "principle of charity" was introduced, it seems, by Wilson [1952], in a somewhat different context.

with the logical constants in terms of which the structure of the beliefs is rendered. For instance, belief in a conjunction is characterized by the circumstance that it is generally accompanied by beliefs in the conjuncts. It may be allowed that cognitive agents sometimes fail to see the consequences of their beliefs, but the only justification for ascribing a certain logical structure to a portion of a person's belief system is that this belief system in general conforms to the constraints that define the relevant logical constants. (Corresponding constraints apply to intention and—perhaps less strongly—to desire.)

What seems to be another necessary assumption behind propositional attitude interpretation is that people often have intentions that they successfully carry out. (This is an intention-related counterpart to the principle of charity.) For instance, interpretation of speech requires that we take the speaker to produce the sounds (relative to some kind of description) that he intends. A person without intentions does not do anything in a way that can reflect the state of his mind. Having no intentions, he will not be prompted to take what he believes about the world into account.

2.7.3 Truth and Interpretation

The concept of truth figures prominently in the Davidsonian account of propositional attitude interpretation. What kind of concept of truth is the relevant one here? It might seem that a kind of correspondence theory of truth is involved here, but this idea should be rejected. We should not associate truth-conditional semantics with correspondence theories of truth.

Davidson [1990b] argues that the concept of truth is a primitive one, that it cannot be defined. (Moore and Frege have expressed similar views, cf. Section 2.2.) Rather, it is one of the conceptually basic predicates of interpretational theories. Semantic interpretation proceeds, according to Davidson, from sentences taken to be true down to hypotheses about the denotations of predicates and the reference of singular terms. Reference and denotation are theoretical constructs only posited to get truth-conditions right (Davidson [1979b]).

A correspondence theory of truth presents an inverse picture. The kind of correspondence that constitutes truth, if there is one, must depend upon the denotations and reference of the elements of the vehicles of truth and falsity (propositions or sentences). For instance, what a sentence like "Peter is lazy" is to correspond to in order to be true must depend on what "Peter" refers to and what "lazy" denotes. A correspondence theory of truth explicates truth in terms of semantic concepts like

denotation and reference. The Davidsonian theory of radical interpretation rather explains reference and denotation in terms of truth (and a number of other concepts). It seems that any correspondence theory of truth must presuppose that certain semantic connections are logically prior to truth. They can be said to subscribe to what Tarski [1944] calls a "semantic conception of truth". Davidson's theory, on the other hand, is a "truth-based theory of semantics" (Ramberg [1989, p. 40]).

2.7.4   BTC-meaning

In this section, I will try to characterize and defend the notion of BTC-meaning and describe its place in a certain picture of language use. It should be stressed that this picture belongs to a kind of interpretational theory that describes human beings and their actions in the terms of a propositional attitude psychology. Everything relating to language should, according to this picture, be traceable back to the intentions involved in concrete cases of language use. All abstract entities posited in a linguistic theory of this kind are therefore inherently context-dependent, in the sense that they are justified only to the extent that they can explain and are supported by the ways in which language is actually used.

Meaning, understood in a wide sense, is a feature both of utterances and linguistic expression types. The meaning of expression types is context-insensitive in the sense that the same expression type with the same meaning may be used in different contexts. This insensitivity is also reflected in our ability to say something about the meaning of a linguistic expression that is considered in isolation from any *particular* context. Context-insensitive meaning-related constraints may relate to context-dependency. For instance, if we say that *you* refers to the addressee of an utterance, we have stated a constraint that holds across a wide variety of contexts (where English is spoken).

Both in cases of utterances and expressions types, it is often impossible to say exactly what they mean. Rather, it seems that meaning is a matter of constraints that seldom completely determine every relevant factor. The constraints associated with expression types are conjoined with other constraints supplied by the context when instances of them occur in a concrete situation.

The concept of BTC-meaning will not be given a strict definition. Rather, its place in a certain explanatory scheme will be clarified and certain requirements on the notion will emerge. The BTC-meaning should then be understood as being the property that in the best way meets these requirements. BTC-meaning primarily belongs to utterances of sentences. The meaning of sentences is partly determined

by the BTC-constraints that are inherited from the sentence by any token of it. The first requirement on BTC-meaning is that it relates to features of sentences in such a way that this is possible. Constraints relating to the utterance context will then allow the BTC-meaning of a concrete utterance of the sentence to be further restricted. So, for instance, the BTC-constraints associated with the sentence "I am hungry" may be that it is true if and only if the speaker is hungry at the time of utterance.

The second requirement on BTC-meaning is that it is to be characterized in terms of truth conditions. This is motivated by the assumption that truth-conditional content plays a crucial role in the general picture of human cognition and behaviour in which this kind of explanation of language has its place. This picture explains and characterizes mental states and events in terms of their content and an important aspect of these contents is their truth conditions. So, the content of a belief may be characterized in terms of what it is for it to be true. Wishes may be described in terms of what it is for them to come true, and intentions in terms of what it is for them to be carried out successfully. This theory is couched in the terms of a propositional attitude psychology and allows us to give a comprehensive account of human beings as rational agents. A notion of truth-conditional meaning will support and be supported by a propositional attitude psychology of this kind and its value is partly derived from the value of this general picture. An important assumption behind a truth-conditional semantics is that language use in many cases may be significantly elucidated in terms of the language users' apprehension of truth conditions.

Another feature of BTC-meaning is systematicity. The BTC-constraints of a sentence should be systematically derived from the meanings of its parts and their modes of combination. This idea presupposes that the smallest parts of sentences that are recognized (the morphemes) are associated with semantic constraints and that each mode of combination whereby composite expressions are formed is associated with a constraint that characterizes the meaning of a composite expression in terms of the meanings of its parts. So, the meanings of subsentential expressions must be defined in ways that makes the overall system agree as much as possible with the constraints set down here. Truth-conditional semantics usually characterizes meaning in terms of denotations. So, if the denotation of a name is an individual, the constraints associated with a name will consist of conditions that this individual has to meet.

The demand for systematicity is motivated by the fact that language users are able to understand the meanings also of complex expressions they have never encountered before. It seems that they possess the ability to grasp the meaning of

a very large number of possible sentences and that the most plausible explanation is that they somehow do this by deriving constraints on the meaning of the whole from semantic constraints associated with the morphemes and modes of composition recognized in a sentence.

In truth-conditional semantics issues relating to lexical semantics and "compositional" semantics are often separated. What is called the **logical form** of a sentence can be defined as a complex constraint defining the truth value of the sentence in terms of the denotations of the lexical units taken to correspond to non-logical constants. So, for instance, the logical form of a sentence like "Some apples are red" may be rendered as '$\exists x[A(x) \wedge R(x)]$' in ordinary predicate calculus. 'A' and 'R' stand for the extensions associated with the words "apple" and "red", respectively. The truth definition for this calculus will tell us that this formula is true just in case the two extensions have at least one element in common. No further constraint on the denotations of these logical constants (apart from their logical type, i.e. that they are one-place predicate extensions) is expressed by the logical form. However, some constraints on their denotations may be assumed to be of a conventional-lexical nature and certain further relevant constraints may derive from the context. In the formal semantics, denotations of expressions of predicate calculus are often defined as relative to an interpretation. In this way, these lexical and contextual constraints are brought together as constraints on the intended interpretation. (Actual absolute truth is truth relative to this interpretation.)

The reason why sentences are semantically analyzed by giving their logical form is that aspects relating to logical structure seem to be less context-sensitive than lexical denotations. For instance, a sentence like "some chairs are too small" contains the vague terms *chair* and *too small*. A context of use may be expected to provide further constraints, but the facts of logical form are not as easily influenced: The sentence will say that some objects are both chairs and too small. Of course, a speaker may wish to convey the idea that all chairs are too small by using this sentence as an understatement, but in this case systematicity considerations strongly support the idea that such a use would be figurative.

Finally, BTC-meaning is intended to capture conventionally established constraints. The motivation behind this requirement is that language users to a large extent understand each other in virtue of conforming to an established linguistic practice and that this practice is often understood in terms of BTC-meaning-related semantic constraints. Again, we should remember the normative nature of these constraints. They only form a standard that language users often try to abide by in order to communicate in the most straightforward way, but they can also exploit

these norms in more indirect ways, and even ignore them altogether.

We may summarize the features of BTC-meaning by saying that it is a notion of meaning that is intended to capture the kind of meaning that is (1) restricted by constraints inherited from sentences by sentence tokens used in a concrete context, (2) truth-conditional, (3) systematic, and (4) conventionally established. It will be supposed that these constraints in at least a significant range of cases determines a complex property that can be characterized in terms of substantial constraints and that these can elucidate important aspects of language use.

BTC-meaning is insensitive to some aspects of language use that may be thought of as pertaining to meaning in a wider sense (see Section 2.7). These appear to include various kinds of emotional attitudes conveyed by means of an utterance without being explicitly stated in a way that would justify their being accounted for in truth-conditional terms. For instance, a statement that "it rains" made with a voice indicating joy and a statement of the same sentence made with a voice indicating regret are, *ceteris paribus*, two utterances with the same truth-conditional content, despite the fact that the speaker may have indicated different emotional attitudes in the two cases. (Such emotional indications may be more or less accurate, more or less misleading, but they do not necessarily affect the truth conditions of a statement.) On the other hand, the two utterances, "it is raining and I'm glad that it does" and "it is raining and I regret that it does" have distinct truth-conditional contents.

There are also other kinds of intentions behind utterances which intuitively are related to "meaning", but cannot be characterized in terms of truth conditions. A speaker may, for instance, mean to offend someone by making a certain utterance, but the speaker may very well make the same statement with the intention not to offend anyone. Such intentions are not defined in terms of truth conditions. Successful communication always involves recognizing intentions relating to aspects beyond truth conditions. So, the complaint that a truth conditional semantics will leave many crucial aspects of language use out of the picture really misses the point: The very motivation behind this view of semantics is the assumption that a quite narrow conception of meaning of this kind allows us to explain certain aspects of language use in a fruitful way.

2.7.5 Non-Declarative Discourse

Truth conditions are primarily associated with statements, i.e. utterances representing claims (that are true or false). Truth-conditional semantics consequently views

making claims as a fundamental kind of linguistic act. Other kinds of utterances, such as questions and commands conform to the truth-conditional order more indirectly.

A sentence (yes/no) question may be understood as a request for information whether a certain state of affairs obtain. This is reflected in the circumstance that the meaning of such a question generally is captured by the formula *is it the case that p?*, where p represents an arbitrary truth-conditional content. It seems that the contents that can be questioned in this way are precisely those that may be asserted. Further, every declarative sentence is related by way of simple and general syntactic principles to a corresponding interrogative one and it generally holds that if they are put forth in the same context the first asserts precisely the same content that is questioned by the second one. So, both from the point of view of syntax and semantics sentence questions closely correspond to declarative sentences. When it comes to *wh*-questions, i.e. questions beginning with an interrogative pronoun or pronominal adverb, the situation is more complicated, but in many cases such a question may be seen as defining a predicate, whose extension the addressee is expected to supply. Their content is in this way rendered in a way that indirectly involves truth-conditions. This idea is also supported by syntactic facts.

Commands may also be analyzed along these lines. They describe what the addressee is requested to do. An important aspect of the content of a command may be characterized in terms of what is the case when it is being executed, or— I think this is a better analysis—in terms of a condition that the addressee must meet. Again, there is a fairly simple syntactic relation between a command and a declarative sentence capturing these truth-conditions or a verb phrase defining this condition.

This suggests that also important kinds of non-declarative utterances may be subjected to a truth-conditional analysis, even if they show the necessity for some further conceptual device allowing us to distinguish between (say) assertions and questions. One way of doing this is to recognize what is often called "force" as a component of the meaning of an utterance (cf. Austin [1962], Stenius [1967], and Davidson [1979a]). So, there are assertive, interrogative and imperative force, and perhaps some further kinds, which are coupled with a particular truth-conditional content (often called a "sense" in this context). There are also utterances which we cannot account for plausibly in these terms, such as interjective utterances, calls for attention etc.

2.8   Concluding Remarks

There are two kinds of considerations that are relevant in formal semantics. The first kind concerns the data that are supposed to support a theory. Are they correct? Secondly, there is the issue of whether a theory accords with the data it is supposed to explain. Questions of the second kind are open to rigorous modes of evaluation, but those of the first kind are not. The presentation of a formal semantic theory should state which intuitions the theory is intended to account for, and if necessary, try to explain and/or defend these intuitions. Rigorous argumentation is only possible when such intuitions are (tentatively) accepted. They form a rather loose and shaky point of departure for a semantic analysis. There are in most cases no relevant empirical data whose degree of objectivity is comparable with that of the data relevant in, say, the natural sciences. But every reader of a semantic thesis may consult his own intuitions (and apply them to concrete and empirically given cases of language use). The objectivity that can be expected from a semantic treatise lies primarily in intersubjective consensus about its adequacy. A truth-conditional semantics, just like many other theoretical proposals, should be seen as an invitation to look for conflicting intuitions.

Another possible situation is that a semantic theory is proposed as a component in a larger system intended to account for the behaviour of a linguistic agent or some aspect of this behaviour. If the other parts of this system are given, it should be open to a more direct evaluation by making precise and more physicalistic predictions about behaviour. Such a system might even be open to testing by being implemented and run on a computer. We should, however, not forget that there is presently very little known about the "things" that correspond to these other components. We may possess some understanding about certain mechanisms involved in language, semantics, logic, and reasoning, but I think it should be stressed that these things remain much of a mystery. The question of whether contemporary philosophy and linguistics are on the track leading to a better understanding of the human mind is consequently a controversial one. However, this work is motivated by the assumption that a truth-conditional semantics and the general picture to which it belongs illuminate important aspects of language use in a significant way.

3

APPROACHES TO PROPOSITIONAL ATTITUDE REPORT SEMANTICS

3.1   Introduction

Human beings are often described in terms of what they believe, know, desire, fear and intend. These verbs are often called **propositional attitude verbs**. The reason for this is that they can often be understood as standing for relations that hold between a cognitive agent and something that can be called a **proposition** or a **propositional content**. Propositional contents are characterized by two features. First, the distinction between true and false applies to them and, secondly, they can be expressed in the form of a declarative sentence. (We will return to the issue of what kind of entity propositions are.)

Propositional attitudes (i.e. the mental states described in terms of propositional attitude verbs) have for a long time been discussed by philosophers. Many of the old traditional problems of philosophy directly or indirectly concern mental states with propositional content. This aspect of the human mind is also highly relevant in relation to language. Language use is often described and explained in terms of propositional attitudes. The subject has therefore been of fundamental interest to philosophers of language and semanticists. Many of them have also concerned themselves with propositional attitudes in a more specialized way. Reports in which propositional attitudes are ascribed to people seem to be an almost inexhaustible source of language use that poses difficulties to semantic analysis. Semanticists and

philosophers of language interested in these semantic puzzles have often tried to show that established theories of meaning do not adequately account for propositional attitude report data and have then proposed allegedly superior theories. In this chapter I shall give an overview of some of the central contributions to this ongoing discussion. The difficulties will be explained and the theories that have been proposed to accommodate them will be reviewed.

This chapter is organized as follows: I will begin by making some general remarks on propositional attitudes (Section 3.2). Next to follow is a brief discussion of behaviourist proposals to the effect that discourse about propositional attitudes is reduced to what is taken to be more basic notions (Section 3.3). In this way the need for a more direct treatment of propositional attitudes and their content is eliminated. If such a reduction is found implausible, the issue of what the relata of propositional attitude relations are remains, and it is discussed in Section 3.4. I shall then address the question of how these are related to the semantic facts of attitude reports (Section 3.5). The next section (3.6) discusses approaches that have been motivated by arguments that propositional attitudes are not primarily matters of binary relations (between a cognitive agent and a proposition). The rest of the chapter is concerned with some important proposals concerning binary analyses of propositional attitude relations and the semantics of propositional attitude reports. Section 3.7 gives an account of Frege's theories. Section 3.8 discusses approaches to propositional attitudes that try to account for their content in terms of symbolic representations. In the next section (3.9), Davidson's paratactic theory is reviewed. In Section 3.10 I discuss some attempts to find cognition-independent relata (referred to as "facts" or "situations") of propositional attitude relations. Accounts of propositional content in terms of possible worlds are treated in Section 3.11. Some issues relating to reference and propositional attitudes are addressed in Section 3.12, which precedes the concluding remarks (3.13).

3.2   Propositional Attitude Psychology

Everyday lay discourse about what people think, desire, fear, hope for, and say seems to presuppose that a crucial aspect of many mental states and linguistic acts is their content and that such contents may be expressed or described by a clause uttered in an appropriate context. This may be illustrated by the following examples:

$$(3.1) \quad \text{Mary} \left\{ \begin{array}{l} \text{says} \\ \text{denies} \\ \text{thinks} \\ \text{wishes} \\ \text{hopes} \\ \text{fears} \end{array} \right\} \text{that} \left\{ \begin{array}{l} \text{all men are mad} \\ \text{Plato is dead} \\ \text{Freud was wrong} \\ \text{a dog will bite her} \\ \text{it will be raining} \\ \text{the problem is undecidable} \end{array} \right\}.$$

These examples suggest that the verbs involved stand for relations that hold of a cognitive agent and something which somehow corresponds to a *that*-clause. An entity of this kind is often referred to as a **proposition**; hence the term **propositional attitude**.[1] The term *attitude* is perhaps more apt when applied to mental *states*, but its use is sometimes extended to cover also mental and communicative events.

This way of attributing content to the utterances and mental states of people is an important feature of many commonsense schemes of describing, explaining, and evaluating human behaviour, but it is not only confined to lay practice. Also many sophisticated theories about human psychology depend upon the assumption that some mental states can be characterized in terms of their propositional content. Behaviourist attempts to develop equally powerful psychological theories which do not rest upon assumptions of this kind meet with considerable difficulties (cf. Chomsky [1959]).

Discourse about propositional attitudes is supported by some kind of **propositional attitude psychology**. Ordinary folk psychologies, as well as different versions of psychoanalytic theory, are of this kind. They all embrace certain fundamental views about the human mind. Among the basic "tenets" we find the idea that people form beliefs by perceiving the world and by reasoning in accordance with certain principles, the idea that people have wishes and sometimes act to make wishes come true, and the idea that their actions are guided by their beliefs. Propositional attitude psychology is a kind of theory that allows us to see a coherent and systematic structure in the behaviour of ourselves and of other people. Further, it is a structure that may be discerned universally in rational behaviour and ratiocination and allows us to compare the thoughts and actions of different human beings.

Most linguistic theories seem to rely upon some version of propositional attitude psychology and take for granted that people speak with intentions to reach certain goals, that they often say what they think is the case, that they have beliefs, which are true or false, and which they may express in the form of an utterance.

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[1] The term "propositional attitude" seems to be due to Russell's article "On Propositions: What They Are and How They Mean" [1919] from 1919.

The present work will mainly be concerned with the semantic analysis of propositional attitude reports and related kinds of discourse. We may distinguish between the analysis of propositional attitude reports and the investigation of propositional attitude psychology (without denying that the two issues are interdependent and that their relation is a controversial issue). The former kind of analysis will be concerned with the logical form of the sentences used to report propositional attitudes, but may ignore, for instance, the details of lexical semantics. The latter kind of investigation will delve deeper into the psychological distinctions made in propositional attitude psychology and may address the issue of how propositional attitude attributions are, or should, be justified, or investigate how minds as described in terms of propositional attitudes are related to brain processes as described by neurology. Some thinkers seem not to have made this distinction, but it is clearly an unnecessary source of confusion not to make clear whether, for instance, the subject of a discussion is problematic features of belief reporting practices or of belief *per se*, or something else.

Similar restrictions in the scope of semantics are often made without much reflection. So, for instance, we may render the truth-conditions of a sentence like "ripe tomatoes are red" by saying that it is true if and only of the intersection of the set of ripe entities and the set of tomatoes is included in the set of red entities. This is possible without a deeper examination of the concepts *red*, *ripe*, and *tomato* (e.g. how are tomatoes individuated?) or of how a statement of this kind is to be justified.

3.3   Behaviourist Approaches to Propositional Attitude Attribution

Empiricist philosophers have often considered mentalistic concepts epistemologically difficult. Mental things are not perceptible, but people do form beliefs about, say, the propositional attitudes of other people with remarkable ease and often consider these attributions well-founded. One way of explaining this circumstance is to say that mentalistic statements really are covert statements about behaviour or behavioural dispositions. A proper semantic analysis will, according to this line of reasoning, show how mentalist notions may be defined in behaviour-related terms. This view may be termed **semantic behaviourism**.

A semantic behaviourist approach to propositional attitudes will give an account of propositional attitude reports by translating them into statements that do not mention propositional attitudes. Belief, for instance, may be assumed to be possible

to define in terms of dispositions to affirmative responses to sentences (under suitable conditions). (The approaches of Carnap [1956, §15] and Grossmann [1960] exemplify this.)

Propositional attitudes disappear from sight when propositional attitude reports are translated into a non-mentalist language. Propositional attitude reports are shown, if this behaviourist programme succeeds, not to be about propositional attitudes. From this we cannot conclude that there are no propositional attitudes, but the reasons for assuming that they exist would no doubt be weakened and natural language semantics would not need to bother about their nature.

Behaviourist approaches face many difficulties. Their programme has proven to be extremely difficult to carry out. Mentalist reports do not easily subject themselves to behaviourist reductions. The connections between mentalist statements and the behavioural evidence that may support them are in most cases extremely complex and depend on background mentalist assumptions. For instance, affirmative responses betray beliefs only to the extent that we assume that the speaker is sincere. It must also be taken into consideration which meaning the speaker associates with the affirmed sentence (cf. Davidson [1973], [1974a], [1986]). The significance of behaviour as evidence for mentalist hypotheses consequently depends upon other mentalist hypotheses in a complicated way. Semantic behaviourism can therefore be said to have met with too little success to be convincing (cf. Chomsky's scathing review [1959] of Skinner [1957]).

3.4   Propositional Attitudes as Involving Propositions

In this section I will discuss semantic analyses of propositional attitude reports that reject behaviourist reductions and favour an analysis in terms of propositions. Other non-behaviourist views are discussed in Section 3.6.

3.4.1   Propositions

Much speaks in favour of analyzing the verbs in the following kinds of sentences as standing for binary relations:

$$(3.2) \quad \left\{ \begin{array}{l} \text{Mary} \\ \text{He} \\ \text{Most people} \\ \text{Everybody} \\ \text{They} \\ \text{No-one} \end{array} \right\} \left\{ \begin{array}{l} \text{said} \\ \text{denied} \\ \text{thought} \\ \text{wished} \\ \text{hoped} \\ \text{feared} \end{array} \right\} \text{that} \left\{ \begin{array}{l} \text{all men are mad} \\ \text{Plato is dead} \\ \text{Freud was wrong} \\ \text{a dog will bite her} \\ \text{it was going to rain} \\ \text{the dog was dying} \end{array} \right\} .$$

These sentences consist of a subject, a verb, and a *that*-clause. These verbs appear to be standing for two-place relations, somehow connecting cognitive agents and whatever a *that*-clause represents (or three-place predicates if time is added as a third argument). This seems to be the simplest kind of analysis that should be considered. As the examples in (3.2) may be taken to illustrate, almost any combination of a subject denoting a cognitive agent, a propositional attitude verb, and a *that*-clause seems to make sense. A wide range of cognitive agents may stand in a number of different relations to a very wide range of propositional contents (as rendered or characterized by *that*-clauses). So, at least three factors should be distinguished in the semantic analysis of examples like those in (3.2), namely, the relation involved, the cognitive agent, and the relatum content. These contents are propositional in the sense that the distinction between truth and falsity applies to them and that their content can be rendered or described by a *that*-clause.

However, some analyses have tried to do without propositional contents and to characterize the content of attitudes in more basic terms. They have accordingly rejected two-place relation analyses of the attitude verbs. I will discuss some of these non-binary analyses of propositional attitudes in Section 3.6.)

If we assume that the two-place relation analysis of propositional attitude verbs is correct, and simply stipulate that the term "proposition" is to apply to the entities that serve as the relata of these attitudes, we face a number of interrelated questions: What kind of entity is a proposition? Which properties and relations apply to a proposition? How is a proposition to be defined?

I will discuss a number of properties of propositions here: first, that they appear to be of an impersonal nature; secondly, their relation to the distinction between truth and falsity and how they enter into logical relationships; and thirdly, that they seem to involve reference to objects. I will also say a few words about their independence from the attitude relation and about their individuation. Then, I will give an overview of different ways of defining propositions. (Details on the different proposals will be found in the more sustained treatments that are to follow.) Finally, in this section, I will say a few words about non-propositional attitudes.

3.4.2   The Impersonal Nature of Propositions

Propositions seem to be impersonal in the sense that in principle any two different cognitive agents may hold an attitude towards one and the same proposition (cf. Bäuerle and Cresswell [1988, p. 498] and Burge [1980]). Consider the following statements:

(3.3)   Everybody believes that Venus is a planet.

(3.4)   Mary didn't believe what Peter said.

A straightforward analysis of these statements will, in each case, stipulate an object towards which several cognitive agents hold an attitude. Beliefs, it seems, primarily belong to a particular person. However, as examples (3.3) and (3.4) suggest, the *objects* of belief do not seem to be personal in this sense.

   It is, of course, possible to reject the idea that there are (in some sense) abstract content elements, in which case we may, for instance, interpret the two statements along the lines of the following two paraphrases:

(3.5)   Everybody holds a Venus-is-a-planet belief.

(3.6)   Mary didn't hold a belief equivalent to what Peter said.

(The scope of the universal quantification ["everybody"] in (3.5) must be understood as dominating that of the existential one ["a"].) This kind of analysis[2] will do away with the need for some kind of public objects to which cognitive agents are related by holding propositional attitudes. However, if this step is taken, the public aspect reappears in the form of impersonal properties of private contents. It is also possible to distinguish a level of private contents, which are correlated with "public" propositions.[3]

   It seems that one of the most important aspects of propositional attitude psychology is that it allows us to characterize mental contents in an impersonal way. It makes it possible to compare the minds of different people, by describing them in terms of universal kinds of attitudes and contents. We may view the issues people discuss, the arguments they propose, the modes of reasoning they employ, etc. as drawn from an impersonal stock of possible contents and ways of connecting

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[2] An approach of this kind to the semantics of indirect discourse is suggested by Scheffler [1953].

[3] This kind of approach is found in Crimmins and Perry [1989].

contents. In this way people may hold the *same* opinions, the *same* beliefs, or be convinced by the *same* arguments (even if this sameness does not correspond to any physical sameness).

3.4.3   Truth, Falsity and Logical Properties

An important feature of propositions seem to be that they are often true or false. We may however recognize propositions that lack a truth value. This might, for instance, be motivated in cases where a belief is considered nonsensical by an external reporter. In many theories the entities called "propositions" are the primary bearers of truth and falsity and their introduction is partly motivated by a desire to find some kind of entity to which these predicates applies as properties.

Another feature of propositions, closely related to their role as the sites of truth and falsity, is that they enter into logical relationships. One of the most important functions of propositional attitude concepts is to support various schemes of describing, explaining, and predicting human behaviour and cognition by viewing it as regulated by certain basic principles of rationality. Many of these principles involve constraints on which propositional attitudes may rationally be held at the same time, and many of these constraints are framed in terms of the logical properties of attitude contents. Davidson (e.g. in [1973], [1974a], [1990b], cf. Ramberg [1989] and Bilgrami [1992]) have argued that creatures are interpretable as rational agents only to the extent that their cognition is assumed to abide by basic rationality constraints of this kind. If this is true, as I think it is, propositional attitude psychology is unthinkable without the assumption that attitude contents enter into logical relationships (see Chapter 7).

3.4.4   Propositions and Reference to Objects

Many propositions seem to involve reference to various objects: We may say that a proposition is *about* an object. However, propositions as wholes hardly refer to objects. Rather, the idea that a proposition may refer to a thing calls for the assumption that there is some referential item involved in the proposition. However, some accounts of propositions, e.g. the one that defines propositions as sets of possible worlds (see Section 3.11), reject this idea.

3.4.5 Propositions and Their Independence from Attitudes

The term "propositional attitude" suggests that these attitudes are all directed towards entities of the same kind, viz. towards propositions. This indicates another desirable property of propositions. They should plausibly serve as the relata of different propositional attitude relations. Otherwise, we will have to discern different kinds of propositions and different kinds of propositional attitudes, and this is a less economic theory than one that only assumes one kind of proposition. The same *that*-clause may often occur as the complement of almost any propositional relation verb, and this supports the idea that the same content may be shown, said, explained, inferred, denied, believed, known, or hoped. Consider the following set of sentences:

$$(3.7) \quad \text{Mary} \left\{ \begin{array}{l} \text{showed} \\ \text{said} \\ \text{explained} \\ \text{inferred} \\ \text{denied} \\ \text{believed} \\ \text{knew} \\ \text{hoped} \end{array} \right\} \text{that Frege was a logician.}$$

Sentences like these show that propositional attitude reports allow the same *that*-clause to figure as a characterization of the content of a wide variety of attitude types. From the point of view of attitude report semantics there does not seem to be any reason to assume that the relata of different propositional attitudes are different.

The idea that the same entities occur as the relata of different kinds of attitudes will also allow us to state certain conceptual constraints that seem to be involved in the lexical semantics of propositional attitude verbs. For instance, to know something may be understood as a special case of believing it; to hope that p excludes knowing that p or knowing that not-p; to hope that p also implies wishing that p.

3.4.6 The Individuation of Propositions

A problem that arises in connection with propositional attitudes is to say in which cases one and the same proposition is to count as the object of two different propositional attitude states. This question is closely related to the issue of how

propositions are to be individuated. A requirement that is crucial if we are to account for propositional attitude ascription practice is that the theoretical notion of "proposition" must be at least as finely discriminated as the possible contents of propositional attitudes are in attitude reports. So, as soon as it is rationally possible at a certain time to affirm "$X\ V$ s p" and to deny "$X\ V$ s q", where X is term denoting a cognitive agent, V a propositional attitude verb, and p and q two *that*-clauses, the two *that*-clauses seem to be assumed to stand for two different propositions (or propositional properties). This is a basic criterion of adequacy that any theory of the semantics of propositional attitude reports has to face. However, some theorists prefer to reject it in certain cases by arguing that propositional attitude report *that*-clauses are sensitive to more factors than which proposition is involved and usually try to give an account of these.

3.4.7   Different Conceptions of What a Proposition Is

The latter parts of this chapter describes a number of approaches to the semantics of propositional attitude reports in some detail and their different conceptions of propositions will be discussed there. For the moment I will just give a brief overview of different ways of conceiving of or defining propositions, by giving a list of what I take to be the basic kinds of approaches. All of them are represented by modern theories.

- **Propositions as primitive abstract objects of a special kind:** This approach does not try to explain or define what propositions are in terms of something more well-known or basic. Frege's theory and the one defended in this book are of this kind.

- **Propositions as sentences or utterances:** This kind of conception of propositions identifies them with sentences or utterances in natural language.

- **Propositions as expressions in a mental language:** Another possibility is to view propositions as expressions in a mental language. This was also common in medieval logic.

- **Propositions as sets of possible worlds:** The idea behind this approach is that a proposition is best seen as a constraint on how things might be. If we recognize that the world might have been different in very many ways, we may also accept the idea that there are many possible worlds (different

configurations of possibilities). We may then simply view a proposition as a set of possible worlds.

3.4.8   Non-Propositional Mental Attitudes

So, far we have mentioned only that there are mental attitudes with propositional content. Are there also other kinds of mental attitudes? The answer seems to be "yes": First, there are mental attitudes directed towards people and other concrete entities. Verbs like *love*, *fear*, and *hate* may stand for relations of this kind. However, these attitudes may also have intensional relata, not corresponding to anything mind-external. It is for instance possible to love, fear or hate something that one falsely believes to exist.

Another kind of attitude seems to be directed towards **properties** or **attributes**, hence Quine's [1958] term **attributary attitude verbs**, which include *seek* and *imagine* (but *imagine* is also used as a *propositional* attitude verb). It is possible to seek a unicorn, for instance, but there are no unicorns, only our ideas of what a unicorn is.

We may also recognize non-relational mental attitudes, if we do not prefer to restrict the application of the term "attitude" to relational states. Such states may be described by adjectives (rather than verbs) such as *happy*, *love-sick*, or *irritated*. Even if these states may be conditioned by directed attitudes, these adjectives characterize them in a non-relational manner.

I will not say much about non-propositional attitudes until Chapter 6, where a number of constructions for the attribution of non-propositional relational attitudes are analyzed. Non-relational attitudes will not be discussed further.

3.5   The Semantic Features of Intensional Contexts

When it comes to the semantic analysis of propositional attitude reports, a number of issues may be discerned. The basic form of such reports is often taken to be the one involving a subject, referring to a cognitive agent (or quantifying over cognitive agents), a verb,[4] specifying which kind of propositional attitude is in question, and a subordinate clause, describing or denoting the propositional content of an attitude. A report structured according to this scheme is (3.8).

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[4] In many languages a copula verb together with an adjective may play a role very similar to that of a single propositional attitude verb. Some English examples are *be convinced*, *be sure* and *be afraid*.

(3.8)   Mary thinks that Venus is a star.

So, there are three constituents of a report of this kind. (I am ignoring the issue of whether there is a verbal phrase involved in the grammatical structure.)

[Mary]$_{NP}$ [thinks]$_v$ [that Venus is a star]$_{that\text{-}clause}$

In view of the high degree of independence of the three constituents—almost any cognitive agent may be connected by almost any attitude verb to almost any *that*-clause—, it is preferable and natural to give a systematic account which assumes that the meaning of a report of this kind is given by the meanings of the three constituents. Most semantic theories assume that this approach is justified, at least in the most common and typical cases. (We will examine some exceptions below, in Section 3.6.) There are also other constructions that are used to attibute propositional attitudes (which will be treated in Chapter 6), for instance, passive ones ("Fido is believed to be a groundhog.", and other constructions without *that*-clauses ("Mary hopes for a miracle.").

So, there is first the issue of the semantical features of propositional attitude report subjects. They seem to represent an ordinary referential use of noun phrases, admit ordinary objectual quantification, and do not pose any particular problems to an extensional treatment. The subject quantification typically ranges over human beings, but propositional attitudes are also sometimes ascribed to animals and machines.

The analysis of propositional attitude verbs is to a large extent a matter of lexical semantics. Many of the concepts represented by these verbs are philosophically controversial and they have received far more attention in philosophy than in lexicology or in linguistics in general.

3.5.1   Failures of Substitutivity

Some of the semantic puzzles that arise in the context of *that*-clause complements of propositional attitude verbs involve **failures of substitutivity**. What is often called **Leibniz' law** captures a basic semantic mechanism. It says that two coreferring terms are interchangeable *salva veritate* in all contexts (consisting of declarative sentence tokens). In other words, what matters to truth, in such cases, is *what* an expression refers to and not *how* it refers to this thing. This situation is to be expected when a referring expression only serves to pick out a particular entity and is illustrated by (3.9).

$$(3.9) \quad \left\{ \begin{array}{l} \text{Marcus Tullius Cicero} \\ \text{The author of } \textit{De Senectude} \\ \text{The man who denounced Catiline} \end{array} \right\} \quad \text{was a roman.}$$

The different sentences of (3.9) attribute a property to one and the same man. It does not matter to truth how we refer to him. Contexts of this kind are said to be **referentially transparent**. (We may also say that an occurrence of a referring term is referentially transparent.)

When it comes to the subordinate clause complements of propositional attitude verbs, the situation is different: Consider the following sentences:

$$(3.10) \quad \text{Mary believes that} \left\{ \begin{array}{l} \text{Marcus Tullius Cicero} \\ \text{the author of } \textit{De Senectude} \\ \text{the man who denounced Catiline} \end{array} \right\} \quad \text{was a roman.}$$

From the point of view of logic and semantics, truth values may be distributed freely over the three statements of (3.10) (at least on one reading of them). Leibniz' law consequently fails, if we take the descriptions of Cicero to refer to him. The ways in which Cicero is described correspond to possible ways of knowing him and this matters to truth in this context. Contexts where Leibniz' law does not hold are said to be **referentially opaque**. Leibniz' law may however still be retained as a universally valid principle. This requires, however, that we do not view these descriptions as referring to Cicero. They may rather be seen as denoting **modes of presentation**, i.e. ways in which an individual may be known, or to put it differently, they stand for (or characterize) different individual concepts. (This is Frege's way of saving Leibniz' law by positing an ambiguity.)

3.5.2   Readings De Dicto and De Re

However, it is also possible to understand the sentences of (3.10) in a way that does not render the differences among the three modes of referring to Cicero significant. We may therefore distinguish between **transparent** and **opaque** readings of the sentences of (3.10). The former correspond to reporting Mary's belief that Cicero is a roman in a way that is not intended to capture Mary's way of thinking about Cicero. In this sense, she may believe that the author of "De Senectude" was a roman, without being the least familiar with the fact that he was an author or that there is a work called *De Senectude*. Her belief is just reported as being about a certain individual and nothing is suggested about the way in which this individual is

known by her. This kind of belief report is said to be *de re*, as opposed to the cases sensitive to how a believer conceives of an object, which are said to be *de dicto*. *De dicto* readings are truth-conditionally sensitive to the wording of a potentially referring expression and *de re* readings only take the referent to be significant in this way.

The difference between *de dicto* and *de re* may be seen as a matter of **quantification scope ambiguity**. The two ways of reading the sentences in (3.10) may be rendered as formula F 3.1 and formula F 3.2. Details are ignored for the moment.[5]

F 3.1 $\exists x[[x = $ the man who denounced Catiline]$\wedge$
   [Mary believes that $\ulcorner x$ was a roman$\urcorner$]]

F 3.2 Mary believes that
   $\ulcorner \exists x[[x = $ the man who denounced Catiline] $\wedge$ [x was a roman]]$\urcorner$

This kind of analysis was suggested by Russell[6] [1905] (cf. Quine [1956]). A corollary of it is that propositional attitude attributions *de re* imply existence. Those which are understood *de dicto* do not. This provides a criterion for the distinction between *de dicto* and *de re*.[7]

The quantifier scope analysis accounts for the fact that the distinction applies in relation to each attitude verb in an "iterated" attitude report (cf. Kripke [1977]). So, a sentence like (3.11) receives at least three readings.

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[5] A natural language expression enclosed within corners stands for the intensional object to which this expression corresponds. For instance, $\ulcorner$Cicero is a roman$\urcorner$ will stand for the proposition that Cicero is a roman. This notation is due to Quine [1956] and is not associated with any detailed account of what these intensional objects are.

[6] Russell [1905] draws a distinction between **primary** and **secondary** occurrences of denoting phrases. Primary occurrences lie outside of the scope of a propositional attitude operator and secondary occurrences lie within such a scope.

[7] There are other ways of drawing the distinction between *de dicto* and *de re*. Attributions *de dicto* are often taken to reflect the way in which the believer himself would express his belief (cf. Loar [1987]). Another way of drawing the distinction is related to context-dependency. Baker and Wald [1979, p. 321] requires that contents *de dicto* should be "completely independent of context". A related idea is that indexical beliefs and attributions of belief always are *de re* (cf. Burge [1977], Burdick [1991], and Bell [1983]). Burge [1977] suggests that demonstrations may occur *de dicto*, but that they have to be understood as pronouns of laziness.

Attempts have been made of reducing *de re* belief attribution to *de dicto* attribution, for instance by Kaplan [1968], Sosa [1970], Pastin [1974] and Markie [1988]. (For objections, see Perry [1979] and Burge [1976], [1977].) Burdick [1982] may be said to analyze belief *de dicto* as a special case of *de re* (cf. Quine [1982]). Kraut [1983] argues that there are no attitudes *de dicto*, while Tienson [1987] tries to show that all belief ascriptions *de re* are false.

(3.11)   Mary believes that James hopes that Peter's dog is asleep.

The three readings may be rendered as follows:

F 3.3 $\exists x[[x = \text{Peter's dog}]\wedge$
       $[\text{Mary believes that }⌜\text{James hopes that }⌜x\text{ is asleep}⌝⌝]]$

F 3.4 Mary believes that
       $⌜\exists x[[x = \text{Peter's dog}] \wedge [\text{James hopes that }⌜x\text{ is asleep}⌝]]⌝$

F 3.5 Mary believes that
       $⌜\text{James hopes that }⌜\exists x[[x = \text{Peter's dog}] \wedge [x\text{ is asleep}]]⌝⌝$

The fact that also the two names "James" and "Peter" allow different readings is ignored here. The three readings are due to the fact that there are three possible scopes of the description "Peter's dog". In the first case (formula F 3.3), it ranges over both verbs. This corresponds to Mary's thinking *de re* that James hopes *de re* that the dog is asleep. The intermediate reading, represented by formula F 3.4, takes the description to range over "James hopes", but not over "Mary thinks", and corresponds to Mary's thinking *de dicto* that James hopes *de re* that Peter's dog is asleep. The third reading (formula F 3.5) corresponds to Mary's thinking that James hopes *de dicto* that Peter's dog is asleep. As this attribution does not suggest that Mary is committed to the existence of a particular dog, the distinction between *de re* and *de dicto* is not applicable with respect to "Peter's dog" to the content of Mary's thought in this third case.

The distinction between *de dicto* and *de re* does not account for every possible way of understanding a denoting phrase within an potentially oblique context. There is also a kind of reading that may be seen as a synthesis of *de dicto* and *de re* and in which a description is used both to refer to an external entity and to give an account of how this entity is known to the cognitive agent. For instance, consider (3.12).

(3.12)   Peter believes that Mary's dog is asleep.

Here, the phrase "Mary's dog" may be intended to refer to Mary's dog Fido, which may happen to be the smallest dog in the world, but (3.12) may be read in a way that would not (given these assumptions) imply that Peter believes that the smallest dog in the world is asleep. How are we to understand this reading in more formal terms? The denoting phrase in (3.12) appears to be doing "double duty" (Burge

[1977, p. 341]): It both serves to denote an individual and to characterize a way in which a cognitive agent identifies this individual. In a sense, then, this phrase occurs logically both inside and outside of the belief operator (cf. Loar [1972], Burge [1976], and Baker and Wald [1979]).

To capture this idea in a formal rendering of the logical form we may assume that the formal correlate of this phrase occurs *twice* in the underlying logical form, which may be assumed to look something like this:

F 3.6 $\exists x [x = \text{Mary's dog} \wedge$
$\quad\quad\quad \text{Peter believes that } \ulcorner[x = \text{Mary's dog}] \wedge [x \text{ is asleep}]\urcorner$

This analysis clearly underscores the idea that this kind of reading is a combination of *de dicto* and *de re*.

3.5.3 Specificity

Another kind of ambiguity is inherent in existentially quantified contents of propositional attitude report sentences, if they are understood *de dicto*. An existential quantification such as that in (3.13) may be understood both in a **specific** and **non-specific** way (cf. Jackendoff [1975] and Grandy [1986]).

(3.13) Mary thinks that a philosopher has written this book.

Mary may think that a particular philosopher has written the book. This is the specific reading. She may also only think that whoever has written the book is a philosopher, without thinking she knows anything more about him. This renders the content non-specific with regard to "a philosopher". A propositional attitude attribution *de re* is always specific, as the quantification in that case is not within the scope of the attitude verb. There are consequently three kinds of readings that arise in this way: The *de re* reading of (3.13) is exhibited as 3.7, the *de dicto* non-specific one as 3.8, and the *de dicto* specific reading as 3.9.

F 3.7 $\exists x [[x \text{ is a philosopher}] \wedge [\text{Mary thinks that } \ulcorner x \text{ has written the book}\urcorner]]$

F 3.8 Mary believes that $\ulcorner \exists x [[x \text{ is a philosopher}] \wedge [x \text{ has written the book}]]\urcorner$

F 3.9 Mary believes that $\ulcorner \mathcal{X} \text{ is a philosopher} \wedge \mathcal{X} \text{ has written the book}\urcorner$

In formula F 3.9 '$\mathcal{X}$' may be understood as corresponding to an individual concept and the specific nature of Mary's belief is taken to consist in the fact that such a concept is involved in the belief.

3.5.4   Other Sources of Ambiguity

Tense operators also produce scope ambiguities (cf. Ejerhed [1980]). If we read them as devices to refer to points of time, these ambiguities may be understood as a kind of *de dicto*/*de re* ambiguities. In a statement like (3.14), the present tense of the *that*-clause complement may be understood as referring to the time of utterance of (3.14) as well as to the time of Peter's predicted utterance.

(3.14)   Peter will say that it is raining.

The first kind of reading strikes me as quite unnatural, but is plausible if we imagine that (3.14) occurs as an answer to the question "Is it raining or snowing right now?". So, supposing that the context somehow supplies a "now" predicate, we may render the two readings as formula F 3.10 and formula F 3.11, respectively.

F 3.10 $\exists t[t$ is now $\wedge$ Peter will say that $\ulcorner$it be raining at $t\urcorner]$

F 3.11 Peter will say that $\ulcorner\exists t[t$ is now $\wedge$ it be raining at $t]\urcorner$

I use "be" as a marker for "is" minus tense. This analysis presupposes that spatial location somehow is accommodated in the background. The first reading may be said to be *de re* with respect to the now-time, whereas the reading of formula F 3.11 is *de dicto*. (I am ignoring other sources of ambiguity. The implicit reference to location also seems to give rise to similar ambiguities.)

   The *de dicto* and *de re* distinction is mainly applied to referring expressions in potentially oblique contexts, but also predicate expressions exhibit a kind of ambiguity that can be understood in a similar way (cf. Swoyer [1983], Broackes [1986]). For instance, consider (3.15).

(3.15)   Mary believes that Fido is a quadruped.

A *de-re*-like reading of (3.15) with respect to "quadruped" would be one that takes this sentence to state that Mary simply believes that Fido has four legs. In this sense, (3.15) may be true even if she takes the word *quadruped* to stand for a property she does not believe Fido has. A *de-dicto*-like reading would take (3.15) to say that Mary takes the word *quadruped* to stand for a property that she thinks Fido has. This might be true even if she thinks that Fido is a two-legged creature. This kind of ambiguity is relevant also in relation to some constituents of referring expressions, in which case it should not be confused with the ambiguity between *de re* and *de dicto* that applies to a referring expression as a whole. Consider example (3.16).

(3.16)   Mary thinks that a quadruped is running.

This sentence may be read *de re*: There is a quadruped and Mary thinks that it is running. It may also be understood *de dicto*: Mary thinks that there is a quadruped and that it is running. In the *de dicto* case "quadruped" may be understood as either Mary's or the reporter's description. For instance, Mary may have expressed her belief as "a four-legged creature is running", in which case a reporter may correctly report her belief by asserting (3.16), even if she expresses another belief as "no quadruped is running". In this case the word "quadruped" is the reporter's characterization of a property. On the other hand, if Mary asserts "a quadruped is running", we may take this to warrant the report (3.16) even if she also claims "no four-legged creature is running". We may label the two kinds of readings of a predicate in an oblique context **meta-perspectival** and **object-perspectival**.[8]

   If quantification over properties is accepted, also this ambiguity may be rendered as a kind of quantification scope ambiguity (in which case it is assimilated to the ambiguity between *de re* and *de dicto* readings). The two different readings of (3.16) that are *de dicto* with respect to "a quadruped" would then be analyzed in something like the following ways:

F 3.12 $\exists x[[x = \text{the quadruped property}] \wedge$
$[\text{Mary thinks that }^{\ulcorner} \exists y[y \text{ exemplifies } x \wedge y \text{ is running}]^{\urcorner}]]$

This would be the meta-perspectival reading. The object-perspectival reading is rendered by:

F 3.13 Mary thinks that $^{\ulcorner} \exists x[\, x = \text{the quadruped property} \wedge$
$\exists y[y \text{ exemplifies } x \wedge y \text{ is running}]]^{\urcorner}$

(This analysis suggests the existence of new ambiguities.) Swoyer [1983] proposes an analysis along these lines (also cf. Pastin [1974] on attitudes *de re* towards properties).[9]

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[8] The choice of these terms is motivated by the idea that a meta-perspectival reading of a predicate word understands it in relation to a meta-discourse about an object discourse or an object mind (i.e. a discourse or a mind that is the object of an analysis), while an object-perspectival reading understands it in relation to the object discourse or the object mind.

[9] Even logical constants may be taken to exhibit perspectival ambiguity, even if the meta- and the object-perspective in most cases are assumed to agree on logic and the interpretation of logical constants. So, for instance, if Mary thinks that Fido is a biped or a quadruped and takes the word "and" to stand for truth-functional disjunction, we may report her belief in the following way:

   Mary thinks that Fido is a biped and that he is a quadruped.

However, I think that examples of this kind are very rare in actual belief reporting practice.

3.5.5   Internal and External Significance of Content

There are at least two points of view from which a propositional content may be approached, and many of the above-mentioned ambiguities are due to this fact. It is possible to differentiate between the **internal** and **external significance** of a propositional attitude. The internal significance is the significance it has from the point of view of the mind to which it belongs. For instance, if we are to describe or evaluate the ways in which a person reasons, we should attend to the internal significance of his attitudes. On the other hand, if we are to derive some useful information about the external world from the attitudes of a cognitive agent, we are interested in how the world would be if they were true. The notion of their content that arises from this perspective may be termed "external significance". It is clear that the two notions of significance will sometimes yield quite different pictures of what a person (say) believes.[10] A matter of considerable controversy has been the question of which way of looking at propositional attitudes is the most fruitful one in the explanation of human action. Action reaches out in the external world, and this speaks in favour of the relevance of the external perspective, but action is often guided by reasoning, which must be understood from an internal point of view. A reasonable synthesis would be to say that both perspectives are indispensable, but several philosophers have tried to argue that either perspective is more basic.[11]

In many and typical cases there is a clear connection between an individual concept and an object, which may be said to be the object of which the concept is a concept. This connection may, for instance, be constituted by the circumstance that beliefs involving this concept have been formed due to causal interactions (e.g. perceptual processes) of the appropriate kind between this object and the cognitive agent in question. The ordinary situation is probably by most standards that there is a one-to-one correspondence between individual concepts and objects (partial, of course). However, it is clear that exceptions to this simple scheme sometimes occur. One and the same thing may confront a cognitive agent in a way that makes him think that he has been dealing with several different things. In other words, he may possess several individual concepts in a way that corresponds to his believing that there are several distinct objects, where there was in fact only one. The opposite situation

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[10] Baker [1987], Carruthers [1987] and Perry [1989] thinks that the two perspectives are oriented towards **explanation** of human action and **communication** about the external world, respectively. Also cf. Ryckman [1986].

[11] See, for instance, Burge [1977], Feldman [1978], Baker [1982], Bell [1983], Carruthers [1987], and Bryans [1992]. Bilgrami [1992] argues in favour of a unified account.

may also arise: A cognitive agent may identify several distinct objects in his mind. In this way, he will possess what from his point of view is an individual concept, but in reality is connected to several distinct entities.[12] We may even imagine that objects and concepts are connected crosswise in a many-to-many relationship.

From an internal perspective, the conceptual structure is what appears, while from an external perspective, the important aspect is which external objects the attitudes are concerned with. In cases where one concept corresponds to several objects, beliefs that are consistent from an internal point of view may appear contradictory from an external perspective. A classical illustration is Quine's [1956] Ortcutt example: Ralph has seen a man at the beach and he knows that this man is a pillar of the community. There is also a man in a brown hat that Ralph has glimpsed under questionable circumstances. Now, Ralph believes that the man at the beach is not a spy and that the man in a brown hat is a spy. However, the man at the beach is identical to the man in a brown hat. His name is Ortcutt. We may then report *de re* that Ralph believes that Ortcutt is a spy and that Ortcutt is not a spy. This may sound like two contradictory beliefs, but from the internal point of view they are not. We may say that there are two **intensional entities** (i.e. the man at the beach and the man in a brown hat) (cf. Geach [1967], Burdick [1982] and Tienson [1987]), and one of them is believed to have a certain property which the other one is believed to lack.

3.6   Non-Binary Analyses of Propositional Attitudes

So far, we have assumed an analysis of propositional attitudes describing them in terms of binary relations holding of a cognitive agent and a proposition. (If time is to be taken care of—it is usually ignored—we have to add a third time argument place.) However, there have been a number of proposals that have rejected this binary analysis, trying to decompose propositional contents into "smaller" units than propositions. Before we go on to take a closer look at the "binary" proposals, some discussion of the "non-binary" ones and comparison of the two kinds of approaches may be in place.

Russell [1910], [1911] (also cf. [1918, Lecture IV]) for some time held the view that there are no propositions that are involved in (what he later called) propositional

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[12] A concept of this kind is in a certain sense defective. An individual concept should uniquely determine which individual it is a concept of.

attitudes.[13] Rather, he thought, the mind holding an attitude is more directly related to the constituents of the content of the attitude. For instance, a sentence like (3.17) would report that a *four*-term relationship holds.

(3.17)   Othello believes that Desdemona loves Cassio.

The Russellian analysis would claim that a four-place relation of *belief* is involved in this case.[14] If (3.17) is true, this relation would hold of Othello, love (as a universal), Desdemona, and Cassio. There is nothing that corresponds to Desdemona's loving Cassio (because this, we may assume, is false), e.g. there is no proposition that Desdemona loves Cassio. This analysis is also motivated by Russell's epistemology: The ultimate analysis is intended to show that our judgments only involve things with which we are directly acquainted (in an empiricist sense).[15]

Russell [1907], [1910] combined this analysis with the idea that a true belief has an objective relatum in the form of a fact. (Russell's metaphysics contains facts as prominent mind-independent members.) So, all kinds of beliefs are complexes of ideas, but only true beliefs have this kind of objective (factual) relatum. For further discussion of this idea, see Section 3.10. Russell tentatively suggests that "[a] valid analysis [...] must break up any apparent subordinate complexes into their constituents, except when such complexes are facts" [1907, p. 48]).

There are some serious objections against an approach of this kind to the logical form of propositional attitude attributions (even if the difficulties associated with Russell's epistemology are ignored): A fundamental problem is that any number of particulars and universals may in principle be involved in the content of a belief and they may be combined in many different ways. Russell's analysis, it seems, is therefore committed to the existence of a very large number of belief relations—an infinity, even, unless some constraint on the complexity of beliefs is assumed—and must recognize a corresponding multiplication in relation to every

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[13] It should be stressed that Russell several times changed his mind about which kind of stance to take towards propositions and propositional attitudes. Here, I only discuss some of his ideas without the intention of giving a comprehensive picture of a position held by Russell at some definite time. Also see Section 3.10 on Russell's views.

[14] Russell does not seem to have developed this theory in any detail or shown how it applies to other kinds of contents. Wrinch [1919] suggests a way of doing this, but her proposal seems in effect, as she herself acknowledges, lead to the reintroduction of propositions. Her approach is in some respects related to the one I will be suggesting in the next chapter.

[15] The analysis of (3.17) suggested here does not go far enough for Russell's epistemological purposes but illustrates his approach. (Desdemona, love, and Cassio are assumed to be defined for Othello in terms of things known by acquaintance, which involve both universals and particulars.)

other kind of (propositional) attitude that is recognized. This is clearly an unintuitive consequence, which reveals that an account of propositional attitudes along these lines will be seriously lacking in economy. This feature will make it difficult to give a comprehensive account of the logical properties of propositional contents that is compatible with this approach. (For instance, if a truth definition is to be given, there will have to be a separate clause for each of the numerous kinds of belief, desire, intention etc.)

Russell's idea that the logical form of statements reporting true beliefs is to be given a treatment radically different from that of reports of false beliefs introduces serious complications. It seems that we may understand belief reports without making assumptions about whether the belief reported is true or not. (And logical form is expected to be partially involved in what must be grasped by a language user who understands a sentence.) Of course, it is possible to avoid this difficulty by viewing the logical form of a belief report that A believes p along the lines of "if p then q and if not-p then r", where q represents an analysis in terms of facts and r one in terms of a broken up complex of ideas. This analysis is however both complicated and contradicts the—admittedly anti-Russellian—intuition that the question of what is believed is independent from the question of whether it is true.

Another philosopher who has suggested a non-binary analysis of propositional attitude relations is Quine [1956] (also cf. [1943], [1977] [1994]), but his aims are quite unlike Russell's. Quine is trying to establish a logical analysis of propositional attitude reports that clearly distinguishes oblique and transparent positions. In particular, he wants to avoid quantification from the outside into an oblique context. His idea is to separate transparent reference to objects from the intensional elements of the attitudes. So, a *de re* belief attribution would be rendered in terms of a three-place belief predicate holding of a cognitive agent, a *de re* entity, and a property intension. An approach of this kind will force us to recognize a separate belief predicate for each number of entities that may be involved *de re* in a belief, and the same multiplication must be assumed in relation to the other propositional attitudes.[16]

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[16] A way of separating referential positions from intensional ones without sacrificing the binary analysis of propositional attitudes is suggested in response to Quine [1956] by Kaplan [1968], who makes use of a denotation relation to bridge the gap between the intensional and the extensional.

3.7   Frege's Gedanken

The origin of many modern views on propositional attitudes, and in particular of the binary relation analysis, is to be found in the writings of Gottlob Frege, most prominently in his article *Über Sinn und Bedeutung* [1892]. He is often said to be the creator of modern logic and the greatest logician since Aristotle and his work has been one of the most important sources of inspiration for the traditions of "analytic philosophy" and of "philosophy of language". Later work on propositional attitude report semantics consists, with very few exceptions, of direct or indirect reactions to the views of Frege.

Frege calls the propositions of his system **Gedanken** (Frege [1918], [1892]). The German word "Gedanke" (for "thought") must here not be understood as standing for a mentalist notion. Frege takes a Platonist stance towards these things (cf. Burge [1992] and Carruthers [1984]). Gedanken and similar entities exist in a "drittes Reich" (Frege [1918, p. 69]) and are independent of physical objects, which belong to the first realm of Frege's metaphysics and from mental phenomena, belonging to the second realm. Third realm objects differ from physical ones in that they are not spatio-temporally located and cannot be perceived and from mental ones in that they exist independently of human beings. When someone thinks, he does not produce a Gedanke. Rather, he grasps something that was already there, for instance the Pythagorean Theorem. Gedanken are of a timeless and unchangeable kind. They possess certain of their properties essentially, for instance, truth, falsity and logical properties. This means that a sentence with indexical components typically express different Gedanken in different contexts. In relation to the Gedanke expressed, the reference of every referring term must be absolutely fixed. By being grasped, judged, or expressed, Gedanken play an important role in human life. (Their properties as contents of mental states and utterances are however, according to Frege, inessential ones.)

Gedanken represent the content of propositional attitude states. It seems that they are intended to capture the *internal* cognitive significance of these states. Frege [1892, p. 25] talks about the **cognitive value** ("Erkentniswert") of statements. As soon as two statements may differ with respect to their cognitive value, e.g. when knowing that one statement is true does not amount to also knowing that the other one is true, they must be said express different Gedanken.[17]

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[17] Evans [1982] calls this **the Intuitive Criterion of Difference**. Also cf. Carruthers [1987], Taschek [1987], [1988], [1992], and Perry [1989].

3.7.1 Frege's Platonism

Frege's main concern seems to be to account for and to stress the reality of the public content idea. He does not only claim that thought contents are public within a certain group of people or speech community or in relation to a certain species. He goes much further than that: The Gedanken are there, true or false, independently of human cognitive and linguistic practice. Most analytic philosophers have rejected this Platonist view. Many circumstances seem to speak against it, even if it is perhaps not open to a knock-down argument.

Frege's theory implies that the range of Gedanken is once and for all determined, but it seems that human concept formation is a very open affair. New things are invented and people arrange them and old things into new classes and discern new kinds of relation among them. Is it really plausible that all things that can be believed are there independently of what happens? Every distinction between two statements in every possible language, past, present, or future, which is sufficiently significant to make someone hold the one true and the other false must correspond to a related distinction with regard to the Gedanken the two statements are taken to express.[18] This will force us to assume a very rich inventory of things in Frege's third realm. It also seems highly implausible that natural language semantics is constrained in this way by the unchanging laws of a timeless realm.

A related problem is the relation between the third realm and the other two realms, i.e. the physical world and human minds. In particular, how is a human mind able to grasp Gedanken and interact with causally inefficient and imperceptible third realm things? It seems Frege has to assume some kind of rationalist epistemology to explain our knowledge of logic and other third realm affairs (cf. Burge [1992]). It should be vital to Frege's theory that the working of human minds in some essential way depends upon Gedanken and the relations among them. Otherwise, it seems that the processes of human minds may go on without third realm things being involved at all. However, cognition must not be taken to be determined by third realm facts. Logic rules the third realm, while human cognition is fallible and may deviate from the laws of truth and logic at any point and for various reasons.

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[18] At least, this is required if Frege's theory is to accommodate all intuitively meaningful distinctions with respect to propositional attitudes. Frege's theory could also be taken to suggest that there may be spurious distinctions that are made in ordinary "loose" propositional attitude psychology, and which do not correspond to any distinction in the third realm. I do not think Frege was much inclined to hold this view however, except, possibly, in that he stresses that cognitive contents must be sharply distinguished from the emotions with which they may be associated in a human mind.

Frege [1918, p. 76] distinguishes between essential and inessential properties of things. Truth and falsity are essential properties of Gedanken (while, for instance, the property of being a Gedanke to which a particular person is belief-related is held to be an inessential property). This sets the stage for another problematic tenet expressed as follows in *Der Gedanke* (Frege [1918, p. 76], English translation [1984, p. 354]):

> [W]e cannot recognize a property of a thing without at the same time finding the thought *this thing has this property* to be true. So with every property of a thing there is tied up a property of a thought, namely truth.

The fact that Frege takes truth (as well as falsity) to be an essential property of a Gedanke should lead us to the question: Does this allow any inessential properties at all? Is it possible that a thing possesses an inessential property, while at the same time the Gedanke that it does is essentially true? Perhaps this may be allowed, but the situation no doubt calls for an explanation. Frege's theory also seems to be committed to determinism: Whatever may truly be said about the past, the present, and the future was true all along in the timeless third realm.

Frege's Platonist metaphysics is as we see a source of many difficulties. A common complaint is that it stipulates a far too rich inventory of abstract objects (cf. Martin [1963] and Eberle [1978]). However, many of his ideas may also be exploited within the framework of a more materialist ontology (if backed up by some instrumentalist or reductionist assumptions). In fact, his general approach may be viewed as being largely independent of his metaphysics. A more conceptualist stance towards Frege's abstract objects (Sinne) is possible. We may tentatively accept it as a means of formulating a semantics for propositional attitude reports and view it as justified to the degree that it is instrumental in this. We may then hold that it reflects some aspects of how people conceive of the mind and mental contents, but reject the idea that the ontology of Sinne is independent of human cognition and language.

3.7.2   Sinn and Bedeutung

An important distinction in Frege's [1892] theory of cognitive significance[19] is that between **Sinn** and **Bedeutung**. Sinne are objects belonging to the third realm and

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[19] I think that his theory should be seen as one of cognitive significance, rather than as one of natural language semantics (cf. Burge [1979b], [1977] and Taschek [1987], [1988], [1992]). Frege

they include the Gedanken. Other kinds of Sinne are expressed by some of the constituents of sentences. Bedeutungen are the referents of various kinds of Sinne. A Sinn has at most one unique Bedeutung and the connection is a matter of an essential fact. A linguistic expression token[20] has a Bedeutung only indirectly, in virtue of expressing a Sinn that has a Bedeutung. For instance, the phrase "the capital of France" will (in normal contexts) express a Sinn, whose Bedeutung is Paris, while an occurrence of a first person singular pronoun will express different Sinne in different contexts: The Sinn of an occurrence of *I* will typically have the one who utters it as its Bedeutung. Some Sinne lack a Bedeutung. The Sinn expressed by "the king of France in 1905" is one of them. Different Sinne may have the same Bedeutung. For instance, "the most famous logician born in 1848" and "the author of *Über Sinn und Bedeutung*" may express two different Sinne with the same Bedeutung.

The Bedeutung of a Gedanke is its truth value. This idea is supported by two principles of great importance in Frege's system. The first says that a Sinn is uniquely determined by its constituent Sinne and their mode of combination.[21] This is reflected in semantics.[22] Substituting a phrase token for another one expressing the same Sinn as the first one does not change the Sinn of the expression in which the substitution occurs. So, if the phrases "Frege" and "Gottlob Frege" express the same Sinn (as they may be taken to do in this context), the statements "Frege was a logician" and "Gottlob Frege was a logician" will express the same Gedanke. The second principle is that the Bedeutung of a complex Sinn is uniquely determined by the Bedeutungen of its constituent Sinne and their mode of combination. (Leibniz' law is a special case of this more general principle.) Now, what is it that remains

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often assumes that the two issues amount to the same thing, but this is one of his more questionable ideas. See below.

[20] It should be stressed that Frege's theory associates Sinne with linguistic tokens, i.e. with concrete cases of language use, rather than with the abstract entities of a language system. This is a necessity in view of the fact that the reference of many words is context-dependent, while the Bedeutung of a Sinn is insensitive to contingent circumstances.

[21] However, the opposite does not seem to hold: Frege allows Sinne to be compositionally polymorphous, i.e. different ways of combining Sinne may sometimes yield the same composite Sinn (cf. Hodes [1982]).

[22] The two compositionality principles of Frege's theory are, I think, best understood as pertaining to Sinne and their Bedeutungen. However, Frege seems to assume that even if natural language often is misleading with regard to the structure of the Sinne expressible in it, expressions of natural language nevertheless in general have a structure that reflects that of the Sinne they express. As a corollary it follows that natural language is compositional (even if there may be exceptions to this rule).

unchanged in relation to a Gedanke when one of its constituent Sinne is replaced by another with the same Bedeutung? One answer is that it is the truth value of the Gedanke. Bedeutung compositionality consequently suggests that the Bedeutung of a Gedanke is its truth value.[23]

Sinne are intended to capture the cognitive significance of propositional attitudes. The intuitive criterion of their individuation derives from the principle that whenever someone believes p without believing q, p and q must express two different Gedanken (cf. Broackes [1987]). This quickly leads to semantic complications. According to the principle of Bedeutung compositionality, two linguistic tokens with the same Bedeutung should be interchangeable *salva veritate* in all contexts (consisting of declarative sentence tokens). If "Cicero" and "Tully" are names of one and the same person, this principle correctly predicts that (3.18) below, is true if and only if (3.19), also below, is true.

(3.18)   Cicero was a roman.

(3.19)   Tully was a roman.

The two Gedanken expressed by (3.18) and (3.19) are, as Frege says, "obviously of differing cognitive value" [1984, p. 157]. There must be something more to the cognitive significance of a name than what it names, and this shows the need to assume that there is a Sinn associated with it.

Now, an apparent paradox is close. Clearly, it is possible to believe what (3.18) says without believing what (3.19) says. So, (3.20) and (3.21), below, may differ with regard to their truth values.

(3.20)   Mary believes that Cicero was a roman.

(3.21)   Mary believes that Tully was a roman.

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[23] Instead of viewing the relation between a Gedanke and its truth value as a special case of that holding between a Sinn and its Bedeutung, one might be tempted to assimilate it to that between subject and predicate (in the senses of Aristotelian and scholastic logic). Frege [1892, p. 34–35] rejects this suggestion as follows: By saying that a Gedanke G is true we just affirm another Gedanke (i.e. that G is true) and this Gedanke must somehow be associated with its truth value. So, the problem of connecting a Gedanke with its truth value is not solved, but reappears. The combination of a subject and a predicate only defines a Gedanke. It never connects a Gedanke to its Bedeutung.

This example seems to contradict Leibniz' law: Two names that name the same person are clearly not interchangeable *salva veritate* in this context. Frege solves this puzzle without abandoning Leibniz' law by assuming that a name in this kind of context (which is said to be **ungerade**, commonly translated as **oblique**) denotes[24] something else than what it does in ordinary contexts. In an oblique context an expression token must denote something that reflects its cognitive value, i.e. the Sinn that another token of the same expression would express in an ordinary extensional context. So, in the contexts of (3.18) and (3.19), "Cicero" and "Tully" express Sinne whose Bedeutung is the roman writer Marcus Tullius Cicero, but when they occur in a *that*-clause complement to a propositional attitude verb, as in (3.20) and (3.21), each of the two names expresses a Sinn whose Bedeutung is identical to a Sinn expressible by the same name in (3.18) and in (3.19), respectively.

This situation arises as a consequence of the view that Gedanken are the objects of propositional attitudes, the Sinn compositionality principle, and the fact that the Bedeutung of a Sinn does not define this Sinn. When a clause occurs as as the complement of a propositional attitude verb it must be understood as *denoting* a Gedanke. The Bedeutung of a constituent of this clause is then taken to be some Sinn which it could express in an extensional context.

Frege assumes that the Sinn of a name reflects a way in which the bearer of the name is known to a cognitive agent. (It should be remembered that the main function of Sinne in Frege's theory is to account for cognitive significance.) A Sinn involves what Frege calls a "**mode of presentation**" ("Art des Gegebenseins" [1892, p. 26]), which seems to correspond to the way in which something is referred to. The bearer of a name may be known in different ways by different cognitive agents and a name may therefore correspond to different Sinne (having the same Bedeutung). One of Frege's examples from *Über Sinn und Bedeutung* [1892, footnote, p. 27] is the name "Aristotle". One possible Sinn of this name corresponds to the description "the pupil of Plato and teacher of Alexander the Great". Another would be "the teacher of Alexander the Great born in Stagira". It is easy to suggest countless others (cf. Seppänen [1974, p. 173] and Crimmins [1992, p. 49–50]). Frege has to allow that a large number of Sinne may be expressed by a name. A thing may be known to a cognitive agent in perhaps an infinite variety of ways.

Frege seems to have overlooked the complexities associated with Sinne. He

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[24] I will use the verb *denote* in such a way that "X denotes Y" is equivalent "Y is the Bedeutung of X", if X is a Sinn. If Y is a linguistic expression token "X denotes Y" is to be understood as "Y is the Bedeutung of the Sinn expressed by X". These definitions only apply to contexts where Frege's concepts are the intended ones.

writes that "the [Sinn] of a proper name is grasped by everybody who is sufficiently familiar with the language or totality of designations to which it belongs" ([1984, p. 158]), but attaches a footnote with the "Aristotle" example to this dictum. The footnote problem is, I think, a much more serious threat to Frege's theory than he seems to have thought. Even if a name is used in accordance with established practice as the name of a particular thing or person, there are so many Sinne that it may express that it is implausible that any language user will grasp all of them. In many cases, ordinary communication does not require more than agreement concerning the Bedeutung of a name. For instance, when somebody asks where Aristotle was born, it is to a large extent irrelevant how Aristotle is known to the two interlocutors. It seems that in order to determine which Sinn is expressed by a name token, we need much more than ordinary linguistic competence. It also seems plausible that we may understand a statement like (3.20) without knowing which "Cicero" Sinn was involved (cf. Schiffer [1992]). Further, it is implausible that a person reporting a belief and the owner of the belief generally associate the same Sinn with a name occurring in the report.[25]

Gedanken and other Sinne are intended to capture internal cognitive structures and Frege's theory is primarily concerned with attitudes *de dicto*. How is a "pure" *de re* belief to be captured? Again we may consider (3.20). There is a reading of this sentence according to which nothing is claimed about how Mary conceives of Cicero. Expressions referring to him are then interchangeable without change in the import of the attribution. (So, "Cicero" occupies a purely referential position.) The solution that probably lies best in line with Frege's approach is to assume that a *de re* attribution of this kind is implicitly an existential statement saying that there is a Sinn S and a Gedanke G such that S denotes Cicero and is part of G, which is further required to be composed out of S and a number of other Sinne in a particular

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[25] This circumstance speaks against the idea that cognitive significance should be accounted for in terms of semantic differences. (See Kaplan [1989b, p. 598–599], [1990] and Kripke [1979] for related arguments.) Frege [1892, footnote, p. 27] regards the presence of this kind of ambiguity with regard to the Sinn of names as an imperfection of natural language, but admits that they may be tolerable from a practical point of view as long as the Bedeutung remains the same. In a logically perfect language names of this kind should not appear.

Frege returns to this problem in *Der Gedanke*, where it is suggested that the fact that the bearer of a name may be cognitively presented to two people in two different ways indicates that "as far as [this proper name] is concerned, [they] do not speak the same language" [1984, p. 359]. This seems to lead to a very idiolectal conception of language, as probably any two language users will disagree with regard to how the bearers of some names are known to them.

way and to be the relatum to which Mary is belief-related.[26]

Frege' theory of Sinn and Bedeutung is committed to an infinite hierarchy of Sinne (cf. Church [1951a], [1951b], [1973], [1974], [1993], and Burge [1979a]).[27] In the basic kinds of context, a name may denote an ordinary material thing and a sentence token a truth value. Let us call such an occurrence of an expression a 0-**level** one. A 0-level token expresses a 0-level Sinn. The bearer of a name is the Bedeutung of a 0-level Sinn of an occurrence of the name. Every n-level Sinn is denoted by some $n + 1$-level Sinn. We have seen that linguistic tokens denote Sinne (themselves denoting what an occurrence of the same expression type would denote in a 0-level context) in oblique contexts. Such tokens necessarily express 1-level Sinne. In a doubly oblique context, as the one found in (3.22), we must assume that expressions denote 1-level Sinne (and express 2-level Sinne).

(3.22)   Peter knows that Mary believes that Cicero was a roman.

This may be shown by the following piece of reasoning. Let us call the larger subordinate clause token in (3.22) 'C_1' ("that Mary believes that Cicero was a roman", and the smaller one 'C_2' ("that Cicero was a roman"). (So, C_2 is a constituent of C_1.) C_1 denotes a Gedanke. This Gedanke is, according to Frege's theory, determined by the Bedeutungen of "Mary", "believes", and C_2, and their mode of combination. Let us call the Bedeutung of C_2 'B_2'. A constituent of B_2 is whatever the "Cicero" token denotes. Let us call this Bedeutung B_{Cicero}. Now, B_{Cicero} cannot be a 0-level "Cicero" Sinn. The reason for this is that B_2 is a constituent of the Bedeutung of C_1 and B_2 is determined by the denotations of its constituents and their mode of combination. One of these constituents is B_{Cicero}. The assumption that B_{Cicero} is a 0-level "Cicero" Sinn would imply that whenever the "Cicero" token is replaced by another expression with a Bedeutung that denotes the same thing as B_{Cicero} does, B_2 would *ceteris paribus* remain the same. And so would the Gedanke denoted by C_1. This cannot be true, because knowing that Mary believes that Cicero was a roman is not the same as knowing that Mary believes that Tully was a roman.

So, when a name occurs in a doubly oblique context, it is a constituent of a clause that denotes a (1-level) Sinn that denotes a Gedanke (a kind of 0-level Sinn).

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[26] Similar ways of quantifying into an oblique context with the aid of a denotation relation are also exploited by Church [1951a], [1951b], [1973], [1974], [1993] and by Kaplan [1968]. Cf. Sosa [1970], Mackenzie [1975], Fales [1978], and Bell [1983].

[27] Dummett [1981, p. 268–269] suggests a way of avoiding this infinite hierarchy of Sinne, by making the Bedeutung of a Sinne depend upon its context. See Linsky [1983, p. 50–55] for a critical discussion.

This name token also denotes a (1-level) Sinn. It generally holds that the deeper we enter into oblique contexts embedded within each other the higher we rise in the Sinn hierarchy. As there are no logical or grammatical constraints on the number of clauses that may be embedded in each other, we must conclude that Frege's theory is committed to an infinite hierarchy of Sinne (which he himself seems to acknowledge in a letter to Russell, cf. Linsky [1983, p. 47]).

Many philosophers have found this hierarchy implausible and argued against it (e.g. Carnap [1956, § 30.]). Davidson [1968] thinks that Frege's theory is incompatible with the demand that a theory of meaning should allow a recursive characterization of the meaning of sentences. The Fregean analysis implies that names (for instance) are infinitely ambiguous. No finite set of rules may therefore specify the denotation of a name in relation to every context.

Frege [1918, p. 64] also stresses that the Gedanke expressed by a sentence token cannot be identified with its meaning. The meaning of a sentence may involve "conversational suggestions". Frege's [1918, p. 64] example is (in the Frege [1984, p. 357] translation) the sentence "Alfred has still not come", which apart from expressing the Gedanke that Alfred has not come also suggests that his arrival is expected, but Frege thinks that this is not part of the asserted Gedanke. (This example is an instance of what Grice [1975] calls a "conversational implicature".) Further, often more information than that provided by the meaning of the sentence is needed to determine which Gedanke is expressed (for instance, when it comes to sentences with deictic expressions). So, to determine which Sinne are expressed by expression tokens is a matter over and above conventional semantics. For instance, knowing what (3.20) conventionally means does not always involve knowing which Sinn "Cicero" denotes in this context. It seems that Frege is forced to admit this. It also seems to accord with our intuitions that the higher a Sinn is located in the hierarchy, the less we may be expected to know about it. For instance, (3.20) seems to be somehow concerned with Mary's concepts of Cicero and romanhood and (3.22) with Peter's concepts of the two concepts of Mary's. We only understand the minds of other people partially. A speaker making a report like (3.22) is, so to speak, two minds away from Mary. When it comes to (3.20), there are difficulties associated with how Mary understands the adjective *roman* and in (3.22) these difficulties are multiplied by those relating to Peter's notions of belief, of romanhood, of ascribing a property to something, etc.

It seems then that the Fregean hierarchy has some intuitive support. As soon as A contemplates some concept of B's, a third party may form a concept of A's concept of B's concept and there are no logical constraints preventing this to

occur any number of times. So, there is at least potentially an infinite hierarchy of possible concepts. What is implausible is that they exist independently of human cognition and that people know them in advance simply in virtue of having mastered a language.

3.8 Sententialist Accounts of Propositional Attitudes

Approaches to propositional attitudes that view them as relations holding between a cognitive agent and some kind of representation (linguistic and/or mental) are said to be **representationalist** or **sententialist**. This idea is compatible with a variety of assumptions about how these representations enter into mental attitudes and about which kind of representation is the adequate one. Those who claim that propositional attitudes should be understood as relations directed towards natural language sentences are often inclined towards behaviourism and think that holding propositional attitudes is largely a matter of social dispositions. There are also mentalistically oriented representationalist theories that claim that propositional attitude verbs should be understood standing for relations to mind-internal representations. Those who try to develop this idea are forced to introduce an artificial language that is intended to capture the (relevant aspects of) structure of the internal representations.[28]

Public language sententialist theories have several *prima facie* advantages. From a metaphysical point of view, sentences are of a familiar kind and closer to materialist facts than most other abstract entities. We also possess fairly clear intuitions concerning their structure, their meaning, and the logical relations that hold among them. It also seems that cognitively significant distinctions in most cases may be expressed in language and therefore correspond to a distinction between two sentences. Further, any distinction between two sentences, may, at least in some context, reflect a corresponding difference in cognitive significance. It seems that propositions (if they are to capture cognitive significance) must be assumed to be as finely discriminated as sentences (cf. Burge [1980]). Some examples of public language sententialist theories are found in Burge [1980] (but he assumes that it is some

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[28] Frege's theory assumes that there are Sinne that correspond to the constituents of a sentence token and the logical relations between these Sinne reflects the structure of the sentence. It may therefore be claimed that Frege's system of Sinne is derived from natural language and that his account of propositional attitude reports really is a sententialist one. However, Frege explicitly denies this by claiming that the Sinne are independent of human cognition and language. Further, they capture, as we have seen, finer distinctions than those based on conventionally established constraints on the use of language.

modified subset of natural language that is relevant), Grandy [1986], and Seymour [1992]. (In the latter two articles it is assumed that some internal representation mediates the relation between a cognitive agent and a sentence towards which he holds a propositional attitude.)

The idea that propositional attitude relations hold of a cognitive agent and a sentence belonging to a certain language does not need to imply that a cognitive agent must understand this or any language in order to stand in this relation to a sentence of this language. An analysis of this kind does not need to make any specific claims concerning the mental details or to assume that sentences are directly involved in the mental states in question (cf. Quine [1956], Burge [1980], Bonevac [1984], Grandy [1986], Seymour [1992]). All that is necessary is that the mental states underlying the behaviour of cognitive agents are somehow possible to interpret in the terms of a language. An English sentence may, for instance, very well express something that Aristotle believed or even what a dog believes.

A difficulty that faces public language sententialist accounts of propositional attitudes is that sentences belong to a language. This property may be seen as an inherent one, but if we define sentences as (say) phoneme sequences we may have to specify the language in relation to which a sentence is to be understood (cf. Carnap [1956], Quine [1956]). This is a serious difficulty because the individuation of languages is a problematic affair (cf. Quine [1956], [1968]).

A common kind of objection to this kind of theory involves the so-called **Church-Langford translation test** (Church [1950] [1951b] [1954]). This test requires that translation should preserve cognitive significance, in the sense that a sentence in the first language should give a speaker of this language the same information as the sentence translating the first one gives to a speaker of the second language. Now, suppose that we analyse (3.23) along the lines of (3.24) (in the formulation of Quine [1956]).

(3.23) w believes that there are unicorns.

(3.24) w believes the proposition meant by 'There are unicorns' in English.

Now, translating (3.24) into German gives us (3.25)

(3.25) w glaubt diejenige Aussage, die 'There are unicorns' auf Englisch bedeutet.

However, it is clear that a speaker of German who is ignorant of English will not understand what w in this case is said to believe. It will not be informative in the same way as a direct translation of (3.23), which would be something like (3.26).

(3.26) w glaubt, daß es Einhörne gibt.

A problem with the argument from the Church-Langford translation test is that it is far from obvious that its notion of translation should be accepted. It assumes that translations should preserve reference, while differences in informativeness are allowed to occur. In actual translation practice, informational significance is often of primary concern. Quoted material is therefore translated and references to the original language are replaced by corresponding references to the language of the translation (cf. Burdick [1982]). The value of Church-Langfordian objections to sententialist theories are consequently not beyond dispute. However, this language-dependency is an embarrassment to theories of this kind: It seems that many propositional attitude reports (for instance (3.23) and (3.26)) describe possible states of affairs that may be reported in many different languages and that the nature of this state of affairs is independent of the language in which it is described.

Another problem is that one sentence may correspond to many propositional contents that should be kept distinct. This comes about due to a number of factors. One is the indexical features of natural language. The reference of personal pronouns, tense operators and similar kinds of expressions crucially depends on the context in which a sentence token is put forth as a statement. Another source of equivocation is lexical, syntactic, and quantificational ambiguity. One way out of these difficulties is to relativize propositional attitude reports to a context in relation to which a sentence is to be understood (cf. Section 3.9 on Davidson's paratactic theory). Another would be to exclude indexical and ambiguous sentences from the range of those that are allowed to represent a propositional attitude content.[29]

Mental representation sentientialist theories assume that an account of propositional attitude reports should view them as being about internal representations and that the logical form of these reports should reveal what is claimed about these representations. They make the psychological claim that propositional attitude states actually involve expressions in some kind of mental representation language and

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[29] It should be pointed out that a sentential account does not need to assume that there is a simple relation between the sentence that is the object of a propositional attitude and a subordinate clause that might occur in a correct report of the same attitude. Consider the following report:

Mary thinks that Frege died yesterday.

It is possible to allow this report, even if it is denied that a sentence with indexical elements may be the content of a propositional attitude. Interpretation in context may somehow yield the appropriate eternal sentence, by replacing indexical expression by expressions with "absolute" denotation. For instance, if the sentence above is uttered on July, 20th 1994, the attitude relatum sentence could be "Frege died July, 19th 1994".

that this is somehow recognized by everyday propositional attitude psychology. The details of a theory of this kind may be spelled out in many different ways. One central issue is the structure of the mental language. Another important question is the ontological one concerning the relation between this mental language and the actual processes of the brain. Views of this kind permeate contemporary philosophy of mind, linguistics, psychology, and artificial intelligence, and are usually coupled with a materialist metaphysics.

One of the most explicit exponents of this kind of view is Fodor [1978], [1976], [1987], who argues in favour of what he calls **the Language of Thought Hypothesis**.[30] This language is an internal representation language, quite unlike the languages used for communication.[31] Fodor further assumes that it is innate.

Other thinkers have supposed that the contents of attitudes often are given as images in the mind. This is an old idea, taken up by, for instance, Russell, who talks about believing "by means of images" [1921, p. 250] (cf. Russell [1920]). To believe is, according to him, to hold a belief-feeling towards a mental image.[32] The idea that we conceive of the contents of beliefs in much the same way as we understand pictures is developed in Jackendoff's [1975], [1980], [1985] treatment of propositional attitude attributions. However, it seems that the differences between the idea that mental representations are image-like and the idea that they rather are linguistic-expression-like are not as significant as might first be supposed. A formal treatment presupposes that mental images are somehow decomposed into simple elements related to each other in terms of certain relations. They are thereby assimilated to expressions in a representation language.[33]

Several formal treatments of propositional attitudes and/or propositional attitude reports rely on the idea that these attitudes are best characterized in terms of internal mental representations. Different formal languages have been introduced to capture the structure of the mental language. Most authors would probably not claim that the mental language is identical to any known logical formalism, rather they make

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[30] Cf. [1989] for arguments in favour of this kind of hypothesis and Egan [1991] for a critique of Fodor.

[31] Hall [1985] also argues that the language of the mind is not any natural spoken language.

[32] This view of Russell's is one of the main targets Wittgenstein is attacking in his *Philosophische Untersuchungen* [1953]. It is also criticized by Joachim [1920] and Schiller [1920] (in a symposium in the 1920 volume of *Mind* where also Russell [1920] participated).

[33] It is even possible to hold that some images are a kind of symbolic expressions. The crucial difference seems to be that ordinary linguistic expressions are linear (one-dimensional) whereas images are (at least) two-dimensional.

an "idealizing assumption" that some kind of logical type structure isomorphism obtains between the two (Boër [1994]).[34]

Approaches to propositional attitude reports that treat them as claims framed in the terms of a theory of internal mental representations invite the objection that ordinary talk about beliefs, desires, and other mental states hardly is supported by a theory of this kind. Descriptions of people in the terms of propositional attitude psychology are usually based on observations of outward behaviour, rather than of their internal states and processes. It might be true that mental states often are described as representation-like things in the head, but this manner of speaking should not be seen as an expression of a theoretical account of the mind. Everyday discourse can hardly be said to be committed to a thesis that cognition is to be explained in terms of internal representations, let alone imply anything about the structure of this internal language. Ordinary discourse about propositional attitudes is compatible with a wide range of different conceptions about how the human mind works. The hypothesis that cognition proceeds and mental states obtain without mental representations being involved would not contradict ordinary propositional attitude attributions. This kind of objection is not conclusive, but I think that it points out a serious difficulty with mentalist representationalist accounts of propositional attitude reports, namely, that they appear to read too much into discourse about propositional attitudes.

A related objection is that propositional attitude reports characterize the content of a reported attitude in indirect discourse, i.e. in terms of the concepts of the reporter's language, not in terms of concepts that belong to the mind or language of the person whose attitude is reported. An account in terms of internal mental representations must somehow bridge the gap between the mind of the person who has the attitude and the reporter who describes its content. This complication speaks against giving an account of the semantics of propositional attitude reports along these lines. It seems that we understand attitude reports without bothering how the content of an attitude is "represented" in the cognitive agent who holds it.[35]

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[34] Among the formal systems that have been applied in this kind of treatment of propositional attitudes reports are **Discourse Representation Theory** (Asher [1986], [1987], Kamp [1990], and Singh and Asher [1993]) and **Situation Semantics** (Barwise and Perry [1983, Chapter 10], and Bonevac [1984]). Similar (i.e. formal mentalist representationalist) treatments of propositional attitudes are found in Moore and Hendrix [1982], Crimmins and Perry [1989], and Haas [1993] (the latter two articles draw upon work in Situation Semantics).

[35] Propositional attitude reports may also be analyzed in representationalist terms that are not claimed to reflect the structure of any natural spoken language or internal mental language. It seems

3.8.1   Intensional Isomorphism and Structured Meanings

Sententialist and possible-worlds-oriented ideas (see below) are combined in approaches that take **structured meanings** to be the objects of propositional attitudes. A structured meaning is a structure much like a phrase marker, in which the nodes are associated with intensions (which in this context are understood as functions from possible worlds to extensions). (The "grammatical" structure is derived from natural language or some logical representation language.) This method articulates propositional content more finely than a "pure" possible worlds approach. (It is based upon Carnap's [1956] notion of **intensional isomorphism** and has later been used by Lewis [1979a], Hill [1976] and Cresswell [1985].) However, it seems that not even words with the same intension are interchangeable *salva veritate* in *that*-clause complements to propositional attitude verbs. For instance, the terms *groundhog* and *woodchuck* are said to be applied to the same species of animal (cf. Hill [1976] and Dowty, Wall, and Peters [1981, p. 173]), but there is certainly a sense in which someone may believe that Fido is a groundhog without believing that Fido is a woodchuck. Synonymy with respect to intension does not need to correspond to a sameness of cognitive significance.[36]

3.9   Davidson's Paratactic Approach

Donald Davidson's **paratactic** approach to the *semantics* of propositional attitude attribution statements takes utterances, not linguistic expression types, to be the relata of the relations expressed by propositional attitude verbs. It is therefore not a sententialist theory. Davidson's position is one that stresses the distinction between semantic analysis of propositional attitude reports and the analysis of the propositional attitudes themselves.

An account of logical form should, according to Davidson, primarily serve as a component of a compositional semantics for the language in question. An important

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that we understand the content of propositional attitudes in a more abstract way, and that this should preferably be reflected in attitude report semantics. Frege's theory can be seen in this light: Sinne are representations of a kind and are in many ways similar to linguistic expressions, but Frege clearly held that their metaphysical status and the nature of their properties are not comparable to the corresponding properties of linguistic items. Sinne exist in the Platonic third realm independently of human speech and cognition.

[36] This and related problems are discussed by Putnam [1953], and Church [1954], who propose modifications to the concept of intensional isomorphism (cf. Beard [1965], and Burge [1978], [1979b]).

aspect of knowing a language is to be able to interpret sentences in it that one has never encountered before. An central tenet in Davidson's philosophy of language is that an ability to assign truth-conditions to sentence tokens is a basic aspect of a language user's competence and that this competence may be captured by a finitely axiomatizable truth theory (cf. Davidson [1967]). The axioms of the theory are not taken to be known one by one by a language user or to describe actual language production or perception processes in any detail, but are intended to give an abstract account of the kind of compositional semantics that a language user must master (cf. Davidson [1986], [1992]). From the point of view of a speaker, it describes how he expects the addressee to interpret him. From the point of view of an addressee, it describes how he thinks that the speaker intends to be interpreted. In both cases, we should take the truth theory to represent some minimal requirement on their competence. (There are also many other things one has to know to be able to use [a] language.)

Davidson presents his semantic analysis of propositional attitude reports mainly in the article *On Saying That* [1968]. One of the drawbacks of many other accounts of their semantics (for instance, Frege's theory) is, according to Davidson, that the treatment of the subordinate complement clauses in such reports is radically different from from the treatment of structurally similar clauses occurring as main clauses. (Frege assumes that they denote and express completely different things in the two cases.)[37] Davidson thinks this is counterintuitive and indicates a lack of systematicity and economy: Subordinate clauses are understood in the same way as the corresponding main clauses and the same semantic account should work for both kinds of clauses. Davidson's approach to propositional attitude reports allows us to preserve this intuition and to meet this requirement.

Consider Davidson's example (3.27), below.

(3.27)   Galileo said that the earth moves.

In an utterance like this, "the earth moves", is an English sentence token, and the truth theory should account for its semantics. Davidson suggests that we should consider it a separate utterance. (An utterance, in this context, is the unit of discourse to which truth-conditions are primarily assigned.) This step allows the truth theory

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[37] Another objection of Davidson's against Frege's theory, which was mentioned above, is that it stipulates that there is an infinity of Sinne that the expressions of a natural language have the power to denote. This is incompatible with the idea that knowledge of a language only involves a finite amount of information.

to apply to it and ascribe the adequate semantic features to it. What is left then is the previous utterance "Galileo said that". Davidson suggests that the "that" here is referential. It refers to the next utterance. So, the verb *say* stands in this context for a relation that holds between a cognitive agent and an utterance. Davidson's is called the **paratactic account** of propositional attitude reports, because it views them as consisting of two separate utterances. It amounts to denying that there (from a logical point of view) is a case of embedding in sentences like (3.27) and that there is an oblique context involved. Coreferential terms will be interchangeable *salva veritate* with respect to the sentence type of the second utterance in (3.27). But, of course, as soon as there is a new occurrence of (3.27) there will be a new "that" token and a new referent of it.

By stating (3.27) a 20th century speaker may assert that a relation holds between Galileo and an utterance. This utterance, "the earth moves", being part of the token of (3.27), is made by this speaker, not by Galileo. If this token of (3.27) is true, Galileo made another utterance and the two utterances in some sense say the same.

If tenable, Davidsons's proposal no doubt evades many problems connected with other approaches to propositional attitude semantics. It is related to sententialist theories, but unlike them it does not take the abstract objects of a language system to be the relata of propositional attitudes. Instead, these attitudes are taken to relate cognitive agents to utterances. Utterances are physical events, not entities of a metaphysically problematic character. Another advantage is that "since they are non-abstract [they] come with a speaker, a time, and a context attached" (Davidson [1989b, p. 14]). Consequently, difficulties related to the ambiguity, indexicality, and language-dependency of sentences are avoided.

The paratactic account faces some serious difficulties. One of them is that an inference like (3.28), below, will turn out to be invalid.

(3.28)   Galileo and Davidson said that the earth moves.
            Therefore: Davidson said that the earth moves.

The "that" token of the premise and that of the conclusion are followed by two different utterances and are not coreferential. So, the inference is invalid by ordinary standards. Burge [1986] thinks that this is unacceptable.

Many commentators have complained that Davidson owes us an account of the relevant **samesay** relation (for instance, Burge [1986], Bigelow [1978], Feldman [1986], Guttenplan [1979], LePore and Loewer [1990], Bäuerle and Cresswell [1988], and Brandl [1993]). Davidson's answer to this is that to clarify this relation

is to do lexical semantics and is not directly pertinent to logical form (Davidson [1993b]). He thinks that his general theory about interpretation and action clarifies as far as possible what is involved in the "samesay" relation.

A common problem indicated by these complaints is that Davidson's paratactic account reads very little semantic structure into propositional attitude reports. The *that*-clause makes up an attitude relatum to which no significant structure is assigned. It is just an unanalyzed event, from the point of view of the paratactic semantics. This contradicts the intuition that there is more semantic structure than that in attitude reports.

Another difficulty is that there are many syntactic constraints on *say-that* sentences that speak against the assumption that tokens of such sentences really form two distinct utterances. There are many kinds of sentences that cannot follow a *that* (cf. Hand [1991]).[38] The paratactic analysis is forced to allow the existence of complicated syntactic constraints which are semantically unmotivated and holds across utterance boundaries.

Some comments on Davidson's views on mental propositional attitudes may be added. He denies that they are relational:

> [B]eliefs are not relational. There is no entity to which a person is related psychologically or epistemologically, where standing in that relation explains or constitutes the belief. (Davidson [1993b, p. 194].)

However, Davidson clearly considers beliefs relational in two other senses: First, they hold in virtue of a person's standing in various kinds of relation to things in the external world.

> [T]he correct determination of the contents of beliefs (and meanings and other propositional attitudes) depends in part on causal connections between the believer and events and objects in the world[.] (Davidson [1989b, p. 11].)

Secondly, beliefs are relational in the sense that they are interpretable. An interpreter may establish correspondences between the assertions and beliefs of a cognitive agent and those of his own. He is thereby able to evaluate and report the beliefs

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[38] Hand's [1991] examples include *exclamations* ("Oh, I love you." but not *"Laura said that oh, I love you.") and *incomplete sentences* ("Not for the Queen of England.", but not *"Mrs. Ramsay said that not for the Queen of England.")

of the interpreted party. When the interpreter reports the content of an utterance or someone else's belief, he specifies the content by making an utterance of his own.

Davidson's view may be compared to Frege's. Frege holds that in a statement like (3.27), the subordinate clause denotes a particular thing (a Gedanke) and if (3.27) is true Galileo's mind and actions must somehow in some substantial way have been related to this Gedanke. According to Davidson, the subordinate clause is just an ordinary declarative utterance, true or false, but, due to this particular context, without assertoric force. (3.27) simply asserts that Galileo stands in a certain relation to this utterance, but this utterance—which may have been made in the 20th century—was not involved in Galileo's mental transactions.

3.10   Facts and Situations

Frege thought that the relata of propositional attitude relations are a kind of entities that are what they are independently of human affairs (e.g. human psychology and language). His account assumes the existence of a kind of Platonic representations (Sinne). For reasons outlined above, Frege's solution is hard to accept. A decision to reject it leaves two possibilities open. Either it must be accepted that attitude contents are somehow dependent upon human languages or human minds, or the existence of some kind of non-representational structures that constitute the relata of propositional attitudes must be recognized. The former option is represented by public language and mentalist representationalist accounts of the kind discussed above. The latter course has also been attempted and involves finding some kinds of constituents of reality that could provide the contents of propositional attitudes without being representation-like in nature. An approach along these lines was for a time advocated by Russell, who thought that **facts** are the objective relata of the attitudes.

Russell's views on propositional attitudes went through at least three stages: Early in the century, for instance in *The Principles of Mathematics* [1903], he assumed the existence of objective propositions being complexes of real world things, such as material objects (particulars) and properties and relations (universals). However, he soon lost faith in this proposition ontology (cf. Russell [1907], [1910], [1911], [1918, Lecture IV]), coming to think that there are no objective falsehoods, that only true beliefs may be assumed to correspond to something in the objective world (i.e. to facts). This lead him to adopt a theory according to which attributions belief which happen to be false must be analyzed in a way that eliminates

propositions and relates a cognitive agent directly to the particulars and universals involved in his beliefs. (This theory is discussed in Section 3.6.) Finally, Russell adopted a mentalist representationalist view of propositions and propositional attitudes (Russell [1919], [1921], [1938b], [1940]). The assumption that facts play a prominent role in relation to propositional attitudes went unchallenged through all these phases of Russell's thought. He was certain "that the world contains facts" and called this a "truism […] so obvious that it is almost laughable to mention [it]" (Russell [1918, Lecture I, p. 500].[39]

In *The Analysis of Mind* [1921], Russell makes a distinction between the **content** and the **objective reference** of a belief. The content is a proposition. Propositions are understood as a kind of representations, i.e. mental images or sentences. The objective reference of a belief is the fact in virtue of which it is true or false and this fact is determined by the content of the belief. Reference is of two kinds, "'true' reference and 'false' reference" (Russell [1921, p. 232]). "Thus, the objective reference of a belief is not determined by the fact alone, but by the direction of the belief towards or away from the fact"[40] [1921, p. 272]. It is not clear (to me) how Russell intended this theory to be applied to propositional attitude *report semantics*. However, if we apply it to natural language in a direct fashion it runs into difficulties. Consider, for instance, (3.29).

(3.29)   Mary believes that Aristotle was born in the spring.

Now, does the *that*-clause complement denote or characterize the *content* or the *objective reference* of the belief attributed to Mary in (3.29)? Well, not much is said about the proposition involved. It is not specified whether it is a word- or an image-proposition, let alone which language or kind of imagery is involved. A natural suggestion is then that the *that*-clause complement in a sentence like (3.29) denotes or characterizes the *objective reference* of an attitude, i.e. the fact that the belief is directed towards (if the belief is true) or away from (if it is false). Which analysis of (3.29) is applicable depends on whether it is a fact that Aristotle was born in the spring or not. (Either it is a fact that Aristotle was born in the spring or it is a fact that Aristotle was not born in the spring.) This being unknown to most people who may understand (3.29), we are led to conclude that (3.29) is ambiguous in the following way and has two readings as paraphrased by (3.30) and (3.31), respectively. (The *that*-clauses are assumed to stand for facts here.) This objection is suggested by a similar one by Ramsey [1927].

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[39] Another adherent of the idea that true statements correspond to facts is Austin [1950].

[40] Russell says that he owes this way of looking at the matter to Wittgenstein.

(3.30) Mary believes-truly that Aristotle was born in the spring.

(3.31) Mary believes-falsely that Aristotle was not born in the spring.

This kind of ambiguity does not seem to be there. In many cases where a belief is ascribed to an agent (for instance as in (3.29)) nothing is implied or even suggested about the truth value of the belief attributed. It is perhaps possible to eliminate this ambiguity without abandoning Russell's 1921 theory, but this will no doubt introduce considerable complications.

A position which has much in common with that of the early Russell is defended by Barwise and Perry [1983], who argue in favour of a framework (**Situation Semantics**) that assumes the existence of fact-like entities, called **situations** (cf. Nivre [1992]). They recognize both **real** and **abstract** situations. The real ones are parts of the world and are classified by abstract situations. Both kinds of situations are taken to be representation-independent. Real situations are parts of the world (Barwise and Perry [1983, p. 7, 58]). Abstract situations are defined in terms of individuals, properties, relations and space-time locations. Some abstract situations classify a real situation and are said to be **factual**.[41] There are also non-factual abstract situations. So, the concept of "abstract situation" is similar to the concept of "proposition" in the early Russell, and the term "real situation" is used in much the same way as Russell uses the term "fact".[42] They suggest a treatment of propositional attitude attribution semantics in terms of sets of alternative situations. The content of a belief is characterized by the set of situation types compatible with the belief. However, Barwise and Perry [1983] in the end find this analysis untenable and reject it in favour of a representationalist treatment.

A kind of argument that is often taken to refute the idea that true propositions correspond to representation-independent facts is the following one (versions of which are found in Church [1956, p. 24–25], Davidson [1967], [1969], [1990b], and Wagner [1986]). The idea to be refuted is that true statements stand for facts. Two crucial assumptions are involved. The first is (α) that correspondence to facts is not sensitive to how individuals are referred to. If a sentence token stands for a fact, and a referring phrase is replaced by a codesignative one, the modified sentence will *ceteris paribus* correspond to the same fact. This is a plausible principle: Which fact a sentence token stands for is not sensitive to the way in which an object involved

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[41] I am ignoring Barwise and Perry's distinction between **actual** and **factual** abstract situations.

[42] Barwise and Perry use the terms "fact" and "proposition" in other senses than Russell employs them.

in the fact is described (as facts are supposed to be representation-insensitive). The second assumption is (β) that two logically equivalent sentence tokens always correspond to the same fact.

Now, if an object is referred to by means of a uniquely identifying description P, i.e. as "the x such that $P(x)$", this referring phrase will have the same reference as "the x such that $P(x)$ and q", where q is any true sentence. So, if $R_1(a_1)$ and $R_2(a_2)$ holds, the following formulae will represent the same fact.

$R_1(a_1)$ [or "a_1 is R_1"]

the x such that $x = a_1$ is R_1 [application of (α)]

the x such that $x = a_1$ and $R_2(a_2)$ is R_1 [application of (α)]

the x such that $x = a_1$ is R_1 and $R_2(a_2)$ [application of (β)]

$R_1(a_1)$ and the x such that $x = a_2$ is R_2 [application of (α)]

the x such that $x = a_2$ and $R_1(a_1)$ is R_2 [application of (β)]

the x such that $x = a_2$ is R_2 [application of (α)]

$R_2(a_2)$ [application of (α)]

This line of reasoning shows that the fact that $R_1(a_1)$ generally is identical to the fact that $R_2(a_2)$ (and similar arguments could be produced for facts of other kinds). This is clearly unacceptable: Every fact of the type corresponding to an individual's having a property would collapse into the same fact. For instance, "the fact that Paris is a capital" and "the fact that this object is a book" would correspond to the same fact.

This argument does not compromise Russell's theory, as he held that logical analysis must eliminate definite descriptions (Russell [1905]): Sentences that contain such descriptions cannot be assumed to reflect the ultimate structure of the facts that exist. However, the argument above refutes the naive idea that true sentences correspond to facts in a simple way.[43] Barwise and Perry [1981] also argue that the argument is not applicable to their approach: They argue that Donnellan's [1966] distinction between **attributive** and **referential** uses of definite descriptions corresponds to an important kind of ambiguity. A definite description may be used in a statement both to pick out a referent without saying anything about the situations in which this referent is involved and to represent something as involved in a certain type of situation. For instance, a sentence like (3.32) may represent two situations:

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[43] Wilson [1974] also suggests a fact ontology and argues that it escapes this objection.

(3.32)   The author of *Begriffschrift* is sleeping.

If the noun phrase is read referentially this sentence simply corresponds to a situation where Frege is sleeping. (That he is the author of *Begriffschrift* is not part of this situation. We just exploit the fact that he is in order to refer to him. On the other hand, if the noun phrase is read attributively this sentence represents a situation in which also the *Begriffschrift* and the authorship relation is involved. (Barwise and Perry [1981] consequently recognize a scope ambiguity of the kind posited by Russell's [1905] theory of definite descriptions in oblique contexts, and it is likely that he would have approved of this application of his ideas.)

However, there are more general objections against fact or situation ontologies. The world does not seem to decompose into facts by itself. There are innumerable ways in which the substance of the world can be portioned into objects (cf. Quine [1976a]) and it does not seem that the world forces us to adopt any particular set of properties and relations in terms of which to construe the facts. Properties and relations cannot simply be identified with their extensions, as this step would identify the facts of the world with the set-theoretic truths, which are logically independent of the contingencies of the ordinary world. For instance, "John is an evangelist" would correspond to the set theoretic fact 'John $\in$ {Matthew, Mark, Luke, John}', but this would be a fact even if John was not an evangelist. The step from the fact that a certain individual has a certain property to the fact that this individual is an element in the extension of this property obliterates everything that is contingent about the first fact. The fact theorist is therefore led to recognize primitive universals (as Russell [1912], [1915a] and Barwise and Perry [1983, p. 50–51] indeed do).[44] Facts are supposed to be independent of language and mental states: They "are what they are whatever we may choose to think about them" (Russell [1918, Lecture I, p. 500], cf. [1938a]). This means that the universals must be independent in the same way. Properties and relations must exist in the external world independently of the ways in which human beings classify things. So, a fact theory must give an account of which objects and which properties and relations really are out there. But, how are we to decide? There are innumerable systems of names and predicates that can be used to describe the world. Choices among them can only be motivated by pragmatic considerations. So, the fact theorist is forced to enter into a metaphysical

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[44] One could perhaps imagine a theory that only recognized unstructured facts—Ramsey [1925] suggests this possibility in passing—, but it is hard to see how they could be of much use. Prototypical facts seem to involve properties and relations. At least, if they are to serve as relata of propositional attitudes in a systematic semantics they can hardly be unstructured primitive entities.

quest for "the ultimate constituents of matter" (Russell [1915b], cf. [1918]). It may even be held that any distinction between particulars and universals is relative to a language (cf. Ramsey [1925], [1927]).

It should be stressed that Russell's aim was not primarily to give an analysis of natural language attitude reports, but the fact that people talk about propositional attitudes without being committed to a sophisticated metaphysics of the kind needed to support a fact ontology clearly speaks against his theory. Another circumstance that speaks against fact and situation ontologies is that entities of this kind do not appear to exist in the same way as material objects. It also seems that talk about facts can often be reduced to statements about ordinary things. A trivial example would be "It is a fact that Fido is a dog", that arguably says nothing more than "Fido is a dog" (cf. Ramsey [1927], Strawson [1949], and Davidson [1990b]). Strawson thinks that fact theories are motivated by a desire to find something that statements refer to in much the same way as referring expressions may refer to ordinary things and he writes that "it is evident that the demand that there should be such a relatum is logically absurd: a logically fundamental type-mistake" [1950a, p. 134].

A denial of the idea that the structure of facts is independent of language and cognition amounts to viewing them as some kind of semantic content structures. Fact theories, I think, invite such a reading. Barwise and Perry seem to be inclined to admit—but only in passing—that the scheme of situations may be a language-dependent affair (Barwise and Perry [1981], [1983, p. 58–60]). The value of a fact or situation theory as a formal account of semantics is largely unaffected by a rejection of the idea that facts or situations are language-independent. The metaphysical status of facts or situations concerns the philosophical understanding of what a fact or situation theorist is up to, not the formal details of his proposals. However, if it is admitted that facts or situations are representation-dependent, fact and situation theories come close to being representationalist ones.[45]

3.11 Possible Worlds

Fact and situation theories are motivated by a desire to find some objective "things" in the external world in terms of which the content of statements and/or propositional attitudes may be characterized. As we have seen, such approaches face serious philosophical and practical difficulties, and many semanticists have found it best

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[45] In a similar way Frege's account may be understood as a representationalist one by those who reject his Platonist "drittes Reich".

to reject them. A very different conception of content, not framed in terms of representations (mental or linguistic), is found in those semantic theories that have used the idea of **possible world** to account for propositional attitude contents. The basic idea behind these theories is that many truths are not necessarily true: The world could have been different and it could have been different in very many ways. As Cresswell [1982, p. 70] puts it: "A representation of a way the world is of course entails the possibility of representing ways the world isn't but might be." We may say that we are able to conceive of other worlds differing from the actual one in various respects. These worlds are then, in some sense, *possible* worlds. This idea allows us to give a natural treatment of various kinds of modality. Something is possible if it is the case in some possible world and necessary if it is true in all possible worlds. (It can hardly be maintained that this *explains* modality, but it suggests a way of giving a formal treatment of modal statements.) It may also be of help in the analysis of the content of propositional attitudes. The content of (say) a belief may be thought of as a set of possible worlds, i.e. those which the belief correctly describes. (The belief is true if and only if the actual world is an element in this set.)[46]

The notion of possible world was introduced by Leibniz. Modern possible worlds semantics is influenced by the **intensional logic** of Carnap [1956]. (Carnap's approach to propositional attitude reports is different, however.) The idea behind intensional logic is that there is a notion of truth, according to which truth is not simply a property, but a relation that holds between a possible world, or whatever formal construct we take to represent a possible world, and a sentence. The semantic values of expressions are not primarily ordinary extensions (Bedeutungen in Frege's terminology), but intensions, which may be understood as functions from possible worlds to ordinary extensions. This means that propositions, i.e. sentence intensions, will be construed as functions from possible worlds to truth values. A proposition will then be the characteristic function of a set of possible worlds (cf. Kripke [1963]). This means that we may as well identify a proposition with a set of possible worlds. (This is a matter of technical considerations.)

The definition of propositions as sets of possible worlds allows logical relationships to be identified with set-theoretical ones: Logical consequence is inclusion; disjunction union; and conjunction intersection. A tautology—or, rather, *the* tautology—is the set of all possible worlds, and the contradiction is the empty set.

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[46] This assimilation of propositional attitudes and modality is criticized by, for instance, Burge [1977] and Linsky [1983].

The structure assigned to propositions in this way is clearly very different from the one assumed by a sentientialist theory.[47] The main difference between possible worlds approaches and sentientialist ones is that the former reject the idea that the content of propositional attitudes should be characterized in terms of representations. However, the stipulation of possible worlds may be guided by the possibilities provided by a representational framework: Kripke [1980, p. 44] says that "[a] possible world is *given by the descriptive conditions we associate with it*" (emphasis in the original).

Possible worlds are in most cases introduced as a kind of primitive entities (cf. Dowty, Wall, and Peters [1981]). Unlike fact or situation theories, possible worlds accounts of propositional attitudes do not have to assume that the (present) world (or any other world) has any definite structure independently of mental or public language. (These worlds do not have any inherent structure at all.)

The content of a belief or a set of beliefs is seen as the set of all possible worlds compatible with the belief(s) in question. These may be said to be the **doxastic alternatives** with respect to a person or a single belief. In relation to knowledge we may then speak about **epistemic alternatives**. If knowledge is viewed as a species of belief (as it usually is in philosophical contexts), every doxastic alternative is also an epistemic alternative (cf. Hintikka [1962], who introduced this terminology). Even if the worlds are taken to be language- and cognition-independent, such a dependency nevertheless enters a possible worlds theory, because the only way to decide which possible worlds have to be posited is, it seems, to consider which possibilities the relevant languages (as intuitively understood) allow and force us to differentiate.[48]

Propositions and other intensional elements may be introduced in a logical system in (at least) two different ways (cf. Burge [1977] and Bell [1983]). First, there is the **modal operator approach** (represented, for instance, by Carnap [1956]), which does not allow any expressions denoting intensions. There are only intension-sensitive operators (such as, for instance, the modal operators '$\diamond$' and '$\square$'), which are not treated as predicate symbols. Secondly, we find languages that allow quantification over intensions. Formalisms of this kind represent the **intensional object**

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[47] For instance, to the sentientialist a conjunction is a more complex object than the two conjuncts, but to the possible world theorist it will be a "smaller" object.

[48] There is an alternative approach to possible worlds that defines them as sets of sentences, rather than introduces them as primitive objects. In this way the language-dependency is made explicit. (So, possible worlds are defined as sets of propositions, rather than propositions as sets of possible worlds.) Carnap [1956, §2] and Wilson [1984] represent this kind of approach (cf. Stalnaker [1976]).

approach, as they treat intensions as objects. This method is used, for instance, in Montague's [1973] intensional logic of the PTQ system (cf. Dowty, Wall, and Peters [1981]).

When it comes to the analysis of propositional attitudes the two methods suggest different treatments. The intensional object approach assumes that propositions are objects. It is then natural to view belief (for instance) as a relation holding of a cognitive agent and a proposition. (We find such a treatment in Montague's [1973] PTQ system.) The modal operator approach, as represented by Hintikka's [1962] doxastic logic, introduces one modal operator for each pair of cognitive agent and propositional attitude type. So, for instance, if we consider what two cognitive agents, a and b believe and know, we have to introduce four operators, 'B_a', 'B_b', 'K_a', and 'K_b'. In this way, the notions of belief and knowledge are assimilated to other modal notions, such as alethic, temporal, and deontic modality and the same kind of model-theoretic apparatus may be used to take care of the semantics of various kinds of modal logic. Modal operators are applied to sentences, which are not treated as terms and the operators are not treated as predicates. Consequently, this approach does not allow quantification over propositions, and there is no way of capturing a relationship like that described in (3.33).

(3.33)   Mary believes everything that Peter believes.

This seems to be a quite serious disadvantage.

A problem in ordinary possible worlds approaches to the analysis of propositional attitudes is that logically equivalent propositions are identified (as they are true in precisely the same possible worlds). (cf. Quine [1968] and Bäuerle and Cresswell [1988]). This is only tenable to the extent that cognitive agents are taken to be **logically omniscient**. This means that the beliefs of a person are closed under logical consequence. Now, it does not seem plausible that cognitive agents are logically omniscient. In fact, people often fail to see the logical consequences of their assumptions. So, a possible worlds theory of belief along these lines is at best an account of a highly idealized notion of belief (cf. Dowty, Wall, and Peters [1981, p. 172], Linsky [1983, Chapter 5]), not the one found in useful reasoning about ordinary people.[49]

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[49] Various attempts has been made to overcome this problem within a possible worlds framework. A radical solution is to allow **impossible worlds** in the sets characterizing propositional contents. The idea is that two logically equivalent propositions may differ with regard to which impossible worlds they are true in. Approaches of this kind have been suggested by Hintikka [1975] and Cresswell [1973]

Possible worlds accounts of propositional attitudes do not say much about psychology. Intensional propositions are only intended to represent the contents of mental states in non-mentalistic terms. Most philosophers and linguists in this tradition probably hold an instrumentalist view of these things. A possible worlds semantics is only a theoretical account of the logical form of (say) belief attribution sentences. It describes certain abstract aspects of a linguistic-cognitive system, without saying how this is realized. Possible worlds are then introduced as a means of giving a formal account of what a system of representations is capable of representing. Few philosophers are realists with respect to possible worlds, but Lewis [1986] is a notable exception.

3.12   Reference and Propositional Attitudes

As we have seen, many of the difficult features of propositional attitude reports are related to reference, but also in relation to the propositional attitudes themselves, reference is a matter of philosophical controversy. Some writers on the subject (e.g. Frege) have arguably not clearly distinguished the two issues of how an expression in an attitude report refers and of how the reported propositional attitude state refers to an external object. The two questions are however clearly distinct and to some degree independent. The first one is concerned with how a reporter refers to an object by means of language and the second one with how an attitude state may refer to this object. For instance, consider:

(3.34)   Mary thinks that the Eiffel Tower is 400 meters high.

If we assume that a person utters (3.34) as a true report about Mary's mental states, the question of how the reporter manages to refer to the Eiffel Tower is clearly different from the issue of how Mary's mental state may be about the same

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(also cf. Dowty, Wall, and Peters [1981, p. 173]). The most obvious objection against such proposals is probably that they will invalidate most of the intuitions that may be taken to speak in favour of the possible worlds analysis of propositional attitude contents. For instance, the interpretation of logical constants will be quite arbitrary if the logical laws governing them are eliminated in this way (cf. Bäuerle and Cresswell [1988]).

A related kind of solution, inspired by ideas from Situation Semantics (Barwise and Perry [1983]), is suggested by Muskens [1989]. He shows how a partial logic may be defined within a possible worlds approach to propositions. This logic allows that propositions may be both true and false (in this respect it is similar to an "impossible worlds" approach) and that they may be neither. Again, the omniscience problem is avoided.

building. (The difference is reflected in the distinction between *de re* and *de dicto* readings of attitude reports).

3.12.1   Names and Descriptions

One much debated issue is the cognitive significance of referential relations. The distinction between descriptions and names is often stressed in this context. A description may be taken to refer to an individual in virtue of being uniquely applicable to this individual. Russell [1905] (cf. Whitehead and Russell [1925]) shows how such descriptions may be eliminated in the underlying logical form of a sentence containing them. The idea is basically to make the "presupposition"[50] that such a description is true of precisely one individual part of the logical form of the sentence in which it occurs. So, for instance, "The king of France is bald" would be analyzed as "There is one and only one thing that is a king of France and he is bald". Russell assumed that most ordinary names really are a kind of disguised description and that they too should be analyzed away according to this method (Russell [1911], [1918], Whitehead and Russell [1925, p. 31, 65–68]). Russell's analysis shows that definite descriptions do not refer to particulars, rather they express quantifications and "reference" to universals.

A Russellian reduction may explain differences in meaning between two names that name the same object, and why it is possible to use a name without being ontologically committed to the existence of its bearer (cf. Quine [1948]). However, Russell assumes that there are also logically proper names, which directly denotes particulars with which we are epistemologically acquainted (in an empiricist sense). So, the Russellian theory of reference says that there are on the one hand descriptions (in which category all ordinary names are included) which are eliminated in the analysis of logical form (in terms of predication and quantification) and on the other hand, genuine names, which refer in virtue of being directly associated with things immediately given to the mind.[51]

Russell's theory is intended to account for differences in cognitive significance between two propositions in a way that makes entities like Fregean Sinne unnecessary. Expressions are assumed to denote particulars and universals directly, whereas

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[50] The idea that this is only a presupposition and not part of the actual claim is due to Frege [1892] and is defended by Strawson [1950b] (cf. Russell's reply [1957]).

[51] There seem to be several serious objections to an empiricism of this kind. For an overview, see Rorty [1982].

Frege assumes that there are entities (Sinne) that mediate between a linguistic token and the thing it denotes. However, Frege partially shares Russell's view of ordinary names in assuming that their cognitive significance is often made explicit by a description, but he thought that when a Sinn of this kind occurs as a constituent of a Gedanke, it is not part of this Gedanke that one and only one individual actually is picked out by this description. It is rather something that is *presupposed* when the Gedanke is affirmed (Frege [1892, p. 40]).[52] There are consequently important differences between the Fregean and Russellian approaches, but they agree in explaining the content and reference of ordinary names in terms of their corresponding to descriptions. (Similar views have been proposed by, for instance, Jespersen [1924, p. 65–71], Searle [1958], Strawson [1959], Burge [1973][53], and Seppänen [1974].) There is both a linguistic and cognitive aspect of this issue. Frege and Russell seem to have intended their analyses to apply to reference both in language and in thought.

A crucial issue is, of course, what kind of description embodies the significance of a name. Frege [1892, footnote, p. 27] and Russell [1918, Lecture 6, p. 208–209] seem to assume that this description is defined in terms of familiar predicates (i.e. predicates corresponding to words in ordinary language).[54] Quine [1948], [1960b, §37] takes another course: He simply introduces a primitive property corresponding to each name. (Hochberg [1957] has some arguments against such predicates.) This step evades the main difficulty with Frege's and Russell's accounts, the fact that there in many cases appears to be innumerable descriptions that can capture their possible cognitive significance. To determine which one best characterizes the way in which the bearer of a name is known to a cognitive agent seems to involve considerations that are much more complex than those that are relevant when we try understand another person's use of a name.

Another objection against the description theory of names is that it seems that people often use names in a regular way without having any description in mind that would identify the bearer of the name (Wilson, [1953], Kripke [1972], Donnellan

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[52] If this presupposition is false, the Gedanke lacks a truth value. So, the sentence "The king of France in 1905 was bald" would, according to Frege's view, express a Gedanke that fails to have any denotation.

[53] See Boër [1975] for a critique of Burge [1973].

[54] Russell's empiricist programme requires that logical form ultimately is rendered in terms of predicates that stand for universals with which we may be acquainted. Many of the predicates in natural language probably stand for universals that we only know by description, and these descriptions must be rendered in terms of universals with which we are acquainted.

[1970], Kaplan [1973] and Boër [1975]). Simply having seen or heard the name in passing may enable a person to use the name to refer to the otherwise unknown thing by that name. Another argument (also from Kripke and Donnellan) is that even if people sometimes do associate a name with a description that uniquely picks out the right individual, there may be several different descriptions that will do as nicely. Consequently, one person may associate a name with one description and another person may associate the same name with another description that defines the same individual. But this situation hardly warrants the conclusion that the name really is ambiguous. Another argument against the Frege-Russell view is that people sometimes associate a name with a description that picks out the wrong individual. So, for instance, someone who thinks that Frege was the logician who wrote *Naming and Necessity* and does not think he knows anything more about Frege, will not be referring to Kripke when he asserts "Frege was a logician".

3.12.2   Causality and Indexicality

Kripke [1972] proposes what may be called **the causal chain picture of reference** (also cf. Evans [1973], McKinsey [1976] and Schwarz [1978]). (Kripke stresses that it is a "picture" rather than a worked-out theory.) It says that names are associated with their bearers due to causal mechanisms. Initially, a name is given to an individual through some act of name-giving, in which case the name-giver must refer to this object demonstratively, or, perhaps, *by means of* a uniquely identifying description. Once this connection is established, other people may hear the name and continue to use it with the intention of preserving its reference. The name is transferred from one language user to another through causal interactions of the right kind. The circumstances that determine the reference of (say) the name "Aristotle" extends back in time to the moment when he was baptized. The relevant causal chain and not idiosyncratic beliefs about Aristotle fixes the referent of this name when someone uses it (with ordinary intentions).

Are the two pictures of the reference of names really incompatible? When a name is transferred from one speaker to another, the typical situation probably is (as Kripke assumes) that the second speaker will use the name with the intention to refer to the same thing as the first speaker referred to in his use of the name. In this sense, a speaker will possess a description that uniquely identifies the right individual, provided, of course, that the first speaker succeeded in referring. I think that the description theory of naming is compatible with this intention chain picture of the reference of names, which seems to be almost identical with the causal chain

picture. The chain ends in a situation where a speaker's intentions are not defined in terms of another speaker's intentions.

The direct reference school critique of the description theory of names appears to be based upon the assumption that descriptions lack indexical elements. Frege holds that a Gedanke or other Sinn possesses its Bedeutung inherently and eternally. In this sense they are not indexical. A sentence may well contain indexical elements, but from the point of view of the Gedanke expressed by a token of it, there are only absolutely referential terms (Frege [1918, p. 64]). The truth value of a Gedanke is not relative in any way. This does not however imply that any information about indexical ties must be lost in the transition from a sentence token (containing expressions whose reference depends on the context of utterance) to the Gedanke it expresses. (It seems that some direct reference philosophers have thought that it does.) These indexical connections to a context may still be reflected in the structure of the relevant modes of presentation. Frege appears to have assumed that they are, but he says very little on the subject.[55]

What Perry [1979] calls **the Problem of the Essential Indexical**,[56] is also highly pertinent in possible worlds approaches to propositional attitudes. Certain "things" are in a sense directly given to the mind in a way that appears to be irreducibly indexical. First, there is the "I", i.e. the individual whose mind it is; secondly, there

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[55] In *Der Gedanke* [1918, p. 66], Frege writes (translation in Frege [1984, p. 359–360]):

> Now everyone is presented to himself in a special and primitive way, in which he is presented to no-one else. So, when Dr. Lauben has the [Gedanke] that he was wounded, he will probably be basing it on this primitive way in which he is presented to himself. And only Dr. Lauben himself can grasp [Gedanken] specified in this way. But now he may want to communicate with others. He cannot communicate a [Gedanke] he alone can grasp. Therefore, if he now says 'I was wounded', he must use 'I' in a [Sinn] which can be grasped by others, perhaps in the [Sinn] of 'he who is speaking to you at this moment'; by doing this he makes the conditions accompanying his utterance serve towards the expression of a [Gedanke].

What Frege says is that each person is presented under a mode of presentation that no-one else may grasp (cf. Perry [1977], Burge [1979b], and Noonan [1984]). This mode of presentation is based upon the inherently and irreducibly indexical way in which a person is cognitively present to himself and to no-one else. However, this idea rhymes badly with Frege's general insistence on the impersonal nature of Gedanken. (For a critique of the whole idea see Kvanvig [1989].) Probably, Frege may have recognized also publicly graspable Sinne of this kind. Even if Frege often characterizes Sinne in terms of uniquely identifying descriptions, his theory is, I think, compatible with the assumption that there may be Sinne that correspond to a person's knowing a thing by way of more direct acquaintance, rather than in virtue of possessing a uniquely identifying description of it.

[56] Of which Frege's Dr. Lauben example (see the previous footnote) shows one aspect.

is the present time, the "now". (The present location, "here", may be understood as the location of the "I" at the present time.) In a sense, thought may refer to these two without having any knowledge about them, so to speak, simply in virtue of its spatio-temporal location (cf. Perry [1986]). Further, a notion of proposition that does not admit of their having indexical ties with the actual propositional attitude states of which they are the contents, will imply that it is possible to know everything, without knowing who, or where, or when one is (cf. Perry [1977] and Lewis [1979b]). The possible worlds conception of propositions, identifying them with the set of possible worlds in which they are true (or amounting in effect to this), are subject to this difficulty. Propositions of this kind represent, so to speak, an absolute view of the worlds, without any anchoring in a specific point of view. In a hypothetical world of omniscient beings nobody would consequently know who he is, according to this conception. An omniscient being would, of course, know everything about himself and everything about everyone else, but he would not, so to speak, know who thinks his thoughts, being omniscient he would know the thoughts of everyone else as well as his own.

Many possible worlds approaches are seriously compomised by this inability to account for the spatio-temporal situatedness of propositional contents, which is an important aspect of propositional attitude psychology. It is, for instance, possible to have a belief *de re* with regard to oneself, without realizing that it is about oneself. For instance, I may see myself in a mirror and form the belief that he (in the mirror) wears a blue shirt, thinking that this person is not I. This belief is clearly different from the belief I could express by saying "I wear a blue shirt". Beliefs belonging to a cognitive agent that he takes to be about the referent of his "I" (i.e. himself) are said to be *de se*, which is a subspecies of belief being *de re* about the person who has them.[57]

The problem with ordinary possible worlds accounts of propositional attitudes is that they obliterate the distinction between attitudes that are *de se* and those that are only *de re* with respect to the one who has them, i.e. without being *de se*. The difference between the two kinds of attitudes is not one that decides between worlds.

The basic ideas of the possible worlds approach may however be modified in a way that allows *de se* beliefs to be accommodated. One proposal is due to Quine [1968]. He suggests that propositions are to be defined in terms of **centered possible**

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[57] See Lewis [1979b], also cf. Geach [1957], Castañeda, [1966], Loar [1976], Stalnaker [1981], Baker and Wald [1979], Cresswell and von Stechow [1982], Fitch [1984], Markie, [1984], [1988], and Zemach [1985]). Quine [1968] uses the term **egocentric propositional attitudes** for propositional attitudes whose content is irreducibly indexical.

worlds, which are pairs of a possible world and a coordinate indicating a point in this possible world. In this way "now", and "I" beliefs may be distinguished from corresponding "absolute" *de re* beliefs. Another suggestion, due to Loar [1976], and generalized by Lewis [1979b], is to take the objects of beliefs to be properties. It should be clear that a *de se* belief may be seen as a self-ascription of a property. On Lewis account, all beliefs are of this kind. He assimilates spatio-temporal location with location in the logical space of possible worlds. The content of a belief is then a property, the property of having a certain logico-spatio-temporal location. Non-indexical beliefs correspond to properties which are only sensitive to logical location, i.e. whether a cognitive agent has such a property is not subject to spatio-temporal variation. (It only depends upon which possible world he "inhabits".)[58]

The context-orientedness of propositional attitudes is also stressed by Davidson, but in his view it is a more general feature that does not apply only to reference. According to him, ascription of propositional attitudes (such as meaning to utterances, intentions, beliefs, and desires) is possible only because there are ways of correlating the actions and utterances of people with publicly perceptible features of the environment. In the basic cases the contents of beliefs must be assumed to be given by the circumstances that cause a cognitive agent to hold them. Propositional attitudes can only be ascribed to a being interacting with the world (cf. Davidson [1973], [1974a], [1983], [1986], [1989a], [1990a], [1991a], [1991b], [1992]). This context-dependency is not more pertinent to names than to descriptions. Rather, it applies holistically to propositional attitude interpretation in general.

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[58] Another proposal is due to Kaplan ([1989a], [1978], [1989b]) who makes a distinction between the **character** and **content** of sentence tokens. The content is the proposition (in the possible worlds sense) expressed by the sentence token. To the extent that this sentence contains indexical expressions, this content is sensitive to the context. The meaning of a sentence type may therefore be viewed as a function from contexts (specified as collections of relevant parameters) to propositional contents. This function is what is called the character of the sentence type. By assuming a compositional semantics we may also talk about the character of subsentential expressions. Kaplan suggests that contents are the objects of thought, whereas characters reflect the cognitive significance of propositional attitude contents. (Kaplan [1989a, p. 530] identifies his notion of "content" with Frege's notion of "thought" [i.e. "Gedanke"] and likens a character to a mode of presentation of a content. However, in Frege's system Gedanken are supposed to capture differences is cognitive significance [and modes of presentation of objects may be included in them]. Kaplan's way of relating his theory to Frege's is therefore highly misleading.) This move allows us to capture the context-directed features of propositional attitudes. There will, for instance, be a cognitive difference between the thought expressed as "I am wounded" and "Dr Lauben is wounded", even if the two thoughts will have the same content if they are entertained by Dr. Lauben. (Cf. Kaplan [1989a, p. 533], where Frege's Dr. Lauben example is discussed. For a critique of the idea that character reflects cognitive significance, see Taschek [1987].)

3.13   Concluding Remarks

As we have seen, a large number of accounts of propositional attitude report se-
mantics have been proposed. Many aspects of this issue are sources of controversy,
and they are often deeply connected to traditional philosophical problems, mainly
those relating to epistemology and metaphysics. There are however many views
of how these issues relate to each other. Russell, for instance, seems to have been
aiming for a theory that would give a unified account of psychology, semantics,
epistemology, and metaphysics, while a philosopher like Davidson represents the
view that inquiries into these areas can and should be kept separate. Other theo-
ries have been proposed as components in anti-psychologistic epistemologies. The
accounts of people like Frege, the early Russell, Carnap, and some of the possible
world theorists seem to belong to this category. Other thinkers, like Fodor, Bar-
wise, Perry, Crimmins, and Kamp have proposed analyses of propositional attitude
attributions that involve substantial psychological claims. These philosophers tend
to be less concerned with epistemology. (An exception is the later—post-1919, or
thereabouts—Russell, who combined a psychologistic outlook with epistemologi-
cal ambitions.) The different contributions to the analysis of propositional attitudes
have consequently been made with very different intentions and represent very
different ways of viewing the area. It should be noted that some of the theories dis-
cussed in this chapter have not mainly been proposed as accounts of propositional
attitude *report semantics*, but there is probably no-one who would deny that they
must somehow be compatible with a plausible analysis of attitude reports in natural
language.

I will conclude this chapter by briefly recapitulating some of the more serious
shortcomings which the various theories that have been proposed face.

Behaviourist reductions of propositional attitude reports seem to be extremely
difficult to achieve, and, further, *if* a programme of reduction was accepted, an
intermediate logical analysis of a more abstract character would probably serve
as an auxiliary step towards a full reduction. (The semantics proposed in the next
chapter does not contradict the idea of a reduction, but is not intended to support
one.)

Non-binary accounts are difficult to defend for the reason that they cannot
accommodate propositional contents of arbitrary complexity and are forced to rec-
ognize a very large number of primitive mental attitude relations. Some arbitrary
constraint on the complexity of attitude contents is imposed. The second problem
conflicts with the desideratum that a semantic theory should be as economic and

systematic as possible.

Frege's theory is, I think, quite adequate in its logical structure, but the "drittes Reich" metaphysics and view of cognition is implausible. Further, Frege offers us just an outline of a semantics of propositional attitude reports, the programme is not developed for any fragment of a natural language. There are just suggestions of how certain semantic puzzles should be dealt with. The account that will be given in the next chapter preserves Frege's most important idea, viz. that propositional attitude contents should be logically analyzed in terms of impersonal intensional (abstract) particulars (called "Sinne" by Frege, but I will use the term "concept") and that these possess denotations.

The main problem with natural language sententialism is that there may be differences in the cognitive significance of propositions which do not correspond to semantic differences between expressions. There is also the opposite problem: The same proposition may often be expressed by different sentences (the distinctions between which is insignificant in a given context). This leads to an unnecessary multiplication of the possible relata of an attitude relation. Further, the significance, including their logical structure, of natural language expressions is highly context-sensitive. I think it is plausible that propositional attitude reporters sometimes intend to ascribe very well-defined contents to the mental states of people and that what they want to say in this sense is more unambiguous than natural language expressions usually are. However, a sententialism that only recognizes sentences belonging to a small regimented subset of a natural language could perhaps escape these objections, but such an approach would have much in common with that of the next chapter. Another problem is the one indicated by the Church-Langford argument: Propositional attitudes often seem to have a content that does not belong to any particular language.

"Mentalese" theories can avoid the problems associated with natural language sententialist accounts by assuming that the "mentalese" in question is a restricted and unambiguous language. My objection to this kind of account is that I do not see that ordinary discourse about propositional attitudes must be construed as assuming anything about mental representations. (Perhaps the mind represents things, but it does not need to do this by means of representations.) However, if mental representations are understood in a sufficiently abstract manner I have no objection against them, and the proposal of the next chapter may be seen as one that stipulates a very abstract mental language. Its advantage is that this system is much simpler and economic than those mentioned in Section 3.8 which are of comparable coverage.

The main disadvantage of Davidson's paratactic account is that is yields quite uninformative truth conditions. The sentences "Mary believes that Aristotle was a philosopher", and "Mary believes that Kant was a philosopher", will be associated with the logical forms 'believe(i_{Mary}, e_A)' and 'believe(i_{Mary}, e_B)'. Any similarity between the contents is obliterated. No semantic structure is read into the *that*-clauses (from the point of view of the truth conditions of attitude reports). However, Davidson's account of logical form may be supplemented by a theory that tries to spell out the structure of attitude contents. If it is seen in this way, the framework of the next chapter is compatible with the paratactic account, but from the Davidson's point of view, it would not be a pure account of logical form. (It would rather be a kind of theoretical explication of propositional attitude reports.)

With regard to theories that assumes that the relata of propositional attitudes are some kind of mind-independent constituents of reality, my objections are mainly sceptical and philosophical. The idea that there are such constituents seem to be difficult to defend. Another problem is that there might be differences between propositional contents that arise, for instance, due to the fact that one and the same external world thing has been mistakenly assumed to be two different entities (e.g. *Cicero/Tully* examples) and they can hardly be taken to correspond to distinctions between facts. Russell's theory that ordinary names really are descriptions making a difference reflected in the facts may solve this problem, but the complications introduced are considerable.

Possible worlds accounts of propositional attitude relata are marred by the circumstance that logically equivalent propositions are identified and that cognitive agents are credited with logical omniscience as a consequence of this. This contradicts the fact that we can make sense of attitude attributions that contradicts this constraint. Another argument against possible world approaches is that they prompt us to use logical formalisms that are more powerful and computationally less tractable than first-order predicate calculus. This is true of, for instance, Montague's [1973] analysis, but nothing in the possible worlds idea prevents us from formalizing it in first-order logic and ideas of this kind will be exploited in the system developed in the next chapter.

In the next chapter I will show how the contents of propositional attitude reports may be analyzed by viewing them as expressing hypotheses belonging to a kind of general theory of propositional attitudes and their contents. I think that the observations made above suggest that contents are best thought of as being characterized in terms of quite abstract intensional elements. There is no need to require that these are to match concepts as conventionally established in a natural language or as

given by the factual elements of reality. This proposal takes a stand on the problems mentioned in this chapter and incorporates them in a framework that is argued to be optimal with regard to simplicity and clarity and effects a reasonable division of labour between logical form and lexical semantics.

4

DERIVING SYSTEMS OF CONCEPTS FROM PREDICATE-FUNCTOR LOGIC

4.1   Introduction

In this chapter I will present and defend a general approach to the logical form of propositional attitude attribution statements. The basic features of this treatment is that it will be based on an ordinary first-order analysis of the content of propositions and that it will itself be entirely within the confines of first-order predicate logic. (The primary first-order formalization of propositional content will itself be rendered within a first-order framework, used to frame the content of propositional attitude attribution statements.) This approach will necessitate the introduction of a comparatively rich ontology, comprising intensional objects (that will be treated as first-order individuals), such as propositions and (other) concepts.

Formal semantic analysis discerns a structure in natural language statements by translating them into a logical formalism. Such a structure is defined in terms of the simple symbols and the modes of syntactic combination of this formalism. The semantics of a logical language usually defines truth in relation to interpretations of its non-logical constants. An analysis that proceeds in this way ascribes certain properties to natural language statements by correlating them with logical formulae. The relevant properties (such as tautologyhood, contradictionhood, and other properties relating to entailment relations) of natural language statements are, so to speak, inherited from the corresponding logical formula, whose semantics

consequently partially determines the criteria whereby the adequacy of translations from natural to formal language are assessed. Other relevant considerations concern the relation between these formally defined properties and properties more directly and intuitively relating to the use of the expressions being analyzed.

The semantics of the logical formalism sets down the constraints that define the semantic values of the expressions of the formalism relative to an arbitrary interpretation. It is formal in the sense that the semantically relevant properties of complex expressions are determined solely by their form (as defined by their syntax) and the denotations of the simple expression (as defined by an interpretation). So, the syntax and semantics of a formal language is a theory about certain objects (viz. the expressions of the formalism) describing them in terms of certain properties and relations.

The analysis of propositional attitude reports and related kinds of statements may prompt us to view them as referring to the semantic contents of sentence tokens and/or to similar entities. For instance, it is natural to view the verb *believe* as standing for a two-place (three-place if time is included) relation holding of a person and a semantic content just in case this person holds a belief with this content. Further, the contents we assign to declarative utterances and mental propositional attitudes seem to be of the same kind. This allows us to view an utterance as expressing a belief (by having the same content as the belief expressed). I will here propose that abstract objects correlated with the expressions of a logical formalism may be viewed as the contents and content components involved in propositional and similar attitudes. This will necessitate a further step of formalization. These abstract objects must themselves be viewed as individuals and be described within a formal language, which will be used to frame the contents of the propositional attitude statements in which we are interested.

What I am suggesting is compatible with a sentientialist approach. The objects taken to be the relata of propositional attitudes are however intended to be understood as representing contents in a more abstract way. (We should remember that predicate calculus (in the form of Frege's [1879] *Begriffsschrift*) was introduced to provide a clear articulation of content.) To illustrate the general idea, let us turn to a concrete example such as sentence (4.1).

(4.1)   Mary believes that Venus is a planet.

Which logical form should, in the light of these considerations, be assigned to the statement (4.1)? The content of the *that*-clause is usually formalized as formula F 4.1.

F 4.1 $\text{planet}(i_{\text{Venus}})$

This formula is true if and only if the individual denoted by 'i_{Venus}' is an element in the extension associated (by the intended interpretation) with 'planet'. In other words, it represents a proposition that a certain thing has a certain property. This formula contains two non-logical constants combined in a particular way, i.e. that of a one-place predicate being applied to its argument. So, two non-logical constants are joined to yield a formula. This suggests that the statement (4.1) may be viewed as a claim that there is a formula which is related to 'i_{Venus}' and to 'planet' in the way described and that this formula represents (or is identical to) the content of Mary's belief. We may then render its logical form as something like formula F 4.2.

F 4.2 $\exists x [\text{believe}(i_{\text{Mary}}, x) \wedge \Re_A(e_{\text{planet}}, e_{\text{Venus}}, x)]$

The second argument of 'believe' and the third of '$\Re_A$' is assumed to refer to a formula or whatever it represents. The two individual constants 'e_{planet}' and 'e_{Venus}' are intended to denote the two non-logical constants 'planet' and 'i_{Venus}', or whatever they may be taken to represent. The three-place relation symbol '$\Re_A$' stands for the appropriate relation, the nature of which, for the moment, will be left open.

A crucial issue that faces this kind of analysis is the nature of the entities that enter into this picture. In particular, what is the nature of e_{Venus}, e_{planet} and the x such that $\Re_A(e_{\text{planet}}, e_{\text{Venus}}, x)$ (presupposing that there is only one x satisfying this condition)? In each of the three cases, there are at least two approaches to this question, the one preferring an external world ontology and the other one being more in favour of intensional entities. (I am now recapitulating various points made in greater detail in the previous chapter.)

The direct reference school philosophers would claim that Venus is directly involved in this belief. This means that e_{Venus} would denote the planet Venus. As an analysis of the *de re* reading of (4.1), this suggestion might do, but there is also a sense in which Mary may believe that Venus is a planet, without at the same time believing that the Morning Star is.[1] If we are to account for a *de dicto* reading of this kind (cf. Section 3.5.2), an analysis along these lines must, for obvious reasons (see Section 3.5), be rejected. Instead, we may follow Frege in assuming that some kind of intensional entity (a Sinn, or in more ordinary parlance, a concept) reflecting a way of knowing Venus is involved in the belief. This means that e_{Venus} is taken to

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[1] There are some philosophers (e.g. Kripke [1979]) who try to deny this, but I think that this intuition is too strong to be rejected.

be a concept denoting Venus. According to this picture, the planet Venus is only indirectly involved in the belief, the connection being mediated by a Venus concept.

The nature of e_{planet} may be conceived of in at least three ways. It may be identified with the *extension* of 'planet', with the *property* of being a planet, and with a planethood *concept*. (I take the distinction between properties and concepts to be that the former are mind-independent universals, while concepts represent "modes of presentation", i.e. ways in which things are apprehended by cognitive agents.) The objection against extensions is that coextensional property words are not generally of equal significance in propositional attitude content clauses (as failures of substitutivity show). Properties are subject to essentially the same objection.[2] Properties are also problematic from an ontological point of view. In view of this, it is natural to assume that predicate concepts are involved in propositional attitude contents. This suggests that also the x such that $\Re_A(e_{planet}, e_{Venus}, x)$ is some kind of conceptual item. However, another more external-world-oriented suggestion would be that it is a possible state of affairs (in this case also an actual state of affairs), understood as a cognition-independent entity (cf. Section 3.10). This proposal strongly suggest that we should take 'e_{Venus}' to stand for Venus, because it must be assumed that it is the planet rather than a concept that is involved in this state of affairs. It would also lead us to assume that e_{planet} is the planethood *property*. A planethood *concept* is hardly involved in the state of affairs that Venus is a planet. Neither should we assume that it is the extension of 'planet' that is, because this assumption would identify this possible state of affairs with a set-theoretic truth. If E is the actual extension of the predicate 'planet', it is a set-theoretic truth that Venus is an element of E, and this set-theoretic circumstance cannot be identified with a astronomic state of affairs (cf. Section 3.10). (Venus would be an element of E, even if it it ceased to be a planet.)

The arguments that have been summarized here support the conclusion that the content that Venus is a planet is an intensional object (a proposition), constituting this content in virtue of standing in a certain relation to a Venus and a planethood concept. There is also the possibility of understanding e_{planet}, e_{Venus}, and the x such that $\Re_A(e_{planet}, e_{Venus}, x)$ along representationalist lines, as being expressions in a formal language, but this is hardly incompatible with the intensional-object view. Formal calculi may be viewed as reflecting the structures of "pure thought" (as Frege [1879] appears to have viewed the matter).

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[2] For instance, words denoting members of the same species must be taken to represent the same property. A standard example is the terms "groundhog" and "woodchuck": They stand for the same species of animal, but to believe that Fido is a groundhog is not generally the same as believing that he is a woodchuck.

The two non-logical constants occurring in formula F 4.1 are 'planet', representing the set of planets, and 'i_{Venus}', standing for Venus. The former non-logical constant is applied to the latter. In order to describe the structure of this logical form we have introduced two individual constants standing for the planethood and Venus concepts respectively. The symbol '$\Re_A$' represents a relation holding among three intensional objects, and it corresponds to the three-place syntactic combination relation holding of a predicate, a term and the formula defined by the application of the former to the latter. This application relation is not represented by a constant in the logical formalism used to frame the content of "Venus is a planet" in the form of formula F 4.1. It is defined by the syntax and semantics of this formalism as a definite kind of syntactic connection abiding by certain semantic constraints. The same is true of the objects related by this relation, which only occur as expressions in the calculus, not as objects recognized by a theory formulated in it. Formula F 4.2, however, expresses a kind of meta-statement and it contains names for the three intensional objects and a predicate standing for the relevant relation.

It might be useful to introduce some terminology at this point. What I will call the **logical form formula** of a propositional content is a formula in a logical formalism that serves as a representation of this content. It will represent the logical form, understood as a constraint defining the denotation of a proposition in terms of the denotations of the non-logical constants involved. For instance, a logical form formula of the propositional content that Venus is a planet is formula F 4.1. Logical form formulae and the subexpressions they contain will, in this analysis, be taken to correspond to a kind of intensional entities, which I will call **concepts**. When it comes to the analysis of statements involving concepts, such as propositional attitude attributions, we have to admit quantification over them and constants denoting them. I will distinguish **conceptual predicates** that only yield true formulae when applied to concepts. For instance, $\lceil \Re_A \rceil$[3] is a conceptual relation. I will say that relations that relate concepts to entities of other kinds are **paraconceptual**, while what will be called **extraconceptual** predicates never are true of sequences of entities involving concepts. The *believe* predicate is paraconceptual, relating a person and a propositional concept[4] and the relation *bigger than* is plausibly extraconceptual.

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[3] When I talk about a predicate as an object, i.e. as a universal, I will enclose the predicate symbol within square quotes. For instance, the symbol 'P' stands for the predicate $\lceil P \rceil$. Universals are not recognized by the formal theory put forth here, but it makes presentation easier if we assume that predicate symbols stand for properties and relations that have some kind of reality.

[4] I will use the term **propositional concept** rather than **proposition** in order to stress that these concepts are nodes in a network of concepts (see below) and that propositional concepts should not

The analysis of the content of a propositional attitude attribution, like (4.1), is based upon a particular formalization of the content of the complement *that*-clause. Now, the formalism used in this formalization does not need to be identical to the one used in the analysis of the attribution statement. However, a propositional attitude ascription may itself occur as a complement *that*-clause in a superordinate attitude attribution, and this speaks in favour of assuming that the same logical formalism should be used to frame the content both of attitude ascriptions and of the complement clauses that occur in them. (This assumption is also supported by the intuition that *that*-clauses are closely related semantically to the corresponding main clauses.) A fundamental feature of the account that will be suggested here is that the structure assigned to a propositional content is the one revealed by ordinary first-order analysis and that this structure is itself characterized within a first-order theory.

It should be noted that so far we have mainly been concerned with *de dicto* readings of propositional attitude reports, as we have only considered the characterization of the conceptual aspect of such attitudes. We will later return to the question of attitudes *de re* (cf. Section 5.3) and of how concepts may be connected to things in the external world.

4.2 Quantification

So far only one kind of propositional content (viz. corresponding to ascriptions of a property to an individual) has been treated. Propositional contents do however also exhibit other logical structures. The *that*-clause in (4.2), for instance, characterizes a propositional concept of another kind.

(4.2)   Mary believes that all computers are radioactive.

This propositional concept (belief in which is attributed to Mary) involves two predicate concepts. But how are these related to the propositional concept? The conceptual relation $\ulcorner \Re_A \urcorner$, considered above, corresponds to a one-place predicate being predicated of an individual, but this kind of conceptual connection is not involved in the case of (4.2). Rather, it is the relation of concept extension inclusion that is relevant here, i.e. a conceptual relation that corresponds to set-theoretic inclusion in the same way as $\ulcorner \Re_A \urcorner$ corresponds to the element relation. However, the

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be confused with propositions as conceived of in other theoretical frameworks.

ordinary first-order predicate calculus translation of "all computers are radioactive" looks like formula F 4.3.

F 4.3 $\forall x [\mathsf{computer}(x) \rightarrow \mathsf{radioactive}(x)]$

Here, the relation between the predicates and the overall formula is defined by means of a truth-functional operator and variables being bound by a quantifier. An ordinary semantics for this formalism would tell us that this formula is true if and only if the extension of 'computer' is included in the extension of 'radioactive'. So, we find that there are two ways (among an infinity of others) of describing the relevant conceptual relations: First, it is possible to introduce a conceptual relation that directly corresponds to inclusion. If we call it '$\Re_\subseteq$', a logical form formula of (4.2) would look something like formula F 4.4.

F 4.4 $\exists x [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, x) \wedge \Re_\subseteq (\mathsf{c}_{\mathsf{computer}}, \mathsf{c}_{\mathsf{radioactive}}, x)]$

Secondly, there is the possibility of introducing conceptual relations that more directly mimic the structure of the corresponding predicate calculus formula (i.e. formula F 4.3). However, this idea runs into serious difficulties. It would force us to introduce some conceptual object corresponding to the variable. (The conceptual relation $\ulcorner \Re_A \urcorner$, or a similar relation, would then relate it and a predicate to the formula concept defined by the application of the predicate to the variable.) This approach is quite counterintuitive. Variables do not seem to correspond to concepts. They just indicate argument places. Further, the use of variables makes the semantics of ordinary predicate calculus imperspicuous in a definite sense (to be explained shortly) and a system of concepts and conceptual relations that mimics this syntax and semantics will therefore be unnecessarily complicated. As Quine has shown us, variables and variable-binding operators are a dispensable device in predicate calculus. (We will turn to his variable-free languages shortly, in Section 4.3).

Formulae in ordinary predicate calculus with variables will often contain smaller formulae with free variables. Now, a formula with n different free variables intuitively stands for an n-place predicate. So, formula F 4.5, for instance, may be intended to stand for the three-place relation that holds of three objects when the first is larger than the second and the second is larger than the third.

F 4.5 $\mathsf{larger\text{-}than}(x, y) \wedge \mathsf{larger\text{-}than}(y, z)$

The two subordinate formulae '$\mathsf{larger\text{-}than}(x, y)$' and '$\mathsf{larger\text{-}than}(y, z)$' intuitively stand for the same two-place relation. The important thing is that two different

variables occupy the argument places (otherwise we would have defined the property "is larger than itself"). The choice of variables is immaterial from the point of view of the subformulae themselves. When they are conjoined, however, the fact that the second argument position of the first subformula is occupied by a variable identical to that found in the first argument position of the second subformula is crucial: Thereby the two argument positions are connected in a semantically significant way. The conjunction of two instances of a two-place predicate in this case defines a three-place predicate. If we take the semantic value (relative to an interpretation) of a formula with free variables to be the predicate it defines, then we find that predicate logic with variables does not possess a compositional semantics:[5] The semantic value of the conjunction formula F 4.5 is not possible to determine from the semantical values of the conjuncts, because of the significance of the identity of variables. A formula like formula F 4.6, below, would define another predicate, but is just like formula F 4.5 a conjunction whose conjuncts (we have supposed) stand for the relation of being larger than.

F 4.6 larger-than$(x, y) \wedge$ larger-than(x, z)

This lack of compositionality is due to the presence of variables. There are two systems of semantically significant structure in ordinary predicate calculus: the "official" syntactic structure (as defined by the syntactic modes of combination) and what we could call the variable cooccurrence structure. A variable does not contribute to the semantic value of an expression by having a certain semantic value itself. Its significance is due to its being bound from the outside, by being identical to another variable token occurring in another expression. So, when we combine the two conjuncts in formula F 4.6 into a conjunction, the semantic value of the conjunction depends on the semantic values of the conjuncts and on *both* the semantic operation represented by conjunction and the identification of two

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[5] It might be objected that variables are only a syntactic device and that they are only there to define by which "mode of combination" predicates are joined together. This suggestion implies that there is an infinity of such modes of combination, as there is no upper limit to the number of variables that may occur in a formula. (Compositionality is thereby in a sense saved: The semantic value of the whole is determined by the semantic values of its constituents and their modes of combination.) However, having an infinite number of modes of combination is clearly unacceptable and this view of the the syntax is inadequate: Variable cooccurrence is not a matter of syntactic rule application. For instance, the conjunction rule in an ordinary first-order logic syntax like the one given by Dowty, Wall, and Peters [1981, p. 56–57] (rule B. 3) or by Allwood, Andersson, and Dahl [1977, p. 71–72] (rule (g) (iii)) just says that two formulae joined by a conjunction sign form a new formula. The syntactic combination rules do not mention the variables occurring in the formulae.

variable occurrences. The latter factor is reflected neither in the syntactic operation (conjoining) or in the semantic values of the conjuncts. Semantically significant links within a formula are established both by means of syntax (as defined by the syntactic rules) and by means of variable cooccurrence.

It seems that we can express an infinite number of relations among a number of concepts and a proposition with the help of variables and quantifiers. There is an infinite number of open formulae in predicate logic and variables can be distributed in these in an infinity of different ways. The semantic consequences of supplying a quantifier binding one of the variables in an open formula depend upon how this variable occurs in it, and this allows for an infinity of possibilities. Likewise, what from the point of view of syntax is one mode of combining two formulae may establish cross-identifications of argument places in an infinity of ways. The problem is not that we can compose an infinite number of non-equivalent formulae out of a collection of logical constants by using quantifiers, variables, and truth-functional operators. Rather, what is a source of difficulty in this approach is that this way of analyzing quantification is to the effect that there is an infinite number of logical operations that can be expressed by the application of a quantifier. Or, in other words, quantification is (from the point of view of the requirements we have made here) insufficiently analyzed as represented in a logic using quantifiers and variables to express quantification.

A traditional semantics for ordinary predicate calculus deals with this situation and establishes compositionality with the help of certain technical manœuvres. One method is to define semantical values as relative to an interpretation *and* a **value assignment**, which is a function assigning values to variables.[6] This approach invalidates the intuition that formulae with free variables represent predicates. Such formulae are rather taken to denote a truth value relative to an interpretation *and* a value assignment. The truth value of formulae without free variables will not be sensitive to the value assignment, and *their* truth values are consequently defined solely in relation to an interpretation. This method saves variables and compositionality, but it complicates semantics and invalidates certain natural semantic intuitions.

These circumstances speak in favour of not deriving the structure of the system of concepts and conceptual relations from ordinary predicate calculus. A concept system of this kind would have to make use of some sort of formal device corresponding to value assignments. It would also have to countenance some kind of

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[6] See Dowty, Wall, and Peters [1981, p. 59–61] for a semantics for first-order predicate calculus along these lines.

intensional objects corresponding to formulae with free variables, for instance, to a predicate being applied to a variable. This conceptual entity could not be understood as a predicate concept (as predicate concepts are predicable) or as a propositional concept (as they are true or false relative to the denotations of their parts as defined by an interpretation). (Crimmins' [1992] "partial propositions" are objects of this kind.)

The discrepancy between syntax and semantics in traditional predicate calculus with variables is also reflected in the following circumstance: Complex denotations are only associated with predicate constants, which are atomic symbols, and the only kind of syntactically complex expressions there are, i.e. formulae, can only denote truth-values, which do not possess any significant structure. Syntactically simple objects denote complex ones, and syntactically complex objects denote simple ones. This circumstance is an aspect of the semantic imperspicuity of ordinary predicate calculus. In the variable-free predicate-functor logic considered below, this kind of discrepancy between syntax and semantics does not obtain.

This discussion of the semantics of ordinary predicate calculus is intended to show that a system of concepts and conceptual relations is best not modeled upon the structure of this calculus. This suggests that we must find another kind of calculus that has the expressive power of ordinary predicate calculus, without exploiting variables in the semantically imperspicuous manner described above. We will find such a calculus if we turn to Quine, who has suggested a number of ways to eliminate variables in predicate calculus. Variables are not needed for the cross-identification of argument places; nor are they needed to express quantification. A small number of functors, whereby new predicates may be defined in terms of primitive or already defined ones, is all that is needed to construct a logic which is precisely as powerful as ordinary first-order predicate calculus (with variables and variable-binding quantifiers). This variable-free language is semantically perspicuous: Every expression denotes a semantic value of the intuitively right kind (i.e. a truth value, a predicate extension, or an individual) relative to an interpretation and the semantics is perfectly compositional. Every syntactic operation will correspond to a semantic one. Quine's calculus will consequently provide an analysis of content structure, that may be recapitulated by our system of concepts and conceptual relations.

4.3 Predicate-Functor Logic

Quine calls a certain kind of language where the use of variables and variable-binding operators has been eliminated a **predicate-functor logic**. A calculus of this kind contains a number of functors that operate on one or two predicates, defining a new one. Quine has suggested a few alternative inventories of such functors—of which there are between four and seven—(in his papers [1960a], [1971], [1976c], [1981a], and [1981b], also cf. [1976b]). Quine's languages do not contain individual constants, but the calculus presented below will.[7]

I will use Quine's [1960a] set of six functors. The notation will however be slightly modified to suit my purposes better. Quine [1976c] has shown how to manage with only four functors, but this gain in economy leads to a corresponding complication of expression and I think that the 1960 set is easier to understand and use. My logic will be a first-order logic with identity (i.e. an identity predicate is included among the logical constants). There are no other logical constants than these seven (viz. the six functors and the identity predicate).[8]

There are two kinds of terms in the present predicate-functor logic: **predicate terms** and **singular terms**. A predicate term consists of a predicate constant or is a complex expression. Singular terms always consist of an individual constant. Predicate terms are of a certain degree (arity). Formulae may be identified with predicate terms of degree 0. The six predicate functors are to be represented by the symbols '$\frown$', '$\overline{\frown}$', 'Σ', '$\sim$', '$\times$', and '$]$'. I will use a predicate-first notation, in order to eliminate the need for parentheses. This means that a predicate will precede its singular term arguments, but that predicate functors will be placed after the predicate term(s) they operate on. (This notation makes it natural to think of singular terms as being applied to predicate terms rather than vice versa.)[9] This syntax implies that complex predicate terms are always formed by strings whose first element is a predicate constant and whose last element is a functor or an individual constant (as complex predicate terms are formed by the application of a

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[7] For some results on predicate-functor logic, see Noah [1980], Grünberg, [1983], Kuhn [1983], and Bacon [1985]. Predicate-functor logic is applied to natural language semantics by Grandy [1976], who suggests that "linguists, psychologists and philosophers should pay more attention to algebraic formulations of logic when discussing the logical form of natural language sentences" [p. 398], and by Purdy [1991].

[8] Those who are interested in the details of Quine's languages and want to compare them to each other and to the one defined here are referred to his papers.

[9] Singular terms are thereby assimilated to quantifiers in a way reminiscent of Barwise and Cooper's [1981] treatment of **generalized quantifiers**.

functor or an individual constant.) Reading the from left to right gives us a bottom-up perspective on how undefined predicates given by the predicate constants are combined into complex ones by means of functor applications.

The two functors '$\curvearrowright$' and '$\overline{\curvearrowright}$' are used to permute argument places in predicates. Applied to a predicate term they yield a predicate term of the same degree. The **minor inversion** functor '$\curvearrowright$' interchanges the two first argument places, whereas the **major inversion** functor '$\overline{\curvearrowright}$' puts the first argument place last. (Applied to a two-place predicate the major and minor inversions are identical.) These functors are necessary because the 'Σ' and '$\rfloor$' functors (see below) operate on the first one or two argument places of a predicate. It is therefore crucial that any argument place can be "moved" to the position where a 'Σ' or '$\rfloor$' functor can "reach" it. If we use a kind of mixture notation we may describe the effects of the two inversion functors as follows (taking variables to be implicitly universally quantified and P to be an arbitrary n-place predicate).

$$P\curvearrowright x_2 x_1 x_3 \ldots x_n \equiv P x_1 x_2 x_3 \ldots x_n$$
$$P\overline{\curvearrowright} x_2 \ldots x_n x_1 \equiv P x_1 x_2 \ldots x_n$$

The two kinds of inversion are sufficient to define any argument place permutation. (There are $n!$ such "permutations" of an n-place predicate, including its original argument place ordering.) For instance, the fact that all six argument place permutations of a three-place predicate may be obtained by applications of these two operators is illustrated by the following six equivalent formulae (note that '$((((P\curvearrowright)\overline{\curvearrowright})a)c)b$' is the syntactic structure of '$P\curvearrowright\overline{\curvearrowright}acb$'):

$$Pabc \equiv P\curvearrowright\overline{\curvearrowright}acb \equiv P\curvearrowright bac \equiv P\overline{\curvearrowright}bca \equiv P\overline{\curvearrowright}\overline{\curvearrowright}cab \equiv P\overline{\curvearrowright}\curvearrowright cba$$

It is easy to verify that the six formulae above are equivalent. Note also that further applications of the '$\curvearrowright$' and '$\overline{\curvearrowright}$' functors on the predicate terms may only yield a new predicate term whose denotation is identical to the denotation of one of the formulae above. Let us introduce the following notation: $[\![x]\!]$ is the semantical value (i.e. denotation) of an expression x, relative to a given interpretation. Then, for instance, $[\![P\curvearrowright\curvearrowright]\!] = [\![P\overline{\curvearrowright}\,\overline{\curvearrowright}\,\overline{\curvearrowright}]\!] = [\![P]\!]$ relative to any interpretation (provided P is of degree 3). And, if P is a two-place predicate, we have, for instance, $[\![P]\!] = [\![P\curvearrowright\curvearrowright]\!] = [\![P\overline{\curvearrowright}\curvearrowright]\!] = [\![P\curvearrowright\overline{\curvearrowright}]\!]$ and $[\![P\curvearrowright]\!] = [\![P\curvearrowright\curvearrowright\curvearrowright]\!] = [\![P\overline{\curvearrowright}\curvearrowright\overline{\curvearrowright}]\!] = [\![P\curvearrowright\overline{\curvearrowright}\,\overline{\curvearrowright}]\!]$.

The **reflection** functor 'Σ' is used to identify two argument places (compare a reflexive pronoun). It operates on an at least two-place predicate term, identifies the

first two argument places, and consequently yields a predicate term whose degree is one step lower than the term to which it is applied. If 'L' is a two-place predicate symbol corresponding to the verb *love*, 'LΣ' corresponds to *love oneself*. Generally it holds:

$$P\Sigma x_1 \ldots x_n \equiv P x_1 x_1 \ldots x_n$$

This functor ('Σ') encodes information that is encoded by means of variables in ordinary predicate calculus, where the identification of argument places is achieved by associating them with the same variable. One of the reasons that the inversion functors ('$\curvearrowright$' and '$\overline{\curvearrowright}$') are of crucial importance is that they allow any two argument places to be "moved" to the front positions where the 'Σ' functor is applicable to them.

The **complement** functor[10] applies to a predicate term and yields the predicate that holds in all those cases where the first predicate does not hold. So, if 'L' is as above 'L$\sim$' stands for the relation of not loving. Applied to a formula, the complement functor yields one with the reverse truth value. The term obtained by an application of the complement functor is of the same degree as the operand term. Its semantics is epitomized by the following formula (which again is expressed in mixture notation).

$$P\sim x_1 \ldots x_n \equiv \neg (P x_1 \ldots x_n)$$

The **Cartesian multiplication** functor '$\times$' is the only one that operates on two predicate terms. The degree of the Cartesian product is equal to the sum of the degrees of the operand predicate terms. If the operands represent the predicates $\ulcorner P \urcorner$ and $\ulcorner Q \urcorner$, whose degrees are m and n respectively, their Cartesian product is the relation that holds of $m + n$ ordered individuals if and only if $\ulcorner P \urcorner$ holds of the first m ones and $\ulcorner Q \urcorner$ holds of the remaining n ones. This is made clearer by the following equivalence:

$$PQ\times x_1 \ldots x_m y_1 \ldots y_n \equiv (P x_1 \ldots x_m \wedge Q y_1 \ldots y_n)$$

So, if 'L' is as above, and 'H' stands for the predicate of being happy, 'HL$\times$' stands for the three-place relation holding of three individuals if and only if the first is happy the second loves the third. An application of '$\times$' does not connect any argument places. (This task is delegated to the 'Σ' functor. No connection

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[10] It is called "negation" in Quine [1960a], but the term "complement" is used in the later papers.

between the three argument places in 'HL×' example is implied. By concatenating the argument sequences in this way, the Cartesian multiplication functor makes it possible to apply the other functors in ways that connect argument places. For instance, 'HL×Σ' will stand for the relation that holds of two individuals if and only if the first is happy and loves the second.

The **cropping** or **derelativization** functor '⌐', finally, "removes" the first argument place by introducing an existential quantification. It consequently yields a predicate term whose degree is one step lower than that of the operand term. The '⌐' "symbol is meant to connote excision of the left column" (Quine [1976c, p. 296]) of a relation. In mixture notation we may characterize its semantics in this way:

$$P \lrcorner x_2 \ldots x_n \equiv \exists x_1 [Px_1 \ldots x_n]$$

If 'L' is as before, 'L⌐' stands for the predicate of being loved by someone (the "subject" being the first argument of 'L') and 'L⌐⌐' for the formula saying that someone loves someone. The '⌐' functor only operates on the first argument place of the predicate represented by the predicate term to which it applies. The importance of the inversion functors ('⌢' and '$\overline{\frown}$') in this calculus is again illustrated: They can "move" an argument place to the position where the '⌐' functor can apply to it.

The predicate-functor logic based upon the six functors introduced here is—I claim—precisely as powerful as ordinary predicate logic (cf. Quine's papers on the subject). I will not produce a formal proof of this claim, but the discussion here and the examples in Section 4.3.3 will hopefully make this assertion more convincing. A formal and quite detailed definition of the syntax and semantics of the present predicate-functor logic will now be given. We will then return to the question of how this notation relates to that of ordinary predicate calculus with variables and illustrate this with reference to a few concrete examples.

4.3.1 The Syntax of PFLST

Let us call the present formalism **Predicate-Functor Logic with Singular Terms**, abbreviated to PFLST. The **lexicon** of a logical formalism contains the non-logical constants of the language. The lexicon of an instance of PFLST contains two kinds of constants: individual constants and predicate constants. A predicate constant is of a certain degree (arity) n and $n \geq 0$.

The following principles define the syntax of an instance of PFLST if a lexicon is given. There are two kinds of expressions in an instance of PFLST, **singular terms**

and **predicate terms**. (Formulae are a special kind of the latter.) A predicate term is of a certain degree n and $n \geq 0$.

In the formulation of the syntax and semantics, I will use 'P' and 'Q' as meta-variables standing for arbitrary predicate terms, 'i' to stand for an arbitrary singular term, and 'Φ' and 'Ψ' to stand for arbitrary formulae. The six predicate functor symbols and the identity predicate symbol will be used in the meta-language to denote the typographically identical symbols of PFLST. A pair or triple of juxtaposed meta-variables stands for the expression obtained by concatenating, in the given order, the expressions denoted by the two or three meta-variables.

4.3.1.1   The Syntax of Singular Terms

The set of singular terms is identical to the set of individual constants.

4.3.1.2   The Syntax of Predicate Terms

The following principles define the syntax of predicate terms.

- A predicate constant of degree n is a predicate term of degree n.

- The identity symbol $\mathbb{I}$ is a predicate term of degree 2.

- If P is a predicate term of degree n, where $n \geq 1$, and i is a singular term, then Pi is a predicate term of degree $n - 1$.

- If P is a predicate term of degree n, where $n \geq 2$, then $P\curvearrowright$ (the minor inversion of P) is a predicate term of degree n.

- If P is a predicate term of degree n, where $n \geq 2$, then $P\overline{\curvearrowright}$ (the major inversion of P) is a predicate term of degree n.

- If P is a predicate term of degree n, where $n \geq 2$, then $P\Sigma$ (the reflection of P) is a predicate term of degree $n - 1$.

- If P is a predicate term of degree n then $P\sim$ (the complement of P) is a predicate term of degree n.

- If P is a predicate term of degree m, and Q is a predicate term of degree n then $PQ\times$ (the Cartesian product of P and Q) is a predicate term of degree $m + n$.

- If P is a predicate term of degree n, where $n \geq 1$, then $P\rfloor$ (the derelativization of P) is a predicate term of degree $n - 1$.

There are no predicate terms except those defined by these principles.

4.3.1.3   The Syntax of Formulae

A formula is any predicate term of degree 0.

4.3.2   The Semantics of PFLST

The semantics of PFLST is to be defined with the help of ordinary model-theoretic techniques. An interpretation of an instance of PFLST assigns semantic values to its non-logical constants and the semantic rules then fixes the semantic values of the composite expressions (all of which are predicate terms). An interpretation is an ordered pair $\langle \mathcal{D}, \mathcal{F} \rangle$, where $\mathcal{D}$ is a domain, i.e. the set of entities over which quantification ranges, and $\mathcal{F}$ an assignment function assigning a semantic value to each item in the lexicon. The two truth values are $\top$ (true) and $\bot$ (false). The following restrictions hold with respect to any interpretation $\mathcal{M} = \langle \mathcal{D}, \mathcal{F} \rangle$:

- If i is an individual constant, then $\mathcal{F}(i) \in \mathcal{D}$.

- If P is a predicate constant of of degree n, where $n \geq 1$, then $\mathcal{F}(P) \subseteq \mathcal{D}^n$.

- If P is a predicate constant of of degree 0, then $\mathcal{F}(P) \in \{\top, \bot\}$.

As before, $[\![E]\!]$ is the semantic value of the expression E (given an interpretation). If c is a non-logical constant, $[\![c]\!] = \mathcal{F}(c)$.

4.3.2.1   The Denotation of Predicate Terms

The following principles define the semantic values of the identity predicate constant and the composite predicate terms (given an interpretation $\mathcal{M} = \langle \mathcal{D}, \mathcal{F} \rangle$).

- $[\![\mathbb{I}]\!] = \{\langle x, x \rangle \mid x \in \mathcal{D}\}$.

- If Pi is a predicate term of degree n, where $n \geq 1$ and P is a predicate term of degree $n + 1$ and i a singular term, then
  $[\![Pi]\!] = \{\langle x_1, \ldots, x_n \rangle \mid \langle [\![i]\!], x_1, \ldots, x_n \rangle \in [\![P]\!]\}$.

- If $P\curvearrowright$ is a predicate term, where P is a predicate term of degree n, $n \geq 2$,
  then $[\![P\curvearrowright]\!] = \{\langle x_2, x_1 \ldots, x_n \rangle \mid \langle x_1, x_2, \ldots, x_n \rangle \in [\![P]\!]\}$.

- If $P\overline{\curvearrowright}$ is a predicate term, where P is a predicate term of degree n, $n \geq 2$,
  then $[\![P\overline{\curvearrowright}]\!] = \{\langle x_2, \ldots, x_n, x_1 \rangle \mid \langle x_1, x_2, \ldots, x_n \rangle \in [\![P]\!]\}$.

- If $P\Sigma$ is a predicate term, where P is a predicate term of degree n, $n \geq 2$,
  then $[\![P\Sigma]\!] = \{\langle x_1, \ldots, x_n \rangle \mid \langle x_1, x_1, \ldots, x_n \rangle \in [\![P]\!]\}$.

- If $P\sim$ is a predicate term, where P is a predicate term of degree n, where
  $n \geq 1$, then $[\![P\sim]\!] = \mathcal{D}^n - [\![P]\!]$.

- If $PQ\times$ is a predicate term of degree $m + n$, where P is a predicate term
  of degree m, $m \geq 1$ and Q is a predicate term of degree n, $n \geq 1$, then
  $[\![PQ\times]\!] = \{\langle x_1, \ldots, x_m, y_1, \ldots, y_n \rangle \mid$
  $$\langle x_1, \ldots, x_m \rangle \in [\![P]\!] \text{ and } \langle y_1, \ldots, y_n \rangle \in [\![Q]\!]\}.$$

- If $PQ\times$ is a predicate term of degree n, where P is a formula (i.e. a predicate
  term of degree 0), and Q is a predicate term of degree n, $n \geq 1$, then, if
  $[\![P]\!] = \top$, $[\![PQ\times]\!] = [\![Q]\!]$, otherwise (i.e. if $[\![P]\!] = \bot$), $[\![PQ\times]\!] = \emptyset$.

- If $PQ\times$ is a predicate term of degree n, where P is a predicate term of degree
  n, $n \geq 1$, and Q is a formula (i.e. a predicate term of degree 0), then, if
  $[\![Q]\!] = \top$, $[\![PQ\times]\!] = [\![P]\!]$, otherwise (i.e. if $[\![Q]\!] = \bot$), $[\![PQ\times]\!] = \emptyset$.

- If $P\rfloor$ is a predicate term, where P is a predicate term of degree n, $n \geq 2$,
  then $[\![P\rfloor]\!] = \{\langle x_2, \ldots, x_n \rangle \mid$
  $$\text{there is an } x_1 \text{ such that } \langle x_1, x_2, \ldots, x_n \rangle \in [\![P]\!]\}.$$

4.3.2.2   The Denotation of Formulae

These rules characterize the semantics of formulae.

- If Pi is a formula, where P is a predicate term of degree 1 and i an individual constant, then $[\![Pi]\!] = \top$ if $[\![i]\!] \in [\![P]\!]$, otherwise $[\![Pi]\!] = \bot$.

- If $\Phi\sim$ is a formula, then $[\![\Phi\sim]\!] = \top$ if $[\![\Phi]\!] = \bot$, otherwise $[\![\Phi\sim]\!] = \bot$.

- If $\Phi\Psi\times$ is a formula, then $[\![\Phi\Psi\times]\!] = \top$ if $[\![\Phi]\!] = \top$ and $[\![\Psi]\!] = \top$, otherwise $[\![\Phi\Psi\times]\!] = \bot$.

- If $P\rfloor$ is a formula (where P is a predicate term of degree 1), then $[\![P\rfloor]\!] = \top$ if $[\![P]\!] \neq \emptyset$, otherwise $[\![P\rfloor]\!] = \bot$.

4.3.3   The Elimination of Variables

The main difference between PFLST and ordinary first-order predicate calculus is that there are no variables, and consequently no ordinary quantifiers, in PFLST. The two languages are equal in expressive power. This means that any PFLST formula corresponds to a formula of ordinary first-order predicate calculus with the same truth conditions, and *vice versa*. (The lexicon and interpretation may be shared by an instance of PFLST and one of ordinary first-order predicate calculus.) Some discussion and examples should make the truth of this claim easier to see and facilitate the understanding of the PFLST semantics.

A minor difference in notation is that in PFLST predicate terms combine with one singular term argument into a predicate term of a one step lower degree. So, '$P(a, b)$' in ordinary notation corresponds to 'Pab' in the notation introduced here, 'P' being two-place. In this formula, 'Pa' is a subexpression denoting a one-place predicate (that of being something which a is related to by the relation $\ulcorner P \urcorner$). In the ordinary predicate logic notation no constituent corresponds to this subexpression. (There are no composite expressions corresponding to predicates at all.)

There are two functors in PFLST doing the work of the ordinary truth-functional operators. They are the complement functor ('$\sim$') and the Cartesian multiplication functor ('$\times$'), which correspond to negation and conjunction, respectively, when applied to formulae. These operators do not only operate on formulae, but also on predicate terms (which denote predicates). This means that we can conjoin predicate terms without having to supply the arguments that would combine with them into formulae.[11] So, if we assume that both 'P' and 'Q' represent two-place predicates

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[11] The Cartesian multiplication operator is in this respect closer to natural language conjunction than is the ordinary purely truth-functional conjunction operator found in ordinary propositional and

and that 'a', 'b', 'c', and 'd' are individual constants, the formulae '$PabQcd\times$' and '$PQ\times abcd$' are equivalent. Any truth conditional composition of formulae can be defined in terms of negation and conjunction and the absence of disjunction, material implication and other binary truth-functional operators does not weaken the expressive power of PFLST.

The derelativization operator ('⅃') represents an existential quantification applying to the first argument place of a predicate. Universal quantification is easily defined in terms of the complement functor and existential quantification. (Remember that generally $\forall x\,\Phi(x) \equiv \neg\exists x\neg\Phi(x)$.) The quantification expressed by the '⅃' operator only involves the first argument place. This means that we must be able to connect argument places. This is done by means of the reflection functor 'Σ', which connects the first two argument places of a predicate. The formula '$P\Sigma⅃$', for instance, corresponds to '$\exists x P(x, x)$' in ordinary syntax, where the identification of the two argument places is expressed by associating the same variable with the two places. In PFLST this identification is performed by means of an application of 'Σ'.

Argument places must often be "moved" to come within the reach of the Σ functor. This need motivates the inversion functors '$\curvearrowright$' and '$\overline{\curvearrowright}$'. They allow us to obtain a predicate term standing for an arbitrarily permuted version of any predicate defined by a predicate term. In particular, any two argument places that we would like to identify by means of 'Σ' can be "moved" to the two initial positions.

If we consider formulae in a notation mixing elements from ordinary predicate calculus and PFLST in a way that allows PFLST predicate terms to occupy the position of ordinary predicate calculus predicate symbols, we can show the stepwise process of conversion from the one notation to the other. (The semantics of this mixture calculus is intuitively obvious and could be precisely defined.) It should be noted that the order in which these steps are exhibited here is immaterial. Let us see how '$\forall x[\mathrm{M}(x) \to \mathrm{L}(x)]$' is recast to conform to the PFLST syntax. (An expression within a box is a PFLST predicate term.)

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predicate calculus. However, natural language conjunction of (say) two property adjectives does not produce a two-place predicate expression. So, "ugly and expensive" corresponds to '$UE\times\Sigma$' (the property of being both ugly and expensive), rather than simply to '$UE\times$' (the relation that holds between any ugly thing and any expensive thing).

$$\forall x[\boxed{\text{M}}(x) \to \boxed{\text{L}}(x)] \qquad \text{[formula in ordinary notation]}$$
$$\neg\exists x\neg[\boxed{\text{M}}(x) \to \boxed{\text{L}}(x)] \qquad \text{[universal quantifier eliminated]}$$
$$\neg\exists x\neg\neg[\boxed{\text{M}}(x) \wedge \neg\boxed{\text{L}}(x)] \qquad \text{[material implication eliminated]}$$
$$\neg\exists x[\boxed{\text{M}}(x) \wedge \neg\boxed{\text{L}}(x)] \qquad \text{[double negation eliminated]}$$
$$\neg\exists x[\boxed{\text{M}}(x) \wedge \boxed{\text{L}\sim}(x)] \qquad \text{[(ordinary) negation eliminated]}$$
$$\neg\exists x\boxed{\text{ML}\sim\times}(x,x) \qquad \text{[(ordinary) conjunction eliminated]}$$
$$\neg\exists x\boxed{\text{ML}\sim\times\Sigma}(x) \qquad \text{[two argument places identified]}$$
$$\neg\boxed{\text{ML}\sim\times\Sigma\rrbracket} \qquad \text{[existential quantifier eliminated]}$$
$$\boxed{\text{ML}\sim\times\Sigma\rrbracket\sim} \qquad \text{[(ordinary) negation eliminated]}$$

If 'M' and 'L' stand for the predicates to be a man and to be lazy, respectively, 'ML$\sim\times\Sigma\rrbracket\sim$' says that all men are lazy. Let us dissect this formula to examine its parts. The term 'L$\sim$' stands for the predicate of not being lazy, and 'ML$\sim\times$' for the relation that holds between any man and anyone who is not lazy. 'ML$\sim\times\Sigma$', then, stands for the property of standing in this relation to oneself, i.e. for the property of being a man without being lazy. 'ML$\sim\times\Sigma\rrbracket$' is a formula saying that there is at least one individual who has this property. 'ML$\sim\times\Sigma\rrbracket\sim$', finally, is the denial of this, i.e. it says that there is no individual who is a man without being lazy. In other words: all men are lazy.

This example illustrates the differences between the ordinary notation for first-order logic and the PFLST notation. In the former, predicates are represented only by simple expressions. Predicate symbols combine with individual constants and variables into atomic formulae and these formulae are combined into more complex formulae by means of truth-functional composition, cross-identification of variables, and quantificational binding of variables. In PFLST, on the other hand, everything is expressed by the modification of predicate terms. In the mixture notation above, this difference is made clear by the way the logical constants are successively incorporated into the predicate terms and the predicate terms conjoined into larger ones as we step by step transform a formula in ordinary notation into one in the PFLST notation.

Let us consider another example. The logical form of one reading of a sentence like "Every logician has read something written by Frege" may be rendered as '$\forall x[\text{L}(x) \to \exists y[\text{W}(y,\text{f}) \wedge \text{R}(x,y)]]$' (constants being interpreted in the obvious fashion). We may convert it into PFLST notation as follows:

$$\forall x[\boxed{\text{L}}(x) \to \exists y[\boxed{\text{W}}(y,\text{f}) \wedge \boxed{\text{R}}(x,y)]]$$
$$\neg\exists x\neg[\boxed{\text{L}}(x) \to \exists y[\boxed{\text{W}}(y,\text{f}) \wedge \boxed{\text{R}}(x,y)]]$$
$$\neg\exists x\neg\neg[\boxed{\text{L}}(x) \wedge \neg\exists y[\boxed{\text{W}}(y,\text{f}) \wedge \boxed{\text{R}}(x,y)]]$$

$$\neg\exists x[\boxed{L}(x) \land \neg\exists y[\boxed{W}(y,f) \land \boxed{R}(x,y)]]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y[\boxed{W\frown}(f,y) \land \boxed{R}(x,y)]]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y[\boxed{W\frown f}(y) \land \boxed{R}(x,y)]]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y\,\boxed{W\frown fR\times}(y,x,y)]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y\,\boxed{W\frown fR\times\frown}(x,y,y)]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y\,\boxed{W\frown fR\times\frown\overline{\frown}}(y,y,x)]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\exists y\,\boxed{W\frown fR\times\frown\overline{\frown}\Sigma}(y,x)]$$
$$\neg\exists x[\boxed{L}(x) \land \neg\,\boxed{W\frown fR\times\frown\overline{\frown}\Sigma]}(x)]$$
$$\neg\exists x[\boxed{L}(x) \land \boxed{W\frown fR\times\frown\overline{\frown}\Sigma]\sim}(x)]$$
$$\neg\exists x\,\boxed{LW\frown fR\times\frown\overline{\frown}\Sigma]\sim\times}(x,x)$$
$$\neg\exists x\,\boxed{LW\frown fR\times\frown\overline{\frown}\Sigma]\sim\times\Sigma}(x)$$
$$\neg\,\boxed{LW\frown fR\times\frown\overline{\frown}\Sigma]\sim\times\Sigma]}$$
$$\boxed{LW\frown fR\times\frown\overline{\frown}\Sigma]\sim\times\Sigma]\sim}$$

The constituent terms involved here may be interpreted as follows:

'W⌢f': the property of being written by Frege.

'W⌢fR×': the relation that holds of three things iff[12] the first is written by Frege and the second has read the third.

'W⌢fR×⌢': the relation that holds of three things iff the second is written by Frege and the first has read the third.

'W⌢fR×⌢‾⌢': the relation that holds of three things iff the first is written by Frege and the second has been read by the third.

'W⌢fR×⌢‾⌢Σ': the relation that holds of two things iff the first is written by Frege and has been read by the second.

'W⌢fR×⌢‾⌢Σ]': the property of having read something written by Frege.

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[12] The conjunction "iff" should be read as shorthand for "if and only if".

'W⌢fR×⌢⎯⌢Σ⌉∼': the property of not having read something written by Frege.

'LW⌢fR×⌢⎯⌢Σ⌉∼×': the relation that holds between a logician and anyone who has not read something written by Frege.

'LW⌢fR×⌢⎯⌢Σ⌉∼×Σ': the property of being a logician and not having read something written by Frege.

'LW⌢fR×⌢⎯⌢Σ⌉∼×Σ⌉': the proposition that there is a logician who has not read something written by Frege.

'LW⌢fR×⌢⎯⌢Σ⌉∼×Σ⌉∼': the proposition that there is no logician who has not read something written by Frege.

These examples show how any formula in ordinary predicate logic notation can be transformed into the PFLST notation. An algorithm spelling out the general procedure in detail could be provided, but is not necessary to our present purposes. This notation will no doubt look quite unfamiliar to most linguists, but its perspicuity should soon reveal itself to anyone who tries to work with it. Nevertheless, I expect my readers to be more used to and comfortable with the ordinary notation and I will use this notation wherever the PFLST notation is not called for. This means that in general I will use ordinary predicate calculus to state principles relating to the framework derived from from PFLST. (In a sense, ordinary predicate calculus will be used as a metalanguage to talk about constructions in PFLST, although this comparison is to some extent misleading.) However, every formula in this work can be rendered in PFLST, but most readers will probably prefer ordinary notation..

4.4   The Concept System

One of the main ideas behind the present proposal is that the system of concepts and conceptual relations is to be modeled upon the structure of PFLST. In this formalism, we find only singular terms and predicate terms, a special kind of which are formulae. Terms of both categories may plausibly be taken to correspond to concepts. We will consequently distinguish two kinds of concepts: **individual**

concepts and **predicate concepts**, the latter kind being further subcategorized according to their degree. Predicate concepts of degree 0 will be referred to as **propositional concepts**. The conceptual relations that determine the content of concepts corresponding to complex PFLST expressions will themselves correspond to the PFLST functors. (Complex terms in PFLST are always formed by the application of a predicate functor on one or two terms or by the combination of a predicate term and a singular term.)

The six predicate functors of PFLST are '$\frown$', '$\overline{\frown}$', 'Σ', '$\sim$', '$\times$', and '$]$' and the corresponding conceptual relations will be called '$\Re_{\frown}$', '$\Re_{\overline{\frown}}$', '$\Re_{\Sigma}$', '$\Re_{\sim}$', '$\Re_{\times}$', and '$\Re_{]}$'. These relations are two-place, with the single exception of the three-place $\ulcorner\Re_{\times}\urcorner$. In the case of the two-place relations, the first argument is the concept that corresponds to the term to which a functor is applied and the second argument corresponds to the term defined by the application of the functor. The first two arguments of $\ulcorner\Re_{\times}\urcorner$ correspond to the two terms to which the Cartesian multiplication functor is applied and the third argument corresponds to the term being defined by this application. There is also a seventh kind of syntactic connection that produces a PFLST predicate term, viz. the application of a predicate term to a singular term. We have already tentatively introduced this conceptual relation, which we called '$\Re_A$'.

Let us now return, armed with the conceptual apparatus introduced above, to the analysis of propositional attitude statements. The statement (4.3) will provide a point of departure.

(4.3)   Mary believes that all men are lazy.

As have been shown above, the logical form of the content *that*-clause may be rendered as formula F 4.7 (from now on I will use more readable predicate constants).

F 4.7 $P_{man}P_{lazy}\sim\times\Sigma]\sim$

Now, this formula contains seven constituents, the two atomic predicate constants, and five expressions formed by applications of predicate functors. Let us assume that there are two concepts, c_{man} and c_{lazy}, corresponding to the two predicates $\ulcorner P_{man}\urcorner$ and $\ulcorner P_{lazy}\urcorner$, respectively. Let us simply number the remaining five concepts according to the order of the predicate functors that close the terms to which they correspond. These five concepts will accordingly be denoted by the five constants 'c_1', 'c_2', 'c_3', 'c_4', and 'c_5'. They consequently correspond to the subexpressions of formula F 4.7 as follows: c_1: '$P_{lazy}\sim$', c_2: '$P_{man}P_{lazy}\sim\times$', c_3: '$P_{man}P_{lazy}\sim\times\Sigma$', c_4: '$P_{man}P_{lazy}\sim\times\Sigma]$', and c_5: '$P_{man}P_{lazy}\sim\times\Sigma]\sim$'.

We are now in a position to describe the relevant relationships that hold among the seven concepts as indicated by the PFLST formula. The description is given in formula F 4.8.

F 4.8 $\Re_\sim(c_{\mathsf{lazy}}, c_1) \wedge \Re_\times(c_{\mathsf{man}}, c_1, c_2) \wedge \Re_\Sigma(c_2, c_3) \wedge \Re_\exists(c_3, c_4) \wedge \Re_\sim(c_4, c_5)$

The conjuncts in formula F 4.8 come in the same order as the functor applications in formula F 4.7 to which they correspond. In effect, formula F 4.8 is a syntactic description of formula F 4.7. But in this context it is intended as a description of the conceptual relations that hold among a number of concepts.

Above, in relation to the analysis of (4.2) we introduced the conceptual relation $\ulcorner\Re_\subseteq\urcorner$, which holds of two property concepts and the propositional concept that each object with the first property also possesses the second. With the help of this relation we rendered the logical form of (4.2) as formula F 4.3. Now, of course, formula F 4.8 in a sense just says the same as '$\Re_\subseteq(c_{\mathsf{man}}, c_{\mathsf{lazy}}, c_5)$'. As soon as the intended constraints on the conceptual relations derived from PFLST are set down, this will be a consequence. We have thereby found a way of defining the $\ulcorner\Re_\subseteq\urcorner$ relation in terms of four of the primitive conceptual relations. Spelled out, this definition would look like formula F 4.9.

F 4.9 $\forall c_1 \forall c_2 \forall p [\, \Re_\subseteq(c_1, c_2, p) \equiv$
$\exists c_3 \exists c_4 \exists c_5 \exists c_6 [\, \Re_\sim(c_2, c_3) \wedge \Re_\times(c_1, c_3, c_4) \wedge$
$\Re_\Sigma(c_4, c_5) \wedge \Re_\exists(c_5, c_6) \wedge \Re_\sim(c_6, p)\,]\,]$

(A predicate-functor logic that contains a functor that directly corresponds to set-theoretic inclusion could be defined. Such a functor is clearly superfluous in the present PFLST.)

The operations associated with the predicate functors are defined by the PFLST semantics. We also want the relevant semantic constraints to be inherited by the system of concepts and conceptual relations. We have so far not done anything to secure this. The semantics for PFLST is in effect a truth theory defining the truth values of PFLST formulae relative to an arbitrary interpretation. A similar system of constraints on the denotations of concepts may be derived from the semantics of PFLST. As I said at the outset, the aim is to keep within a first-order framework and this requires that this system of semantic constraints relating to concepts is accommodated within a first-order theory.

The basic conceptual relations will be associated with denotational constraints. If we assume that concepts possess denotations in the same way as PFLST expressions

and adopt the convention that the denotation of a concept or PFLST expression x is $[\![x]\!]$, we may express these constraints as follows:

- For two arbitrary concepts c_1 and c_2 and an arbitary PFLST expression E_1 it holds that if $\Re_{\frown}(c_1, c_2)$ and $[\![c_1]\!] = [\![E_1]\!]$, then $[\![c_2]\!] = [\![E_1 \frown]\!]$.

- For two arbitrary concepts c_1 and c_2 and an arbitary PFLST expression E_1 it holds that if $\Re_{\overline{\frown}}(c_1, c_2)$ and $[\![c_1]\!] = [\![E_1]\!]$, then $[\![c_2]\!] = [\![E_1 \overline{\frown}]\!]$.

- For two arbitrary concepts c_1 and c_2 and an arbitary PFLST expression E_1 it holds that if $\Re_{\Sigma}(c_1, c_2)$ and $[\![c_1]\!] = [\![E_1]\!]$, then $[\![c_2]\!] = [\![E_1 \Sigma]\!]$.

- For two arbitrary concepts c_1 and c_2 and an arbitary PFLST expression E_1 it holds that if $\Re_{\backsim}(c_1, c_2)$ and $[\![c_1]\!] = [\![E_1]\!]$, then $[\![c_2]\!] = [\![E_1 \sim]\!]$.

- For three arbitrary concepts c_1, c_2, and c_3 and two arbitary PFLST expressions E_1 and E_2 it holds that if $\Re_{\times}(c_1, c_2, c_3)$, $[\![c_1]\!] = [\![E_1]\!]$, and $[\![c_2]\!] = [\![E_2]\!]$, then $[\![c_3]\!] = [\![E_1 E_2 \times]\!]$.

- For two arbitrary concepts c_1 and c_2 and an arbitary PFLST expression E_1 it holds that if $\Re_{\mathbb{J}}(c_1, c_2)$ and $[\![c_1]\!] = [\![E_1]\!]$, then $[\![c_2]\!] = [\![E_1 \mathbb{J}]\!]$.

- For three arbitrary concepts c_1, c_2, and c_3 and two arbitary PFLST expressions E_1 and E_2 it holds that if $\Re_A(c_1, c_2, c_3)$, $[\![c_1]\!] = [\![E_1]\!]$, and $[\![c_2]\!] = [\![E_2]\!]$, then $[\![c_3]\!] = [\![E_1 E_2]\!]$.

These tentative rules indicate what is necessary to frame a truth theory for propositional concepts. This truth theory is intended to make explicit the denotational constraints by which the conceptual system abides, in the same way as an ordinary model-theoretic semantics for a language captures certain internal properties and relations holding of expressions in the language without connecting them to external reality. The semantics defines truth relative to an arbitrary interpretation, but only by fixing an interpretation—and this is a move that lies outside of the formal semantic definition of the language—do we associate expressions with elements of reality and make the absolute notion of truth applicable. Essentially the same approach will be taken to the truth theory for propositional concepts. The truth theory is assumed to be part of the propositional attitude psychology that lies behind propositional attitude reports. This psychology also involves other theoretical components (see Chapter 7).

4.4.1 A Truth Theory for Propositional Concepts

What kind of ontology is assumed by a truth theory for propositional concepts along the lines outlined above? Apart from assuming that there are various kinds of concepts and a world of things of which the concepts are concepts, we need the basic constructions of set theory. We may also use some arithmetics, which is reducible to set theory. I will also assume that there is a kind of primitive entities which will be called **concept extension interpretations**, corresponding to different ways of associating concepts with denotations. They may be understood as a kind of possible worlds.

Below, I will try to set down the constraints that are to be captured by the relevant truth theory. These constraints can be seen as a collection of axioms, but they are better viewed as theorems that should follow from an adequate axiomatization. I will not state the axioms necessary to the relevant parts of set theory and arithmetics, just take some of their notions for granted. For a full axiomatization of set theory the reader is referred to Carnap [1958, Sections 43–44].

4.4.1.1 Combinatorial Constraints

In order to simplify semantics, some constraints concerning how different concepts and propositions may relate to each other should be set down. As the content articulation scheme proposed here mimics the PFLST articulation of propositional contents, these constraints will essentially recapitulate the PFLST syntax.

First we need a predicate to single out predicate concepts. Let us call it 'PREDCON' and make it two-place in order to provide a place for information concerning the degree of a predicate concept. Remember that propositional concepts are identified with predicate concepts of degree zero. We also need an ⌜INDCON⌝ one-place predicate to distinguish individual concepts. The two categories of concepts are mutually exclusive:

Constraint 4.1

$\forall c \neg [\exists n [\text{PREDCON}(c, n)] \land \text{INDCON}(c)]$

A predicate concept is never of two different degrees:

Constraint 4.2

$\forall c [\neg \exists m \exists n [\text{PREDCON}(c, m) \land \text{PREDCON}(c, n) \land m \neq n]]$

There are no negative degrees:

Constraint 4.3

$\forall c \forall n [\text{PREDCON}(c, n) \rightarrow n \geq 0]$

There is one concept that has a privileged status, namely the identity predicate concept, which corresponds to the only predicate in PFLST which is represented by a logical constant ('$\mathbb{I}$'). This concept is called '$c_{\equiv}$' and is a predicate concept of degree 2:

Constraint 4.4

$\text{PREDCON}(c_{\equiv}, 2)$

We may now easily describe the combinatorial properties of various kinds of concepts. These constraints listed below closely follow the PFLST syntax given above.

Constraint 4.5

$\forall c_1 \forall c_2 [\Re_{\frown}(c_1, c_2) \rightarrow \exists n [\text{PREDCON}(c_1, n) \land \text{PREDCON}(c_2, n) \land n \geq 2]]$

Constraint 4.6

$\forall c_1 \forall n [(\text{PREDCON}(c_1, n) \land n \geq 2) \rightarrow \exists c_2 [\Re_{\frown}(c_1, c_2)]]$

There are two combinatorial constraints associated with each basic conceptual relation. First, there is one that sets down the properties of the entities that may be related by means of the relation (e.g. Constraint 4.5) and, secondly, there is one saying that if a concept is of the right kind there is always a concept to which the first concept is related by this relation (e.g. Constraint 4.6). (This applies *mutatis mutandis* to Constraints 4.13 and 4.13 relating to $\ulcorner \Re_{\times} \urcorner$.) There is for this reason two combinatorial axioms associated with each basic conceptual relation. The remaining ones follow here.

Constraint 4.7

$\forall c_1 \forall c_2 [\Re_{\overline{\frown}}(c_1, c_2) \rightarrow \exists n [\text{PREDCON}(c_1, n) \land \text{PREDCON}(c_2, n) \land n \geq 2]]$

Constraint 4.8

$\forall c_1 \forall n [(\text{PREDCON}(c_1, n) \land n \geq 2) \rightarrow \exists c_2 [\Re_{\overline{\frown}}(c_1, c_2)]]$

Constraint 4.9

$$\forall c_1 \forall c_2 [\Re_\Sigma(c_1, c_2) \to \exists n [\text{PREDCON}(c_1, n) \land \text{PREDCON}(c_2, n-1) \land n \geq 2]]$$

Constraint 4.10

$$\forall c_1 \forall n [(\text{PREDCON}(c_1, n) \land n \geq 2) \to \exists c_2 [\Re_\Sigma(c_1, c_2)]]$$

Constraint 4.11

$$\forall c_1 \forall c_2 [\Re_\sim(c_1, c_2) \to \exists n [\text{PREDCON}(c_1, n) \land \text{PREDCON}(c_2, n)]]$$

Constraint 4.12

$$\forall c_1 \forall n [\text{PREDCON}(c_1, n) \to \exists c_2 [\Re_\sim(c_1, c_2)]]$$

Constraint 4.13

$$\forall c_1 \forall c_2 \forall c_3 [\Re_\times(c_1, c_2, c_3) \to \\ \exists m \exists n [\text{PREDCON}(c_1, m) \land \text{PREDCON}(c_2, n) \land \text{PREDCON}(c_3, m+n)]]$$

Constraint 4.14

$$\forall c_1 \forall c_2 \forall m \forall n [(\text{PREDCON}(c_1, m) \land \text{PREDCON}(c_2, n)) \to \exists c_3 [\Re_\times(c_1, c_2, c_3)]]$$

Constraint 4.15

$$\forall c_1 \forall c_2 [\Re_\exists(c_1, c_2) \to \exists n [\text{PREDCON}(c_1, n) \land \text{PREDCON}(c_2, n-1)]]$$

Constraint 4.16

$$\forall c_1 \forall n [(\text{PREDCON}(c_1, n) \land n \geq 1) \to \exists c_2 [\Re_\exists(c_1, c_2)]]$$

Constraint 4.17

$$\forall c_1 \forall c_2 \forall c_3 [\Re_A(c_1, c_2, c_3) \to \\ \exists n [\text{PREDCON}(c_1, n) \land \text{INDCON}(c_2) \land \text{PREDCON}(c_3, n-1)]]$$

Constraint 4.18

$$\forall c_1 \forall c_2 \forall n [(\text{PREDCON}(c_1, n) \land n \geq 1 \land \text{INDCON}(c_2)) \to \exists c_3 [\Re_A(c_1, c_2, c_3)]]$$

Having set down the combinatorial constraints associated with the conceptual relations, we may turn to the ones defining the denotational semantics of the concept system. In order to simplify this task, a number of auxiliary notions, relating to the extensions of predicate concepts, will be introduced and defined.

4.4.1.2 Definitions of Auxiliary Predicates

We need a concept of n-tuple (in order to account for the semantics of predicate concepts). This notion is most easily defined in terms of the notion of ordered pair (i.e. 2-tuple). So, $\langle a, b, c \rangle$ is defined as $\langle a, \langle b, c \rangle \rangle$ and $\langle a, b, c, d \rangle$ as $\langle a, \langle b, c, d \rangle \rangle$, etc. An n-tuple is consequently an ordered pair whose second element is an $n - 1$-tuple. We also assume that it holds for any a that $\langle a \rangle = a$.

Ordered pairs are easily defined in terms of sets. We may take $\langle a, b \rangle$ to be the same as $\{a, \{a, b\}\}$,[13] and introduce a predicate $\ulcorner\text{PAIR}\urcorner$ which captures the property of being an ordered pair. Let us begin by defining the three-place predicate $\ulcorner\text{PAIR}\urcorner$, which holds of any ordered pair, its first element, and its second element.

Definition 4.1

$$\forall t \forall x \forall y [\, \text{PAIR}(t, x, y) \equiv$$
$$\exists m [\, x \in t \land m \in t \land \forall n [n \in t \to (n = x \lor n = m)] \land$$
$$x \in m \land y \in m \land \forall n [n \in m \to (n = x \lor n = y)]]]]$$

The idea is (leaving quantification implicit) that $t = \{x, m\} = \{x, \{x, y\}\}$ (and $m = \{x, y\}$). The property of being an ordered pair is now easily defined. Note that the symbol 'PAIR' is used for both a three-place and a one-place predicate. (The context will disambiguate between them.)

Definition 4.2

$$\forall t [\text{PAIR}(t) \equiv \exists x \exists y [\text{PAIR}(t, x, y)]]$$

The property of being an n-tuple of elements from a certain set is now easy to define. $\text{TUPLE}(t, n, D)$ holds whenever t is an n-tuple each of whose elements are members of the set D in virtue of the following definition:

Definition 4.3

$$\forall t \forall n \forall D [\, \text{TUPLE}(t, n, D) \equiv$$
$$(\, (n = 1 \land t \in D) \lor$$
$$(n > 1 \land \exists e \exists x [e \in D \land \text{TUPLE}(x, n - 1, D) \land \text{PAIR}(t, e, x)]))]$$

---

[13] This definition of ordered pair is due to Kuratowski (cf. Quine [1960b, p. 259]).

It is also useful to have a symbol for the relation that holds between two n-tuples whenever the second one is obtained from the first one by interchanging its two first elements. It should be clear that this relation is intimately connected to the way in which the '$\curvearrowright$' functor works.

Definition 4.4

$$\forall t_1 \forall t_2 [\, \text{TUPLEMININV}(t_1, t_2) \equiv$$
$$(\, \exists e_1 \exists e_2 [\text{PAIR}(t_1, e_1, e_2) \wedge \text{PAIR}(t_2, e_2, e_1) \wedge \neg \text{PAIR}(e_2)] \vee$$
$$\exists x \exists y_1 \exists y_2 [\, \text{PAIR}(t_1, e_1, y_1) \wedge \text{PAIR}(y_1, e_2, x) \wedge$$
$$\text{PAIR}(t_2, e_2, y_2) \wedge \text{PAIR}(y_2, e_1, x)]])]$$

The idea is that either $t_1 = \langle e_1, e_2 \rangle$ and $t_2 = \langle e_2, e_1 \rangle$ or $t_1 = \langle e_1, \langle e_2, x \rangle \rangle$ and $t_2 = \langle e_2, \langle e_1, x \rangle \rangle$. ($y_1 = \langle e_2, x \rangle$ and $y_2 = \langle e_1, x \rangle$.)

By means of this relation over tuples we are in a position to define the relation that holds between two sets whenever the first is the denotation of a PFLST predicate term and the second one is the denotation of the predicate term obtained by applying the minor inversion functor '$\curvearrowright$' to the first term. Let us call this relation 'MININV'. Its definition is obvious:

Definition 4.5

$$\forall s_1 \forall s_2 [\, \text{MININV}(s_1, s_2) \equiv$$
$$(\, \forall t_1 [t_1 \in s_1 \rightarrow \exists t_2 [\text{TUPLEMININV}(t_1, t_2) \wedge t_2 \in s_2]] \wedge$$
$$\forall t_2 [t_2 \in s_2 \rightarrow \exists t_1 [\text{TUPLEMININV}(t_1, t_2) \wedge t_1 \in s_1]])]$$

A relation between two tuples that holds whenever the second tuple is obtained from the first by putting the first element of the first tuple last is also useful. It corresponds to the major inversion functor '$\overline{\curvearrowright}$' in the same way that $\ulcorner$TUPLEMININV$\urcorner$ corresponds to the minor one. Let us call this relation 'TUPLEMAJINV', and define it as follows:

Definition 4.6

$$\forall t_1 \forall t_2 [\text{TUPLEMAJINV}(t_1, t_2) \equiv$$
$$(\exists e_1 \exists e_2 [\text{PAIR}(t_1, e_1, e_2) \wedge \text{PAIR}(t_2, e_2, e_1) \wedge \neg \text{PAIR}(e_2)] \vee$$
$$\exists x \exists y_1 \exists y_2 \exists z [\text{PAIR}(t_1, e_1, y_1) \wedge \text{PAIR}(y_1, e_2, x) \wedge \text{PAIR}(t_2, e_2, z) \wedge$$
$$\text{PAIR}(y_2, e_1, x) \wedge \text{TUPLEMAJINV}(y_2, z)]])]$$

The idea is that either $t_1 = \langle e_1, e_2 \rangle$ and $t_2 = \langle e_2, e_1 \rangle$ or $t_1 = \langle e_1, \langle e_2, x \rangle \rangle$ and $t_2 = \langle e_2, z \rangle$, where z is the result of applying this major inversion of tuples on $\langle e_1, x \rangle$. ($y_1 = \langle e_2, x \rangle$ and $y_2 = \langle e_1, x \rangle$.)

By means of the $\ulcorner$TUPLEMAJINV$\urcorner$ relation over tuples the relation that holds between two sets whenever the first is the denotation of a PFLST predicate term and the second one is the denotation of the predicate term obtained by applying the major inversion functor to the first term. Let us call this relation 'MAJINV'. The idea behind its definition is the same as that behind the definition of $\ulcorner$MININV$\urcorner$.

Definition 4.7

$\forall s_1 \forall s_2 [\, \text{MAJINV}(s_1, s_2) \equiv$
$\quad\quad (\, \forall t_1 [t_1 \in s_1 \rightarrow \exists t_2 [\text{TUPLEMAJINV}(t_1, t_2) \wedge t_2 \in s_2]] \wedge$
$\quad\quad\quad \forall t_2 [t_2 \in s_2 \rightarrow \exists t_1 [\text{TUPLEMAJINV}(t_1, t_2) \wedge t_1 \in s_1]])]$

We also need a relation between predicate term extensions that correspond to the reflection operator 'Σ'. Let us call it 'REFLECTION'. It may be defined as follows:

Definition 4.8

$\forall s_1 \forall s_2 [\, \text{REFLECTION}(s_1, s_2) \equiv$
$\quad\quad (\, \forall t \forall e \forall x \forall y [(t \in s_1 \wedge \text{PAIR}(t, e, x) \wedge \text{PAIR}(x, e, y)) \rightarrow x \in s_2] \wedge$
$\quad\quad\quad \forall x [x \in s_2 \rightarrow \exists t \exists e \exists y [\text{PAIR}(t, e, x) \wedge \text{PAIR}(x, e, y) \wedge t \in s_1]])]$

This is to be understood in such a way that if $t \in s_1$ and $t = \langle e, \langle e, y \rangle \rangle$, then $\langle e, y \rangle \in s_2$. ($x = \langle e, y \rangle$.) If $x \in s_2$, the objects t, e, and y, are such that $x = \langle e, y \rangle$, $t = \langle e, \langle e, y \rangle \rangle$, and $t \in s_1$.

The complement functor ('$\sim$') corresponds to set subtraction, the complement of a predicate extension being the difference between the set of all n-tuples (where n is the degree of the predicate involved) and the extension of the operand predicate. The notion of a total predicate extension is therefore useful. The relation $\ulcorner$TOTPRED$\urcorner$ will be taken to be three-place, relating a total predicate extension, its degree, and the domain over which it is a predicate. Its definition is straightforward:

Definition 4.9

$\forall r \forall D \forall n [\text{TOTPRED}(r, n, D) \equiv \forall t [\text{TUPLE}(t, n, D) \equiv t \in r]]$

There is also need for a notion of **Cartesian multiplication**, which is easily defined with the help of a relation holding whenever its three arguments are an m-tuple, an n-tuple, and the $m + n$-tuple that is obtained by concatenation of the m-tuple and the n-tuple. This $\ulcorner$CONC$\urcorner$ relation may be defined as follows:

Definition 4.10

$$\forall t_1 \forall t_2 \forall t_3 \big[\text{CONC}(t_1, t_2, t_3) \equiv$$
$$\big((\neg \text{PAIR}(t_1) \wedge \text{PAIR}(t_3, t_1, t_2)) \vee$$
$$\exists e \exists x \exists y [\text{PAIR}(t_1, e, x) \wedge \text{PAIR}(t_3, e, y) \wedge \text{CONC}(x, t_2, y)] \big) \big]$$

The latter disjunct of the definiens expresses the idea that $\text{CONC}(\langle e, x \rangle, t_1, \langle e, y \rangle)$ holds whenever $\text{CONC}(x, t_1, y)$. (When x is not a pair, it holds that $\text{CONC}(x, t_1, \langle x, t_1 \rangle)$.) With this $\ulcorner\text{CONC}\urcorner$ predicate in store the operation of Cartesian multiplication on two predicate extensions is easily defined:

Definition 4.11

$$\forall s_1 \forall s_2 \forall s_3 \big[\text{CARTPROD}(s_1, s_2, s_3) \equiv$$
$$\big(\forall t_1 \forall t_2 [(t_1 \in s_1 \wedge t_2 \in s_2) \rightarrow \exists t_3 [\text{CONC}(t_1, t_2, t_3) \wedge t_3 \in s_3]] \wedge$$
$$\forall t_3 [t_3 \in s_3 \rightarrow \exists t_1 \exists t_2 [\text{CONC}(t_1, t_2, t_3) \wedge t_1 \in s_1 \wedge t_2 \in s_2]] \big) \big]$$

We also need to define the relation between two predicate extensions that corresponds to the cropping or derelativization functor ('⌐'). It will be called 'DERELAT'. This relation holds between two sets of tuples whenever the second set contains all and only those tuples that are obtained by "decapitating" a tuple in the first set.

Definition 4.12

$$\forall s_1 \forall s_2 [\text{DERELAT}(s_1, s_2) \equiv$$
$$\big(\forall t [t \in s_1 \rightarrow \exists e \exists x [\text{PAIR}(t, e, x) \wedge x \in s_2]] \wedge$$
$$\forall x [x \in s_2 \rightarrow \exists e \exists t [\text{PAIR}(t, e, x) \wedge t \in s_1]] \big)]$$

The idea is that if $\langle e, x \rangle \in s_1$, then $x \in s_2$, and if $x \in s_2$, there must be an e such that $\langle e, x \rangle \in s_1$.

Finally, we may use a set-theoretic operation (represented by the relation called 'APPL') corresponding to the application of a relation (whose degree is two or higher) to an individual, in which case a relation of a one step lower degree is obtained, holding of a series of ordered individuals just in those cases where the argument relation holds of the argument individual and the same series of individuals (in the order mentioned). This relation, holding of the extension of the predicate, the individual, and the predicate extension defined by the application, is easily defined:

Definition 4.13

$$\forall s_1 \forall e \forall s_2 \big[\text{APPL}(s_1, e, s_2) \equiv$$
$$\big(\forall t [t \in s_1 \rightarrow \exists x [\text{PAIR}(t, e, x) \wedge x \in s_2]] \wedge$$
$$\forall x [x \in s_2 \rightarrow \exists t [\text{PAIR}(t, e, x) \wedge t \in s_1]] \big)]$$

We have now defined a collection of relations among predicate term extensions the use of which will facilitate the formulation of the truth theory that applies to the system of concepts.

4.4.1.3   Denotation and Truth

The concepts posited in this theory may, but need not, be tied to the world by means of possessing a certain denotation or (in case of propositional concepts) a truth value. The semantics of a first-order language essentially consists of a collection of constraints concerning the distribution of denotations over expressions. The corresponding constraints applying to concepts will be expressed here by the use of model-theoretic techniques. (A kind of model theory will be embedded within the first-order theory in which the concept system has its place.) This will make it easy to give an account of logical consequence and alethic modality, as these notions apply to propositional concepts. I will assume that the denotations of concepts are fixed by what I will call a **concept extension interpretation**, which corresponds to what is simply called an *interpretation* (or a *model*) when it comes to setting down the semantics of a logical formalism. A concept extension interpretation corresponds to one particular way of assigning denotations to the elements of the system of concepts. However, a concept does not need to be linked to reality. A concept may therefore lack a denotation relative to a concept extension interpretation. I will suppose that the system of concepts is associated with a **domain** of entities that provide the possible denotations for individual concepts. This set is represented by the constant 'D_Δ'. Only concepts may have denotations (of this kind) and their denotations must be of a kind appropriate to the type of concept. We may define the notion of possible denotation, to be represented by the two-place relation $\ulcorner \Delta_\diamond \urcorner$, as follows.

Definition 4.14

$$\forall c \forall d [\, \Delta_\diamond(c, d) \equiv$$
$$\big(\big(\mathrm{PREDCON}(c, 0) \land (d = \top \lor d = \bot) \big) \lor$$
$$\exists n \exists d_t [n \geq 1 \land \mathrm{PREDCON}(c, n) \land \mathrm{TOTPRED}(d_t, n, D_\Delta) \land d \subseteq d_t] \lor$$
$$\big(\mathrm{INDCON}(c) \land d \in D_\Delta \big) \big)]$$

There are a number of constraints that should be set down to ensure that concept extension interpretations will behave in the desired way. They should be required to assign only possible denotations to the concepts. If we take 'Δ_r' to represent

the three-place relation holding of a concept extension interpretation, a concept, and the denotation (if any) that this concept has with respect to this denotation, this constraint may be expressed as follows:

Constraint 4.19

$$\forall M \forall c \forall d [\Delta_r(M, c, d) \rightarrow \Delta_\diamond(c, d)]$$

Another important constraint is that there is at most one denotation associated with a concept with respect to a given interpretation:

Constraint 4.20

$$\forall M \forall c \forall d_1 [\Delta_r(M, c, d_1) \rightarrow \neg \exists d_2 [\Delta_r(M, c, d_2) \wedge d_1 \neq d_2]]$$

I will shortly use the notion of concept extension interpretation to define the alethic modalities as they apply to propositional concepts. This presupposes that every possible way of assigning denotations to the concepts corresponds to a concept extension interpretation. We must therefore set down some constraints to the effect that this is indeed the case.

We need another classification of concepts (apart from the distinction between predicate and individual concepts) that will divide them into primitive and derived ones. The derived ones are those whose denotations may be determined from the denotations of the concepts to which they are conceptually related, whereas the denotations of the primitive concepts are independent. This notion of primitive concept is represented by the one-place predicate whose symbol is 'PRIMCON'. A constraint on this predicate is that a primitive concept is either an individual concept or a predicate concept:

Constraint 4.21

$$\forall c [\text{PRIMCON}(c) \rightarrow (\text{INDCON}(c) \vee \exists n [\text{PREDCON}(c, n)])]$$

Now, we need to stipulate that any possible assignment of denotations to the primitive concepts corresponds to a concept extension interpretation. We do this in two steps. First, we require that there is at least one total concept extension interpretation, i.e. one in relation to which every primitive concept has a denotation.

Constraint 4.22

$$\exists M \forall c [\text{PRIMCON}(c) \rightarrow \exists d [\Delta_r(M, c, d)]]$$

Secondly, we require that, for any concept extension interpretation, any concept, and any possible denotation of this concept, there is a concept extension interpretation relative to which this concept has this denotation and all other primitive concepts have the same denotations (or lack one) relatively to the former interpretation.

Constraint 4.23

$$\forall M_1 \forall c_1 \forall d_1 [(\text{PRIMCON}(c_1) \wedge \Delta_\diamond(c_1, d_1)) \rightarrow$$
$$\exists M_2 [\forall c_2 [c_2 \neq c_1 \rightarrow \forall d_2 [\Delta_r(M_1, c_2, d_2) \equiv \Delta_r(M_2, c_2, d_2)]] \wedge$$
$$\Delta_r(M_2, c_1, d_1)]]$$

We may also add a constraint to the effect that, for any concept extension interpretation, there is also one relatively to which an arbitrarily chosen primitive concept lacks denotation and all other primitive concepts have the same denotations (or lack one) relatively to the former interpretation.

Constraint 4.24

$$\forall M_1 \forall c_1 [\text{PRIMCON}(c_1) \rightarrow$$
$$\exists M_2 [\forall c_2 [c_2 \neq c_1 \rightarrow \forall d [\Delta_r(M_1, c_2, d) \equiv \Delta_r(M_2, c_2, d)]] \wedge$$
$$\neg \exists d [\Delta_r(M_2, c_1, d)]]]$$

We may now turn to the semantic constraints related to the basic conceptual relations derived from the PFLST functors. These will show how the denotations of derived concepts are constrained by the denotations of the concepts to which they are conceptually related. The denotations of the primitive concepts are completely independent, as the constraints above require. This means that two primitive concepts cannot be conceptually related in a way that imposes a constraint on their denotations.

4.4.1.4   Constraints on the Conceptual Relations

The denotational constraints associated with the conceptual relations are quite easily formulated in terms of the notions we now have in store. They closely correspond to those set down in the PFLST semantics. Even if the two formulations differ in details, they should be equivalent.

Constraint 4.25

$$\forall M \forall c_1 \forall c_2 [\Re_\frown(c_1, c_2) \rightarrow$$
$$\forall d_1 [\Delta_r(M, c_1, d_1) \rightarrow \exists d_2 [\Delta_r(M, c_2, d_2) \wedge \text{MININV}(d_1, d_2)]]]$$

Constraint 4.26

$$\forall M \forall c_1 \forall c_2 [\, \Re_{\overrightarrow{\sim}}(c_1, c_2) \rightarrow$$
$$\forall d_1 [\Delta_r(M, c_1, d_1) \rightarrow \exists d_2 [\Delta_r(M, c_2, d_2) \wedge \text{MAJINV}(d_1, d_2)]]]$$

Constraint 4.27

$$\forall M \forall c_1 \forall c_2 [\, \Re_{\Sigma}(c_1, c_2) \rightarrow$$
$$\forall d_1 [\Delta_r(M, c_1, d_1) \rightarrow \exists d_2 [\Delta_r(M, c_2, d_2) \wedge \text{REFLECTION}(d_1, d_2)]]]$$

Constraint 4.28

$$\forall M \forall c_1 \forall c_2 [\, \Re_{\sim}(c_1, c_2) \rightarrow$$
$$\forall d_1 [\, \Delta_r(M, c_1, d_1) \rightarrow$$
$$\exists d_2 [\, \Delta_r(M, c_2, d_2) \wedge$$
$$((d_1 = \top \wedge d_2 = \bot) \vee$$
$$(d_1 = \bot \wedge d_2 = \top) \vee$$
$$\forall d_t [\, \text{TOTPRED}(d_t, n, \mathbf{D}_\Delta) \wedge d_2 = d_t - d_1])]]]$$

Constraint 4.29

$$\forall M \forall c_1 \forall c_2 \forall c_3 [\, \Re_{\times}(c_1, c_2, c_3) \rightarrow$$
$$\forall d_1 \forall d_2 [\, (\Delta_r(M, c_1, d_1) \wedge \Delta_r(M, c_2, d_2)) \rightarrow$$
$$\exists d_3 [\, \Delta_r(M, c_3, d_3) \wedge$$
$$((d_1 = \bot \wedge (d_3 = \bot \vee d_3 = \emptyset)) \vee$$
$$(d_2 = \bot \wedge (d_3 = \bot \vee d_3 = \emptyset)) \vee$$
$$(d_1 = \top \wedge d_2 = d_3) \vee$$
$$(d_2 = \top \wedge d_1 = d_3) \vee$$
$$\text{CARTPROD}(d_1, d_2, d_3))]]]$$

Constraint 4.30

$$\forall M \forall c_1 \forall c_2 [\, \Re_{\mathfrak{I}}(c_1, c_2) \rightarrow$$
$$\forall d_1 [\Delta_r(M, c_1, d_1) \rightarrow \exists d_2 [\Delta_r(M, c_2, d_2) \wedge$$
$$((d_1 \neq \emptyset \wedge d_2 = \top) \vee$$
$$(d_1 = \emptyset \wedge d_2 = \bot) \vee$$
$$\text{DERELAT}(d_1, d_2))]]]$$

Constraint 4.31

$$\forall M \forall c_1 \forall c_2 \forall c_3 [\, \Re_A(c_1, c_2, c_3) \rightarrow$$
$$\forall d_1 \forall d_2 [\, (\Delta_r(M, c_1, d_1) \wedge \Delta_r(M, c_2, d_2)) \rightarrow$$
$$\exists d_3 [\, \Delta_r(M, c_3, d_3) \wedge$$
$$(\, (d_2 \in d_1 \wedge d_3 = \top) \vee$$
$$(d_2 \notin d_1 \wedge d_3 = \bot) \vee$$
$$\text{APPL}(d_1, d_2, d_3))]]]]$$

The denotational constraints relating to the seven conceptual relations corresponding to the six predicate functors and the operation of applying a predicate to a singular term have now been set down. A constraint that determines the denotation of the identity concept (called '$c_{\equiv}$') should also be added.

Definition 4.15

$$\forall M \forall d [\, \Delta_r(M, c_{\equiv}, d) \equiv$$
$$(\, \forall e [e \in \mathbf{D}_\Delta \rightarrow \exists t [\text{PAIR}(t, e, e) \wedge t \in d]] \wedge$$
$$\forall t [t \in d \rightarrow \exists e [\text{PAIR}(t, e, e) \wedge e \in \mathbf{D}_\Delta]])]$$

4.4.2   Actual Denotations

A truth theory of the kind outlined in the previous section sets down the semantic constraints that relate to concepts, in terms of denotations relative to a concept extension interpretation. However, we should also be able to characterize actual denotation, in particular actual truth value. In relation to a propositional attitude ascription, the concepts involved typically have fixed denotations. One way of introducing a notion of actual denotation, represented by the two-place relation symbol 'Δ_a', is to single out a certain interpretation as the actual one, and to define actual denotation as denotation relative to this interpretation. If we call this concept extension interpretation '$\mathbf{M}_a$', we may express this idea as follows.

Definition 4.16

$$\forall c \forall d [\Delta_a(c, d) \equiv \Delta_r(\mathbf{M}_a, c, d)]$$

The notions of truth and falsity, corresponding to the conceptual predicates $\ulcorner \text{TRUE} \urcorner$ and $\ulcorner \text{FALSE} \urcorner$, respectively, are then easily defined in terms of actual denotation:

Definition 4.17

$$\forall p [\text{TRUE}(p) \equiv \Delta_a(p, \top)]$$

Definition 4.18

$$\forall p[\text{FALSE}(p) \equiv \Delta_a(p, \perp)]$$

It should be noted that our system of conceptual constraints does not require that each concept has an actual denotation. There may consequently be propositional concepts which are neither true or false.

4.4.3 Restrictions on Actual Denotations

The truth theory imposes constraints on the distribution of denotations over concepts, and this may be crucial to the understanding of various modes of inference relevant in relation to reasoning about propositional attitudes.

Just to take a very simple example, let us again consider (4.1). The premiss that Venus actually is a planet should, together with premiss (4.1), warrant the conclusion that Mary believes something true. Here, the truth theory comes in. One of its consequences is that if a one-place predicate concept, c_1, an individual concept, c_2, and a propositional concept, p, are such that $\Re_A(c_1, c_2, p)$, then p is true if and only if the actual denotation of c_2 is an element in the actual denotation of c_1 (Constraint 4.31). If we assume that the logical form of the relevant reading of (4.1) is given by formula F 4.10, the two denotational constraints set down as formula F 4.11 and formula F 4.12 determines the relevant properties of the two concepts involved in this example.

F 4.10 $\exists p[\text{believe}(\mathsf{i}_{\text{Mary}}, p) \wedge \Re_A(\mathsf{c}_{\text{planet}}, \mathsf{c}_{\text{Venus}}, p)]$

F 4.11 $\Delta_a(\mathsf{c}_{\text{Venus}}, \mathsf{i}_{\text{Venus}})$

F 4.12 $\forall d[\Delta_a(\mathsf{c}_{\text{planet}}, d) \equiv \forall x[x \in d \equiv \text{planet}(x)]]$

The assumptions that Venus is the denotation (in the sense of 'Δ_a') of $\mathsf{c}_{\text{Venus}}$ and that the set of planets is the denotation of $\mathsf{c}_{\text{planet}}$, allow us to infer that Mary's belief (p in formula F 4.10) is true if and only if Venus is a planet.

4.4.4 Logical Consequence

One of the reasons for having a notion of truth as a relation between an interpretation and a propositional concept ('$\Delta_r(M, p, \top)$') is that it allows us to define the notion

of logical consequence fairly easily. Logical consequence is involved in many normative requirements concerning belief and most other propositional attitudes and is consequently of great importance in the evaluation of interpretational hypotheses.

The relation of logical consequence ($\ulcorner$CONSEQ$\urcorner$) applies to a set of premisses (which are predicate concepts) and a supposed conclusion (which is a predicate concept) and may be defined as follows.

Definition 4.19

$$\forall P \forall c [\, \text{CONSEQ}(P, c) \equiv$$
$$(\, \forall p[p \in P \rightarrow \text{PREDCON}(p, 0)] \land \text{PREDCON}(c, 0) \land$$
$$\neg \exists M [\forall p[p \in P \rightarrow \Delta_r(M, p, \top)] \land \Delta_r(M, c, \bot)]]$$

4.4.5   Alethic Modality

Possibility and necessity, when understood as pertaining to alethic modality, are notions intimately related to the notion of truth. The most common way of defining necessity is to say that a proposition is necessarily true if and only if it is true relative to all possible worlds, whose counterparts in the present account are the concept extension interpretations, but as these are allowed to leave the extensions of concepts undefined, necessity in relation to propositional concepts is better defined by saying that a propositional concept is alethically necessary if there is no concept extension interpretation in relation to which it is false.

Definition 4.20

$$\forall p [\text{NECESSARY}(p) \equiv (\text{PREDCON}(p, 0) \land \neg \exists M [\Delta_r(M, p, \bot)])]$$

Alethic possibility is correspondingly defined as follows.

Definition 4.21

$$\forall p [\text{POSSIBLE}(p) \equiv (\text{PREDCON}(p, 0) \land \exists M [\Delta_r(M, p, \top)])]$$

However, these definitions are only adequate to the extent that alethic modality is taken to be a matter only of logical structure, but there may also be conceptual relations understood as imposing definite constraints on what is possible. For instance, it may be held that the following sentence expresses a necessary truth.

(4.4)   Every horse is an animal.

If we name the corresponding propositional concept '$p_{(4.4)}$', its properties will be described by formula F 4.13.

F 4.13 $\exists c_1 \exists c_2 \exists c_3 \exists c_4 [\, \Re_{\backsim}(c_{\mathsf{animal}}, c_1) \wedge \Re_{\times}(c_{\mathsf{horse}}, c_1, c_2) \wedge$
$$\Re_{\Sigma}(c_2, c_3) \wedge \Re_{\exists}(c_3, c_4) \wedge \Re_{\backsim}(c_4, p_{(4.4)})]$$

We may introduce a conceptual predicate $\ulcorner\textsc{concnec}\urcorner$ representing the property of being a conceptual necessity. We may then assert that $\textsc{concnec}(p_{(4.4)})$. Now, we may easily revise the definitions of alethic necessity and possibility in a way that prevents them from violating any of the conceptual necessities:

Definition 4.22

$\forall p [\, \textsc{necessary}(p) \equiv$
$\quad (\textsc{predcon}(p, 0) \wedge \neg \exists M [\forall q [\textsc{concnec}(q) \rightarrow \Delta_r(M, q, \top)] \wedge \Delta_r(M, p, \bot)])]$

Definition 4.23

$\forall p [\, \textsc{possible}(p) \equiv$
$\quad (\textsc{predcon}(p, 0) \wedge \exists M [\forall q [\textsc{concnec}(q) \rightarrow \Delta_r(M, q, \top)] \wedge \Delta_r(M, p, \top)])]$

4.5   Attitudes, Concepts, and Interpretation

What has been outlined here is a framework within which to state hypotheses about the propositional attitudes of people. It posits a network of concepts, which are associated with denotations and are related by a number of basic logical relations ($\ulcorner\Re_{\frown}\urcorner$, $\ulcorner\Re_{\overline{\frown}}\urcorner$, $\ulcorner\Re_{\Sigma}\urcorner$, $\ulcorner\Re_{\backsim}\urcorner$, $\ulcorner\Re_{\times}\urcorner$, $\ulcorner\Re_{\exists}\urcorner$, and $\ulcorner\Re_{A}\urcorner$). A number of constraints defines the logical properties of this system. The notion of "concept" is a primitive one: The concepts just serve as the nodes in this network.

There are also mental attitude relations that relate cognitive agents to concepts. Propositional attitude relations relate them to propositional concepts. As I will try to show in Chapter 6, there are also mental attitudes whose relata are individual concepts (e.g. "to think about Atlantis") or predicate concepts (e.g. "to seek a unicorn"). The system of concepts consequently provides a coherent system of possible attitude contents if the Chapter 6 analyses are tenable.

What gives "content" to concepts (which, *per se*, are unstructured objects) is their place in the network of other concepts, related logically to each other, to cognitive agents by means of attitude relations, and to other things by means of the denotation relation ($\ulcorner\Delta_a\urcorner$). In particular, I think that there is a presumption that certain of the

beliefs in which a concept is involved are taken to define which concept it is. Some of these beliefs may be considered "analytic truths" or "conceptual necessities" (see Section 4.4.5). For instance, that horses are animals may be considered an analytic truth, defining an important aspect of the concept of horse, whereas my belief that I have not seen any horse today is intuitively quite insignificant (accidental) in relation to the concept of horse. Which beliefs are considered conceptual necessities is a matter of decisions that impose restrictions on what is to count as possible with regard to these concepts. To give a definition is to make such a decision explicit, but we also impose such restrictions implicitly. Lexical semantics can, at least partially, be seen as a matter of which restrictions of this kind are associated with concepts. So, the distinction between "meaning" and accidental belief lies, I think, in the stability of the beliefs (and other attitudes) involved.

The concepts posited in this framework have some features that may seem somewhat artificial. One source of artificiality is the two conceptual relations derived from the PFLST inversion functors (i.e. $\ulcorner\Re_\frown\urcorner$ and $\ulcorner\Re_{\overline{\frown}}\urcorner$). The constraints associated with them require that there are different concepts corresponding to every permutation of a given predicate concept. For instance, any two-place non-symmetric relational concept is $\ulcorner\Re_\frown\urcorner$-related (and $\ulcorner\Re_{\overline{\frown}}\urcorner$-related) to another concept. The only difference between two concepts so related is, so to speak, the ordering of arguments. From the point of view of an informal understanding of concepts, this multiplicity may seem spurious, but it is however reflected in lexical semantics in numerous cases. Relations that are each other's converses correspond to concepts that are $\ulcorner\Re_{\overline{\frown}}\urcorner$-related. Examples of such pairs of relations are $\ulcorner<\urcorner$—$\ulcorner>\urcorner$, *stronger-than—weaker-than*, and *parent—child*, and *own—belong to*. Passivization may also be understood as corresponding to this semantic relation (cf. Allwood, Andersson, and Dahl [1977, p. 90]). Cartesian product concepts may also seem somewhat artificial. For instance, if c_{happy} is the concept of being happy and c_{love} the concept of loving, there is a concept c_{HL} such that $\Re_\times(c_{happy}, c_{love}, c_{HL})$. The concept c_{HL} then corresponds to the three-place relation holding of three entities whenever the first is happy and the second loves the third. This is hardly a concept in an intuitive sense. The theoretical notion of concept assumed here is probably wider that most notions of concept found in philosophical and linguistic theories, but from the viewpoint of an extensional semantics it is quite natural.

4.6 Comparisons with Other Approaches

We have now defined a set of constraints that restrict the structure of a system of concepts as it arises from the assumption that a certain collection of primitive concepts exist. This system will recapitulate the structure of PFLST, whose syntax defines an infinite language when a lexicon of non-logical constants is given. An important feature of the present proposal is that it characterizes the content in terms of concepts which are elementary entities in a network of concepts abiding by certain constraints. The formal theory does not say anything more about what concepts are. This approach to the semantics of propositional attitudes is therefore philosophically relatively neutral in the sense that it is not conjoined with the assumption that a semantic theory of this kind should take a stand on philosophical issues or provide arguments in favour of a particular metaphysics or epistemology. (However, the idea that such a separation is to some extent possible is, of course, in a sense, a philosophical one.)

The account proposed here has definite similarities with Frege's theory of Sinn and Bedeutung. Both theories assume the existence of an abstract system of content elements (Sinne or concepts), which are associated with denotations. Frege's theory is not very well worked out, and my proposal may be seen as one way of supplying some of the crucial details. However, several of Frege's assumptions have been rejected: The present theory is not committed to a Platonist conception of its ontology. Concepts are introduced by people to interpret people and do not belong to some third realm of timeless entities.

It is possible to view the present proposal as one belonging to the representationalist/sententialist tradition. The system of concepts is modeled after the syntax of PFLST in a way that associates a concept with each PFLST expression (given an appropriate lexicon whose elements stand in a one-to-one relation to the concepts). But, there is no requirement that each possible distinction between two PFLST expressions is to correspond to a distinction between two concepts. So, two PFLST expressions may be associated with the same concept. For instance, a doubly negated formula is distinct from the formula obtained by removing both negations, but they *may* be assumed to correspond to the same concept. (This amounts to denying that double negation in this case makes a difference in cognitive significance, but it would in a case where a cognitive agent is taken to fail to "see" that a double negation amounts to propositional identity.) This possibility shows that the constraints assumed here allow the concepts to be understood as being more abstract content representatives that PFLST expressions. However, it is possible to

add a few constraints that would establish a one-to-one correspondence between concepts and PFLST singular and predicate terms. This system would clearly be sententialist in character. However, the weaker system suggested here is compatible with a non-representationalist interpretation.

It would also be possible to add constraints to the present system that would in effect lead to the identification of concepts with intensions (in Carnap's [1956] sense). Each concept determines a (possibly partial) function from concept extension interpretations to possible denotations of this concept.[14] Of course, this function is not an object recognized in this framework, but it is implicitly there. Functions of this kind are comparable with intensions in Carnap's [1956] sense (functions from state descriptions/possible worlds to extensions). If we want to individuate concepts precisely as finely as intensions, we may achieve this by adding the constraint that two concepts are distinct if and only if their denotations differ with respect to some concept extension interpretation. This constraint may be expressed as formula F 4.14.

F 4.14 $\forall c_1 \forall c_2 [c_1 = c_2 \equiv \forall M \forall d [\Delta_r(M, c_1, d) \equiv \Delta_r(M, c_2, d)]]$

A similar constraint is actually imposed on primitive concepts (Constraint 4.23), which are distinct if and only if there is some concept extension interpretation relative to which their denotations differ.

These considerations show that the kind of analysis proposed here is quite eclectic, in the sense that it allows ideas from many different theoretical approaches to be accommodated. It represents, I think, a minimal framework within which all truth-conditionally semantic features of propositional attitude attribution statements may be accounted for. It is "minimal" in two senses: First, the present system involves a minimal ontology; apart from ordinary external world objects, it only recognizes set-theoretic constructs, concepts, and concept extension interpretations. (Concepts and interpretations could probably be defined in terms of sets.) Secondly, the account proposed here is minimal in the sense that it involves a very small number of psychological and philosophical assumptions. This is, of course, a matter of logical weakness, but I think it might be advantageous to discuss various aspects of propositional attitudes and the sentences used to describe them in terms of a comparatively uncommitted framework.

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[14] This function, F_c, could be defined as follows: It holds for every concept extension interpretation that $F_c(M) = d$, if $\Delta_r(M, c, d)$, otherwise $F_c(M)$ is undefined.

5

THE SEMANTICS OF PROPOSITIONAL CONTENT

5.1 Introduction

The framework suggested in the previous chapter will now be applied to the semantic analysis of *that*-clauses characterizing propositional contents. Intensional complements of other kinds will be discussed in the next chapter. From the point of view of a binary analysis of propositional attitude relations like the one defended in this book, the basic form of propositional attitude statements are those consisting of a cognitive agent subject, a propositional attitude verb, and a *that*-clause complement. In particular, the cognitive significance of words in *that*-clause complements and ambiguities between *de dicto* and *de re* readings and between non-specific and specific readings will be treated in this chapter. I will also discuss the analysis of multiply oblique constructions, anaphoric reference, and negative existence. (These kinds of semantic phenomena also occur in connection with many of the other kinds of intensional constructions discussed in Chapter 6.) Finally, I will briefly discuss the treatment of nouns and adjectives that may be read as standing for properties of propositional concepts.

5.2 That-Clauses as Direct Objects

The general idea behind the treatment suggested in the previous chapter is that a *that*-clause complement may be seen as a description of a propositional concept. The basic structure of this description is derived in the following way: The content

of the *that*-clause is given an ordinary first order analysis, which is expressed in PFLST. Primitive concepts corresponding to each non-logical constant (cf. Section 4.3.1), and non-primitive concepts corresponding to each composite predicate term are posited and the relations among these concepts are derived from the PFLST formula according to the principles set down in the previous chapter. The conceptual framework of Chapter 4 is intended to capture the internal significance of attitude contents, i.e. the logical structure they possess from the point of view of the mind to which they belong. The denotation relation ($\ulcorner \Delta_a \urcorner$) characterizes one aspect of their external significance, but the core structure of the conceptual system does however reflect internal significance.

Propositional attitude verbs are characterized by taking *that*-clauses as complements, which can be classified as direct objects (Quirk, Greenbaum, Leech, and Svartvik [1972, §11.17]). The analysis proposed here assumes that these clauses stand for a complex predicate applying to propositional concepts. So, an attitude report of the form "$X \ V$s T" will correspond to a logical form of the structure '$\exists p[V'(i_x, p) \wedge T'(p)]$', where X is a proper name denoting i_x, V is a propositional attitude verb, representing the propositional attitude relation $\ulcorner V' \urcorner$, and T is a *that*-clause representing the complex predicate $\ulcorner T' \urcorner$.

That-clauses are similar to declarative main clauses. The conjunction *that* is a mark of their status as subordinate clauses, but it may be omitted if the *that*-clause occurs as an object. (This seems to be a mark of a more informal style.) Quirk, Greenbaum, Leech, and Svartvik [1972, §11.17] call these clauses without a *that* "zero *that*-clauses". The semantic effect of this omission often seems to be imperceptible. However, in spoken communicative act reports the presence of a *that* is a sign that indirect speech is intended, but this conjunction may be absent both in direct and in indirect speech reports.

5.2.1   Direct and Indirect Speech

Two kinds of reports of what people say have traditionally been distinguished. First, there are reports involving direct speech (oratio recta), such as (5.1) and, secondly, there are reports involving indirect speech (oratio obliqua), such as (5.2) (cf. Quirk, Greenbaum, Leech, and Svartvik [1972, §11.74]).

(5.1)   'I am exhausted,' she complained.

(5.2)   She complained that she was very tired.

A direct speech report gives a more or less verbatim account of what was said. (The verb *complain* as used in (5.1) is then understood as standing for a relation between a person and a string of words.)

In indirect speech reports the content rather than the wording of an utterance is reported. (So, (5.1) and (5.2) may be true accounts of the same event.) The syntactic mark of this is that a *that*-clause is used, whereas there is no syntactic constraint on the relatum expression in a direct speech report. (Any string of words may occur in direct speech.) In the treatment suggested here indirect speech reports are analyzed in the same way as propositional attitude reports. This is motivated by the fact that *that*-clauses in indirect speech use behave with regard to failures of Leibniz' law and *de dicto/de re* ambiguity just as in reports of the content of propositional mental states. It is also motivated by the intimate connection between what can be said and what can be believed, intended, and desired (which can be seen as an explanation of the semantic facts just mentioned). It seems to be an important tenet of propositional attitude psychology that the content of propositional attitude states can be expressed by an utterance.

5.3 The Cognitive Significance of Proper Names

Let us begin by discussing two fairly simple attributions like (5.3) and (5.4).

(5.3)   Mary believes that Cicero was a roman.

(5.4)   Mary believes that Tully was a roman.

A token of (5.3) may be true in a sense that would not allow the name "Cicero" to be replaced by "Tully" (which names the same person) *salva veritate*. (A corresponding token of (5.4), would then be false, while (5.3) would be true.) The names "Cicero" and "Tully" are still two names of the same person. Examples of this kind led Frege to conclude that the semantic contribution of a name in contexts like those is something over and above what the name names. A Frege-style analysis would assume that there are two concepts involved in an attribution like (5.3): One is a concept of Cicero and the other one a predicate concept of having been a roman (fusing tense and romanhood to make things simpler). They may be called 'c_{Cicero}' and 'c_{roman}'. (I will not address the analysis and the possible readings of "roman" in this context until later. For the moment, we are concerned with proper names.) Further, there is a propositional concept and (5.3) says that Mary is *believe*-related to this concept.

The crucial feature of this propositional concept is that it is determined by the romanhood concept being applied to the Cicero concept, or, in the terms introduced above, that it is a p such that $\Re_A(c_{\mathsf{roman}}, c_{\mathsf{Cicero}}, p)$. These considerations suggest that formula F 5.1 captures the logical form of this reading of (5.3).

F 5.1 $\exists p[\mathsf{believe}(i_{\mathsf{Mary}}, p) \wedge \Re_A(c_{\mathsf{roman}}, c_{\mathsf{Cicero}}, p)]$

This logical form may help explain why believing that Cicero was a roman is not the same thing as believing that Tully was. The two names "Cicero" and "Tully" may be assumed to stand for two different individual concepts (denoting the same person). This situation is typical of *de dicto* attributions, whereas *de re* readings are not sensitive to the manner in which an individual is referred to. So, the corresponding *de dicto* reading of (5.4) would be:

F 5.2 $\exists p[\mathsf{believe}(i_{\mathsf{Mary}}, p) \wedge \Re_A(c_{\mathsf{roman}}, c_{\mathsf{Tully}}, p)]$

The difference between formula F 5.1 and formula F 5.2 accounts for the fact that (5.3) and (5.4) may be understood in a way that makes them non-equivalent.

We will shortly return to the *de dicto* reading, but first we may see how a *de re* reading is to be captured. What characterizes a *de re* reading of (5.3) is that the way in which Cicero is referred to is taken to be immaterial to its truth value. Substituting his name for another codesignative denoting phrase would leave the truth value of the attribution unchanged. This kind of reading is in the present framework best understood as saying that *any* concept denoting Cicero may be involved in Mary's belief. This idea would then yield a logical form like formula F 5.3.

F 5.3 $\exists p \exists c[\mathsf{believe}(i_{\mathsf{Mary}}, p) \wedge \Re_A(c_{\mathsf{roman}}, c, p) \wedge \Delta_a(c, i_{\mathsf{Cicero}})]$

This logical form (formula F 5.3) avoids reference to any particular Cicero concept. The propositional concept is characterized as standing in a certain conceptual relation to some concept denoting Cicero, and formula F 5.3 may count as giving the logical form of the *de re* readings of both (5.3) and (5.4).

A problem with the analysis of the *de dicto* reading embodied in a logical form like formula F 5.1 is that it assumes that a particular concept is referred to. Now, any name naming a fixed entity may in principle stand for any number of concepts. So, is it not possible to use (5.3) *de dicto* without being able to refer to a particular Cicero concept? It seems that we may use (5.3) to make a belief attribution *de dicto* without being able to say more about her Cicero (or perhaps it is better to write "Cicero") concept than that it is a Cicero concept. (I will shortly return to the issue

of what makes a concept a *Cicero* concept). If this is true, we should eliminate the reference to the concepts in formula F 5.1, formula F 5.2 and formula F 5.3 (presupposing that all three concepts should be handled in a similar manner). This might be done in the way represented by formula F 5.4 (the *de dicto* reading of (5.3)), formula F 5.5 (the *de dicto* reading of (5.4)), and formula F 5.6 (the *de re* readings of (5.3) and (5.4)).

F 5.4 $\exists p \exists c_1 \exists c_2 [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge \mathcal{C}_{\mathsf{roman}}(c_1) \wedge \mathcal{C}_{\mathsf{Cicero}}(c_2)]$

F 5.5 $\exists p \exists c_1 \exists c_2 [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge \mathcal{C}_{\mathsf{roman}}(c_1) \wedge \mathcal{C}_{\mathsf{Tully}}(c_2)]$

F 5.6 $\exists p \exists c_1 \exists c_2 [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge \mathcal{C}_{\mathsf{roman}}(c_1) \wedge \Delta_a(c_2, \mathsf{i}_{\mathsf{Cicero}})]$

Here, three conceptual predicates, $\ulcorner \mathcal{C}_{\mathsf{Cicero}} \urcorner$, $\ulcorner \mathcal{C}_{\mathsf{Tully}} \urcorner$, and $\ulcorner \mathcal{C}_{\mathsf{roman}} \urcorner$, have been introduced. They stand for the properties of being a Cicero concept, a Tully concept, and a romanhood concept, respectively. This analysis would allow us to describe the potential cognitive difference between two codesignative names in terms of their representing two different properties of concepts ($\ulcorner \mathcal{C}_{\mathsf{Cicero}} \urcorner$ and $\ulcorner \mathcal{C}_{\mathsf{Tully}} \urcorner$, respectively).

Now, is it plausible that a language user makes a distinction between Cicero and Tully concepts, when he intends a belief attribution like (5.3) to be understood *de dicto*? In some sense I think it is. He may claim that Mary believes that Cicero was a roman and deny that Mary believes that Tully was a roman. Frege's analysis is that two names are taken to correspond to two different ways of knowing Cicero. However, we do not have to follow him in assuming that they directly correspond to two concepts. By introducing conceptual properties like $\ulcorner \mathcal{C}_{\mathsf{Cicero}} \urcorner$ and $\ulcorner \mathcal{C}_{\mathsf{Tully}} \urcorner$, we can associate a name with a *kind* of concept. So, this analysis connects names (understood *de dicto*) with conceptual properties.

Now, the question arises: Wherein do these conceptual properties consist? In the "Cicero"/"Tully" case the difference may plausibly be assumed to consist in Cicero's being known as "Cicero" in the first case and as "Tully" in the second. Partee [1982] calls readings of this kind "metalinguistic". This way of explaining differences in cognitive significance between two codesignative names is not plausible in all cases (but I think it is in the "Cicero"/"Tully" case). In a case like (5.5), another account is called for.

(5.5)   A babylonian discovered that Phosphorus is Hesperus.

A babylonian might very well have discovered that Phosphorus is Hesperus without being the least acquainted with the two names "Hesperus" and "Phosphorus". It is nevertheless intuitively possible to make a distinction between his Hesperus and his Phosphorus concepts. This speaks in favour of rendering the logical form of (5.5) as formula F 5.7.

F 5.7 $\exists i \exists p \exists c_1 \exists c_2 \exists c_3 [\, \mathsf{babylonian}(i) \wedge \mathsf{discovered}(i,p) \wedge \Re_A(\mathsf{c}_\equiv, c_1, c_2) \wedge$
$\qquad\qquad \Re_A(c_2, c_3, p) \wedge \mathcal{C}_{\mathsf{Hesperus}}(c_1) \wedge \mathcal{C}_{\mathsf{Phosphorus}}(c_3)\,]$

In this case we are led to assume that the distinction between the Phosphorus and Hesperus concepts is not made in terms of knowledge of the names. Rather, "Phosphorus" is the name of Venus as it appears star-like in the morning, while "Hesperus" is associated with its evening appearance. In this way the possible cognitive differences between "Phosphorus" and "Hesperus", between "the Morning Star" and "the Evening Star", and between "die Morgenstern" and "die Abendstern" amount to the same. The names are again associated with different ways of identifying the object, with different modes of presentation, but these do not involve the names as in the "Cicero"/"Tully" case. Examples of this kind prompted Quine [1979] to divide readings *de dicto* into two kinds: *de voce* and *de sensu*. Readings *de voce* are sensitive to the specific choice of word and take a propositional attitude attribution to be made in terms of this word. So, if Mary believes *de voce* that Tully denounced Catiline, she has associated this information with these very names. Readings *de sensu* are only sensitive to the meaning of a word, in the sense that "Phosphorus", "the Morning Star", and "die Morgenstern" may be taken to be names with the same meaning.

Pairs of codesignative proper names, that in this way are conventionally associated with different descriptions of the object named, are not very common. In most cases where a cognitively significant difference obtains between two names, this is a matter of *ad hoc* contextual features that do not correspond to any conventionally established semantic properties of the two names. But the distinction between "Phosphorus" and "Hesperus" seems to be a matter of conventional meaning: To know how to use these names in a conventional way involves knowing that "Phosphorus" is the name of a certain celestial body *as it appears in the morning*, and that "Hesperus" is the name of the same object *as it appears in the evening*. But in general, which conceptual distinction two names are intended to express is not determined by reference to conventionally established semantic factors. This means that few names may occur *de sensu*.

The distinction between *de voce* and *de sensu* has to do with how we understand the conceptual predicates we have associated with proper names in the scope of an attitude verb being understood *de dicto*. This means that this distinction is not reflected in the logical forms assigned to sentences like (5.3), (5.4), and (5.5).[1]

5.3.1 Direct Reference

Many philosophers have argued that proper names and indexical expressions are directly referential and that they enter into the contents of propositional contents without there being concepts (or Sinne, or modes of presentation) to mediate this connection (cf. Section 3.12). The analysis proposed here assumes that concepts are always involved, but this assumption can be withdrawn without radical changes in the system.

According to the approach that is preferred here, a propositional attitude which is reported as being *de re* with respect to a certain entity, e, has this property only in virtue of being directed towards a propositional concept that is conceptually related in a denotation-constraining way to an individual concept c denoting e. Individual concepts enter into denotation-constraining relations with propositional concepts by being related to them by the relation $\ulcorner \Re_A \urcorner$, corresponding to the application of a predicate concept to an individual concept. (I will shortly mention some arguments in support of this solution.) It would however be possible to eliminate the need for mediating individual concepts by introducing a paraconceptual relation that directly applies a predicate concept to an individual (instead of to a *concept*). This relation could be called '$\Re_{AD}$', and with this symbol in store we could render the logical form of the *de re* reading of (5.3) as formula F 5.8.

F 5.8 $\exists p \exists c [\mathsf{believe}(\mathsf{i_{Mary}}, p) \wedge \mathcal{C}_{\mathsf{roman}}(c) \wedge \Re_{AD}(c, \mathsf{i_{Cicero}}, p)]$

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[1] In order to preserve intuitions concerning possible truth distributions, we must assume that all Cicero, Tully, Hesperus, and Phosphorus concepts denote what they are supposed to do. We may express this in the following ways:

$$\forall c [\mathcal{C}_{\mathsf{Cicero}}(c) \rightarrow \Delta_a(c, \mathsf{i_{Cicero}})]$$
$$\forall c [\mathcal{C}_{\mathsf{Tully}}(c) \rightarrow \Delta_a(c, \mathsf{i_{Cicero}})]$$
$$\forall c [\mathcal{C}_{\mathsf{Phosphorus}}(c) \rightarrow \Delta_a(c, \mathsf{i_{Venus}})]$$
$$\forall c [\mathcal{C}_{\mathsf{Hesperus}}(c) \rightarrow \Delta_a(c, \mathsf{i_{Venus}})]$$

The introduction of '$\Re_{AD}$' allows us to view formula F 5.6 as an alternative to formula F 5.8.

Some additional constraints should be imposed on the paraconceptual relation '$\Re_{AD}$'. First, some combinatorial constraints must be set down:

Constraint 5.1

$$\forall c_1 \forall c_2 \forall i [\Re_{AD}(c_1, i, c_2) \rightarrow \exists n [\text{PREDCON}(c_1, n+1) \wedge i \in D_\Delta \wedge \text{PREDCON}(c_2, n)]]$$

Constraint 5.2

$$\forall c_1 \forall i \forall n [(\text{PREDCON}(c_1, n) \wedge n \geq 1 \wedge i \in D_\Delta) \rightarrow \exists c_2 [\Re_{AD}(c_1, i, c_2)]]$$

Then we need a constraint defining the way in which the '$\Re_{AD}$' relation determines denotation.

Constraint 5.3

$$\forall M \forall c_1 \forall c_2 \forall i [\Re_{AD}(c_1, i, c_2) \rightarrow \\ \forall d_1 [\Delta_r(M, c_1, d_1) \rightarrow \exists d_2 [\Delta_r(M, c_2, d_2) \wedge ((i \in d_1 \wedge d_2 = \top) \vee \\ (i \notin d_1 \wedge d_2 = \bot) \vee \\ \text{APPL}(d_1, i, d_2))]]]]$$

Compare Constraint 4.31. The point of this excursus is to demonstrate that a decision between direct and non-direct reference does not need to have any far-reaching consequences with regard to the formal details of the present system. As we see, both ways of viewing reference may be accommodated.

The possibility of understanding tokens of sentences like (5.3) and (5.4) in a way that makes them truth-conditionally non-equivalent speaks against a general direct reference theory of names. However, the idea that *de re* attitude reports involve direct reference along the lines of formula F 5.8 is, as far as I can see, tenable, but some circumstances speak against adopting this strategy within the present approach. First, an attitude that is reported *de re* may in principle also be reported *de dicto*, in which case a mediating individual concept has to be posited anyway. Secondly, the picture without direct reference seems to me tidier: There are concepts among which the basic logical relations obtain and there is a denotation relation that relates concepts to what they stand for. The $\lceil \Re_{AD} \rceil$ relation is an unnecessary and complicating addition to this picture.

Another argument against the direct reference account has to do with the definition of logical consequence in Section 4.4.4. It is possible for a person to have two beliefs reported *de re* as an affirmation and a negation of the same possible fact

without really being contradictory. Consider Quine's [1956] Ralph, who has formed two different Ortcutt concepts and who may be said to believe both that Ortcutt is a spy and that Ortcutt is not a spy. The direct reference picture above will not allow that there is a concept extension interpretation that allows both beliefs to be true (because the two Ortcutt concepts drop out of the picture). However, if we assume that the contents of the two beliefs involve two individual concepts, it is logically possible that they denote two different individuals, and Ralph's two beliefs do not come out as contradictory.

The formula F 5.8, exploiting the $\ulcorner \Re_{AD} \urcorner$ relation, is simpler than formula F 5.6. So, the direct $\ulcorner \Re_{AD} \urcorner$ relation makes the logical form formulae of *de re* readings simpler. This advantage may however be preserved without our committing ourselves to direct reference. A $\ulcorner \Re_{AD} \urcorner$ relation may simply be defined in terms of conceptual denotation ($\ulcorner \Delta_a \urcorner$) and conceptual application ($\ulcorner \Re_A \urcorner$), as follows:

F 5.9 $\forall c_1 \forall c_2 \forall i [\Re_{AD}(c_1, i, c_2) \equiv \exists c_3 [\Delta_a(c_3, i) \wedge \Re_A(c_1, c_3, c_2)]]$

If $\ulcorner \Re_{AD} \urcorner$ is introduced as a non-primitive relation in this way, formula F 5.8 may simply be seen as an abbreviated version of formula F 5.6. In this way we may preserve the notational advantages of $\ulcorner \Re_{AD} \urcorner$, without having to buy the theoretical disadvantages of direct reference. It should be pointed out that the question of which kinds of non-primitive notions could be defined in order to improve clarity and readability has not been addressed here. It can, however, be expected that a suitable inventory of non-primitive notions would greatly facilitate a practical application of this system.

5.4   The Cognitive Value of Predicate Words

Also in relation to predicate words (i.e. nouns, adjectives and verbs standing for predicates of various degrees) occurring in *that*-clause complements to propositional attitude attributions, a number of interpretational possibilities may be discerned. A *de re* reading of a name in this kind of context amounts to supposing that the corresponding individual concept involved in the propositional attitude just has the denotation in common with the name. Predicate words are also open to a reading of this kind: In relation to (5.3) (whose logical form is rendered by formula F 5.4), it would imply that the property concept involved in Mary's belief just has the denotation in common with the "roman" predicate. The idea that a romanhood

concept is any concept that denotes the set of romans could be expressed in formal terms as in formula F 5.10

F 5.10 $\forall c[\mathcal{C}_{\mathsf{roman}}(c) \equiv \forall d[\Delta_a(c,d) \equiv \forall x[x \in d \equiv \mathsf{roman}(x)]]]$

However, we do not need to understand property concepts as being classified solely in terms of their denotations. Other factors may also be taken to be crucial, such as which beliefs they are involved in. However, this is a matter of how we understand the conceptual property (e.g. $\ulcorner\mathcal{C}_{\mathsf{roman}}\urcorner$) associated with a property word, and it does not pertain to logical form. This analysis suggests that the ambiguity between meta-perspectival and object-perspectival readings (p. 43) of property words in the scope propositional attitude verbs concerns how we understand the conceptual property associated with a property word and not the logical form of sentences.

5.5 Quantified Phrases in That-Clause Complements

Quantified noun phrases in the *that*-clause complement of a propositional attitude ascription sentence are ambiguous in a number of ways. Consider sentence (5.6).

(5.6)   Mary believes that all dogs are dangerous.

There seems to be at least two possible ways of reading the universal quantification in (5.6): One may be called the narrow scope reading and the other the wide scope reading. (When the scope of the universal quantification is narrow, the scope of the attitude verb is wide, and when the scope of universal quantification is wide, the scope of the verb is narrow.) The narrow reading may be rendered as formula F 5.11 (supposing the doghood and dangerousness concepts to be named).

F 5.11 $\exists p \exists c_1 \exists c_2 \exists c_3 \exists c_4 [\,\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_{\sim}(\mathsf{c}_{\mathsf{dog}}, c_1) \wedge \Re_{\times}(\mathsf{c}_{\mathsf{dangerous}}, c_1, c_2) \wedge$
$\Re_{\Sigma}(c_2, c_3) \wedge \Re_{\Box}(c_3, c_4) \wedge \Re_{\sim}(c_4, p)\,]$

In this reading, the universal quantification is part of the propositional concept that forms the content of Mary's belief. It is consequently a belief which she may express by uttering the sentence "all dogs are dangerous". The other reading does not take the universal quantification to be a part of Mary's belief. Rather, it corresponds to ascribing a large number of beliefs to Mary. In relation to any arbitrarily chosen dog, Mary is, so to speak, said to believe that it is dangerous. (This reading suggests that the quantification is to be understood in a sense weaker than the literal one—such

as "Mary believes that every dog she meets is dangerous", or something similar—, but I ignore this complication[2] here.) The logical form of this reading may then be rendered as:

F 5.12 $\forall x[\mathsf{dog}(x) \rightarrow \exists p \exists c[\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A(c, \mathsf{c}_{\mathsf{dangerous}}, p) \wedge \Delta_a(c, x)]]$

Again, things are simplified by the assumption that there is a named dangerousness concept (called 'c$_{\mathsf{dangerous}}$'). When it comes to existentially quantified noun phrases, there is again a narrow and a wide scope reading. A case in point is the sentence (5.7), which was discussed in Section 3.5.

(5.7)   Mary thinks that a quadruped is running.

The wide scope reading (remember that this refers to the scope of the quantification), also called the *de re* reading, is rendered by:

F 5.13 $\exists x \exists p \exists c[\mathsf{quadruped}(x) \wedge \mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A(\mathsf{c}_{\mathsf{running}}, c, p) \wedge \Delta_a(c, x)]$

This reading simply says that there is a quadruped which Mary thinks is running, in a sense that allows that Mary does not believe that it is a quadruped.

The formula F 5.14 captures the narrow scope reading of (5.7).

F 5.14 $\exists p \exists c_1 \exists c_2[\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_{\times}(\mathsf{c}_{\mathsf{quadruped}}, \mathsf{c}_{\mathsf{running}}, c_1) \wedge \Re_{\Sigma}(c_1, c_2) \wedge \Re_{\exists}(c_2, p)]$

This formula is perhaps easier to understand if it is considered that the logical form of "Some dogs are dangerous" is rendered as 'P$_{\mathsf{dog}}$P$_{\mathsf{dangerous}}\times\Sigma$]' in PFLST notation. The quantification is part of the propositional concept involved in the belief. This is therefore a non-specific *de dicto* report. Mary is just said to think that some (possibly completely unknown) quadruped is running.

There is also a specific *de dicto* reading of (5.7). It takes her to think that a specific quadruped, known by her, is running. This reading is rendered by formula F 5.15.

F 5.15 $\exists p \exists c_1 \exists c_2 \exists c_3[\,\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_{\times}(\mathsf{c}_{\mathsf{quadruped}}, \mathsf{c}_{\mathsf{running}}, c_1) \wedge$
$$\Re_{\Sigma}(c_1, c_2) \wedge \Re_A(c_2, c_3, p)]$$

This logical form takes the specificity of Mary's thought to amount to an individual concept's being involved in it. If we assume that it corresponds to an individual, to be called 'i$_{\times}$', we may express the content of this thought by 'P$_{\mathsf{quadruped}}$P$_{\mathsf{running}}\times\Sigma\mathsf{i}_{\times}$' (compare the previous paragraph). From this PFLST formula we derive the conceptual relationships exhibited in formula F 5.15.

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[2] This kind of implicitly restricted reading of universal quantification is ubiquitous, and is hardly a phenomenon that is more common in propositional attitude contexts.

5.6   Attitudes De Se

As we saw in Section 3.12.2, many philosophers have pointed out that there is a particular kind of relation *de re* that might obtain between a propositional attitude and the cognitive agent who entertains it. It holds in those cases where the cognitive agent identifies this *re* with himself, in the sense that he identifies this *re* with what he takes to be the referent of the first person singular pronoun in his speech. Attitudes of this kind are said to be *de se*. A person may also hold attitudes *de re* towards himself, without (in a sense) realizing that they are directed towards himself. Such attitudes are not *de se*. For instance, a person may see himself in a mirror and he may note that the person he sees wears a blue shirt. He may further have forgotten that he wears a blue shirt and think that his shirt is red. He may point to the man in the mirror and correctly say: "He wears a blue shirt". He may also sincerely say: "I wear a red shirt". We are now justified in saying that this person believes both that he wears a blue shirt and that he wears a red shirt. Both beliefs are reported *de re*, but only the latter is *de se*. (It also happens to be false.) He has two individual concepts, and an external observer may discover that they denote the same person. Now, it seems that each normal cognitive agent has one and only one *de se* concept of himself. (Having several *de se* concepts would amount to a split personality.)[3] He may also form other concepts of himself, but only one has the privileged status of being the *de se* one. It occupies a unique position in the attitude system of a cognitive agent and we may therefore assume that it stays the same through his life. (A person will however continually change his propositional attitudes towards the propositions determined by his *de se* concept.)

   We may introduce a paraconceptual relation, represented by '$\mathcal{C}_{de\text{-}se}$', that is taken to hold between any cognitive agent and his *de se* concept. An important constraint on this relation would be that a *de se* concept denotes its "owner":

Constraint 5.4

$$\forall i \forall c [\mathcal{C}_{de\text{-}se}(i, c) \rightarrow \Delta_a(c, i)]$$

We may also add a uniqueness constraint. A person has only one *de se* concept:

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[3] If a person regularly at some times associates a set of properties with his *de se* self and at other times another set of properties to it, it seems that we are dealing with a kind of split personality. This person has, in a sense, two minds. Locke's (*Essay concerning Human Understanding*, [1690, Bk. 2, Ch. 27, §§ 9–11]) criterion of *personal identity* is based on this idea.

Constraint 5.5

$$\forall i \forall c_1 \forall c_2 [(\mathcal{C}_{de\text{-}se}(i, c_1) \wedge \mathcal{C}_{de\text{-}se}(i, c_2)) \rightarrow c_1 = c_2]$$

The introduction of *de se* concepts allows us to make a distinction in logical form between propositional attitude attributions which are *de re* with respect to the cognitive agent to whom the attitude is ascribed without necessarily being *de se* and *de se* attributions. We may illustrate this in relation to a sentence like (5.8), where "Mary" and "she" are presupposed to be coreferential.

(5.8)   Mary thinks that she is stupid.

The weaker *de re* reading is rendered by:

F 5.16 $\exists p \exists c [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A (\mathsf{c}_{\mathsf{stupid}}, c, p) \wedge \Delta_a(c, \mathsf{i}_{\mathsf{Mary}})]$

This reading does not exclude that the *de se* reading is true. The *de se* reading would be represented by the following logical form:

F 5.17 $\exists p \exists c [\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \Re_A (\mathsf{c}_{\mathsf{stupid}}, c, p) \wedge \mathcal{C}_{de\text{-}se}(\mathsf{i}_{\mathsf{Mary}}, c)]$

It is easily seen that formula F 5.17 and Constraint 5.4 together imply that formula F 5.16 is true. The weaker reading (formula F 5.16), but not the stronger one (formula F 5.17), would be true in a situation where Mary is reading a paper she herself has written and thinking that the author of this paper is stupid without realizing that she herself is the author. (She might have forgotten that she wrote it.)

Apart from a *de se* concept, the conceptual system of a person's mind must also be assumed to contain another essentially indexical concept, namely a *now* concept. It is quite natural, I think, to view the denotation of this concept as being a function of time (the identity function). In the same way as an attitude *de re* towards oneself does not need to be *de se*, attitudes *de re* towards the present moment of time does not need to involve the *now* concept. The following kind of example will illustrate this. Mary may competently and sincerely have asserted that November, 8th is Frege's birthday, someone may have heard this and on November, 8th he may truthfully say that Mary thinks that Frege's birthday is today. However, at the same time as he says this Mary may believe that it is November, 7th and she would not assent to the statement "Frege's birthday is today". We are now in this situation justified in holding that Mary believes both that Frege's birthday is today and that Frege's birthday is not today. The former belief is an attitude *de re* towards today, but does not involve her *now* concept, while the latter belief involves this concept. I assume

that the notion of *today* is to be understood as the calendar day that contains the *now* moment of time. (I am assuming that we quantify over stretches of time.) So, if we take '$P_{birthday}$' to stand for the relation between a person and any of his birthdays, and 'P_{tin}' to stand for the relation of temporal inclusion, we may render the logical form of the statement "Frege's birthday is today" as '$P_{tin} \frown t_{now} P_{birthday} i_{Frege} \times \Sigma$⟧', '$t_{now}$' standing for the *now* moment of time that is supplied by the context. For the sake of illustration, some lexical "decomposition" has been performed and the *today* concept has been analyzed as a day in which the *now* point of time is included.[4] Now, this PFLST formula will indicate how we are to analyze the following statement (5.9).

(5.9)   Mary believes that Frege's birthday is today.

To give an adequate analysis of this statement we will have to add an argument indicating time to the predicates represented by 'believe' and 'Δ_a'. (Above, the temporal aspect has been ignored to simplify things.)

F 5.18 $\exists p \exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists c_5 \exists c_6 \exists c_7 \exists c_8 [\, \mathsf{believe}(i_{Mary}, p, t_{now}) \wedge \Re_\frown(c_{tin}, c_1) \wedge$
$$\Re_A(c_1, c_2, c_3) \wedge \Re_A(c_{birthday}, c_4, c_5) \wedge$$
$$\Re_\times(c_3, c_5, c_6) \wedge \Re_\Sigma(c_6, c_7) \wedge \Re_\beth(c_8, p) \wedge$$
$$\Delta_a(c_2, t_{now}, t_{now}) \wedge \Delta_a(c_4, i_{Frege}, t_{now})]$$

This analysis represents the reading of (5.9) that does not identify today as the denotation of Mary's *now* concept. (It is *de re* with respect both to Frege and the time of utterance.) In the scenario suggested above, this reading makes (5.9) true. There is however the stronger reading, that would reflect her sincere and competent assent to "Frege's birthday is today" and which would make reference to Mary's *now* concept. This stronger reading describes a state of affairs that does not obtain in the imaginary situation sketched above. If we assume that the *now* concept is denoted by 'c_{now}', we may render the logical form corresponding to this reading of (5.9) as:[5]

F 5.19 $\exists p \exists c_1 \exists c_3 \exists c_4 \exists c_5 \exists c_6 \exists c_7 \exists c_8 [\, \mathsf{believe}(i_{Mary}, p, t_{now}) \wedge \Re_\frown(c_{tin}, c_1) \wedge$
$$\Re_A(c_1, c_{now}, c_3) \wedge \Re_A(c_{birthday}, c_4, c_5) \wedge$$
$$\Re_\times(c_3, c_5, c_6) \wedge \Re_\Sigma(c_6, c_7) \wedge$$
$$\Re_\beth(c_8, p) \wedge \Delta_a(c_4, i_{Frege}, t_{now})]$$

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[4] I do not however wish to suggest that the two issues of lexical meaning and sentence logical form should be mixed up in this way.

[5] In order to simplify comparison with the logical form of the other reading, the numbering of the variables corresponds to that of formula F 5.18.

Again, we must assume that the denotation of a concept with a privileged status of the kind occupied by the *now* and by *de se* concepts is restricted in an essential way. The following constraint may be compared with Constraint 5.4.

Constraint 5.6

$$\forall t[\Delta_a(c_{now}, t, t)]$$

This constraint and the stronger reading of (5.9) (i.e. formula F 5.19) taken together imply the weaker reading of the same sentence (i.e. formula F 5.18). The advantage of allowing a concept with continuously changing denotation is that it eliminates the need to assume that there is a unique *now* concept correlated with every moment of time. (Frege's theory is committed to such a sequence of Sinne.) This solution will force us to recognize that denotation is time-sensitive: Concepts determined by the c_{now} concept may have different denotations at different times. Another solution would be to assume that there is a unique *now* concept associated with each moment of time. This move would turn denotation into a relation that is not time-sensitive. (This would be a more Fregean approach.)

It seems that all other indexically defined concepts somehow are defined in terms of the *now* and *de se* concepts, and of non-indexical concepts, which is plausible in view of the fact that the *de se* concept gives the spatial and the *now* concept the temporal location of a cognitive agent. For instance, *here* may be defined as the location of *I now* (but *now* cannot be defined as *I here*, because I have been here many times).

5.7   Multiply Oblique Constructions

A propositional attitude attribution clause may occur as the *that*-clause complement of a superordinate attitude ascription, for instance, as in (5.10).

(5.10)   James believes that Mary thinks that Fido is dangerous.

I will show that the approach to the analysis of propositional attitude attribution sentences suggested here is applicable also to this case. We will also notice that the kind of analysis suggested in this book will lead us to recognize that sentences like (5.10) have a considerable number of readings.

The logical form of the *that*-clause (i.e. of "Mary thinks that Fido is dangerous") of (5.10) could look something like:

F 5.20 $\exists p \exists c_1 \exists c_2 [\mathsf{think}(i_{\mathsf{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge \mathcal{C}_{\mathsf{dangerous}}(c_1) \wedge \mathcal{C}_{\mathsf{Fido}}(c_2)]$

This reading is *de dicto* with respect to Fido. The different possible ways of reading the *that*-clause corresponds to different beliefs being attributed to James. The formula F 5.20 reads as '$\mathsf{P}_{\mathsf{think}} i_{\mathsf{Mary}} \mathcal{C}_{\mathsf{Fido}} \mathcal{C}_{\mathsf{dangerous}} \Re_A \times \Sigma] \times \Sigma] \times \Sigma]$' in PFLST notation. If we assume that the content of the belief reported in (5.10) is given by this formula and understand (5.10) *de dicto* with regard to "Mary", we arrive at the following logical form for (5.10).

F 5.21 $\exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists c_5 \exists c_6 \exists c_7 \exists c_8 \exists c_9 \exists c_{10}$
$\exists c_{11} \exists c_{12} \exists c_{13} [\, \mathsf{believe}(i_{\mathsf{James}}, c_1) \wedge \Re_{\mathsf{J}}(c_2, c_1) \wedge \Re_{\Sigma}(c_3, c_2) \wedge$
$\Re_{\mathsf{x}}(c_{13}, c_4, c_3) \wedge \Re_{\mathsf{J}}(c_5, c_4) \wedge \Re_{\Sigma}(c_6, c_5) \wedge$
$\Re_{\mathsf{x}}(c_{12}, c_7, c_6) \wedge \Re_{\mathsf{J}}(c_8, c_7) \wedge \Re_{\Sigma}(c_9, c_8) \wedge$
$\Re_{\mathsf{x}}(c_{11}, c_{10}, c_9) \wedge \mathcal{C}_{\Re_A}(c_{10}) \wedge \mathcal{C}^{\mathbf{2}}_{\mathsf{dangerous}}(c_{11}) \wedge$
$\mathcal{C}^{\mathbf{2}}_{\mathsf{Fido}}(c_{12}) \wedge \mathcal{C}_{\mathsf{Mary}}(c_{13}) \wedge \mathcal{C}_{\mathsf{think}}(c_{14})$

The sentence (5.10) has been analyzed in precisely the same way as sentences not involving doubly oblique constructions. The *that*-clause content has been given a first-order analysis and its content has been characterized in terms of concepts and conceptual relations. What is new in this case is that the *that*-clause content itself is rendered in conceptual terms, i.e. is accommodated in the way suggested in Chapter 4. So, this analysis (formula F 5.21) assumes that there are concepts corresponding to some of the conceptual relations. $\ulcorner \mathcal{C}_{\Re_A} \urcorner$ is consequently the property of being a concept of the $\ulcorner \Re_A \urcorner$ relation. Further, **meta-conceptual** properties are introduced. $\ulcorner \mathcal{C}^{\mathbf{2}}_{\mathsf{Fido}} \urcorner$ is the property of being a concept of the property of being a Fido concept.[6] ($\ulcorner \mathcal{C}^{\mathbf{2}}_{\mathsf{dangerous}} \urcorner$ is understood accordingly.)

Note that we have only explored one possible reading of (5.10). However, the present kind of analysis suggests that reports about propositional attitudes that are about other propositional attitudes are many-ways ambiguous. For instance, let us consider just one word in (5.10), namely "Fido". There seem to be the following interpretational possibilities:

> (1) "Fido" is understood *de re* relatively to *thinks* and *de re* relative to *believes*.

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[6] The $\ulcorner \mathcal{C}^{\mathbf{2}}_{\mathsf{Fido}} \urcorner$ property is intended to abide by the following constraint:

$\forall c [\mathcal{C}^{\mathbf{2}}_{\mathsf{Fido}}(c) \equiv \forall d [\Delta_a(c, d) \equiv \forall x [x \in d \equiv \mathcal{C}_{\mathsf{Fido}}(x)]]]$

(2) "Fido" is understood *de re* relatively to *thinks* but *de dicto* relative to *believes*.

(3) "Fido" is understood *de dicto* relatively to *thinks* and the existence of a Fido concept is understood *de re* relative to *believes*.

(4) "Fido" is understood *de dicto* relatively to *thinks* and the existence of a Fido concept is understood *de dicto* relative to *believes*.

Most other (content) words generate similar series of ambiguities and the interpretational possibilities associated with each word are multiplied accordingly. This is consequently a very fine-grained analysis. However, I think the distinctions made make sense and that these ambiguities should not be rejected as spurious. A sentence like (5.10) is perhaps not experienced as highly ambiguous, but I think this is due to the circumstance that sentences are almost always used in contexts that substantially reduce the number of possible readings. We usually understand a sentence by imagining a context in which it is used and we become aware of ambiguities by considering it in another imaginary context of use.

5.8   Concepts and Anaphoric Reference

Pronouns are often used to refer back to entities referred to earlier in the discourse. Some of these cases are interesting from the point of view of the analysis of propositional attitude attribution semantics, especially those where a pronoun and its antecedent are found on different sides of a border between oblique and referentially transparent discourse.

The simplest case of this kind occurs when one of two coreferring terms is found in an oblique context and the other one is placed in a referentially transparent position. An example of this kind is (5.11).

(5.11)   Fido is a dog and Mary thinks that he is dangerous.

In a case like this it seems that Mary's attitude must be *de re* towards Fido. It is characterized as being directly about Fido and nothing is said or implied about how she thinks about Fido. The pronoun is the speaker's way of referring to Fido. It is, for instance, not possible to use "she" instead of "he" to indicate that Mary thinks that Fido is a she-dog. So, the logical form of (5.11) plausibly appears as:

F 5.22 $\mathsf{dog}(\mathsf{i_{Fido}}) \wedge \exists p \exists c [\mathsf{think}(\mathsf{i_{Mary}}, p) \wedge \Re_A(\mathsf{c_{dangerous}}, c, p) \wedge \Delta_a(c, \mathsf{i_{Fido}})]$

Another interesting case is the one represented by a sentence like (5.12).

(5.12)   James thinks that Fido is a groundhog, but Mary thinks that he is a dog.

Here, the antecedent of a pronoun in a *that*-clause complement is found in another oblique context. In this case, both a *de re* and a *de dicto* reading is possible. The *de re* reading would look something like:

F 5.23 $\exists p \exists c [\mathsf{think}(\mathsf{i}_{\mathsf{James}}, p) \land \Re_A(\mathsf{c}_{\mathsf{groundhog}}, c, p) \land \Delta_a(c, \mathsf{i}_{\mathsf{Fido}})] \land$
$\qquad\quad \exists p \exists c [\mathsf{think}(\mathsf{i}_{\mathsf{Mary}}, p) \land \Re_A(\mathsf{c}_{\mathsf{dog}}, c, p) \land \Delta_a(c, \mathsf{i}_{\mathsf{Fido}})]$

This is simply the conjunction of two belief attributions which are *de re* towards the same individual. There is also a *de dicto* reading of (5.12), which would be compatible with a situation in which James and Mary are mistaken about the existence of Fido. They have formed an idea of Fido, but there is no Fido. This situation may have arisen, for instance, because they trusted a false story in which certain claims about Fido were made. How are we to understand the anaphora in this case? In some sense, their attitudes are directed towards the same object. This is what the anaphora in the report reflects. Now, there is nothing in the external world to which "Fido" and "he" refer. They refer, if they do so at all, to things in Mary's and James' minds, so to speak.[7] In the present framework the most natural way of accounting for the connection between the two contents described in the dual attribution (5.12) is to take them to involve the same individual concept. This would lead us to assume the following logical form of the *de dicto* reading of (5.12):

F 5.24 $\exists p_1 \exists p_2 \exists c [\,\mathsf{think}(\mathsf{i}_{\mathsf{James}}, p_1) \land \Re_A(\mathsf{c}_{\mathsf{groundhog}}, c, p_1) \land$
$\qquad\qquad\quad \mathsf{think}(\mathsf{i}_{\mathsf{Mary}}, p_2) \land \Re_A(\mathsf{c}_{\mathsf{dog}}, c, p_2) \land \mathcal{C}_{\mathsf{Fido}}(c)]$

This analysis assumes that one and the same concept determines the content of the thoughts of two different cognitive agents. What in this imaginary case would justify the idea that they possess the same concept is that each concept token was in some sense acquired in the same way. Mary and James might have heard the same story about Fido, for instance, and if their other concepts were similar in relevant respects they might have formed the same Fido concept.

A similar approach could be taken to a sentence like the following one:

(5.13)   Mary thinks that Fido is a groundhog, but he does not exist.

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[7] This is an instance of what Geach [1967] calls **intentional identity**. Cf. Edelberg [1986].

Again there is a pronoun which appears to be referring back anaphorically to a male individual, but if this statement is true there is no such individual. The two conjuncts are clearly connected by being about the same thing. Again, the present framework suggests that it is a concept. The second conjunct may be understood as saying that Mary's Fido concept lacks denotation. We may consequently render its logical form as:[8]

F 5.25 $\exists p \exists c[\text{think}(i_{\text{Mary}}, p) \wedge \Re_A (c_{\text{groundhog}}, c, p) \wedge \mathcal{C}_{\text{Fido}}(c) \wedge \neg \exists i[\Delta_a(c, i)]]$

5.9 Negative Existence

Should the treatment in formula F 5.25 be extended to negative existence in relation to proper names generally? I am inclined to think so. It only makes sense to say that an "entity" does not exist when possible mental attitudes somehow give a content to the concept of the "entity". So, for instance, a sentence like (5.14), may be analyzed as in formula F 5.26:

(5.14) Santa Claus does not exist.

F 5.26 $\forall c[\mathcal{C}_{\text{Santa-Claus}}(c) \rightarrow \neg \exists i[\Delta_a(c, i)]]$

This formula says that no Santa Claus concept has a $\ulcorner \Delta_a \urcorner$-denotation. We may assume that what characterizes such a concept is that it is involved in the appropriate ways in the content of certain important beliefs and dicta about Santa Claus. This analysis is supported by the fact that "Santa Claus" cannot be seen as referring to a material world individual. This would imply that there is such an individual, which is denied by the sentence under consideration. If "Santa Claus" cannot be understood as a name of a thing, I think that the most natural suggestion is that it stands for something that emerges in people's images of Santa Claus. A treatment along the lines of that given to names read *de dicto* is then the alternative that is preferable in view of systematicity. This is how we arrive at formula F 5.26.

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[8] It should perhaps be pointed out that the constraints imposed on the conceptual system in Chapter 4 does not determine whether a proposition like p (in formula F 5.25) is to count as true or false or as lacking denotation when formula F 5.25 is true. I think this indeterminacy is warranted by the fact that it is hard to say whether beliefs about things that are mistakenly assumed to exist are to count as false or as truth-value-less, but I am strongly inclined to think that they are not true (cf. Russell [1957]).

5.10   On Nouns and Adjectives Relating to Propositional Concepts

The present account of propositional attitude report semantics assumes that the *that*-clause complements of attitude verbs are descriptions of propositional concepts. This should lead us to expect that there are also noun phrases that may be understood as propositional concept descriptions and this seems to be the case, as we will see shortly. There are both adjectives and nouns standing for conceptual properties and relations.

5.10.1   Propositional Attitude State Nouns

There are many nouns that are derived from propositional attitude verbs and which stand for attitude *states* of the corresponding type. Some verb/noun pairs of this kind are, *believe/belief*, *think/thought*, *observe/observation*, *conjecture/conjecture*, *assume/assumption* and *suspect/suspicion*. So, if we have mentioned that Mary believes that Fido is a dog, we may go on to talk about Mary's belief, or simply about this belief. The word *belief* denotes a class of state types which may be individuated at different levels of abstraction. A distinction may, for instance, be made between Mary's belief that Fido is a dog and James' belief that Fido is a dog, but it is also possible to say that they share the belief that Fido is a dog. As we see, a *that*-clause complement may be attached to a noun of this kind and it is understood as a description of the content of the corresponding propositional attitude state.

   I will not address the issue of how discourse that seems to involve reference to states should be handled in a formal semantics. Some collocations involving a verb and a propositional attitude state noun seem to be extensionally equivalent[9] to a corresponding propositional attitude verb, and can therefore be handled within the present framework. For instance, to hold the belief that … is to believe that …, to make the observation that … is to observe that …, and to make the assumption that … is to assume that …, and so on. At least, it seems clear that these constructions with a semantically comparatively empty verb and a propositional attitude noun may be analyzed as standing for logically simple predicates.

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[9] They are extensionally equivalent in the sense that it generally holds (for all p and X), that, for instance, X believes that p *if and only if* X holds the belief that p.

5.10.2   Properties of Propositional Concepts

As was noted above, propositional attitude states are sometimes individuated at a level of abstraction where only their kind and propositional content matter. Propositional state nouns may consequently occur as heads in noun phrases that quantify over propositional objects. For instance, consider an example like (5.15).

(5.15)   Some beliefs are false.

In this case, "some beliefs" may be understood as "some propositional concepts that have the property of constituting the content of a belief of some cognitive agent". The noun *belief* may consequently, in this case, be understood as standing for a kind of propositional concept. A meaning postulate like formula F 5.27 would express the relation between the property of being a belief in this sense and the relation represented by the verb *believe*.

F 5.27 $\forall x[\mathsf{belief}(x) \equiv \exists i[\mathsf{believe}(i, x)]]$

This formula says that what someone believes is a belief.

It is possible to modify a propositional attitude state noun with a genitival attribute and this restricts the denotation of the noun phrase to attitudes belonging to the elements of the denotation of the genitival noun phrase, as in (5.16):

(5.16)   Mary's belief that Fido is a dog is true.

Again it is possible to understand the subject noun phrase as quantifying over propositional concepts (which is to understand it in accordance with Russell's [1905] theory of definite descriptions) or to see it as referring to a propositional concept, in which case there is a presupposition that this propositional concept has the characteristics mentioned (a more Fregean[1892]-Strawsonian[1950b] view).

A possible paraphrase of (5.16) is (5.17):

(5.17)   Mary believes that Fido is a dog, which is true.

A difference between this paraphrase and (5.16) is that it explicitly says that Mary has a certain belief. This cannot plausibly be said to be a matter of presupposition as Frege and Strawson would claim in relation to (5.16). The logical form of a *de re* reading of (5.17) would look like formula F 5.28:

F 5.28 $\exists p \exists c_1 \exists c_2 [\, \mathsf{believe}(i_{\mathsf{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge$
$\mathcal{C}_{\mathsf{dog}}(c_1) \wedge \Delta_a(c_2, i_{\mathsf{Fido}}) \wedge \mathrm{TRUE}(p)]$

However, there are also cases in which propositional attitude state nouns irreducibly stand for attitude *states*, for instance, in a sentence like (5.18).

(5.18)   Mary's belief that Fido is a dog is well-founded.

It is not the content of a belief that is said to be well-founded, rather it is the belief state as a whole. A well-founded belief belonging to one cognitive agent may have the same content as a non-well-founded belief that belongs to another person. An attempt to give the logical form of this kind of statement would force us to face the issue of how state sentences are to be treated, and again I will not address this question. It might be argued that the adjective in (5.16) also should be understood in the same way, i.e. as standing for a property applying to the belief state, rather than directly to the belief content. I do not try to settle this issue: I only claim that formula F 5.28, where the property of being true is understood as applying to the content of Mary's belief, represents a possible way of understanding (5.16).

There are also nouns that sometimes seem to stand for categories of propositional concepts. (The trivial example is of course the term *propositional concept* that denotes the class of all propositional concepts.) Some nouns of this kind, such as *disjunction*, *conjunction*, *generalization*, and *negation* connote the logical properties of the propositional concepts denoted. The nouns *truth* and *fact* denote the class of true propositional concepts (at least in some of their uses.) There are also a number of nouns that denote classes of propositional concepts by describing their position in a theoretical system, such as *axiom*, *theorem*, and *corollary*, or in an argument, such as *premiss* and *conclusion*.

Adjectives may also be used to ascribe properties to propositional concepts. Among the relevant adjectives we find *true*, *false*, *alleged*, *probable*, *evident*, *plausible*, *obvious*, *well-known*. Whether these adjectives are implicitly relational or not is a controversial issue, but from the point of view of sentence logical form they appear to stand for properties.

Ordinary copulative sentences like (5.19) may be used to ascribe properties to propositional concepts.

(5.19)   That Fido is a dog is $\left\{ \begin{array}{l} \text{true} \\ \text{a fact} \end{array} \right\}$.

A more common construction type is probably that with the *that*-clause as **postponed subject** and an **anticipatory subject**, consisting of an *it* token (cf. Quirk, Greenbaum, Leech, and Svartvik [1972, §14.36]). An example is (5.20).

(5.20)   It is $\left\{\begin{array}{l} \text{true} \\ \text{a fact} \end{array}\right\}$ that Fido is a dog.

The adjective *true* and the noun *fact* have a peculiar status. The sentences in (5.19) and (5.20) are intuitively truth-conditionally equivalent to "Fido is a dog". This speaks against viewing the words *true* and *fact* as they are used here as standing for properties. (A similar argument applies to *false*.) The verb phrases "is true" and "is a fact" may be taken to represent an operator that undoes whatever effect is accomplished by "that". An analysis of this kind would claim "that p is a fact" is equivalent to "p" for any sentence p.[10] (Some syntactic constraints would have to be added.) However, some considerations speak against this kind of analysis. First, it is inapplicable in cases like (5.21), where there is no *that*-clause whose content may be affirmed.

(5.21)   Everything Mary said was true.

Secondly, there are many adjectives and nouns applying to propositional concepts for which similar eliminativist approaches are out of the question. Systematicity considerations consequently support the idea that "true" and "fact" in (5.20) stand for properties. Thirdly, it also seems clear that some propositional concepts are sometimes true or false. These considerations support the idea that truth and factuality should be seen as properties.

    Some adjectives, when occurring in constructions like (5.19) and (5.20) will turn the *that*-clause subject into an oblique context. Consider the cases in (5.22).

(5.22)   It is $\left\{\begin{array}{l} \text{said} \\ \text{plausible} \\ \text{well-known} \\ \text{obvious} \end{array}\right\}$ that Fido is a woodchuck.

It is not generally possible to interchange words with the same denotation for each other *salva veritate* in the *that*-clause of these sentences. They appear to be oblique and ambiguous in the same way as the *that*-clause complements of propositional attitude verbs and these adjectives are also related to such verbs in many cases. They also seem to stand for cognition-related properties. These circumstances speak in

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[10] This kind of analysis is advocated by Ramsey [1927], Strawson [1949], and Hugly and Sayward [1992]. A critical discussion of the idea is found in Davidson [1990b].

favour of viewing uses of *that*-clauses as complements to adjectives like those in (5.22) and as complements to propositional attitude verbs as semantically equivalent.

There are also adjectives that are used in these kinds of construction in sentences that do not seem to say anything about propositional attitude states or their contents. For instance, consider sentences like:

(5.23)   It is $\left\{\begin{array}{l} \text{nice} \\ \text{sad} \\ \text{regrettable} \end{array}\right\}$ that Fido is a woodchuck.

All of these sentences may be understood as ascribing a properties to a state of affairs. They imply that the *that*-clause postponed subject is factual and it does not seem to be an oblique context. The analysis of these sentences seem to call for the assumption that there are **states of affairs** or **facts** in the domain of discourse. I will not discuss the matter further (but see Section 3.10).

5.11   Concluding Remarks

The aim of the present chapter was to demonstrate how the framework presented in Chapter 4 applies to a number of semantic problems. In Sections 5.3 and 5.4 the cognitive significance of names and other content words was discussed. The main conclusion was that they should be seen as standing for conceptual properties. The analysis of ambiguities between *de dicto* and *de re* and between specific and non-specific readings was addressed in Section 5.5. The accommodation of attitudes *de se* was then discussed, and the problem of multiply oblique contexts was treated in Section 5.7. Some of the most difficult kinds of problems confronting a semantics for propositional attitude reports have thus been faced. Some additional issues have also been addressed: The influence of anaphoric relations within "conceptual" discourse was briefly investigated in Section 5.8. Finally, we turned our attention towards nouns and adjectives that stand for properties applying to propositional concepts—or propositional attitude states.

6

CONCEPTUAL ATTITUDE REPORTS

6.1 Introduction

There is a number of English verbs that may stand for relations holding of a cognitive agent and a concept—propositional attitude verbs are a special case—, and which enter into a number of different sentential construction types. Here, I will give an overview of these verbs and show how the semantics of the sentential constructions into which they enter may be accommodated within the framework introduced in Chapter 4. I will do this by discussing a number of construction types in which these verbs are used. I will begin by giving a brief survey of the class of conceptual relation verbs. To simplify comparisons between different kinds of sentences, I will then distinguish a number of abstract construction types, in which verbs of this kind occur, and after having given a schematic overview of these construction types, I will discuss each of them in some detail, trying to motivate the analyses I have given. There will also be some discussion of the (so-called) parenthetical use of propositional attitude verbs, about some adjectives and adverbs that are closely related to conceptual attitude relations, and about modal statements.

6.2 An Overview of Conceptual Relation Verbs

A classification of conceptual relation verbs may be based on different kinds of properties. An intuitively important distinction among such verbs is that between

communication verbs[1] and verbs which do not stand for communication-related relations. Communication verbs like *say*, *claim*, *stress*, *deny*, and *suggest* occur with *that*-clause complements and these constructions exhibit the same kind of semantic behaviour (the same kinds of ambiguity and lack of referential transparency) as those involving ordinary propositional attitude verbs. From the point of view of issues relating to logical form, communicative verbs of this kind behave as propositional attitude verbs and it is therefore suitable to apply the term **propositional relation verb** to verbs of both kinds.

Not all communication verbs are propositional, in the sense of not allowing a *that*-clause complement. Among the exceptions we find *speak*, *talk*, and *lie*. However, it seems that some non-propositional communication verbs stand for communicative acts which are propositional in the sense that they must have a propositional content. For instance, the verb *lie* is associated with a constraint implying that an act of lying must have a propositional content, but does not combine with a *that*-clause complement. (The conventional meaning of the verb *lie* corresponds to a definition of *lying* as something like "intentionally saying something *false* with the intention not to reveal these intentions".)

An important feature of propositional attitude psychology is that communicative acts and propositional attitudes may have contents of the same kind. Whether, for instance, every belief may be expressed in communication may remain a controversial issue, but it seems to be a crucial tenet of propositional attitude psychology that most kinds of belief may be communicated.

There are also communicative attitudes that seem to be directed towards non-propositional concepts. For instance, *talk about*, *mention*, and *describe* sometimes combine with objects that refer to things that, so to speak, only exist in a speaker's mind. This calls for a conceptual attitude analysis.

Mental attitudes such as those represented by verbs like *believe*, *know*, and *intend* are non-communicative in the sense that attitudes of the kinds they correspond to may occur without being expressed in communication.[2] There are both state- and event-like relations of this kind. Verbs like *believe*, *intend*, and *hope* represent state-like attitudes. This is reflected in their tendency not to occur in progressive form. Other non-communicative propositional verbs, such as *decide*, *realize*, and

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[1] Surveys of English communication verbs are given by Austin [1962], Vendler [1972], and Allwood [1978].

[2] This is not to say that an agent's ability to hold attitudes of this kind is independent from his linguistic abilities. The philosophically controversial issue of to what extent various mental abilities are conditioned by linguistic competence will not be addressed here.

understand, are often used to represent kinds of momentary mental events. These events consist in general of changes in the propositional attitude states of a cognitive agent. To decide, for instance, is (in one sense of this verb) to form an intention.[3]

Many propositional relation verbs are used systematically both in event- and state-related senses. So, for instance, a word like *understand* (cf. Allwood [1986]) may be used as in (6.1) to describe a mental event or as in (6.2) to describe a state.

(6.1)   Mary suddenly understood that Fido is a groundhog.

(6.2)   Mary has understood for a long time that Fido is a groundhog.

It seems that the content-related aspect of propositional attitudes is independent of the differences between states and events. Any content that characterizes a state can also characterize an event, and *vice versa*.

Some mental attitudes may be understood as having a content in form of a property or individual concept. Verbs like *think about*, *imagine*, and *fear* may stand for attitudes of this kind. Again this analysis is motivated by the fact that these attitudes may be directed towards "objects" whose real existence is not presupposed.

6.2.1   Criteria of Intensionality

Analyses in terms of concepts are intended to take care of intensional constructions. A relevant question, then, is: How do we recognize an intensional context? I think that the foremost criterion is that it is a context in which a definite or indefinite description or proper name may occur without there being an existential presupposition attached to it. Another related criterion is the possibility of ambiguities between *de dicto* and *de re* readings. However, it seems that the two criteria seldom gives different results. Any mental attitude relation that may take a non-existing "thing" as its relatum seems to be capable also of being directed towards a real object. (For instance, it is possible to describe someone as thinking about Atlantis—without presupposing that this city ever existed—as well as about London.) The scene is thereby set for *de dicto*/*de re* ambiguity in discourse about such relations and their objects.

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[3] Discussions of the lexical semantics of verbs of this kind are found in Kiparsky and Kiparsky [1970], Bonevac [1984], Asher [1987], and Nivre [1987].

6.3   Construction Types Related to Attitude Ascription

We may recognize a number of construction types used in statements about conceptual relations. Before turning to more concrete cases, I will describe how these types may be defined in syntactico-semantic terms, in order to be able to refer to them in the exposition below, where these notions will be illustrated by concrete examples. This analysis will be based upon the idea that verbs are associated with **complements**. The typical feature of complements is that their presence to a large extent is conditioned by the choice of verb. Complements encode information that is meaningful only in relation to a particular argument slot of the predicate represented by the verb. It should be noted that complement *types* as understood here are defined in both semantic and syntactic terms.[4]

6.3.1   Complement Types

In this section, I will only give a brief overview of the complement types: Discussion of the analyses and further examples will be provided later.

The grammatical subject will be considered a complement. In many of the cases discussed below, the subject is required to refer to the cognitive agent with whose mental states the statement is concerned. Let us call such a subject a **cognitive agent subject** (**CAS**). This kind of subject may, of course, also be a quantified noun phrase representing a quantification over cognitive agents. (Below, I will describe the properties of noun phrase complements only as they occur as singular terms, taking the generalization to cases involving quantification to be a matter of course.) Another kind of subject that is relevant in this context is what I call **information source subjects** (**ISS**). These subjects may refer to cognitive agents as well as to lifeless things and events. What characterizes an **ISS** complement is that it stands for an entity that causally influences the mental attitudes of a cognitive agent. The difference between **CAS** complements and **ISS** complements is that a **CAS** complement is associated with a verb requiring a cognitive agent subject, while this is not necessary when it comes to **ISS** complements.

Another kind of complement which is very important in the present context is exemplified by a *that*-clause that characterizes a proposition. Such a complement

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[4] The idea that verbs are to be classified according to which sets of complement they combine with derives from **valency** and **case** grammars. For overviews of different theories in this traditions see Lyons [1977, Chapter 12] and Somers [1987].

may be called a **propositional that-clause** (**PTC**). Most of the statements discussed previously in Chapters 4 and 5 involve constructions with a **CAS** and a **PTC**. A closely related complement type consists of subordinate clauses introduced by a *whether* (e.g. "He knows *whether they will come.*"). They will be referred to as **propositional whether-clauses** (**PWC**). Propositions may also be described by means of noun phrases, occurring as grammatical objects, as in "Frege denied *the idea that Sinne are language-dependent*". We may call these **propositional noun phrase objects** (**PNO**). Some noun phrase objects may be seen as standing for individual or property concepts (e.g. "Peter imagined *a griffin.*"). They may be referred to as **concept noun phrase objects** (**CNO**). There are also noun phrase objects that stand for other entities (e.g. material objects) than concepts. These will be called **ordinary noun phrase objects** (**ONO**). Another type of complement is an infinitival phrase that may be analyzed as specifying a property concept (as in "Mary wants *to buy a unicorn.*"). A complement of this kind may be referred to as a **concept infinitival phrase** (**CIP**). There are also various kinds of prepositional phrase complements. Those containing noun phrases specifying propositions (as in "Mary believes *in the Pythagorean Theorem.*"), I will call **propositional prepositional phrases** (**PPP**), and those containing noun phrases specifying individual or property concepts (as in "James talked *about Santa Claus.*") **concept prepositional phrases** (**CPP**). These two labels may be prefixed with the preposition involved. Present participle phrases (i.e. a present participle verb without a subject but with other complements) sometimes occur as intensional complements, which will be called **conceptual present participle phrases** (**CPA**). (An example of this is provided by "Peter imagined Mary *chasing a unicorn.*") (They sometimes occur governed by a preposition.) Subordinate clauses introduced by a *wh*-word is another type of complement, which we may call **wh-clause complements** (**WHC**) (an instance of which we find in a sentence like "Mary knows *who wrote Begriffsschrift.*").

With the help of these complement type labels it is easy to define construction types simply in terms of which complements are present. For instance, the basic construction of propositional attitude attribution sentences may be defined as **CAS+PTC**. (The presence of the verb may be left implicit.) The semantic definition of the complement types indicates which analysis of their logical form is suggested here. The constructions types listed in Table 6.1 will be considered in this chapter. This table also gives examples of a number of verbs that enter into the construction types discerned.

Construction Types	Verbs
CAS+PTC	*know, believe, suspect guess, think, assume, hope, wish, realize, see, hear, learn, say, claim, deny, explain, decide, agree, imagine, fear, confirm, prove*
CAS+PNO	*explain, imagine, confirm, prove*
CAS+PPP	*know, believe, think, hope, learn, fear, look*
CAS+PWC	*know, see, ask, wonder, decide, confirm, prove*
CAS+CIP	*hope, wish, intend, try, decide, agree, refuse, fear*
CAS+CNO	*suspect, see* (hallucinatory), *hear* (hallucinatory), *seek, hunt, draw, imagine, fear*
CAS+CPP	*think, hope, look*
CAS+WHC	*know, guess, realize, see, hear, learn, say, deny, ask, wonder, imagine*
CAS+CNO+CIP	*know, believe, intend, take*
CAS+CNO+CPA	*suspect, see* (hallucinatory), *draw, imagine*
CAS+ONO+*as*-CPP	*know, see*
ISS+PTC	*confirm, prove*
ISS+PNO	*confirm, prove*
ISS+CAO+PTC	*convince, persuade*
ISS+CAO+CIP	*persuade*

Table 6.1: Construction types and examples of verbs entering into them.

6.3.2 Cognitive Agent Subject and Propositional That-Clause

The sentences analyzed in the two previous chapters belong to the **CAS+PTC** construction type, which there is no reason to discuss in greater detail here. From the point of view of the approach in this book, it is the prototypical sentential construction of propositional attitude reports, making explicit the binary-relation nature of propositional attitudes.

6.3.3 Cognitive Agent Subject and Propositional NP Object

It seems that there are noun phrase objects naming propositions or quantifying over them (**PNO**). Consider a sentence like: (6.3)

(6.3)   Mary proved the Pythagorean Theorem.

If we understand "the Pythagorean Theorem" as a proper name, we may render the logical form of (6.3) as:

F 6.1 $\mathsf{proved}(\mathsf{i}_{\mathsf{Mary}}, \mathsf{i}_{\mathsf{Pythagorean\text{-}Theorem}})$

6.3.4 Cognitive Agent Subject and Propositional PP

This **CAS+PPP** construction type is exemplified by a sentence like (6.4).

(6.4)   Mary believes in the hypothesis that Fido is a dog.

This statement may logically be analyzed as a conjunction. It asserts that Mary believes that Fido is a dog and that that Fido is a dog is an hypothesis. The logical form of its *de re* reading may therefore be rendered as formula F 6.2.

F 6.2 $\exists p \exists c_1 \exists c_2 [\, \mathsf{believe\text{-}in}(\mathsf{i}_{\mathsf{Mary}}, p) \wedge \mathsf{hypothesis}(p) \wedge$
$$\Re_A(c_1, c_2, p) \wedge \mathcal{C}_{\mathsf{dog}}(c_1) \wedge \Delta_a(c_2, \mathsf{i}_{\mathsf{Fido}})]$$

6.3.5   Cognitive Agent Subject
and Propositional Whether-Clause

The **CAS+PWC** construction, found in example (6.5), is closely related to **CAS+PTC** constructions.

(6.5)   Mary $\left\{ \begin{array}{c} \text{asked} \\ \text{wondered} \end{array} \right\}$ whether Fido is a groundhog.

The only difference between this construction type and the more common **CAS+PTC** construction is the choice of subordinating conjunction. Some verbs (e.g. *know* and *see*) allow a choice between a **PTC** and a **PWC** complement. In these cases a sentence of the form "X Vs whether p" is truth-conditionally equivalent to "X Vs that p or that not-p". For instance, to know whether Fido is a dog is to know that Fido is a dog or that Fido is not a dog. So, (6.6) may be given the logical form of formula F 6.3.

(6.6)   Mary knows whether Fido is a dog.

F 6.3 $\exists p \exists c_1 \exists c_2 [\text{know-whether}(i_{\text{Mary}}, p) \land \Re_A(c_1, c_2, p) \land \mathcal{C}_{\text{dog}}(c_1) \land \Delta_a(c_2, i_{\text{Fido}})]$

The relation between *knowing-whether* and *knowing-that* mentioned above could be expressed as follows in a "meaning postulate".

F 6.4 $\forall i \forall p_1 [\, \text{know-whether}(i, p_1) \equiv$
$\qquad\qquad \exists p_2 [\Re_{\backsim}(p_1, p_2) \land (\text{know-that}(i, p_1) \lor \text{know-that}(i, p_2))]]$

The choice of conjunction is in some cases dictated by the verb (e.g. in the case of *wonder*). The choice of *whether* appears to underline the interrogative nature of the attitude expressed by a verb of this kind. **PWC** complements seem to be oblique and incident to ambiguities in the same ways, and for the same reasons, as **PTC** complements. This suggests that the logical form of **CAS+PWC** constructions is to be rendered along the lines of the corresponding readings of structurally isomorphic **CAS+PTC** constructions, e.g. as in formula F 6.3.

6.3.6   Cognitive Agent Subject
and Concept Infinitival Phrase

An instance of the **CAS+CIP** construction type is given by (6.7).

(6.7)   Mary wishes to speak.

The **CIP** may be understood as characterizing a property concept and (6.7) says that Mary, so to speak, wishes to have this property. This analysis is motivated by the circumstance that **CIP**s of this kind are ambiguous (cf. the example below) and oblique in the same ways as **PTC**s. This suggests that they characterize a conceptual item. A **CIP** is not propositional however, because it lacks a subject, but it can be understood as a property concept. The logical form of this statement may therefore be rendered as formula F 6.5.

F 6.5 $\exists c[\mathsf{wish}(\mathsf{i}_{\mathsf{Mary}}, c) \wedge \mathcal{C}_{\mathsf{speak}}(c)]$

Noun phrases in **CIP**s exhibit a clear ambiguity between specific and non-specific readings (cf. Jackendoff [1975], [1980]). This is clearly seen in a sentence like (6.8):

(6.8)   Mary wants to buy a dog.

A specific reading of this sentence takes Mary to have a particular dog (real or just a figment of her imagination) in mind. Her wish is, so to speak, directed towards an individual concept. There is both a specific reading *de re* and one *de dicto*. If we take *buy* to represent a two-place predicate, we may define the property represented by the **CIP** in (6.8) under the specific reading *de re* by the PFLST predicate term '$\mathsf{P}_{\mathsf{buy}} \frown \mathsf{i}_{\mathsf{X}}$', where '$\mathsf{i}_{\mathsf{X}}$' is an individual constant standing for the (specific) dog Mary wants to buy. This reading therefore corresponds to this logical form:

F 6.6 $\exists c \exists c_1 \exists c_2 \exists c_3 \exists x [\, \mathsf{want}(\mathsf{i}_{\mathsf{Mary}}, c) \wedge \Re_{\frown}(c_1, c_2) \wedge \Re_A(c_2, c_3, c) \wedge$
$$\mathcal{C}_{\mathsf{buy}}(c_1) \wedge \Delta_a(c_3, x) \wedge \mathsf{dog}(x)]$$

There is no *reference* to a concept corresponding to 'i_{X}'. It is only said that there is an individual concept denoting a dog involved.

    The specific *de dicto* reading of (6.8) is the one that takes Mary, not the reporter, to be the one who classifies what Mary wants as a dog. The **CIP** may therefore be understood along the lines of the PFLST term '$\mathsf{P}_{\mathsf{dog}}\mathsf{P}_{\mathsf{buy}} \frown \times \Sigma \mathsf{i}_{\mathsf{X}}$', which represents the property of buying the dog i_{X}. The specific reading *de dicto* will therefore be assigned the following structure:

F 6.7 $\exists c \exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists c_5 \exists c_6 [\, \mathsf{want}(\mathsf{i}_{\mathsf{Mary}}, c) \wedge \Re_{\frown}(c_2, c_3) \wedge \Re_{\times}(c_1, c_3, c_4) \wedge$
$$\Re_{\Sigma}(c_4, c_5) \wedge \Re_A(c_5, c_6, c) \wedge \mathcal{C}_{\mathsf{dog}}(c_1) \wedge \mathcal{C}_{\mathsf{buy}}(c_2)]$$

A non-specific reading of (6.8) assumes that Mary's does not have any idea of which dog she wants to buy: She just wants there to occur an event in which there is a dog that she buys. The **CIP** may then be understood in accordance with the PFLST term '$P_{dog}P_{buy}\curvearrowright\times\Sigma\mathbf{]}$'. We may consequently render the non-specific reading as formula F 6.8.

F 6.8 $\exists c\exists c_1\exists c_2\exists c_3\exists c_4\exists c_5[\,\mathsf{want}(\mathsf{i}_{\mathsf{Mary}},c)\wedge\Re_{\curvearrowright}(c_2,c_3)\wedge\Re_{\times}(c_1,c_3,c_4)\wedge$
$$\Re_{\Sigma}(c_4,c_5)\wedge\Re_{\beth}(c_5,c)\wedge\mathcal{C}_{\mathsf{dog}}(c_1)\wedge\mathcal{C}_{\mathsf{buy}}(c_2)]$$

6.3.7   Cognitive Agent Subject and Concept NP Object

A number of verbs enter into constructions that seem to call for the labeling **CAS+CNO**. Consider (6.9).

(6.9)   Mary seeks a unicorn.

A token of (6.9) may be true without there being any unicorns. This suggest that a concept provides the "aim" of Mary's quest. However, a *de re* reading is possible, taking Mary to be seeking a particular real unicorn. (This reading may be ruled out by the assumption that the speaker does not think that there are any unicorns.)

Again there is both a specific and non-specific *de dicto* reading. The specific *de dicto* reading takes Mary to be seeking what she herself considers to be a specific unicorn, i.e. the "aim" corresponds to an individual concept. This reading poses some problems. How are we to capture *both* that the "aim" is a certain individual concept and that her mind, so to speak, connects this concept with unicornhood. The latter seems to be a kind of belief. A possible analysis of this reading is therefore provided by formula F 6.9.

F 6.9 $\exists p\exists c_1\exists c_2[\mathsf{seek}(\mathsf{i}_{\mathsf{Mary}},c_1)\wedge\mathsf{believe}(\mathsf{i}_{\mathsf{Mary}},p)\wedge\Re_A(c_2,c_1,p)\wedge\mathcal{C}_{\mathsf{unicorn}}(c_2)]$

Another solution to this problem is to take (6.9) to mean the same as (6.10).

(6.10)   Mary tries to find a unicorn.

This transformation may be viewed as a matter of "lexical decomposition" (cf. Dowty, Wall, and Peters [1981, p. 219], where this analysis is criticized). This decomposition allows us to analyze the specific *de dicto* reading of (6.10) along the lines of formula F 6.7.

Both the lexical decomposition solution and the one in formula F 6.9 are unattractive because they assume a very indirect relation between form and content. A third possibility would be to assume that specific and non-specific seeking represent two different predicates:

F 6.10 $\exists c[\text{specific-seek}(i_{\text{Mary}}, c) \wedge \mathcal{C}_{\text{unicorn}}(c)]$

This analysis assumes that the distinction between specific and non-specific readings in this case is a matter of lexical ambiguity and that it is not reflected in the structure of the logical form. What speaks against this analysis is that the distinction between specific and non-specific readings in other cases is most naturally seen as pertaining to logical form.

The non-specific *de dicto* reading may be rendered as:

F 6.11 $\exists c[\text{seek}(i_{\text{Mary}}, c) \wedge \mathcal{C}_{\text{unicorn}}(c)]$

A similar idea prompts Quine [1958] to suggest that verbs of this kind should be called **attributary attitude verbs**. They stand for attitudes towards attributes (i.e. properties or, rather, in the present analysis *property concepts*). (If the third analysis above is adopted, 'seek', must be understood as standing for non-specific seeking, in contradistinction to 'specific-seek'.)

There is also a *de re* reading of a sentence like (6.9). (*De re* readings are always specific.) We may view it as involving an individual concept. Thus we arrive at a logical form of this kind:

F 6.12 $\exists c \exists x[\text{seek}(i_{\text{Mary}}, c) \wedge \Delta_a(c, x) \wedge \text{unicorn}(x)]$

This analysis of seeking *de re* assimilates this case to that of propositional attitudes *de re* (cf. Section 5.5). It can also be argued that *seek* sometimes stands for a relation that directly relates a cognitive agent and an ordinary external world object. Thereby, (6.9) read in this way becomes an instance of the **CAS+ONO** construction type. This analysis may be preferred as the most straightforward one.

6.3.8 Cognitive Agent Subject and Concept PP

A number of verbs behave just like *seek* with the single difference that they take a **CPP** complement, rather than a **CNO** one, i.e. there is a preposition that mediates between the verb and the relatum noun phrase. Among these we find *look for*,

hope for, and *talk about*, where the present framework leads us to suppose that the verb and preposition together represent one relation. They allow all three kinds of reading described in connection with **CAS**+**ONO** constructions. A number of these verbs also seem to stand for relations that do not admit of non-specific readings, for instance, *refer to*. (Reference is, at least in books on semantics, a specific matter.)

6.3.9   Cognitive Agent Subject and Wh-Clause

The verb *know* is commonly used in what seems to be its basic sense—of holding a "justified true belief"—with subordinate *wh*-clause complements, as in the sentences of (6.11).

(6.11)   Mary knows $\begin{Bmatrix} \text{who wrote Cratylus} \\ \text{what happened in 399 BC} \\ \text{when Socrates died} \\ \text{where Socrates was born} \\ \text{how Socrates died} \\ \text{why Socrates died} \end{Bmatrix}$.

These statements all say that Mary possesses more or less specific knowledge concerning the circumstances of the subordinate *wh*-clauses. These subordinate *wh*-clauses are clearly, both syntactically and semantically, closely related to *wh*-questions. To know when Socrates died is to have an adequate and true answer to question (6.12) below, and this kind of relationship holds generally.

(6.12)   When did Socrates die?

To take the *wh*-complement to represent a kind of property concept appears to be the simplest logically tenable analysis. The logical form of (6.13) will consequently appear as formula F 6.13, if we take *die* to represent a two-place predicate concept (this predicate holding of a person and a time span if and only if this person died during this time span).

(6.13)   Mary knows when Socrates died.

F 6.13 $\exists p \exists c_1 \exists c_2 \exists c_3 \exists c_4 [\, \mathsf{know}(\mathsf{i_{Mary}}, p) \wedge \Re_A(c_1, c_2, c_3) \wedge \Re_A(c_3, c_4, p) \wedge$
$\mathcal{C}_{\mathsf{die}}(c_1) \wedge \Delta_a(c_2, \mathsf{i_{Socrates}}) \wedge \mathsf{qual}(c_4)]$

This formula represents the logical form of a *de re* reading of (6.13). I have introduced a predicate 'qual' to represent the highly context-sensitive property of being a time span concept that would qualify as representing a component of *knowing when*. All discourse involving *knowing who*, *knowing where*, or *knowing when* must be understood against background assumptions about what kind of knowledge would qualify. These conditions are not a matter of conventionalized lexical semantics, but must be assumed to be determined by reference to the practical or theoretical significance of the pieces of knowledge in question. The ⌜qual⌝-clause is just a way of bringing this component into the picture without analyzing it.

There is also an intimately related kind of construction which is used to say what someone knows, without fully specifying the content of this knowledge. They are constructions like the ones in (6.14).

$$(6.14) \quad \text{Mary knows} \left\{ \begin{array}{l} \text{the name of Plato's mother} \\ \text{the year when Socrates died} \\ \text{the cause of Socrates' death} \end{array} \right\}.$$

These are construction with NP objects syntactically similar to some of the non-doxastic uses of *know*. In the sentences in (6.14), the verb is quite clearly used in a doxastic sense. They may be paraphrased as follows:

$$(6.15) \quad \text{Mary knows} \left\{ \begin{array}{l} \text{what the name of Plato's mother was} \\ \text{what the year when Socrates died is} \\ \text{what the cause of Socrates' death was} \end{array} \right\}.$$

Someone, X, knows the name of Plato's mother, for instance, if and only if there is a name Y such that X knows that Y was the name of Plato's mother. The object position in the (6.14) constructions appears to be an oblique context and we are prompted to analyze the object as standing for a property concept. The construction of the (6.14) examples is consequently of the **CAS+CNO** type.

6.3.10 Cognitive Agent Subject, Concept NP Object, and Concept Infinitival Phrase

The **CAS+CNO+CIP** construction is found in a sentence like (6.16).

(6.16) Mary took Atlantis to be a planet.

It seems that both the **CNO** and **CIP** are oblique in a way that motivates this labeling. The **CNO** in (6.16) appears to stand for an individual concept and the **CIP** for a predicate concept (as ususal). The predicate verb consequently seems to stand for a three-place predicate (four-place if time is included as a fourth argument). The logical form of (6.16) may thus be exhibited as formula F 6.14.

F 6.14 $\exists c_1 \exists c_2 [\mathsf{took}(\mathsf{i}_{\mathsf{Mary}}, c_1, c_2) \wedge \mathcal{C}_{\mathsf{Atlantis}}(c_1) \wedge \mathcal{C}_{\mathsf{planet}}(c_2)]$

6.3.11 Cognitive Agent Subject, Concept NP Object, and Concept Participle Phrase

An example of a construction of the **CAS+CNO+CPA** type is provided by sentence (6.17).

(6.17)   Mary imagined Fido finding a unicorn.

The **CNO** and **CPA** labelings are motivated by the fact that the corresponding constituents are clearly intensional. Here, it seems, the **CNO** ("Fido") corresponds to an individual concept (both a *de re* and a *de dicto* reading is possible, and the **CPA** ("finding a unicorn") may be seen as a kind of clausal construction lacking a subject. It may consequently be understood as standing for a property concept. The noun phrase "a unicorn" is incident to a three-way ambiguity: It admits a specific *de dicto*, a specific *de re* and a non-specific reading. The analysis proposed here consequently recognizes six readings of sentence (6.17). The one that is *de re* both with respect to "Fido" and "a unicorn" looks like formula F 6.15.

F 6.15 $\exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists c_5 \exists x [\, \mathsf{imagined}(\mathsf{i}_{\mathsf{Mary}}, c_1, c_2) \wedge \Delta_a(c_1, \mathsf{i}_{\mathsf{Fido}}) \wedge$
$$\Re_A(c_5, c_4, c_2) \wedge \Re_\frown(c_3, c_5) \wedge \mathcal{C}_{\mathsf{finding}}(c_3) \wedge$$
$$\Delta_a(c_4, x) \wedge \mathsf{unicorn}(x)]$$

The treatment of the other readings follows the same principles as those exemplified in the previous analyses.

6.3.12 Cognitive Agent Subject, Ordinary NP Object, and Concept PP

The verb *know* occurs in **CAS+ONO+as-CPP** constructions, e.g. in a sentence like (6.18) below.

(6.18)   Mary knows $\left\{ \begin{array}{l} \text{Catiline} \\ \text{the governor of Africa in 67 BC} \end{array} \right\}$ as a rival of Cicero.

The meaning of statements of the form "X knows Y as Z" (when used in the sense of (6.18)) is not easy to pin down with precision, but it roughly means that X has some knowledge about Y which is concerned with circumstances related to the fact that Y is/are/was/were Z. (The precise nature of this relation is a difficult issue.) This fact, it seems, must be known by Z. To be more precise, a statement of this kind generally implies "X knows that Y is/are/was/were Z", with Y being read *de re*. It seems therefore that the object is to be labeled **ONO**: It appears to be a referentially transparent one. So, in the sentences in (6.18) the phrases referring to Catiline are interchangeable *salva veritate*. It is possible to know the governor of Africa in 67 BC as a rival of Cicero without knowing that Catiline ever was a governor of Africa. It also seems to me that there is no reading of (6.18) that imposes such a constraint, i.e. in relation to which the constituent labeled **ONO** is an oblique one.

The **as-CPP** seems to constitute an oblique context: Coreferential terms cannot generally be substituted *salva veritate* for each other. The statements (6.18) and (6.19) may very well differ with regard to truth value.

(6.19)   Mary knows $\left\{ \begin{array}{l} \text{Catiline} \\ \text{the governor of Africa in 67 BC} \end{array} \right\}$ as a rival of Tully.

This suggests that *know as* in these cases represents a three-place relation holding of a cognitive agent, an individual, and a property concept. So, the *de dicto* reading of the shorter version of (6.19) may be rendered as:

F 6.16 $\exists c_1 \exists c_2 \exists c_3 \exists c_4 [\, \mathsf{know\text{-}as}(i_{\mathsf{Mary}}, i_{\mathsf{Catiline}}, c_1) \wedge \Re_\frown(c_2, c_3) \wedge$
$$\Re_A(c_3, c_4, c_1) \wedge \mathcal{C}_{\mathsf{Tully}}(c_4) \wedge \mathcal{C}_{\mathsf{rival\text{-}of}}(c_2)]$$

6.3.13   Information Source Subject and Propositional That-Clause

There are a number of verbs that enter into constructions with **PTC** complements, but whose subject is not a **CAS**. Among these we find *confirm*, *corroborate*, and *prove*. The subject appears to stand for a source of information that somehow influences the mind of a cognitive agent, or, at least, potentially may do so. We may therefore call subjects of this kind **information source subjects** (**ISS**). This source may be another cognitive agent, but it may also be a lifeless thing or an event (cf. example

(6.20)). The **PTC** complement of these verbs also appear to be as ambiguous and oblique as those of propositional attitude verbs. This also speaks in favour of the idea that they stand for relations that somehow are cognition-dependent.

(6.20)   The Encyclopaedia Britannica confirms that Frege was born in 1848.

The logical form of the *de re* reading of (6.20) should, in the present system, be rendered as:

F 6.17 $\exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists p [\, \mathsf{confirm}(\mathsf{i}_{\mathsf{EncBrit}}, p) \wedge \Delta_a(c_1, \mathsf{i}_{\mathsf{Frege}}) \wedge \Delta_a(c_2, \mathsf{i}_{1848}) \wedge$
$$\mathcal{C}_{\mathsf{born}}(c_3) \wedge \Re_A(c_3, c_1, c_4) \wedge \Re_A(c_4, c_2, p)]$$

6.3.14   Information Source Subject and Propositional NP Object

Many verbs occurring in **ISS+PTC** constructions are also used in **ISS+PNO** constructions. Some verbs, like *refute*, are used only in the latter one. The two constructions are similar from a semantic point of view. The crucial difference is that the propositional argument is characterized by means of a noun phrase in the **ISS+PNO** construction type, an example of which is given by sentence (6.21), which may be understood along the lines of formula F 6.18.

(6.21)   A letter confirmed all of Mary's fears.

F 6.18 $\exists x [\, \mathsf{letter}(x) \wedge \forall p [\, \mathsf{fear}(\mathsf{i}_{\mathsf{Mary}}, p) \rightarrow \mathsf{confirm}(x, p)]]$

6.3.15   Information Source Subject, Cognitive Agent Object, and Propositional That-Clause

Information source subjects also occur in constructions with cognitive agent objects. The **ISS+CAO+PTC** construction is exemplified by (6.22).

(6.22)   Peter convinced Mary that Venus is a planet.

This verb is most naturally assumed to stand for a three-place relation that holds of an "information source", a cognitive agent, and a propositional concept. The **PTC** is incident to the same kinds of ambiguity as in ordinary **CAS+PTC** constructions. This is also to be expected from the circumstance that the verbs occurring in

this construction seem to stand for relations that may be explicated in terms of propositional attitudes. For instance, to *convince* A that p is to cause A to believe (strongly) that p. So, the *de re* reading of (6.22) may be rendered as:

F 6.19 $\exists p \exists c_1 \exists c_2 [\, \mathsf{convinced}(\mathsf{i_{Peter}}, \mathsf{i_{Mary}}, p) \wedge \Re_A(c_1, c_2, p) \wedge$
$\qquad\qquad \mathcal{C}_{\mathsf{planet}}(c_1) \wedge \Delta_a(c_2, \mathsf{i_{Venus}})]$

6.3.16   Information Source Subjects, Cognitive Agent Object, and Concept Infinitival Phrase

There is also a number of verbs that take part in **ISS**+**CAO**+**CIP** constructions, as exemplified by sentence (6.23).

(6.23)   James convinced Mary to buy a dog.

In the sense relevant here, convincing someone means something like causing him to form an intention, and the **CIP** in (6.23) clearly corresponds in semantic function to the **CIP** complement of intention-related verbs (such as *intend*, *try* etc.). In a context like this one, the verb *convince* may consequently be taken to stand for a three-place relation holding of an "information source", a cognitive agent, and a property concept.[5] So, a *non-specific* reading of (6.23) may be rendered as:

F 6.20 $\exists p \exists c_1 \exists c_2 \exists c_3 \exists c_4 \exists c_5 \exists c_6 [\, \mathsf{convinced}(\mathsf{i_{James}}, \mathsf{i_{Mary}}, c_1) \wedge \mathcal{C}_{\mathsf{buy}}(c_2)$
$\qquad\qquad\qquad \wedge \mathcal{C}_{\mathsf{dog}}(c_3) \wedge \Re_{\frown}(c_2, c_4) \wedge \Re_{\times}(c_3, c_4, c_5) \wedge$
$\qquad\qquad\qquad \Re_{\Sigma}(c_5, c_6) \wedge \Re_{\sqcup}(c_6, c_1)]$

6.4   Parenthetical Use of Propositional Attitude Verbs

In ordinary **CAS**+**PTC** propositional attitude report constructions the **PTC** is a subordinate clause and in a sense it has a subordinate role also semantically. Such a report may primarily be about a cognitive agent and his mental attitudes. Sometimes, however, it is the **PTC** content that is in the focus of interest. That this content

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[5] Jackendoff [1985], discussing a similar sentence, thinks that the attitude is towards a contemplated action. Actions, it seems, are contemplated under a certain description (hardly a uniquely identifying one). However, I think that the **CIP** complement stands for a property concept representing a property of the agent having the intention in question, namely the property of performing an action with certain characteristics. The **CIP** must be of an appropriate kind: To "convince someone to be Mary's brother", for instance, does not make sense, if the words are understood "literally".

happens to be the content of a propositional attitude state may be of subordinate significance. There is a kind of construction, peculiar to certain propositional attitude verbs, that is used in these cases. Urmson [1952] calls it the **parenthetical use** of propositional attitude verbs. A sentence where a verb is used in this way corresponds to a sentence with an ordinary **PTC** complement. Syntactically, the parenthetical use[6] is characterized by two features: The content of the propositional attitude is rendered by an ordinary indicative main sentence and the propositional attitude verb and its other complements are inserted somewhere within or at the end of the indicative sentence, as in the following examples.

(6.24)   Your house is, *I suppose*, very old.
         Frege was a logician, *you know*.
         He is dead, *I am sorry to say*.

The italicized groups of words seem to modify a main sentence, rather than to be the sites of the superordinate verb. This is also reflected in the circumstance that what seems to be stated is the content of the non-italicized main sentence. For instance, an assertion of (6.25) will plausibly be understood as a statement about animals rather than about the speaker's mental states.

(6.25)   Groundhogs are more common than woodchucks, *I guess*.

It even seems to be possible to hold that an utterance of (6.25) will be false even if the speaker actually guesses that groundhogs are more common than woodchucks. By adding "*I guess*" the speaker just weakens the assertoric force of his utterance. His words do not suddenly reveal that what seemed to be an utterance about animals in fact was one about his propositional attitudes. These intuitions are not too strong and may no doubt be contended, but if we assume that they are correct, it seems that the italicized groups of words in (6.24) and (6.25) should be understood as independent comments, which, so to speak, are made in passing. So, the comment "*I guess*" in (6.25) may be read as involving an implicit indexical reference to the preceding sentence token, i.e. as "I guess (that) groundhogs are more common than woodchucks." An alternative analysis is to treat these sentences as syntactic variants of the corresponding **PTC** constructions and take them to be truth-conditionally synonymous.

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[6] I define it in syntactic terms, whereas Urmson [1952] rather understands the parenthetical use in semantico-pragmatic terms. Urmson's analysis is challenged by Charlesworth [1965].

Aijmer [1980, p. 13–15] draws a distinction between two kinds of reading of propositional attitude attribution sentences. There are literal readings which take them to be about mental attitudes and there are conversational readings which take them to be assertions of the **PTC** content. (The latter kind of reading corresponds to Urmson's "parenthetical use".) For instance, consider Aijmer's example (6.26).

(6.26)   Scientists believe that nuclear power is dangerous.

The literal reading takes this to be a statement about belief, whereas the conversational reading takes it to be an assertion that nuclear power is dangerous preceded by an **epistemic qualifier**. This epistemic qualifier is just an indication of a reason to trust the main assertion. However, from the point of view of BTC-meaning (cf. Section 2.7.4) I think that we should not assume that there is an ambiguity of the kind Aijmer describes. There is no reading of (6.26) that would make it truth-conditionally synonymous with "nuclear power is dangerous". It is possible to express the belief that nuclear power is dangerous and that this belief is well-founded by uttering (6.26), and to make these points may be more important than to say something about the beliefs of scientists. But both messages may be communicated by means of saying something about the beliefs of scientists. So, the level of BTC-meaning may be taken to be insensitive to this distinction ("literal"/"conversational") between communicative intentions: Both kinds of use may be served by the same BTC-meaning.

6.5   Conceptual Relation Adjectives

There is a number of adjectives that may be viewed as standing for conceptual relations. This is illustrated by a sentence like (6.27). Both the subject and the **CIP** complement of the adjective appear to be intensional contexts.

(6.27)   Peter is said to be a murderer.

Sentence (6.27) may be read *de dicto* in this way:

F 6.21 $\exists c_1 \exists c_2 [\mathsf{said}(c_1, c_2) \wedge \mathcal{C}_{\mathsf{Peter}}(c_1) \wedge \mathcal{C}_{\mathsf{murderer}}(c_2)]$

There is however a strong preference to understand the subject of constructions like (6.27) *de re*, and this reading may be rendered as:

F 6.22 $\exists c_1 \exists c_2 [\mathsf{said}(c_1, c_2) \wedge \Delta_a(c_1, \mathsf{i}_{\mathsf{Peter}}) \wedge \mathcal{C}_{\mathsf{murderer}}(c_2)]$

In this situation, Peter may be taken to be more directly involved. If we eliminate the concept that mediates the reference to Peter, the *de re* reading will rather look like:

F 6.23 $\exists c[\mathsf{said}(\mathsf{i}_{\mathsf{Peter}}, c) \wedge \mathcal{C}_{\mathsf{murderer}}(c)]$

The analysis represented by formula F 6.23 is simpler than that of formula F 6.22, but the latter may be preferred because it allows us to assume that the first argument of $\ulcorner\mathsf{said}\urcorner$ always is a conceptual one.

It seems to me that there is a tendency to avoid non-specific readings of the subject of this construction. If they are, a sentence like (6.28) only has specific readings (one *de re* and the other one *de dicto*), and this would explain why one like (6.29) sounds strange (at least to my ears).

(6.28)   A logician is said to know the proof.

(6.29)   ?Any logician is said to know the proof.

The relevant intuitions are not too strong, and other speakers of English may disagree about these judgments.

6.6   Epistemically Qualifying Adverbs

Urmson notes that the kinds of comments that can be made by means of parenthetically used propositional attitude verbs often also can be made by means of adverbs. Instead of inserting "I think", one may modify an assertion with *probably* much to the same effect in many cases. Some sentence adverbs of this kind seem to turn the sentence in which they occur into an oblique context. These adverbs include *probably*, *allegedly*, *obviously*, *certainly*, *evidently*, *according to …*, and *in plain words*. Most of them are related to propositional attitudes. For instance, (6.30) is roughly synonymous with (6.31).

(6.30)   According to Mary, Fido is a groundhog.

(6.31)   Mary holds that Fido is a groundhog.

The logical form of (6.30) is, I think, best understood as being of the same structure as that of (6.31). The other adverbs in this group are not relational in the same way. A sentence like (6.32) may be read along the lines of (6.33).

(6.32) Frege is obviously the greatest logician since Aristotle.

(6.33) It is obvious that Frege is the greatest logician since Aristotle.

It seems that adverbs like *allegedly*, *clearly*, and *plausibly* are best seen as standing for properties applying to propositional concepts (cf. McCawley [1973]). This is also supported by the fact that these adverbs make the sentences in which they occur incident to the ordinary kinds of ambiguity and obliqueness of intensional contexts.

   An adverbial expression like *in plain words* seem to work somewhat differently. A sentence in which it is inserted becomes logically stronger. I think "in plain words" should be seen as a meta-comment and a sentence like "x is, in plain words, p", for instance, may be understood as the conjunction "x is p", and "'p' consists of plain words".[7] Those of my intuitions relevant here are not too strong.

6.7 Modal Statements

Modal sentences provide, along with propositional attitude attributions, the prime examples of oblique constructions. Certain kinds of necessity and possibility may be said to be matters of **epistemic modality**. An epistemic possibility is something that is compatible with a certain body of knowledge, while a state of affairs is epistemically necessary if a body of knowledge implies that it obtains. These kinds of modality are intimately connected to propositional attitudes and the framework of Chapter 4 is applicable to their analysis. Let us consider a sentence that obviously involves epistemic modality:

(6.34) Fido may, for all Mary knows, be a groundhog.

The *de re* reading of this sentence should, I think, be analyzed along the lines of formula F 6.24.

F 6.24 $\exists p \exists c_1 \exists c_2 [\mathsf{EP}(p, \mathsf{i}_{\mathsf{Mary}}) \wedge \Re_A(c_1, c_2) \wedge \mathcal{C}_{\mathsf{groundhog}}(c_1) \wedge \Delta_a(c_2, \mathsf{i}_{\mathsf{Fido}})]$

In this formula, 'EP' (to be read "epistemically possible for") stands for the relation holding between a cognitive agent and what may be the case for all he knows. What motivates this assimilation to propositional attitude attributions suggested by

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[7] Quine [1943], [1960b, p. 153] suggests a similar analysis of the sentence "Giorgione was so-called because of his size".

formula F 6.24 is mainly the inherent connection to propositional attitudes and the fact that "Fido" and "be a groundhog" seem to be placed in a context that is oblique in the same way as a *that*-clause complement of a propositional attitude verb is. So, codesignative words cannot be interchanged *salva veritate*, and (6.34) is open to the same kinds of reading as the sentence "Mary believes that Fido is a groundhog".

In Section 4.4.5 an analysis of alethic modality was suggested. There are other kinds of modality than epistemic and alethic, and the analysis of modalities is a philosophically controversial matter into which I will not delve any deeper here.

6.8   Conclusions

The aim of this chapter has been to show that the kind of analysis suggested in the previous chapters is applicable to a wide range of sentence types used to talk about the content of mental states. It is impossible to demonstrate that every sentence of this kind can be accommodated in a natural and plausible way, for the simple reason that there is no definition of this category of statement to take as the point of departure for a demonstration of such a claim. This chapter has however shown that the present framework of propositional attitude report semantics is systematically applicable to a wide variety of sentences used to make conceptual attitude reports and that it allows us to account for the semantically relevant ambiguities that are encountered. The interested reader will take this as an invitation to look for statements that can falsify this claim.

I also think that the examples in this chapter have shown that many of the kinds of intensional entities (concepts) posited in Chapter 4 provide the relata of mental attitude relations. Propositional concepts are the relata of propositional attitudes, while individual concepts enter the picture as the relata of attitudes in specific readings of constructions involving a **CNO** or **CPP** complement. Property concepts are involved in non-specific readings of the same kinds of complements and of **CIP** and **CPA** complements. Interestingly, there does not seem to be any complement type that corresponds to relational concepts.

Six of the conceptual complement types may be seen as a product of two classification principles: First, there is the three-way distinction between propositional, predicative, and individual concepts. Secondly, there is syntactically based classification distinguishing between clausal construction (i.e. those headed by a verb), noun phrases and prepositional phrases. Their interrelationship is made clear in Table 6.2. It is not indicated in this table that the **CPA** complement type sometimes

Phrase	Concept Type		
Type	*propositional*	*predicative*	*individual*
clausal	**PTC**	**CIP/CPA**	-
nominal	**PNO**	**CNO**	
prepositional	**PPP**	**CPP**	

Table 6.2: Conceptual Complement Types

occurs governed by a preposition.

The present treatment is intended to apply to all kinds of intensional language use. The aim of the present chapter has been to give an overview of sentential constructions in English that involve intensional complements and to demonstrate how they can be accommodated in the Chapter 4 framework. It cannot be proved that all relevant constructions have been taken care of—they probably have not—, but I do think that the examples discussed in this chapter should have increased our confidence that all kinds of intensional discourse can be given an adequate treatment within the present framework.

Another question is whether this kind of analysis is applicable to the corresponding constructions of other languages. It seems that languages quite close to English, such as Swedish, German, and French, allow constructions that are isomorphic to those discussed here and analyzable in the same way. It lies outside the scope of the present work to investigate to what extent the semantic framework introduced in Chapter 4 is universally applicable to human languages, but the conjecture that it will apply as favourably to most germanic and romance languages as to English does not seem too bold.

Another question of extensibility is this: Can the present treatment be "saved" if it turns out that a logic more powerful than first-order predicate calculus is needed to take care of natural language semantics? Those conceptual relations that have been recognized here ($\ulcorner\Re_\frown\urcorner$, $\ulcorner\Re_{\widehat{}}\urcorner$, $\ulcorner\Re_\Sigma\urcorner$, $\ulcorner\Re_\sim\urcorner$, $\ulcorner\Re_\times\urcorner$, $\ulcorner\Re_\sqcap\urcorner$, and $\ulcorner\Re_A\urcorner$) are derived from PFLST and are thus tailored to the accommodation of first-order content, but the general approach will also extend to some more powerful formalisms. For instance, a predicate-functor logic equivalent to Montague's [1973] intensional logic could quite easily be defined. Non-logical constants would have to be typed, but variables could be eliminated in the same way as before and only a few new functors would

have to be added. A decision to use this intensional logic to take care of propositional contents would consequently not preclude a treatment of propositional and other conceptual attitude reports similar to that proposed here. (However, the main reason for using Montague's logic is that it makes another treatment of attitude reports possible.) So, the general idea that attitude contents are to be seen as nodes in a network of logically related concepts is to some extent independent of the question of what kinds of concepts there are and *how* concepts might be logically related to each other. (Montague's logic implies a richer inventory of concept types and logical relations.) Now, is it possible to define a content representation language that makes a concept network approach impossible (i.e that is not equivalent to a predicate-functor language)? Perhaps, but such a language would be strikingly different from ordinary formalisms like first-order predicate calculus and Montague's intensional logic, and it is hard to imagine a possible reason why to use such a language (if there is one).

7

CONCLUSION

7.1 Recapitulation

I will conclude this thesis by briefly recapitulating the aims and achievements of the work that has been reported here. After introducing the subject of propositional attitude reports in Chapter 1, I turned, in Chapter 2 to the task of giving an overview of the assumptions and methodological practice lying behind truth-conditional approaches to natural language semantics. I tried to show how the notion of truth-conditional content belongs to an account of language use as purposive behaviour guided by intentions entering into a structure of means to ends.

The aim of Chapter 3 was to give an overview of what philosophers, logicians, and linguists, mainly those belonging to the post-Fregean traditions of analytic philosophy and formal semantics, have said about the semantics of propositional attitude attribution statements. A number of different approaches to their semantics could be distinguished. Consideration of them and their difficulties warrants the conclusion, I suggested, that propositional attitude discourse should be analyzed as characterizing attitude content in terms of a system of fairly abstract and primitive content elements (concepts). In Chapter 4, I developed this idea further, trying to refine it and implement it in a powerful, yet simple and formally constrained theory. The novel feature of this formal system is that its structure is derived from a Quinean predicate-functor logic, which allows us to eliminate certain unnecessarily complicated features of traditional logical calculi (variables and the mechanisms of variable binding). This step makes it possible to recognize only two kinds of concepts: individual concepts and predicate concepts (of different degrees), propositional concepts being zero-place predicate concepts. Chapters 5

and 6 demonstrated further how the formal framework of Chapter 4 may be applied to various English constructions. The problems associated with the analysis of *that*-clause complements were addressed in Chapter 5, which also provided treatments of "conceptual" anaphoric reference, and of nouns and adjectives that stand for classes of propositional concepts. Chapter 6 gave an overview of different kinds of propositional and other conceptual attitude attribution sentences in English and showed how the logical forms of these locutions could be rendered in accordance with the ideas presented in Chapter 4.

7.2   Evaluation

The main contributions of the present thesis are the inventions of the formal framework developed in Chapter 4. The key idea—to derive a system of concepts from the structure of (a) Quinean predicate-functor logic—is, as far as I know, original. This idea is rewarding in two respects: First, it allows us to characterize content in terms of concepts and logical relations, locating them in a conceptual network, without having to introduce any non-conceptual items to get the logical relationships right. In particular, there is no need for any kind of variable or label to take care of quantification or cross-identification of argument places. Secondly, the system is quite simple in that only seven basic conceptual relations ($\ulcorner\Re_\frown\urcorner$, $\ulcorner\Re_{\frown}\urcorner$, $\ulcorner\Re_\Sigma\urcorner$, $\ulcorner\Re_\sim\urcorner$, $\ulcorner\Re_\times\urcorner$, $\ulcorner\Re_\sqcap\urcorner$, and $\ulcorner\Re_A\urcorner$) are needed to express any kind of conceptual relationship expressible in first-order predicate calculus.

A possible objection against the present treatment may be answered at this point. The quite fine-grained analysis that is required by the six basic conceptual relations often makes conceptual constraints expressed in the logical forms of propositional attitude attributions quite complicated (in terms of the number of clauses necessary). However, this complication may be relegated to the background if common kinds of non-basic conceptual relations are defined in terms of the basic ones. (An example is provided by formula F 4.9 on page 109.)

The advantage of an abstract content approach of the present kind over sententialist accounts and standard possible worlds approaches is that contents are allowed to be just as finely discriminated as the semantics of attitude reports requires. Standard possible worlds accounts identify equivalent propositions and the implausible principle that all cognitive agents are logically omniscient is, so to speak, built into the system. Natural language sententialist accounts are marred by the difficulty that the content of a sentence depends upon its context of use and by the fact

that differences in wording does not need to be taken to be cognitively significant. Davidson's paratactic account evades the first of these problems, but the price paid is that there is no structure read into the attitude contents. The present account tries to be richer in that respect. However, the abstract content approach proposed here may be understood as a kind of artificial language sententialist approach.

An important advantage of the treatment of the logical form of propositional attitude reports proposed here is that it indicates a way of dealing with a fairly wide range of contents (viz. those it is possible to express in first-order predicate calculus) within a quite restrained framework. It is therefore plausible that the present account, due to its simplicity, ontological economy, and formally constrained nature, could be of use in a computer application, e.g. in a knowledge representation language capable of stating hypotheses about mental attitudes.

The present study may also prove valuable in directing its readers attention towards Quinean predicate-functor logic. A new notation may suggest new ways of looking at things and predicate-functor logic represents a conception of quantification and the relationship between syntax and semantics that is quite different from that embodied in ordinary predicate calculus. Predicate-functor logic may prove a source of useful insights also in other areas of application.

The formal framework introduced in Chapter 4 is intended to apply to all kinds of discourse about intensional attitudes. Chapters 5 and 6 survey different kinds of intentional idioms in English and show that they can be accommodated in a plausible manner. This work consequently gives an overview of intensional constructions in English and suggests a uniform and systematic treatment of their semantics.

The aim of the present chapter was to place the truth-conditional account of propositional attitude report semantics given here into a larger picture of the use of such reports. I argue that the information encoded by the conceptual system is of the kind that language users may plausibly be assumed to grasp in their understanding of language.

7.3 Issues for Further Investigation

A commonplace in the final chapter of a dissertation is a paragraph about prospects for further research, suggesting the picture of an ongoing inquiry proceeding like the exploration of unknown territories. In this context this picture is almost ridiculous: Discourse about propositional attitudes is a very well-known thing and—in a sense—we all know what we are doing when we engage in it. Yet, it has shown

itself to be a theoretically very difficult phenomenon: Almost every claim that is made about it gives rise to new questions and any possible argument invites new objections. Every little detail of a theory about propositional attitudes seems to suggest an issue for further consideration.

However, I think that the present account may be taken as a point of departure for the investigation of a number of issues. One is suggested by a deficiency of the present work, namely that it does not account for the strength of propositional attitudes (other than as a distinction between attitude relations [e.g. between *suspicion* and *conviction*]). Belief and desire are formalized as a simple either-or matter, while they often are described as a matter of degree. A belief, for instance, may be everything from a vague feeling to a conviction. Decision theory suggests ways of dealing with belief strength, but the problems are considerable: Ordinary belief reporting practice does not seem to measure this strength in mathematical terms. An issue that may be worth addressing is consequently how the present framework could be augmented to allow attitude strength to be accounted for.

A formalized semantics like the one put forth here may also be taken as a point of departure for more empirically oriented studies. An interesting issue is to what extent the kind of semantic possibilities that have been accommodated here are being put to use in actual propositional attitude reporting practice. To what extent are, for instance, *de re* and *de dicto* and (in the latter case) specific and non-specific readings actually found?

Practical reasoning about propositional attitudes is another possible object of empirical study. How do people arrive at hypotheses about such matters and how do they defend the claims they make about other people's propositional attitudes? An investigation of reasoning on propositional attitudes would have to make assumptions about the logical structure of the relevant premises and conclusions and the account given here is a possible candidate for the account that is needed to that end.

Another avenue for further work would be to incorporate the proposals made here in a more extensive semantic account of a language, or in a fully formalized compositional semantics. Implemented on a computer, such a system could be used as a tool in empirical studies of the kind suggested above. An even more ambitious task would be to develop computer models of propositional attitude interpretation. The system proposed here would—in view of its formally constrained and conceptually parsimonious nature—be a good candidate for a knowledge representation framework within which to formalize hypotheses about propositional attitude states.

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