Natural Language Semantics
A Naturalistic Approach

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Abstract

Within linguistics, the dominant truth-conditional approach to semantics belongs to the Tarskian, model-theoretic tradition. Theories in this tradition offer an abstract, mathematical description of the truth conditions of natural language expressions in terms of their correspondence with the world. This thesis takes issue with existing model-theoretic accounts of quantification on the basis that the specific abstract relations that they describe could not plausibly be models of natural language-to-world relations.

Recent decades have seen much philosophical interest in naturalistic theories of reference and mental content. In one sense, these theories address the above concern by trying to identify something naturalistic for semantic correspondence to consist in, such as causal-historical chains or ceteris paribus laws. In another sense, they fail to address the problem, since no account is given of either the semantic structure or the truth conditions of even the tiniest fragment of a natural language. Crucially, it is far from clear that model-theoretic semantics, in anything like its present form, can accommodate the solutions proposed by naturalistic theories of content. If correspondence truth and naturalism are both to be retained, a new theory is needed.

I begin by arguing that the class nominalism underlying model-theoretic semantics is unsuited to this naturalistic project, and propose that a variant of Armstrong's realist metaphysic, incorporating Donald Baxter's theory of aspects, provides the ideal ontology. I revise and extend Baxter's theory for a more complete and precise account of the instantiation of properties and relations, and show that the theory of aspects allows for an appealing treatment of both numbers and general facts.

Against the background of this realist metaphysic, and drawing on insights from naturalistic theories of mental content, I propose an original theory of mentally represented semantic structures and their truth-conditional analysis. Within this framework, I treat the core semantic phenomena of predication, negation, conjunction, and disjunction, and devote considerable attention to relations. I also develop a detailed theory of quantification, which includes a fully naturalistic account of both universal quantification and numerals.

Declaration

I hereby declare that this thesis is of my own composition and that it contains no material previously submitted for the award of any other degree. The work reported in this thesis has been executed by myself except where due acknowledgement is made in the text.

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Acknowledgements

Preface

I adhere to the following conventions throughout the thesis. Single quotes are used to name or mention expressions. Italicised expressions name properties, or are used for emphasis, but never name expressions or concepts. Small capitals are used to name concepts. Double quotes are used for citation and scare quotes.

Contents

Chapter 1

Introduction

In this thesis I address the problem of giving a correspondence-based semantic theory for natural language within the confines of naturalism. On the one hand, this is primarily a linguistic task, since it involves the construction of a theory capable of describing and explaining the truth conditions of natural language expressions. On the other hand, the constraints of naturalism, when applied to this task, require careful attention to a number of philosophical considerations. The first part of the thesis (Chapters 2–4) is therefore dedicated to issues in metaphysics, philosophy of language, and philosophy of mind. This lays the groundwork for the second part of the thesis (Chapters 5 and 6), in which I propose an original linguistic theory of semantic structures and their truth conditions.

Through the remainder of this introduction I explain the notions of naturalism, and of a correspondence-based semantic theory. I show that existing semantic theories fail to meet the criteria of one or the other. Existing linguistic theories are either non-correspondence-based, or their approach to quantification is incompatible with semantic naturalism. Existing naturalistic theories of reference and/or content are insufficiently developed to qualify as linguistic semantic theories, since they do not assign truth conditions to specific expressions or semantic structures. I explain the importance of a naturalistic correspondence theory, and discuss my approach to a solution.

1.1 Approaches to semantics

There are two basic sorts of approaches to semantics within theoretical linguistics. One sort of approach takes the view that semantic reality is an aspect of *narrow* psychology. That is to say that semantic reality consists in structured mental entities (which may be theoretically represented, for example, by feature matrices), which reside entirely within the mind/brain. This is consistent with the way that other linguistic faculties, such as syntactic and phonological competence, are understood within theoretical linguistics—as *purely psychological* phenomena. Examples of this approach are the various theories of lexical and cognitive semantics (see, e.g., Jackendoff, 1990, 1996, and Pustejovsky, 1995). We briefly touch on these sorts of theories again in Chapter 3. However, because the present task concerns correspondence-based semantic theories, narrow-psychological theories are of limited relevance.

The other major sort of approach, which I refer to as truth-conditional semantics (TCS), takes explaining the truth-conditions of linguistic expressions as central to the semantic task. This distinguishes it quite sharply from the narrow-psychological sort of approach outlined above, where truth—at least as a correspondence between language and *the world*—doesn't feature at all.

It ought to be noted that TCS theories need not subscribe to *correspondence* truth. For example, Davidson (1984) denies the need for an explanatory theory of reference and, although he previously described it in such terms, considers that his is not a correspondence notion of truth (1990: 303, referenced by Devitt, 1997: 37,180). My view is that if a theory includes such statements as "'John' denotes John" and "for all x, 'walks' applies to x iff x walks", it is committed to semantic facts that require some sort of explanation—even if that "explanation" just amounts to the claim that these are ultimate and irreducible facts, or merely formal/arbitrary ones. There is an alternative, instrumentalist interpretation of these claims that does not commit Davidson and his followers to physicalistically expressible semantic facts (that is, even assuming physicalism). Criticism of this position can be found in Devitt (1997: 184–6). An appraisal of semantic instrumentalism would take us too far from the task at hand, so I merely note it as an alternative, though not one that I would advocate, since I am assuming both correspondence truth and scientific realism. The following criticisms of model-theoretic semantics are

on a scientifically realist interpretation of its claims. If an instrumentalist (therefore, non-correspondence-based) interpretation is viable, then these criticisms may not apply, and therefore would not threaten the compatibility of MTS with naturalism.

Many of the TCS theories that appear to subscribe to correspondence truth are model-theoretic. Some notable examples are Lewis (1972), Montague (1973), Barwise & Cooper (1981), Kamp (1981), Link (1983), Keenan & Faltz (1984), Keenan & Stavi (1986), and Fox & Lappin (2005). I refer to this sort of approach as model-theoretic semantics (MTS). If there are well-developed correspondence theories in a non-model-theoretic framework, besides those in the Davidsonian tradition mentioned above, I am not aware of them. However, the critical remarks below concerning MTS are only intended to apply to the sorts of semantic theories of which the above examples are representative—theories whose interpretation is fairly explicitly model-theoretic. Such theories specify (or at least implicitly assume) an object language L, a model M, and various conditional statements (the model theory) of when an expression of L is true in M. Both L and M are formal objects. L is a tuple consisting of, e.g., a set of variables, a set of individual and predicate constants, and a set of logical constants. M is a tuple consisting of, e.g., a set of entities A, a denotation function from individual constants to elements of A and from predicate constants to subsets of A, a variable assignment function, a set of indices (world-times), and so on.

MTS explains truth and falsity in terms of a correspondence between natural language (NL) expressions on the one hand, and parts of the world on the other. This is consistent with the doctrine of correspondence truth, the idea that *being true* is an expression's (relational property of) corresponding in a certain way with the world. A correspondence-based semantic theory is one in which, roughly, the truth values of expressions depend on the way those expressions correspond to world affairs. Being true is a matter of corresponding, in some specific way, to a certain portion of the world. I don't argue for correspondence truth over its alternatives here, since the problem at hand is not which view of truth is correct, but rather how to construct a correspondence-based theory within the confines of naturalism.[1]

Developing a correspondence-based semantic theory requires specifying exactly what the correspondence consists in (e.g. what sorts of relations), and exactly what the relevant

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[1] See Devitt (1997) for discussion of correspondence truth and its alternatives, including deflationary and verificationist notions.

bits of the world are. MTS meets these criteria. The ontologies of MTS typically consist of basic individuals, sets, functions, and other formal entities. Commonsense entities such as cats, trees, and stones are represented in the ontology as basic individuals. Properties such as *being a cat*, *being a tree*, and *being a stone* are represented as sets of those basic individuals. For example, the property of *being a cat* is represented as the set of individual cats. Alternative ontologies have been proposed. Link (1983), for example, proposes a theory of plurals that employs a mereological lattice-theoretic ontology, rather than a set-theoretic one. Keenan & Faltz (1984) represent properties as the basic individuals in their theory, and commonsense entities (cats, trees, stones, etc.) as sets of those properties. For present purposes, these alternative ontologies are similar enough to be regarded as equivalent.

What all theories of MTS have in common is a well-specified ontology and a detailed account of the correspondences that truth and falsity consist in. This aspect of MTS sets the standard for correspondence-based semantic theories. Nevertheless, there is reason to question whether MTS, at least on a scientifically realist interpretation, is compatible with naturalism in every respect. We turn to this matter in the following section.

1.2   Naturalism and causal closure

Naturalism is the idea that there is nothing more to reality than the natural world, and/or that all aspects of reality are amenable to scientific investigation. These are the metaphysical and epistemological versions of naturalism, respectively. The former is the most relevant one here.

A related and highly plausible doctrine that has arguably led to the widespread acceptance of naturalism in the sciences and philosophy (Papineau, 2008) is that there is "causal closure" of the natural/physical (henceforth just 'natural') world. That is to say that all natural effects have exclusively natural causes.

This is significant because, assuming that the doctrine of causal closure holds true, if semantic phenomena are to have any effect in the natural world, which is to say any causal influence whatever, they must themselves be natural. If one is persuaded of causal closure (which, it seems, practically everyone with a scientific bent is—even those who

want to allow room for the supernatural), and one believes that semantic phenomena make a causal difference in the natural world (for which I consider arguments presently), then one should also believe that semantic reality is part of the natural world. The aim of this thesis is to reconcile the requirements of a truth-conditional semantic theory with semantic naturalism.[2]

The mass of literature on naturalistic theories of reference and mental content might suggest that there are already a number of naturalistic frameworks for doing truth-conditional semantics.[3] However, the focus of these theories is on providing a naturalistic foundation for reference, and for the intentionality of language and thought more generally. In contrast, the theory I present here draws on insights from these theories and applies them to the *linguistic* task of providing a semantic theory, which is to say a theory that assigns truth conditions to particular expressions, given a particular ontology. No existing theory of content that I am aware of addresses this linguistic task directly. Millikan perhaps comes closest to providing a semantic theory in this sense, since she includes significant discussion of how certain quantifiers and other functional (in the sense opposed to that of 'lexical') vocabulary fit into her theory of content (1984). She also devotes a significant portion of the book to explaining how expressions map onto world affairs. Nevertheless, one is left without a clear idea of how any particular expression's truth value should vary in correspondence with world affairs or, for that matter, what a given world affair is like in Millikan's ontology.

I suggested above that MTS is a benchmark for correspondence truth-based semantic theories. It has contributed countless analyses, and proposed solutions to a wide variety of semantic problems. Since it represents our best attempt to capture the truth conditions of NL expressions, the question of its compatibility with naturalism (or just causal closure) is a central concern.

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[2]Whenever 'naturalism' is used in the context of philosophical semantics, it carries the notion that semantic reality is not only part of the natural world, but also causally integrated. This distinction is potentially important, since a naturalistic ontology may admit of entities that are typically regarded as abstract, such as sets and functions (see [2.2.2]). It is in the causally integrated sense that I claim semantic reality is naturalistic.

[3]See for example Dretske (1981), Millikan (1984), and Fodor (1990).

1.2.1 The problem of merely abstract correspondence

If mathematical entities and relations are causally inefficacious, as the philosophical consensus has it, then a semantics based in mathematical reality could make no causal difference in the natural world. In line with this, Millikan argues convincingly that a correspondence theory that consists in purely mathematical mapping functions is vacuous.

> If any certainty has emerged from the last thirty years of philosophy, it is that a *pure* correspondence theory of truth is vacuous. By a *pure* correspondence theory I mean a theory that signs or representations, when true or correct, are true or correct *merely* by virtue of there being a, some, mapping function that maps these representations onto parts of the world or reality. [...] If any correspondence theory of truth is to avoid vacuousness, it must be a theory that tells what is different or special about the mapping relations that map representations onto representeds.
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> The difference or specialness cannot be merely a formal specialness, say, a special kind of simplicity [...] No kind of formal specialness is logically more special than any other [...] The specialness that turns a mathematical mapping function into a representation-represented relation in a given case must have to be some kind of special status that this function has in the real, the natural, or the *causal* order rather than the logical order.
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> (Millikan, 1984: 86–7)

While Millikan's basic claim is surely correct, it is not obvious that this has significant consequences for MTS. After all, the denotation function may be a mathematical description of a perfectly natural reference relation. Devitt appears to think that this is the only obstacle for a naturalised version of Tarski's theory of truth (1996: 167). Here I disagree with Devitt, however. I claim in [1.2.2] that there is a significant problem for MTS in its treatment of quantification.

My present concern is that Millikan's words suggest another, quite dubious idea. This is that a mathematical mapping can acquire a special status due to the function it has in the natural world. It might seem that the correct reading of these words is that a *natural relation*, which may trivially be *described* as, or in terms of, a mathematical mapping, may have a certain function in the natural world. However, further remarks from Millikan, which I criticise in [4.1.2], suggest that it is the strict reading that she intends: that a mathematical mapping may acquire a natural function.

Millikan is not the only author to claim that formal mappings may be put to some naturalistic purpose. A similar idea seems to be involved in the suggestion that we *know*, or merely believe in, abstract truth-conditions, and thereby make naturalistic use of a formal language and its formal correspondence with the world. This may be found in remarks from both Partee (1979) and Lewis (1983). Consider, in particular, the following passage from Lewis.

> My proposal is that the convention whereby a population P uses a [formal] language λ is a convention of truthfulness and trust in λ. To be truthful in λ is to act in a certain way: to try never to utter any sentences of λ that are not true in λ. Thus it is to avoid uttering any sentence of λ unless one believes it to be true in λ. To be trusting in λ is to form beliefs in a certain way: to impute truthfulness in λ to others, and thus to tend to respond to another's utterance of any sentence of λ by coming to believe that the uttered sentence is true in λ.
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> (Lewis, 1983: 167)

Such notions, I claim, raise more difficulties than they could hope to solve.[4] What is it to know or believe in a certain denotation function, and therefore to know or believe that 'tree' denotes the set of trees, and 'dog' the set of dogs, and so on? If this bit of knowledge concerns, as it surely must, real trees and real dogs, it would be absurd to consider it some kind of mathematical knowledge. Plausible epistemologies of the natural world presuppose a suitable theory of truth that connects us to external reality in some non-arbitrary way. If the correspondence of *truth* is abstract, how could knowledge of the truth conditions involve, e.g., actual trees and actual dogs in any non-arbitrary way? If truth is naturalistic *independently of this knowledge or belief*, then there's no sense to the idea that language users make naturalistic use of a formal correspondence through this knowledge or belief.

To my mind, the only role that mathematical entities and relations might serve is in the *theory* of semantic reality, thereby fulfilling the same sort of role as they fulfil in any other

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[4]The idea that competence in a language should consist in knowledge of truth-conditions is rarely supported by argument. Here I agree with Devitt, that "[t]here is no good reason to suppose that a person who is competent with a sentence – who has the ability to use it with a certain meaning – must thereby have any propositional knowledge about what constitutes its meaning" (1996: 173). Cf. also Fodor & Lepore (2002: 95): "It is [...] not plausible that understanding the word 'red' requires knowing what quotation is, or having the concept of denotation, or the concept of a property, and so on".

sort of formalised scientific theory. These mathematical entities and relations are not part of the reality that our theories aim to uncover—not, at least, if we have reason to believe that semantic reality is causally efficacious.

There is a related epistemological objection to consider, which is roughly this: How could getting things *right* be so utterly arbitrary, especially when getting things right so often offers the best explanation for our successes in interacting with the world? In light of this, how could someone's being right about something, having a *true* thought or belief, be no more than the thought's standing in some arbitrary, mathematical relation to a world affair? Could it really be that profound (true) ideas about, e.g., the nature of black holes have no more *special* a relation with black holes than they have with, say, my missing the bus yesterday?

If you think that meaning consists in merely formal relations, then the problem you have is that even if your thoughts about X *somehow* have a special naturalistic relation with X, then this isn't a matter of what those thoughts *mean*. And if it isn't a matter of what they mean, then it isn't a matter of truth, or of getting things right. If you think that meaning consists only in "internal" relations (e.g. "inferential role"—see [3.1]) then, once again, even if your thoughts about X *somehow* have a special naturalistic relation with X, then this isn't a matter of what those thoughts mean, and it doesn't address the problem. The only solution is to make those special naturalistic relations to the world, however "indirect",[5] actually constitutive of meaning.

In any case, there are sound reasons for believing that facts of a semantic nature make a causal difference. Dretske makes the following excellent *prima facie* case.

> We all know how useful a commodity information is, how even the smallest scrap can radically alter the course of human affairs. Think about its role in business, education, and war. Or consider the consequences of telling Michael about his wife's passionate affair with Charles. Kaboom! Their lives are never the same again. A small piece of information dramatically alters a part (and – who knows – maybe eventually the entire course) of world history. In light of such obvious examples, how can anyone seriously doubt the causal efficacy of information and, hence, its

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[5]As Devitt notes, it is an impossible requirement to identify reference with a first-order physical relation. "Reference relations, like mental relations, are ('wide') functional relations which can have many different physical realizations" (1997: 183).

In further support of this, Dretske (1988) develops a plausible theory of beliefs, etc., as "structuring causes" of behaviour within his wider theory of content. I return to Dretske's ideas about the causal role of meanings in Chapter 4.

It is clear, therefore, that there are good reasons to require that the mathematical relations described by MTS to be plausible models of natural mind-world relations. In the following section I suggest that there is a significant problem in this regard with either of the standard ways that MTS treats quantification.

1.2.2   The problem of quantification

In certain theories of MTS, the truth conditions of quantified expressions are captured by variable assignments. A variable assignment is an arbitrary mapping from a set of variables in the object language to individuals in the model (see Dowty *et al.*, 1981: 57–65 or Cann, 1993: 120–22). Variable assignments are a clear example of a model of a correspondence that could not consist in natural relations. There are too many assignments and, unlike the denotations of terms like 'dog' and 'tree', there is no imaginable story of how tokens of 'x', 'y', 'z', etc. could be *assigned to*, in any naturalistic sense, all the different entities they must under all those different assignments. That is, at least, on a scientifically realist interpretation of the claims. The theory says that truth consists partly in a set of relations between variables and particulars in the world. There is no imaginable collection of *natural* relations that all the variable assignment functions could consist in. Since not every *thing* is denoted in the denotation function, the variable assignments cannot supervene on the relations described therein. Therefore, I am much inclined to think that the theory has an irreducibly non-naturalistic component. The problem is not that the correspondence is expressed in terms of a mathematical model. That is just ordinary scientific practise. The problem is that it is a mathematical model of a correspondence that *could not plausibly consist in natural relations*. Since, however, the meanings of various NL quantifiers, including 'most', 'many', etc., are proved not to be expressible in terms of variable assignments (Barwise & Cooper, 1981: 161–2, 214–6), there ought to be very little at stake on this point. Variable assignments have been more or less universally aban-

doned in favour of Generalized Quantifier Theory (GQT). The focus of my argument, therefore, is on the compatibility of GQT with semantic naturalism.

First we must consider what GQT says about quantifier meanings. Here are some examples from Barwise & Cooper (1981: 169), which form part of the model-theory, as an alternative to variable assignments.

(1) a. $[\![\text{some}']\!]$ is the function which assigns to each $A \subseteq E$ the set of sets $\{X \subseteq E \mid X \cap A \neq \emptyset\}$

 b. $[\![\text{every}']\!]$ is the function which assigns to each $A \subseteq E$ the set of sets $\{X \subseteq E \mid A \subseteq X\}$

 c. $[\![\text{no}']\!]$ is the function which assigns to each $A \subseteq E$ the set of sets $\{X \subseteq E \mid X \cap A = \emptyset\}$

Here we have three quantifying determiner denotations. 'Some' denotes a function from a set (property) N to the set of sets (properties) that have a non-zero intersection with N. 'Every' denotes a function from a set (property) N to the set of sets (properties) of which N is a subset. Finally, 'no' denotes a function from a set (property) N to the set of sets (properties) that have a null or empty intersection with N.

For GQT to be a theory of natural semantic reality, it must be that a) there is a natural correspondence between every property and some relevant set of properties, as determined by the model-theoretic condition for each quantifying determiner, and b) this correspondence is *denoted by* that quantifying determiner. Not only, therefore, must all these correspondences be describable in naturalistic terms, they must be the sorts of correspondences that can serve as *denotations* for quantifying determiners.

I claim that although, with the right ontology, the condition in a) may be met, the condition in b) cannot. Once we have accepted a suitable naturalistic ontology, the motivation for describing semantic correspondences in terms of sets and functions is considerably reduced. Crucially, it becomes clear that the naturalistic alternatives to the sorts of formal relations described by GQT cannot be denotations. Naturalism urges us to drop the idea that there is a relation akin to reference between quantifying determiners on the one hand, and a correspondence among properties on the other. GQT cannot be the right

mathematical description of a natural semantic correspondence because it has the wrong components. It describes a denotational correspondence where there cannot be one.

An abandonment of quantifier denotations has very significant consequences for the theory of truth. If 'some' and 'every' have no denotation, how else might the truth conditions of 'Some man laughed' be differentiated from those of 'Every man laughed'? This is a problem explored in [5.3]. An original theory of truth is proposed in [5.4].

I should acknowledge that my claim above raises a meta-problem: If the correlations among properties cannot be denoted, how is it possible to talk about them at all (i.e., when theorising about semantic reality)? When we talk about identity, or the number *three*, there is no *thing*—not even a relation—that we might be referring to. This means that talk about identity and talk about the number *three* as though these were *things* must, when the chips are down, either be paraphrased away, or else be explained in a radically different way from other talk. Note that I am not denying that there is *semantic access* to identity, threeness, etc., only that our access to them is nothing like the denotation relations for quantifiers that are described by GQT. The problem is no more severe than the problem for the class nominalist who wants to make sense of talk about set-membership, or for the resemblance nominalist who wants to make sense of talk about resemblance (see [2.1] for discussion of these and other metaphysical positions). In each case, we need a special theory. Fortunately, these are not problems that need to be solved before we can make headway with more ordinary semantic problems.

1.3   Thesis overview

As noted, the task of this thesis is to devise a semantic theory or framework that is capable of defining the truth conditions of specific NL sentences within the confines of naturalism. Beyond this, of course, the theory must make the kinds of descriptive and explanatory generalisations that are familiar from MTS. Among the most important of semantic phenomena are predication, negation, quantification, conjunction, and disjunction. I propose analyses of each of these as an alternative to the existing model-theoretic ones.

It was noted above that a correspondence-based semantic theory, if it is to be capable of

capturing generalisations comparable to those of MTS, requires a well-articulated ontology. With an appropriate ontology in place, it should be possible to describe what any given state of affairs consists in. One can say, for example, what sort of entity *John's loving Mary* is, how it differs from *Mary's loving John*, and how it stands to the entities John, Mary, and *loving*, respectively. Only with answers to these questions in place can one say what sort of correspondence must hold for 'John loves Mary' to be true. An important task, therefore, is to find an ontology that is both well-articulated and suited to the concerns of naturalism. Chapter 2 is dedicated to this task. I begin with an introduction to the realist and nominalist alternatives, and argue that there are several good reasons for adopting realism. One particular form of realism due to D.M. Armstrong is argued to offer the ideal ontology for the theory. The remainder of that chapter is concerned with Donald Baxter's account of instantiation. I suggest a number of modifications and refinements to Baxter's theory, and use this as the basis of a metaphysical account of numbers (quantities) and totality.

I turn then to the broad philosophical issues of how it is possible for semantic properties such as reference and truth to belong to the natural, physical world. Chapter 3 reviews theories of word meaning, some of the literature on semantic externalism, and Kripke's ideas on reference. In Chapter 4, I review a number of theories of mental content: theories which are intended to solve the problem of naturalised truth. I conclude that the most promising solution is offered by a hybrid of informational and teleological accounts.

The remainder of the thesis is dedicated to the presentation of my semantic theory. In Chapters 5 and 6, I present an original theory of semantic representations and their truth-conditional analysis. Chapter 5 is concerned with the core semantic phenomena of predication, negation, quantification, conjunction, and disjunction, including a theory of truth. I also present a semantic account of numerals. In Chapter 6 I present a semantic theory of relational structures based on Baxter's metaphysical account of relations, and my revisions thereof, as proposed in Chapter 2.

Finally, in Chapter 7, I review the conclusions of the thesis and make a number of suggestions for further development of the semantic theory.

Chapter 2

States of Affairs

In the previous chapter, I set out the task of developing a correspondence-based semantic theory that is thoroughly naturalistic. I argued that MTS is not adequate for this task in its treatment of quantification.

In this chapter, I begin by reviewing the metaphysical alternatives for a naturalistic semantic theory. It is only by getting clear on the metaphysical issues that detailed semantic accounts of the language-world correspondence for specific expressions are possible. I claim that class nominalism, the *de facto* metaphysic of MTS, should be rejected in favour of a naturalistic alternative.

This alternative is Armstrong's "immanent" realism. Following a summary of the theory's main features, I turn to Baxter's theory of instantiation. Baxter gives an intuitive account of instantiation that solves a difficult problem for realism. I suggest some small modifications and extensions to Baxter's theory in order to provide the ontological basis for a semantic theory.

2.1 Realism and nominalism

The term 'realism', as it is used here, refers to realism about universals. This kind of realism, along with the opposing doctrine of nominalism, is the subject of this section. Realism is the doctrine that universals exist, or that universals are real entities. Examples of universals include such properties as *being a cat*, *being a tree*, and *being a stone*.[1] A

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[1] A problem for the form of realism endorsed in this thesis is that of uninstantiated universals. Either the property of *being a ghost* is a real but uninstantiated property (which immanent realism doesn't allow), or

universal is an entity that is repeatable in each of the particulars that have it. Assuming that there is such a property as *being a cat*, realism holds that this one property is instantiated in each of the individual cats. Cats, unlike the property of *being a cat*, are particulars rather than universals, and therefore "non-repeatable". Whereas each particular cat is distinct from every other cat, the property or universal of *being a cat* is the very same in each instantiation. As Armstrong (1997: 21) writes, "[u]niversals are entities that are identical, strictly identical, in different instantiations". I say much more about this strict identity in [2.3], below. Each instantiation of a universal is a state of affairs, or a world affair. I also discuss the nature of states of affairs and instantiation in detail in [2.3].

Nominalism is the doctrine that opposes realism. Rodriguez-Pereyra (2008) divides nominalism into two distinct doctrines: the rejection of universals on the one hand, and the rejection of abstract entities on the other.[2] The kind of realism I endorse here also rejects abstract entities (that is, entities that exist outside of space and time), and so is nominalist only in that naturalistic sense. In what follows, the term 'nominalism' is used only to refer to nominalism about universals.

There are several kinds of nominalism about universals, each of which offers a different alternative to postulating universals. I count "predicate nominalism" as the least plausible of these. This extreme form of nominalism holds that having a property is a matter of being in the extension of a certain term (Armstrong, 1989: 10). For example, being a tree is just a matter of being in the extension of the term 'tree'. This immediately threatens a form of antirealism about the external world (see remarks below concerning "Realism") by putting semantics at the bottom of the pile. I therefore reject it.

A far better alternative is resemblance nominalism.[3] Like other nominalisms, resemblance nominalism denies the existence of universals. Its distinctive feature is that it treats resemblance as a primitive that holds between like particulars. Resemblance is not

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there is nothing for the word 'ghost' to denote. My first attempt at a solution (suggested by Armstrong's combinatorial view of possibility) would be to take *being a ghost* as an impossible combination of real universals (e.g. *being dead* and *being animate* and *being intangible*). These would not be true universals, but might serve as denotations in the form of mere fusions of the component universals. Some pseudo universals would be uninstantiated of necessity, because of the incompatibility of their components. Others would be contingently uninstantiated, as in, e.g., the property of *being a 123 year old woman*.

[2]The latter kind of nominalism opposes realism about abstract entities, or Platonism.

[3]A fairly recent defence of a version of resemblance nominalism is Rodriguez-Pereyra (2002).

a further *thing*, such as a relation that needs to be explained in the terms of the theory. Resemblance is claimed to be ultimate and irreducible, much like identity.

Resemblance nominalism is eminently plausible and comes a close second to realism. Why, then, should we prefer realism to resemblance nominalism? Because, as Armstrong puts it, "once universals are accepted, the formal properties of resemblance can be explained by nothing more mysterious than the formal properties of strict identity" (1989: 57). This is especially clear given Baxter's ingenious solution to the problem of instantiation, explored at length in [2.3], below.

Finally we turn to the most relevant form of nominalism for present purposes, which Armstrong calls "class nominalism" (1989: 8). Class nominalism holds that having a property is a matter of belonging to a certain set. Being a tree, for example, is simply a matter of belonging to the set of trees. The property of *being a tree* is identified with the set of trees, and having that property is identified with being one of its members.

Class nominalism is significant because it is the *de facto* metaphysic of MTS. In the following section I consider various problems associated with class nominalism, and propose that some kind of realism is a much more appropriate ontological basis for a naturalistic correspondence-based semantic theory.

Before we proceed to criticism of class nominalism, I note another kind of realism that is also assumed here: realism about the external world. Precisely what this sort of realism entails (let's call it 'Realism') is the subject of some debate and, no doubt, confusion. I agree with Devitt (1997) that Realism ought to be understood as a (purely) metaphysical doctrine, involving no amount of semantics nor epistemology. A crucial element of Devitt's position is that Realism should not be confused or conflated with correspondence truth. Certainly, they are treated as separate ideas here, and I endorse them both.

Devitt characterises Realism as the highly plausible idea that most types of commonsense and/or scientific entities exist mind-independently and objectively (1997: 23). Some of Devitt's discussion is unfortunately made less transparent by his nominalism. For example, Devitt may say that there are lots of cats, and that these exist mind-independently and objectively but, under his non-specific sort of nominalism, it isn't clear what all cats are supposed to have in common (of course, it doesn't help at this level of discussion to say merely that they're all cats) or therefore how this sameness is to be construed as

objective and mind-independent.[4] Irrespective of realism about universals, it is not only the *things*, but also the *ways things are* that are supposed to be mind-independent and objective. But for anyone who is a realist of both kinds, universals such as *being a tree* and *being an electron*, as well as the particulars that have those properties, are supposed to exist mind-independently and objectively.[5] Equally, particulars are supposed to instantiate the universals they do mind-independently and objectively. In addition to the considerations against class nominalism, to be discussed presently, I take it to be a further advantage of realism about universals that it supports Realism. As just noted, it may be difficult for the nominalist Realist to explain what he means when he says not only that cats exist mind-independently and objectively, but that *their being cats* is mind-independent and objective also.

I turn now to criticism of class nominalism. The first reason for rejecting class nominalism, for present purposes, is that it is non-naturalistic, since it is committed to abstract (i.e. non-spatiotemporal) entities. In particular, it depends on *irreducibly abstract* mathematical entities such as classes and functions. The kind of realism that I endorse, below, admits the existence of these entities, but accommodates them within the natural, spatiotemporal world. This is discussed below in [2.2.2].

Although class nominalism seems to be incompatible with naturalism *per se* (because it is committed to irreducibly abstract entities), it may nevertheless be compatible with the idea that semantic reality belongs to the natural, causal world. After all, if class nominalism can accommodate, e.g., biological and geological reality, it should be able to accommodate a naturalistic semantic reality. This would require us to abandon naturalism *per se*, but would allow us to retain both causal closure and the idea that semantic reality is

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[4]Each version of nominalism will have its own story—e.g., the term 'cat' applies to all of them, and to nothing else—but not necessarily one that should appeal to someone who thinks that *being a cat* is mind-independent and objective. As for the class nominalist's story, see the objections below.

[5]Certain properties, such as *being happy*, are quite obviously mind-dependent in some sense. Such properties are nevertheless objective; it is not a matter of opinion—not even her own opinion—whether Sally is happy right now. The Realist is only against construing properties that on the face of it have nothing to do with minds whatever, especially physical properties such as *being a proton*, as mind-dependent. The sort of mind-dependence that antirealists have in mind is not the trivial sort found with mental properties, or even the less trivial sort found with artifacts (involving human purposes, etc.). In contrast, a verificationist antirealism might hold, for example, that protons and/or the property of *being a proton* are (partly) constituted by our ways of knowing about them.

part of the natural world.

Note, however, that I have raised objections against understanding MTS as a theory of natural semantic reality. The theory of quantification was discussed as an example for which the abstract relations and entities involved are highly unlikely to have naturalistic counterparts. Perhaps it is for this reason that semanticists who are attracted to class nominalism, such as Lewis (1997), or to a "rather formal conception of metaphysics" such as Link (1998: 271), are apparently not at all attracted to a naturalistic view of semantic correspondence.

The second reason, which commentators such as Armstrong (1989: 13) and Rodriguez-Pereyra (2002: 223) take to be among the most important, is that class nominalism reverses the natural order of explanation for properties. Philosophical commonsense suggests that Colin belongs to *this* class, the set of dogs, because Colin is a dog. Class nominalism has it the other way around by claiming, implausibly, that Colin is a dog because he belongs to this particular class. Rodriguez-Pereyra argues convincingly that this appearance of implausibility is more than superficial.

> [I]t is not simply a pre-theoretical and uncritical belief that properties determine class-membership but not vice versa. All we know about classes we know from Class or Set Theory, which is very well developed, and there is nothing there that says, entails, or suggests that some classes may make their members share a property, resemble each other, or have similar causal powers.
>
> (Rodriguez-Pereyra, 2002: 223)

The third reason for rejecting class nominalism is that it must present naturalness as an unexplained primitive of certain classes (Armstrong, 1989: 14). That some classes are natural and others are not is an ultimate and irreducible, or "brute", fact. This explanatory failure is a clear reason to prefer either realism or resemblance nominalism.

I claim that these are sufficient reasons to reject class nominalism, and to adopt a realist alternative.

2.2 Armstrong's realism

In this section, I describe the realist metaphysic that provides the background for my naturalistic semantic theory. As noted above, a metaphysical theory is realist if it is committed to the existence of universals in addition to particulars. In this thesis, I endorse a variant of Armstrong's "immanent realism" (1978a; 1978b; 1989; 1997; 2004). According to this moderate form of realism, universals exist as part of the natural world, in some sense "in" the particulars that instantiate them (hence the descriptor 'immanent'). As Armstrong puts it, "universals exist only in particulars" (1997: 22). He calls this "Aristotelian realism", as opposed to Platonic realism.[6] Crucially, therefore, his realism is naturalistic in a way that class nominalism (and Platonic realism) is not.

Armstrong has developed a broad and deep metaphysic that encompasses his own theories of laws and causation, modality (e.g., his combinatorial theory of possibility), the nature of mathematical objects, and even a theory of truth.[7] I cannot do justice to all of this here. In what follows, I review just the essential components, insofar as they apply directly to the purposes of the thesis.

2.2.1 Internal and external relations

In the previous section I gave a number of properties as examples of universals. These properties, such as *being a cat*, *being a tree*, and *being a stone*, are examples of one-place or monadic universals. In addition to these, Armstrong's realism acknowledges the existence of polyadic universals, which is to say relations. Whereas the instantiation of a property involves a single particular, as in the state of affairs of *Tom's being a cat*, the instantiation of a relation involves two or more particulars. For example, the state of affairs of *John's loving Mary* involves two particulars, John and Mary.

Armstrong draws what is for him an important distinction between external and internal relations (1997: 87). External relations are regular relations like *loving* and *giving*, and hence universals. External relations have a central semantic role as the referents of relational predicates such as transitive verbs. The nature of external relations and their

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[6]Platonic realism holds that universals are transcendent, hence non-natural, entities.

[7]I criticise Armstrong's ideas about truth in [5.1.2].

instantiation is the topic of [2.3.4]. The whole of chapter 6 is dedicated to the semantics of relations.

The status of Armstrong's internal relations is much less clear. Armstrong claims that an internal relation is one that "supervenes on" the existence of its terms, and is therefore no addition of being. For Armstrong, this is not to deny the existence of the relation (1997: 87). The supervenience that Armstrong has in mind does not apply exclusively to properties (particulars may supervene, or be supervened on), and it is not asymmetric.[8] It therefore has little to do with the strong and weak versions of supervenience that Kim (1993) defines. Armstrong defines his notion as follows.

> We shall say that Q supervenes on P if and only if there are P-worlds [worlds containing P] and all P-worlds are Q-worlds [worlds containing Q].
>
> (Armstrong, 1997: 11)

Armstrong claims, though it surely does not follow from his definition alone,[9] that whatever supervenes is no addition of being. Since internal relations supervene on their terms, they are claimed to be nothing over and above those terms. They are also claimed to be *necessary* given their terms, which, assuming a certain view of necessity, follows from the definition given. Identity is one such internal relation for Armstrong; specifically, he claims that '[s]ymmetrical supervenience yields identity' (1997: 12). Given an existent, there is the necessary internal relation of identity between the existent and itself.

Analysing identity in terms of (symmetrical) supervenience is a bad idea, primarily because Armstrong's supervenience is much more mysterious than identity. His account in terms of possible worlds is not even available to him in its given form, since he thinks (and here I agree) that only the actual world exists (1997: 174); talk of possible worlds is supposed to be a mere convenience. He analyses identity and other internal relations with an "extensional" theory of necessity (=existing in all possible worlds) that he cannot have (Armstrong, 2004: 96–7). It would seem that the best way to introduce necessity "intensionally", in this case, would be in the form of identity—basic and unanalysed.

Crucially, because the features of supervenience are completely unexplained, the features

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[8]Armstrong suggests that mereological supervenience is symmetrical. See discussion later in [2.2.2].

[9]This is because, *prima facie*, there may be *distinct* necessary co-existents. Incidentally, this is precisely what is proposed under Baxter's account of relations. See [2.3.4].

of identity are no better explained in its terms. Perhaps more can be said about the nature of identity, but it is doubtful that symmetrical supervenience improves our understanding of it. It is better to take identity as basic, since we seem to understand it well enough *as something basic*, than to analyse it in terms of a more obscure notion.

Furthermore, I suspect that Armstrong's notion of an internal relation, resting as it does on his notion of supervenience, doesn't solve any problems, and obscures the fact that all cases of so-called internal relations are just instances of identity (and distinctness). I support this claim in [2.3.3], where I present an alternative to Armstrong's account of numbers that avoids relations altogether.

2.2.2 Mereology

At this stage, I take a brief detour to consider mereology, the theory of the relation of part to whole. It features centrally in Armstrong's metaphysic and, of further relevance to this thesis, in Link's (1998) semantic work on plurals (see [5.8] for my account of numerals, which employs a very different sort of quantification over plural entities). It seems to have a major role to play in both realist and nominalist theories.

An important mereological concept is that of a *fusion* (also called a 'collection', 'aggregate' or 'sum'). The fusion of A and B is the whole entity composed of parts A and B. Lewis (1991) defends a version of Donald Baxter's doctrine of "composition as identity". This is the idea that a (single) fusion is identical with its many parts (1991).[10] He writes:

> [I]f you are already committed to some things, you incur no further commitment when you affirm the existence of their fusion. The new commitment is redundant, given the old one.
>
> (Lewis, 1991: 81–2)

This, of course, follows if the fusion *just is* its parts. The importance of this is that it solves a significant metaphysical problem, which is that in having both parts and wholes

---

[10]Since Armstrong accepts the thesis of composition as identity, he regards mereology as a further case of *symmetrical* supervenience (1997: 12), which is to say that a whole supervenes on its parts, and several parts supervene on the whole that they constitute. The criticisms aimed toward analysing identity as symmetrical supervenience of course apply equally here.

in one's ontology, one seems to be double counting. Composition as identity removes this worry, and also gives a satisfying account of the actual relation of part to whole (i.e., mere identity).

Not everyone agrees that Lewis's mereology is ontologically "innocent". Commentators have objected in particular to the intelligibility of a many–one identity (see, e.g., van Inwagen, 1994). Even Lewis (1991) claims that composition is only "like" (p. 82), or "strikingly analogous to" (p. 84), identity, noting a difficulty with the fact that the whole is one whereas the parts are many (p. 87). I agree with Wallace (2005) that this worry stems from a failure to fully appreciate the Fregean insight of relative counting. It may also arise from the tendency to wrongly think of a number or quantity as a property (or relation). I offer a view of numbers or quantities in [2.3.3] that resists this tendency.

Baxter has a solution in his idea that a fusion is a single thing in one "count", and many things (i.e., its many parts) in a different "count" (see [2.3], where I give a detailed analysis of this notion). I deny this part of Baxter's theory for reasons detailed below, and instead maintain that a fusion may be both many things and one thing in a single count, and hence fully identical with its many parts in that count.

Baxter (2001: 454) supposes that to be a single thing is to be identical with each of one's parts (in a certain count). He uses counts as a solution to the general problem of how something may differ from itself. This problem does not arise in the mereological case, however, since we need only say that the parts are distinct from one another, not that the whole is distinct from itself. Neither should we claim that the whole is identical to any of its parts *individually* (something that Baxter *does* claim, and makes possible with his count distinction). The parts are only identical with the whole *collectively*, as their fusion. These considerations support a strong version of composition as identity, in which composition is taken to be a case of regular, strict identity. I therefore treat fusions as regular entities, and consider them ontologically "innocent" in virtue of their identity with their parts.

Lewis (1991) makes the significant claim that classes are mereological fusions of singletons.

> There is more mereology in set theory than we usually think. The parts of a class
> are exactly the subclasses [...] The notion of a singleton, or unit set, can serve as the
> distinctive primitive of set theory. The rest is mereology: a class is the fusion of its

> singleton subclasses, something is a member of a class iff its singleton is part of that class.

<div align="right">(Lewis, 1991: vii)</div>

Since Armstrong accepts the thesis of composition as identity, this mereological account of classes is attractive to him. Provided that he can give an account of set-membership in the case of the unit class or singleton, his realist ontology can admit classes of entities along with the entities themselves.

The account he gives of the relation of an entity to its singleton is precisely that of a particular to a state of affairs. Take for example Mary and her singleton. Mary instantiates various universals, and among them are various unit-determining properties, such as *being a woman*, *being a doctor*, and *sleeping*. These properties all "determine a unit", unlike properties such as *being red* and *being smooth* (1997: 189). The unit-determining properties divide the world up into discrete units (women, doctors, sleepers), whereas the non-unit-determining properties do not. According to Armstrong, a singleton set is any state of affairs in which a particular instantiates a unit-determining property.

2.2.3   Numbers as internal relations

Numbers are a particularly interesting example of internal relations in Armstrong's metaphysic. His theory is that numbers are internal relations between a property and a fusion of particulars. The intriguing metaphor is this: given seven swans on the lake, the property of *being a swan on the lake* carves up this collection into seven individual swans-on-the-lake (Armstrong, 1997: 176). Armstrong suggests we might say that the property of being a swan on the lake *sevens* the fusion. I claim that this account, while instructive, won't suffice. In [2.3.3], below, I offer an alternative just in terms of identity and distinctness.

2.3   Baxter's theory of instantiation

In the standard terminology, a particular is said to *instantiate* (or "participate in") a universal. Instantiation is the means by which a particular and universal come together in a state of affairs.

Instantiation is a traditional difficulty for realists. Perhaps the biggest difficulty is the regress attributed to F.H. Bradley. It is roughly this: Take instantiation to be a relation, which is to say a further entity. This relation needs binding to each of its terms. So what will do the job? Presumably, only a further relation. So what binds *this* entity to each of the terms and the relation of instantiation? And so on. Perhaps the most important feature of Baxter's theory is that it resolves this regress.

Baxter proposes a solution to the problem of instantiation with his theory of "partial identity".[11] His theory rests on the idea that both particulars and universals have so-called aspects. Aspects are not parts. As Baxter notes, perhaps the best way to understand the idea of an aspect is by considering the way that the phrases 'insofar as' and 'inasmuch as' are used in English. Consider, for example, the phrase 'John inasmuch as he is clever'. According to Baxter, this refers to one aspect of John, the aspect in which he is clever.

Similarly, we can speak of the property of *being clever* insofar as John has it. Here we refer to an aspect of *being clever*, the aspect in which John has it. This, of course, is also an aspect of John, the very same aspect as we refer to with the above phrase 'John inasmuch as he is clever'. It is this (strict) identity between the aspect of John and the aspect of *being clever* that instantiation consists in. Thus Baxter writes:

> [T]he non-relational tie is the identity of an aspect of a universal with an aspect of a particular [... T]he partial identity of particular and universal [...] is the identity of a shared aspect
>
> (Baxter, 2001: 453–4)

Given this claim that instantiation consists in the strict identity of aspects shared by a particular and a universal, we must consider the way in which a particular or universal stands to its various aspects. According to Baxter, this is also a matter of identity. A particular or universal is numerically identical with its aspects, and each of its aspects are numerically identical with one another.[12]

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[11]I henceforth avoid this phrase since it may be confused with *identity-in-a-part*. In its place we use another of Baxter's terms, "cross-count identity", the sense of which is explained below. Whatever you think identity-in-a-part is (i.e. really a partial identity or just regular identity of parts—see Armstrong, 1997: 18), cross-count identity is something else.

[12]To say that two things are numerically identical is just to say that they are *one and the same* or, in other words, strictly identical. It is traditionally opposed to qualitative identity, which is to say loose identity.
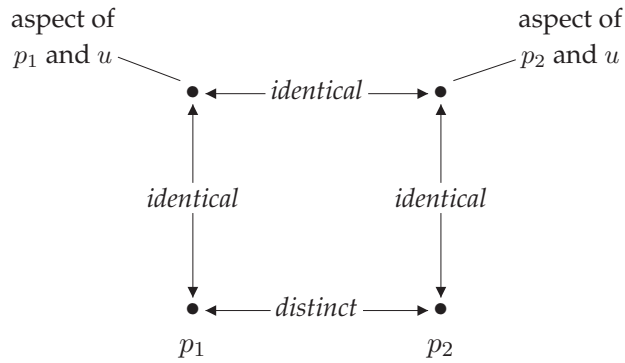
Figure 2.1: A Contradiction in the Theory of Aspects?

This appears to lead to some obvious contradictions. Suppose we take two particulars p_1 and p_2 that we assume to be distinct. Further suppose that both particulars instantiate the same universal u. *Ex hypothesi*, there is an aspect of each particular that is identical with an aspect of u. Furthermore, the particulars are identical with their aspects, and the aspects of u are identical with one another. By the transitivity of identity, it follows that the two particulars are identical. We therefore seem to have an inconsistent set of assumptions. This is illustrated in Figure 2.1.

Baxter avoids the charge of contradiction with a "count" distinction. According to this, the particulars in the example are identical with their aspects *in one count*, whereas the universal is identical with its aspects *in another count*. In this case we can say that each of the particulars is *cross-count identical* with the universal. Thus, he writes:

> [Instantiation] is a cross-count partial identity. The very aspect which (in one count) is an aspect of a particular is (in another count) an aspect of a universal.
>
> (Baxter, 2001: 456)

In the following section, I consider Baxter's count distinction in detail.

2.3.1 The count distinction

My understanding of the count distinction is strongly influenced by the following passage from Baxter.

> One way to think of this proposal is in terms of intersecting identities [...] Each of the intersecting identities is as primitive, fundamental, as the other.

	...	p_1	p_2	p_3	p_4	p_5	p_6	...
...								
u_1					•		•	
u_2		•	•	•		•		
u_3				•				
u_4				•				
u_5				•				
u_6			•	•	•	•	•	
u_7				•				
u_8							•	
...								

u-count (vertical) — *p-count* (horizontal)
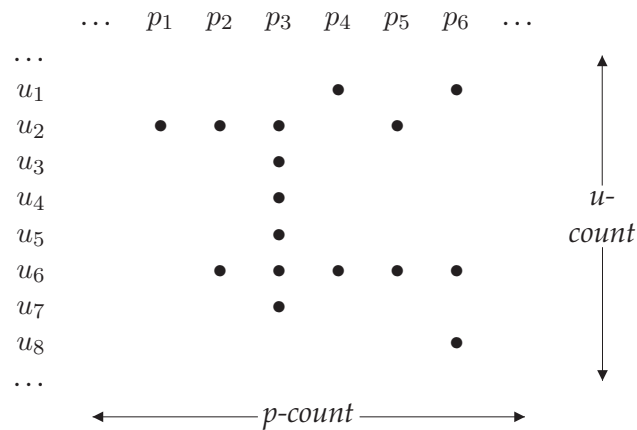
Figure 2.2: Representation of cross-count identity

One could give the essence of Baxter's theory as the idea that identity is always relative to a count. Baxter (2001) does not give an explicit statement of what a count is, but it is nevertheless clear that the aspects of a particular or universal may be counted as *one* insofar as they are aspects of one particular or of one universal, and as *many* insofar as they are aspects of many particulars or of many universals.

I propose that each count is a primitive, independent dimension of identity.[13] I recognise at least two such counts, which I call the particular (p-) count and the universal (u-) count. Several aspects of one particular are one in the particular count, and many in the universal count. Several aspects of one universal are one in the universal count, and many in the particular count.

The question remains of how to understand phrases such as 'identical in a count'. To be identical in a count is to be identical in one dimension of identity or another. To be identical in the p-count is to be p-identical. That which is (self-)p-identical is *one* in the p-count but possibly *many* in the u-count. That which is (self-)u-identical is *one* in the u-count but possibly *many* in the p-count. I illustrate this in Figure 2.2. The dots represent aspects that belong to the particulars and universals of the columns and rows, respectively, that they appear in. Both counts are represented simultaneously.

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[13]Baxter informs me that he "would rather say that numerical identity is relative to two different ways of counting, than that there are two sorts of numerical identity" (p.c.). I propose that the best way to account for these *real* ways of counting, and the existence of aspects, is in terms of multiple sorts of numerical identity (which is to say *counts*, as I define them).

To make the illustration more concrete, take p_3 to be the particular Jane, and p_6 to be the particular Bob. Further suppose that u_1 is the property of *being a man*, u_2 is the property of *being a woman*, and u_6 is the property of *being a lecturer*. According to Figure 2.2, then, Jane is a woman, and not a man; Bob is a man, and not a woman; and Jane and Bob are both lecturers (everyone is a lecturer except p_1).

It may be tempting to take the vertical dimension to be that of p-identity, and the horizontal dimension to be that of u-identity. This is because all aspects in a column are p-identical, and all aspects in a row are u-identical. Note, however, that it is the horizontal dimension according to which particulars are individuated; it therefore embodies both their self-identity, and their distinctness from one another. We can unambiguously refer to the horizontal dimension as the p-count, the count in which there is no distinction between the aspects of a particular. Similarly, the vertical dimension embodies both the self-identity of universals, and their distinctness from one another. In this dimension we have the u-count, the count in which there is no distinction between the aspects of a universal.

If this is not clear, consider what happens when we remove the vertical dimension (the dimension in which p-identity is "preserved") by collapsing the diagram vertically. The result is that we *lose the universals*, because the remaining p-count "sees" no distinct aspects of a particular, only a collection of self-identical particulars and their distinctness from one another. The vertical dimension is concerned with the individuation of universals (their u-identity and u-distinctness), not with the identity of particulars *per se*.

2.3.2   Cross-count identity defined

Cross-count identity, as stated, is a point of "intersection" in the two dimensions of identity. We can understand this as a simple combination of p-identity and u-identity. For the sake of clarity, I give the following semi-formal definition ('iff' henceforth abbreviates 'if and only if').

(2) CROSS-COUNT IDENTITY (p/u version):

A is p/u cross-count identical with B iff there is a Z such that A is p-identical with Z and B is u-identical with Z.

Two *aspects* may be symmetrically cross-count identical. Supposing we have aspects A, B, C, D such that A is u-identical with B, C is u-identical with D, A is p-identical with C and B is p-identical with D, it follows that A is cross-count identical with D and D is cross-count identical with A—hence that A and D are symmetrically cross-count identical. Two p- or u-identical aspects are symmetrically cross-count identical, as is a single self p- and u-identical aspect. That is, any single aspect is cross-count identical with itself (aspects being individuated with respect to both p- and u-identity), since an aspect is both u-identical and p-identical with itself. In general, however, cross-count identity is non-reflexive. No particular nor universal is cross-count identical with itself.

A particular and a universal cannot be symmetrically cross-count identical, since for A to be cross-count identical with B, A (rather than B) must be p-identical with Z, and B (rather than A) must be u-identical with Z. Thus, in a case where B is p-identical with Z and A is u-identical with Z, we would—according to the proposed definition—say that B is cross-count identical with A, and not that A is cross-count identical with B. Moreover, if B is cross-count identical with A (where A and B consists of one particular and one universal), it is necessarily the case that A is not cross-count identical with B. This is because a particular, which is individuated under p-identity alone, is not u-identical with anything, and similarly *mutatis mutandis* for universals.[14]

Finally, it should be noted that cross-count identity is intransitive. This is important since, otherwise, strings of cross-count identities would establish further cross-count identities between particulars and universals that do not share an aspect. The definition enforces intransitivity by requiring that for two entities to be cross-count identical they share an aspect.

It might be objected that a primitive notion of instantiation should be preferred to Baxter's theory, including the version of it presented here, on the grounds of simplicity. Baxter responds to this sort of objection, noting that his theory gives a unifying account of the otherwise mysterious features of instantiation (as identified by Armstrong): "Besides being contingent, it is non-mereological, makes states of affairs particular, and is a kind of inseparability" (2001: 449; Baxter's page references to Armstrong omitted). The notions of aspect, cross-count identity, and identity in a count are not primitive, since they

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[14]Baxter has suggested to me that the fact that cross-count identity turns out asymmetric by my definition is a nice result, since 'we say that particulars instantiate universals and not vice-versa' (p.c.).

are definable in terms of p-identity and u-identity. I claim that p-identity and u-identity are much better and less mysterious primitives than instantiation owing to their close similarities with regular identity.[15]

2.3.3   A revised view of numbers

In [2.2.3], I discussed Armstrong's metaphysical account of natural numbers. I suggested that this account was inadequate, since the notions of supervenience and internal relations upon which it is based have no explanatory value. In this section I propose an alternative based on mere identity and distinctness.

We begin with the notion of atomicity. If a particular is atomic then it has no distinctness within itself or, as I am inclined to say, no internal distinctness. This is more than mere self-identity, which every particular has, trivially. A particular is atomic if and only if all of its parts are identical (that is, fully identical) with the whole.[16] Note that it follows from this that no part of the particular is distinct from any other part of the particular, hence that there is no internal distinctness.

To the extent that there are such atomic particulars, they are unities, and may only be counted as one. There is no counting something that is fundamentally a unity as *two* or *three* or *four*, etc. Whenever we can count a thing as *two* or more, there is distinctness within that thing.

Composition as Identity is the idea that things are identical with the fusion of their parts. What this does *not* entail is that the parts of a thing are all identical with one another (i.e., it does not entail atomicity).[17] Take, for example, any non-atomic particular. For such a particular, by definition, there is a way of dividing it into at least two parts such that a)

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[15]It is a fair objection, however, that the account of relations requires the additional and somewhat mysterious primitive of a necessary connection ("conecessitation") among distinct aspects, described in [2.3.4] below.

[16]Compare Link's (1991: 66) definition: 'a is an atom iff all parts of a are identical with a'. I add 'fully' since otherwise every particular, given Composition as Identity, is trivially atomic.

[17]This is why aspects are not parts (compare the brief remarks early in [2.3]). Baxter (1988) proposes that (spatiotemporal) parts be treated as aspects identical to the whole in a count. This proliferates counts to an extent that I find unacceptable. Since, on my view, the existence of a count amounts to the existence of another dimension of numerical identity, I prefer to keep the number of counts down to a minimum.

those parts are distinct (do not overlap to any extent), and b) the fusion of those parts is identical (fully identical) with the whole.

The particular we imagine here may have no atomic parts, in which case it is arbitrary how we (continue to) divide it up. Such ways of counting particulars are probably of no practical interest. I therefore make the assumption that every particular is either atomic or a fusion of a finite number of atomic particulars. This enforces a limit to the extent of the divisibility (and hence countability) of a particular, down to and along the boundaries of its atomic parts.

It may be metaphysically necessary that for a particular to have two proper parts, it must be cross-count identical with a universal in each of those parts. This would follow from the requirement that every particular instantiate a universal, since each part of a particular is itself a particular. Even if that is the case, I deny that their being distinct parts, and hence distinct particulars, in any way involves their u- (or t-) identity. After all, distinct parts of a particular may instantiate the very same universal, and nothing within the u-count, in which they are one and the same, makes them two. Even if there are *parts of the universal*, in the u-count, these do not correspond to parts of particulars. For example, if the universal of *being a bachelor* has a *being male* part and a *being unmarried* part, Fred and George's each being distinct parts of Fred⊕George (the fusion of Fred and George), as well as being bachelors, does not consist in any way in the distinctness of *being male* and *being unmarried*. The relevant distinctness is just the p-distinctness between Fred and George.

Let us take a particular consisting of any two atoms (although the example works with any two fusions of atoms also). By hypothesis, the two atoms are distinct from one another, despite the fact that together they are identical with the whole particular. We assume that each atom instantiates universal u_1, a unit-determining property, by cross-count unit-identity. Here we have a distinctness between unities. This distinctness between unities, I submit, is *two*. Here I make what I take to be a reasonable assumption that distinctness is *essentially* binary, just as identity is *essentially* unary.[18] The property u_1 determines what it is we have *two* of.

---

[18]This does not undermine the idea of many-one identity. In this case, we are effectively counting the many parts as one, which is always a valid way of counting a fusion (and does not, *pace* Baxter, imply a special count or dimension of identity in which the whole is one).

If we can accept this account of *two*, it is but a short step to a full account of the natural numbers. Suppose that in virtue of a distinctness we have an instance of *two* (i.e., two of something with respect to u_1). Now further suppose that we have a u_1-determined unity fully p-distinct from that *two*. In that case we have *three*. That is to say that *three* is a distinctness between a unity and a *two*. A further distinctness still is *four*, and so on. This is illustrated in (3).

(3) p_1 p_2 p_3 p_4

u_0

u_1 $\{\{\{\bullet_1 \longleftrightarrow \bullet_1\}_2 \longleftrightarrow \bullet_1\}_3 \longleftrightarrow \bullet_1\}_4$

u_2

(p-distinctness)

$\longleftarrow$ p-count $\longrightarrow$
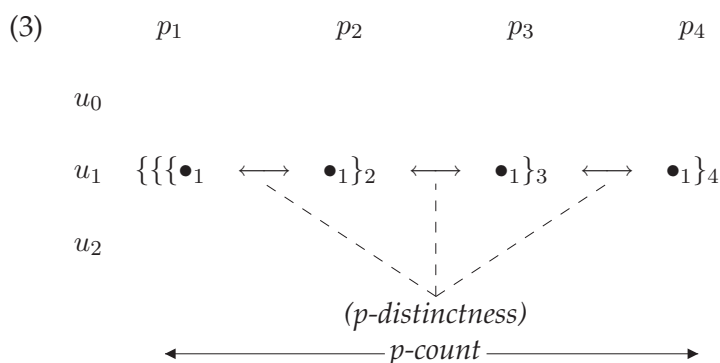
The diagram shows four particulars, p_1, p_2, p_3, and p_4. Each of these particulars instantiates universal u_1. The braces indicate the following (arbitrary)[19] fusions: $p_1 \oplus p_2$, $p_1 \oplus p_2 \oplus p_3$, and $p_1 \oplus p_2 \oplus p_3 \oplus p_4$. Within the fusion $p_1 \oplus p_2$, p_1 and p_2 are p-distinct, and each is a unit with respect to u_1. They are therefore *two* with respect to u_1. Within the fusion $p_1 \oplus p_2 \oplus p_3$ we have the fusion $p_1 \oplus p_2$, which was determined to be *two* with respect to u_1. Furthermore, p_3 is a unit with respect to u_1, and is p-distinct from $p_1 \oplus p_2$. $p_1 \oplus p_2 \oplus p_3$ is therefore *three* with respect to u_1. We iterate to get *four*, and so on.

Armstrong proposes that we treat the number zero as an internal relation between any particular and any unit-determining property that the particular does not instantiate in any of its parts (1997: 177). I suggest that we take the essence of Armstrong's idea here without employing any internal relation. We treat *zero* as the mere cross-count *distinctness* between a particular and a universal or, in other words, the absence of a shared aspect.

The advantage of my view over Armstrong's is that it does not invoke a mysterious "supervening" internal relation to account for the natural numbers. It employs only the apparatus of identity and distinctness, which are relatively well-understood, and already occupy a central position (if not *the* central position) in the metaphysic. Furthermore, it

---

[19] We could, of course, have started with the fusion of any two particulars that are units with respect to u_1, such as p_2 and p_4, and then added the remaining particulars in any order.

successfully analyses the way that each number stands to the others (i.e. the successor function). For Armstrong, this remains entirely unexplained.

2.3.4   Relations

In this section I present an adaptation of Baxter's account of relations, which clarifies some of his ideas and fills in a number of details. His theory of relations is a natural extension of his account of properties. According to this theory, to stand in a relation is just to instantiate a universal by means of cross-count identity (Baxter, 2001: 458).

Baxter gives the example of Abelard's loving Heloise. He notes that this consists in Abelard and Heloise each sharing an aspect with the universal of *loving*. On the non-symmetry of the loving relation, he writes:

> [W]e must distinguish two aspects of Loving—Loving-by and Loving-of. Abelard insofar as he loves Heloise is partially identical with Loving, in virtue of being partially identical with Loving-by. Heloise insofar as Abelard loves her is partially identical with Loving in virtue of being partially identical with Loving-of.
>
> (Baxter, 2001: 457)

According to this, *loving* consists of both *loving-by* and *loving-of*. Baxter describes these as aspects of *loving*, and hence introduces a further count—the count in which *loving-by* and *loving-of* are one universal. For the present, we put this issue to one side, and focus on the two halves of the relation.

According to Baxter, a particular may instantiate *loving-of* and *loving-by* just as it may instantiate any other property. However, his account does not capture the fact that Abelard may love more than one person, and hence instantiate *loving-by* several times over (similarly for Heloise and *loving-of*). Suppose, for example, that Abelard loves Heloise and Isobel. What is it for Abelard to be cross-count identical with *loving-by* in more than one aspect? Where does the distinctness lie between these aspects, which are each identical with Abelard in one count and identical with *loving-by* in another?

Relational properties such as *loving Heloise* are just like non-relational properties insofar as they may be instantiated only once by a single individual at a given time. *Loving Heloise* is just like *sleeping* in this respect. To capture the possibility of multiple instantiation, I

31

suggest that relations be viewed as distinct relational properties that are identical in a further count. Each relational property is a universal in its own right. This is illustrated in (4).

(4)

$$p_1 \quad p_2 \quad p_3 \quad p_4 \quad p_5 \quad p_6$$

loving-by$_1$ (u_1)   •

loving-by$_2$ (u_2)   •   •   •

...

...

loving-of$_1$ (u_3)   •   •
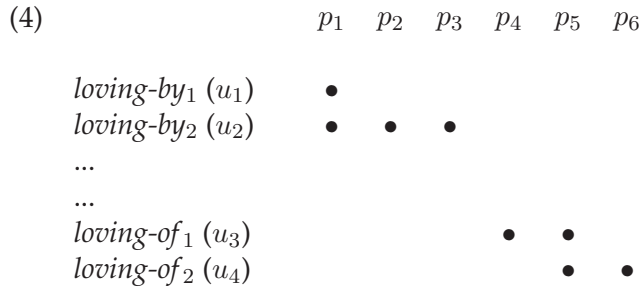
loving-of$_2$ (u_4)   •   •

The above diagram shows six distinct particulars each instantiating one or more of four distinct relational properties. These are two properties of *loving-by* and two of *loving-of*. The individual relational properties are labelled here as *loving-by*$_1$, *loving-by*$_2$, etc. We return to the issue of *which* relational properties these are shortly.

Since we take relational properties to be identical in a further count, they must share aspects with a new sort of basic entity: the relation-part. This is illustrated in the following diagram.

(5)

$$r_1 \qquad\qquad r_2$$

loving-by$_1$ (u_1)   •

loving-by$_2$ (u_2)   •

     ...

loving-of$_1$ (u_3)   •
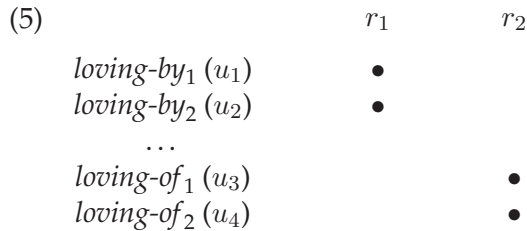
loving-of$_2$ (u_4)   •

According to (5), *loving-by*$_1$ and *loving-by*$_2$ belong to r_1, while *loving-of*$_1$ and *loving-of*$_2$ belong to r_2. The information in these two diagrams may be combined into the following three-dimensional representation.

(6) $r_1:$
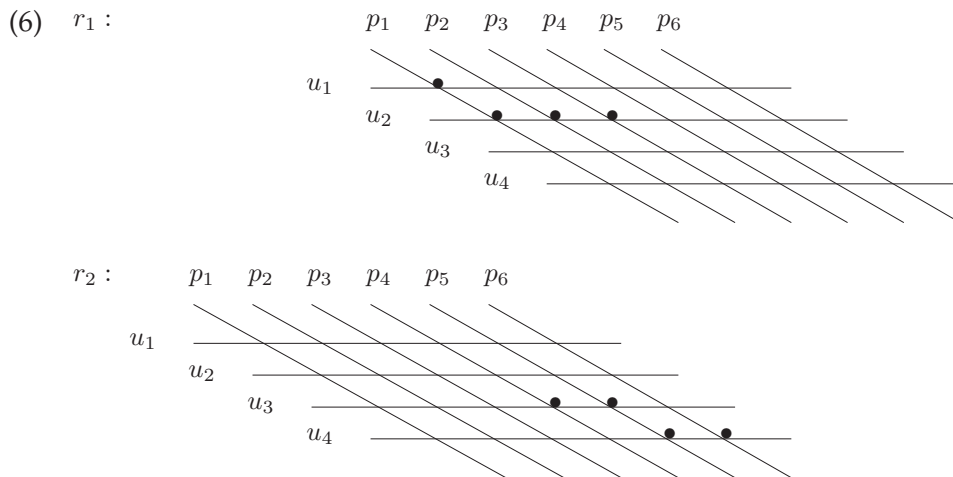
The diagram shows two planes, r_1 and r_2.[20] The aspects within each plane are r-identical. That is to say, all the aspects in the top plane are identical with r_1, and all the aspects in the bottom plane are identical with r_2. The aspect in the top plane at the intersection of p_1 and u_1 is therefore an aspect shared by all three entities: the relation-part r_1, the particular p_1, and the universal u_1.

We can identify r_1 as the *loving-by* part of *loving*. *Loving-by* is a relation-part in my terminology. Technically, it is one-place and therefore a kind of "general" relational property— specifically, the general relational property of *loving someone*, which may be represented by the lambda expression $\lambda x\exists y[love(x,y)]$. Similarly, we can identify r_2 as the *loving-of* part of *loving*. It is the general relational property of *being loved by someone*, which may be represented by the lambda expression $\lambda y\exists x[love(x,y)]$. Strictly speaking, therefore, the r-count is concerned with the individuation of relation-parts. Relations exist as conecessitating relation-parts, a claim which I return to at the end of the section.

The point to note is that universals u_1 and u_2 are each cross-count identical with r_1, since there is one or more aspect of each of these universals in the plane of r_1. Similarly, universals u_3 and u_4 are each cross-count identical with r_2, since there is one or more aspect of each of these universals in the plane of r_2. I claim that a universal is a relational property of some relation-part if and only if it shares an aspect with that relation-part (in other

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[20]One could equally, of course, have shown the planes of two particulars or two universals. r-identity is not a privileged dimension. A full three-dimensional grid would perhaps provide a better representation, but it would be harder to read. One can imagine stacking several of these planes to get the desired effect. The "vertical" dimension is then that of r-identity and r-distinctness (the r-count). "Travel" in any one dimension is neutral to the other two.

words, if and only if the universal and the relation-part are cross-count identical). It follows that u_1 and u_2 are relational properties of r_1, and u_3 and u_4 are relational properties of r_2. This ensures that relational properties such as *loving John* and *loving Mary* have something in common: their r-identity. It means that they are instances of the *very same* relation-part.

For a particular to be cross-count identical with *lifting-of* (r_2) is also for it to be cross-count identical with one or more, as appropriate, of the universals that constitutes it—e.g., *being lifted by Mary*. To see this, refer back to the diagram in (6). For a particular to appear in the plane of r_1, it must have an aspect in at least one of the rows corresponding to the individual universals/relational properties that are cross-count identical with r_1. These, of course, are the relational properties that make up r_1. An aspect shared by a particular and a relation-part may be shared with any one of several universals (relational properties) that make up the relation-part. If it is necessary for a relation to have at least one relational property, which I claim it is, a particular that instantiates a relation-part necessarily instantiates at least one relational property of that relation-part.

I have opted to say that a universal is cross-count identical with a relation-part, rather than vice-versa, whenever that universal (i.e. relational property) belongs to that relation-part (e.g. *loving Mary* belongs to *loving-by*). The corresponding definition of cross-count identity for a universal and a relation-part is as follows.

(7) CROSS-COUNT IDENTITY (u/r version):

A is u/r cross-count identical with B iff there is a Z such that A is u-identical with Z and B is r-identical with Z.

Note that this definition is similarly asymmetrical when applied to any given universal and relation-part. To distinguish the two forms of cross-count identity, we refer to the first kind as p/u cross-count identity, and this kind as u/r cross-count identity.

I give the following general definition for two-dimensional cross-count identity, of which p/u and u/r cross-count identity are instances, where ϕ and ψ are metavariables ranging over dimensions of identity.

(8) TWO-DIMENSIONAL CROSS-COUNT IDENTITY:

A is ϕ/ψ cross-count identical with B iff there is a Z such that A is ψ-identical with Z and B is ψ-identical with Z.

There is a final, crucial part to Baxter's account of relations. Some mechanism is required to ensure that Abelard's *loving-by* corresponds to a loving of Heloise, and not to that of some other person. Similarly, we must ensure that Heloise's *loving-of* corresponds to a loving by Abelard, rather than anyone else. On this, he writes:

> [T]here is a necessary connection between Abelard insofar as he loves Heloise and Heloise insofar as Abelard loves her. Neither aspect can exist without the other.
>
> (Baxter, 2001: 458)

We can represent this idea as in (9). The curved line stands for the necessary connection between the two aspects. This necessary connection is all that is required to hold aspects of *loving-by* and aspects of *loving-of* together. We should not claim that they are in any way *identical* (although, surprisingly, Baxter does: "the relation is: Abelard insofar as he loves Heloise, and Heloise insofar as Abelard loves her, counted as identical", 2001: 457). I take the necessitating connection, which I refer to above as 'conecessitation', between aspects to be ultimate and irreducible, just as identity is. Identity does not entail conecessitation, and conecessitation does not entail identity. Conecessitation may hold between distinct existents, and it may be that identical existents do not conecessitate (e.g., the distinct aspects of a particular or a universal do not conecessitate one another). Much like identity, conecessitation is not a relation. It is a deep metaphysical constraint over how certain aspects may come into, and leave, existence.

(9)
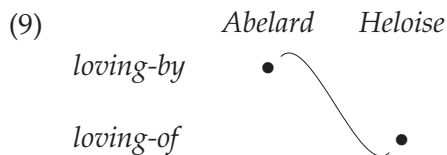
Before proceeding, I mention a possible point of confusion. It has been noted that rows of *loving-by* and *loving-of* are relational properties. However, notice that any given row of *loving-by* is made up of the aspects of different lovers. It follows that no row of aspects can be the relational property of being loved *by* any particular person. Rather, each row

of *loving-by*, the agentive part of the relation, is a relational property of loving *of* some particular person.

This follows from the fact that the aspects of any given row of *loving-by* correspond to a column of aspects in *loving-of*. This may be observed by following the curved lines between aspects in (10). Every aspect of a column belongs to a single particular, which is to say that the aspects are p-identical. As such, every instantiation of a *loving-by* is a loving *of* its corresponding particular. I label each row of *loving-by* with the relational property of *loving of* that it corresponds to in square brackets (i.e. '[*loving of X*]', where 'X' is the name of a particular). Similarly, every row of *loving-of* is labelled with the relational property of *being loved by* that it corresponds to.

(10)

	Lee	*Alex*	*Hilary*	...	*Ashley*	*Sam*	*Drew*	
loving-by$_{534}$	•	•	•					[=*loving of Drew*]
loving-by$_{535}$	•							[=*loving of Sam*]
loving-by$_{536}$	•							[=*loving of Ashley*]

loving-by$_{534}$ [=*loving of Drew*]
loving-by$_{535}$ [=*loving of Sam*]
loving-by$_{536}$ [=*loving of Ashley*]
...
...
...
loving-of$_{231}$ [=*being loved by Lee*]
loving-of$_{232}$ [=*being loved by Alex*]
loving-of$_{233}$ [=*being loved by Hilary*]
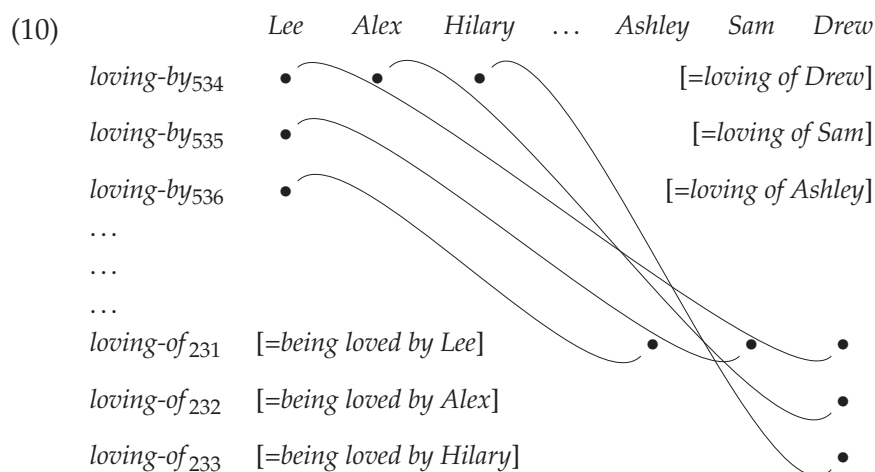
Now we return to the issue of what makes a full relation (such as *loving*, without the '-by' or '-of') other than an arbitrary fusion of its relation-parts (e.g., the fusion of *loving-of* and *loving-by*, which are distinct relation-parts—r-distinct, by my account). This follows simply from the conecessitation between the aspects of each relation, a 1–1 mapping of aspects. This mapping is exclusive to such pairs (or triples, and so on) of relation-parts. What does not follow from this is the identity of *loving-by* and *loving-of*. These are distinct relation-parts that belong together in virtue of conecessitation.

2.3.5   Instantiation and change

Armstrong is convinced that instantiation is necessary—that if a given particular and universal are partially identical they are necessarily so (2004: 47–48, 80–1). He is not

claiming, however, that all actual states of affairs are necessary ones. This is because he believes that the particulars and universals themselves are contingent existents. A given state of affairs may be contingent because, although the identity of a particular and universal is necessary, *that* the particular and universal exist is not.

According to this idea, nothing exists that might be green that isn't, in fact, green. Change requires a counterpart. A red leaf that was once a green leaf is strictly speaking not the same leaf. They are different particulars, in which case they are the same leaf only in some loose sense.

Contrary to this, Baxter's theory of instantiation suggests that we can take a thing just with respect to one dimension of identity or another. The property of *being green* is u-identical across time, although how many and which aspects it has may not be constant. Put simply, u-identity and p-identity are both necessary, hence unchanging across worlds and times. Cross-count identity, however, is contingent.

Baxter's solution to this problem is to make a particular-at-a-time another kind of *aspect* of that particular, an aspect that can share an aspect with a universal in the familiar way (2001: 459). The best way to understand this is to add a fourth intersecting dimension to identity. Accordingly, a state of affairs becomes a three or four-way partial identity. This would be to introduce another kind of entity, alongside particulars, universals, and relation-parts, which is something like a moment.[21] If we look in what we may call the t-count (for 'time'), we see distinct moments only. If we look across the t- and p-counts together, we see particulars in their time-slice aspects. Similarly, if we look across the t- and u-counts together, we see universals in their time-slice aspects. Finally, when we look across the t-, u-, and p-counts, we see states of affairs in their time-slice aspects. That is, if we ignore just the dimension of relation-parts, all aspects are aspects of three kinds of things: particulars, universals, and moments. If we also ignore the dimension of time, states of affairs still exist as the shared aspects of particulars and universals. It is just that each of these aspects may be distinct in a further count. Note that on this view, there are no aspects of aspects *per se*. To say that a particular-at-a-time (which is itself an aspect) and a universal *share an aspect*, is just to say that the given particular, universal,

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[21]Note that this does not require that time consist of discrete, atomic moments. Just as for universals and particulars, we allow for the possibility that they be infinitely divisible. Discontinuous fusions of moments would seem to count as moments also, though they would likely be of no serious interest.

and moment share an aspect. Whenever a particular, universal, and moment share an aspect, we can describe them as $p/u/t$ cross-count identical, which I define as follows.

(11) CROSS-COUNT IDENTITY ($p/u/t$ version):

   A, B, C are $p/u/t$ cross-count identical iff there is a Z such that A is p-identical with Z, B is u-identical with Z, and C is t-identical with Z.

I give the following general definition for three-dimensional cross-count identity, of which $p/u/t$ cross-count identity is an instance, where ϕ, χ, and ψ are metavariables ranging over dimensions of identity.

(12) THREE-DIMENSIONAL CROSS-COUNT IDENTITY:

   A, B, C are $\phi/\chi/\psi$ cross-count identical iff there is a Z such that A is ϕ-identical with Z, B is χ-identical with Z, and C is ψ-identical with Z.

Let us consider how this helps with the problem of change. Take a simple example of a particular P. Suppose P at time t_1 is a green leaf, in which case there are two aspects, both of which are p-identical with P and t-identical with t_1, one of which is u-identical with *being a leaf*, and the other of which is u-identical with *being green*. Suppose further that P at time t_2 is a red leaf, in which case there are two aspects, both of which are p-identical with P and t-identical with t_2, one of which is u-identical with *being a leaf*, and the other of which is u-identical with *being red*. P at time t_2 is p-identical with P at time t_1. This is because, by definition, a particular is p-identical with itself (irrespective of t- and u-identity). From t_1 to t_2, the pattern of aspects shared by particulars and universals may differ. This is illustrated in the following diagram, where p_1 represents P, u_1 the property of *being a leaf*, u_2 the property of *being green*, and u_3 the property of *being red*. The *very same* particular has different properties at t_2 than it had at t_1.

(13) t_1 :
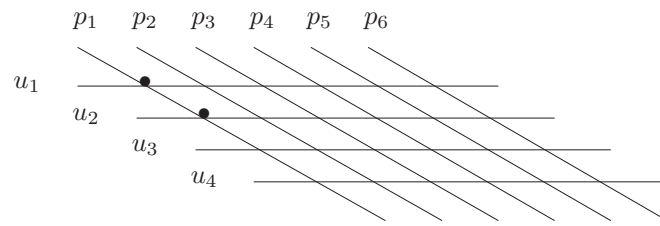
t_2 :
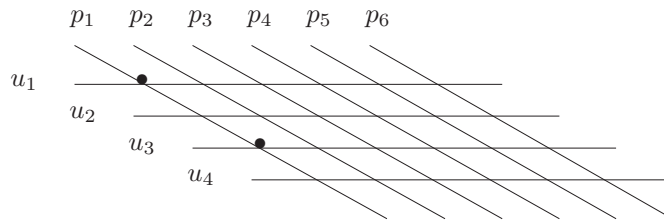
If this account is correct, then the natural laws that govern change must govern what aspects there are, which is to say where they are shared. Where a given aspect exists, its p-, u-, or t-identity is necessary, but its existence is not necessary. It follows that cross-count identity in general is contingent, since *in general* an aspect shared by a particular and a universal may not exist. This is a reversal of Armstrong's view, according to which instantiation is necessary, but the existence of the particular and the universal concerned is contingent. The above brings further clarity to Baxter's view, which is intuitively the more plausible. The intuition that particulars and properties are strictly identical over time is not one that we should abandon lightly.

Chapter 3

Word Meaning and Reference

In this thesis, I maintain the standard representationalist assumption that (certain kinds of) words have referents, which is to say things in the world that they refer to. This is an essential part of any compositional correspondence theory of truth, in which the correspondences between expressions and states of affairs are built out of correspondences between words and things in the world. Everyone who thinks that words exhibit reference agrees that a term's property of referring to its referent is part of its meaning, but there is considerable disagreement over what other factors, if any, are involved.

The purpose of this chapter is two-fold. Firstly, it is to lay out the geography of thought about word meaning in linguistics and philosophy. I do not propose to reach any firm conclusions, but rather to show how a range of issues are interrelated, and the extent to which they bear on the problem of reference. In the first section, I review a number of important ideas about word meaning in linguistics and philosophy. In particular, I consider ways in which inferential properties are claimed to be constitutive of meaning.

Secondly, its purpose is to consider one avenue for a naturalistic theory of reference. In the second section, I look at Kripke's outline of a causal-historical account of reference. This is important as a *prima facie* case for the possibility of a naturalistic theory of reference for proper names and names of natural kinds. We consider problems that suggest that it must, at the very least, be supplemented by another kind of theory (teleological, informational), examples of which are covered in Chapter 4.

I consider an argument from Putnam that suggests that nothing inside the head can completely determine a term's reference. Together with Kripke's arguments, there is a good case for externalism: the idea that meanings are partly outside the head.

3.1 Word meaning

Any theory of natural language semantics requires a theory of word meaning. This is because, on standard assumptions of compositionality, the meaning of a linguistic expression is a *function* (in a broad sense) of the meanings of its component words and the way that they are combined.

Neither model-theoretic nor cognitive theories are committed to a particular view of word meaning, and this is reflected in the range of approaches represented within the fields. How, precisely, the reference of a term is determined or constrained is left open. In this section we explore the major alternatives for theories of word meaning, and their relevance to the present project.

Frege (1892) identified sense and reference as the two components of meaning. Sense is the means by which a term has its reference, or property of referring. In this section I am primarily concerned with sense—how words or concepts, by their nature, get their property of referring.

In model-theoretic semantics, the divide between reference and sense is roughly characterized as that between extension and intension (note the 's'). An intension, in this technical sense, is (roughly) a function from possible world-times to extensions. This allows for the treatment of terms in so-called opaque contexts. For example, the term 'the King of Norway' has a different extension depending upon what world and/or time is relevant to the utterance in which it appears. The function from world-times to extensions is a formal way of capturing this variability of extension. Montague (1973) famously treats 'John seeks a unicorn' on the reading that doesn't entail the existence of a unicorn. This involves treating *seeking* as a relation between John and the intension of 'a unicorn', which is a function from world-times to the set of properties some unicorn or other has at that world-time.

I have no alternative to intensions to offer, which is to say no solutions to the variety of problems traditionally solved with intensions. I merely note that model-theoretic semantics takes great metaphysical liberties here—chief among them modal realism (see Lewis, 1986)—for the sake of this semantic gain. If naturalistic considerations count for anything, I doubt that intensions are the way to go.

Besides intensions, model-theoretic semantics recognises sense relations in the form of lexical decompositions and/or meaning postulates. There is considerable debate between linguists and philosophers about which, if either, of these are genuine aspects of word meaning. That is the topic of the following section.

3.1.1 Inferential role

Inferential role shows up in the theory of word meaning in at least two ways. Firstly, concepts may have other concepts as proper parts. For example, the concept BACHELOR may be a conjunction of the concepts UNMARRIED and MAN. Secondly, there may be certain inferences involving a concept that must be entertained in order for that concept to be possessed. For example, it might be that one must entertain the inference CAT → ANIMAL in order to qualify for possession of the concept CAT. In this case, ANIMAL isn't necessarily a *part* of the concept CAT but, still, one cannot possess CAT without possessing ANIMAL. These alternatives correspond, very roughly, to the approaches of lexical decomposition and meaning postulates, respectively.

3.1.2 Lexical decomposition and meaning postulates

Various theories of lexical decomposition have been offered, according to which the meaning of a word/concept is given by its internal structure of component concepts. Notable examples are Dowty (1979) within model-theoretic semantics, and Pustejovsky (1995) within lexical semantics.

Lexical decomposition amounts to a theory of word meanings as definitions. It involves such claims as: the concept BACHELOR consists of the concepts UNMARRIED and MAN. That is, BACHELOR and UNMARRIED MAN are the same complex concept. This is roughly equivalent, on the conceptual level, to saying that the meaning of 'bachelor' is given by its definition as 'unmarried man'. It is therefore of great significance to proponents of lexical decomposition whether words are definable (i.e. whether they have satisfactory definitions). According to Fodor, there are no satisfactory definitions for the vast majority of words.

> There are practically no defensible examples of definitions; for all the examples we've

got, practically all words (/concepts) are undefinable. And, of course, if a word (/concept) doesn't have a definition, then its definition can't be its meaning. (Oh well, maybe there's one definition. Maybe BACHELOR has the content unmarried man. Maybe there are even six or seven definitions; why should I quibble? If there are six or seven definitions, or sixty or seventy, that still leaves a lot of words/concepts undefined, hence a lot of words/concepts of which the definitional theory of meaning is false. The OED lists half a million words, plus or minus a few.)

<div align="right">(Fodor, 1998: 45)</div>

There are other problems for lexical decomposition. Fodor discusses what is known as the Residuum Problem (1998: 109–10). Certain concepts present a particular difficulty in terms of how they should decompose. We might suppose that RED decomposes into COLOURED and something else. Unfortunately, nothing appears to fit the bill, except perhaps RED itself. This may be one reason for preferring meaning postulates (see below) to lexical decomposition.

There are also problems surrounding the notion of a primitive concept. As Fodor observes, "[n]ot all concepts could be definitions, since some have to be the primitives that the others are defined in terms of; about the acquisition of the primitive concepts, some quite different story will have to be told" (1998: 44). This at least suggests that definition theories are incomplete. As Devitt observes in the following passage, descriptions (of which we can consider definitions to be a variety) are not sufficient to determine reference.

> A description theory explains the reference of a word by appealing to the application of descriptions associated with the word. So the theory explains the reference of the word by appealing to the reference of other words. How then is the reference of those other words to be explained? Perhaps we can use description theories to explain their reference too. This process cannot, however, go on forever: There must be some words whose referential properties are not parasitic on those of others. Otherwise, language as a whole is cut loose from the world. Description theories pass the referential buck. But the buck must stop somewhere.

<div align="right">(Devitt, 1996: 159)</div>

This suggests that whether or not definitions have a place in the theory of meaning, a different theory is needed for the basic, undefinable vocabulary.

Meaning postulates are an important alternative (or complement) to lexical decomposition. These are universally quantified conditional or biconditional generalisations that express necessary relations between denotations. For example, the meaning postulate $\forall x \Box [\mathit{bachelor}'(x) \rightarrow \mathit{unmarried}'(x)]$ expresses that necessarily any individual in the denotation of 'bachelor' is also in the denotation of 'unmarried'.

Both definitions and meaning postulates are ways of expressing sense relations between concepts in ways that are supposed to be constitutive of conceptual content. Fodor criticises Partee (1995) for suggesting that it might be a virtue that it's indeterminate whether a certain inference exists as a content-constitutive meaning postulate, or as a bit of general knowledge.

> Exactly because meaning postulates break the 'formal' relation between belonging
> to the structure of a concept and being among its constitutive inferences, it's unclear
> why it matters which box a given such 'fact' goes into; i.e. whether a given inference
> is treated as meaning-constitutive. Imagine two minds that differ in that 'whale →
> mammal' is a meaning postulate for one but is 'general knowledge' for the other.
> Are any further differences between these minds entailed? If so, which ones? Is this
> wheel attached to anything at all?
>
> (Fodor, 1998: 111–2)

In other words: What is it about a given inference that makes it constitutive of content? There is a clear answer in the case of lexical decompositions in terms of what they claim about the structure of concepts (e.g., that UNMARRIED is a *part* of BACHELOR, etc.), but this sort of connection is entirely absent from the theory of meaning postulates. This is the key difference between a decomposition of BACHELOR into UNMARRIED and MAN, and a biconditional meaning postulate according to which anything in the denotation of BACHELOR is in the denotation of UNMARRIED MAN, and vice versa.

Fodor maintains that theories that make use of inferential role need a principled distinction between content-constitutive and non-content-constitutive inferences.

> It's a general problem for theories that seek to construe content in terms of inferen-
> tial role, that there seems to be no way to distinguish the inferences that constitute
> concepts from other kinds of inferences that concepts enter into. The present form of
> this general worry is that there seems to be no way to distinguish the inferences that

45

define concepts from the ones that don't. This is, of course, old news to philosophers. Quine shook their faith that 'defining inference' is well defined, and hence their faith in such related notions as analyticity,[1] propositions true in virtue of meaning alone, and so forth.

<div align="right">(Fodor, 1998: 45)</div>

Fortunately, this does not present a problem for the theory I propose here. The only form of inferential role that I depend on is that of the "logical" vocabulary, which I take to include the equivalents of logical connectives and quantifiers (including numerals).

3.1.3 Outlook

The idea that none of the inferential properties of terms contribute to their meaning is commonly referred to as "atomism". The idea that only some of the inferential properties of terms are meaning constitutive is called "molecularism".[2] These two ideas are sometimes combined as varieties of *localism*, which is contrasted with *holism*, according to which all of a term's inferential properties are constitutive of its meaning.

Above it was suggested that the lack of a principled distinction between content-constitutive and non-content-constitutive inferences leads to atomism. Equally, however, it may lead to holism. If there is no means of deciding which inferences are content-constitutive and which are not, it may be that they all are.

Unlike molecularism, however, holism doesn't sit well with representationalism. This is because every person entertains at least slightly different inferences over their concepts, yet these must somehow determine that tokens of the same concept have the same referent, regardless of who is entertaining them. Since representationalism is a starting assumption for this thesis, I reject holism.

If molecularism is untenable, since it rests on an unprincipled distinction, one may be

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[1]It is interesting to note that there might be no analytic truths, not because there are no content-constitutive inferences for non-logical vocabulary, but because being true is always a matter of corresponding with the world in a particular way. If so, there can be no truth in virtue of meaning alone, if this entails no involvement of the world. Even the identity of the referents of two names in an identity statement is a matter of how the world is.

[2]Note that one may be a molecularist and still deny that concepts have internal structure by opting for meaning postulates over lexical decompositions/definitions.

forced to accept atomism. One consequence of atomism is very hard to swallow, however. This is *radical concept nativism*, the idea that all concepts are innate. It is claimed to follow from atomism because, if concepts have no internal structure, one can't learn/acquire new concepts by putting existing ones together (or by learning certain content-constitutive inferences involving the new concepts).[3]

Strictly speaking, I am forced toward a molecularist position by the fact that inferential properties of certain concepts are required to account for their representational roles in my theory (see [5.5]). Mine is a very weak form of molecularism, however, since the concepts in question are essentially logical (the analogues of quantifiers, numerals, and logical connectives). I offer no resolution to the problems associated with atomism and molecularism, merely noting that my theory is broadly compatible with either.

In the following section, I consider Kripke's sketch of a causal-historical theory of reference, along with a complementary argument from Putnam that nothing in the head could possibly determine reference.

3.2   Externalism and reference

> I know of [...] no plausible theory of what makes one thing *about* another, that isn't externalist in character. It is the relations—causal, informational, historical, or whatever—that, on a given Sunday afternoon, makes something in my brain about football rather than philosophy. Thoughts are in the head, but what makes them the thoughts they are is not there.
>
> (Dretske, 1995: 143)

In this section I consider the related issues of externalism and reference. Externalism is the idea, as suggested by Dretske's words above, that whatever determines what thoughts or expressions are about is outside the head. This means that in doing semantics, one is at least partly concerned with non-mental reality. The area of semantics most clearly concerned with external links to non-mental reality is the theory of reference.

We begin this section with the revised "picture" of reference that Kripke (1980) offers. This provides a *prima facie* case for the possibility of a naturalistic theory of reference.

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[3]See Margolis (1998), however, for a model of acquisition under which "[u]nstructured concepts needn't be innate".

Although I endorse a different sort of theory in chapter 4, Kripke's ideas introduce important ideas about the historical dimension of reference. I also consider an influential thought experiment from Putnam that reinforces the idea that nothing in the head alone could determine reference.

3.2.1 Rigid designation

Kripke (1980) introduces the notion of a *rigid designator*. The intuition that Kripke offers is that a proper name designates the same object in all possible worlds (which is to say possible situations). Proper names are thereby rigid designators.

In his second lecture, Kripke brings out the consequences that this has for identity statements. He illustrates the fact that identity statements are not, in general, known *a priori*.

> [S]omeone can use the name 'Cicero' to refer to Cicero and the name 'Tully' to refer to Cicero also, and not know that Cicero is Tully. So it seems that we do not necessarily know *a priori* that an identity statement between names is true.
>
> (Kripke, 1980: 101)

Kripke notes that nevertheless "[i]t doesn't follow from this that the statement so expressed is a contingent one if true" (1980: 101). That is, he employs a distinction between the epistemological notion of *a priori*, and the metaphysical notion of *necessary* (1980: 34–6).

The necessity of identity statements between names follows from their rigidity. If 'Hesperus' designates Hesperus, then it does so (designates *that very object*) in all possible worlds. Similarly for Phosphorus.[4] If 'Hesperus' and 'Phosphorus' designate the same object in our world, they must do so in every possible world, since whatever each designates in this world, it designates that in every possible world.

> Of course, it is only a contingent truth (not true in every other possible world) that

---

[4]Two areas of possible confusion may be dealt with here. Firstly, to say that 'Hesperus' designates Hesperus in every possible world is to say that *our word* 'Hesperus' *in this world* designates Hesperus in every possible world that it exists (1980: 77). Secondly, Kripke takes identity statements to be about the objects designated, not their names. 'Hesperus is Phosphorus' says that the object that 'Hesperus' denotes is identical to (is the same thing as) the object that 'Phosphorus' designates (1980: 107).

the star seen over there in the evening is the star seen over there in the morning, because there are possible worlds in which Phosphorus was not visible in the morning. But that contingent truth shouldn't be identified with the statement that Hesperus is Phosphorus. It could only be so identified if you thought that it was a necessary truth that Hesperus is visible over there in the evening or that Phosphorus is visible over there in the morning.

<div align="right">(Kripke, 1980: 105)</div>

This is really just to emphasise that 'Hesperus' does not express the property of *appearing over there in the evening*.[5] This is not an essential property of Hesperus. It might have been obscured by Earth's atmosphere, or there might have been no living things to observe it. But Kripke's intuition is that Hesperus could not have been, for example, a distant *artificial* light source. He discusses a table standing before him as he delivers the lecture. He asks whether *this very table* could have been made from a different block of wood, or a different material altogether. His intuition is that it could not. Nothing made of a different material, or even a different block of wood, would be *this very table*.

We could conceivably discover that, contrary to what we now think, this table is indeed made of ice from the river. But let us suppose that it is not. Then, though we can imagine making a table out of another block of wood or even from ice, identical in appearance with this one, and though we could have put it in this very position in the room, it seems to me that this is *not* to imagine *this* table as made of wood or ice, but rather it is to imagine another table, *resembling* this one in all external details

<div align="right">(Kripke, 1980: 113–4)</div>

Kripke also considers whether the Queen (meaning Elizabeth II) might not have had the parents she in fact did (1980: 112), and similarly suggests that she could not. 'How could a person originating from different parents, from a totally different sperm and egg, be *this very woman*?' (1980: 113).

We see the relevance of rigid designation in the idea of grounding, which is considered below.

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[5]If it expresses any property at all, it is that of *being Hesperus* (Cf. Kripke's comment about cows, 1980: 128).

3.2.2 Natural kinds

Kripke (1980) also offers interesting and influential discussion of natural kind terms. In relation to Kant's discussion of analytic judgements, Kripke considers whether we could discover that gold was not yellow (1980: 118). He imagines a situation in which "an optical illusion were prevalent, due to peculiar properties of the atmosphere … where gold mines are common". This illusions leads us to see gold as yellow, when it is in fact blue.

Kripke remarks that under the circumstances, we would not say that "What we took to be gold is not in fact gold". He explains thus.

> The reason is, I think, that we use 'gold' as a term for a certain *kind* of thing. Others have discovered this kind of thing and we have heard of it. We thus as part of a community of speakers have a certain connection between ourselves and a certain kind of thing. The kind of thing is *thought* to have certain identifying marks. Some of these marks may not really be true of gold.
>
> (Kripke, 1980: 118)

The idea is that a term like 'gold' gets grounded in a certain kind of thing. Subsequent uses of 'gold' will be about gold, whether or not the speaker associates the right kind of description.

Kripke also emphasises that fitting the description normally associated with 'gold' is not sufficient for being gold. Rather, something must actually be of the same kind as that in which the term was grounded; it must share the *essence* of gold. This serves as a consideration against descriptions as determinants of reference.

Another example that Kripke discusses involves tigers. He notes Ziff's (1960) observation that a three-legged tiger is not a contradiction in terms (1980: 119), and concludes that 'four-legged' is not a part of the concept of tiger. Of course, as Kripke notes, cluster concept theories have no problem dealing with this sort of example. They can claim that a sufficient (possibly weighted) majority of the relevant properties is sufficient for something's being a tiger. He therefore considers whether tigers might *never* be four-legged. For this, he imagines another sort of optical illusion, which causes the discoverers of tigers to see four legs where there are only three. Kripke similarly concludes that we

would not say that "there turned out to be no tigers after all"; rather, "we would say that in spite of the optical illusion [. . .] tigers in fact have three legs" (1980: 120).

Following an example from Putnam (1962), Kripke takes this further to imagine whether tigers might turn out to have *none* of the properties we take them to have (1980: 121–2). Suppose cats turned out to be "strange demons [. . .] planted by a magician"; according to Kripke, "the inclination is to say, not that there turned out to be no cats, but that cats have turned out not to be animals" (*ibid.*).

What Kripke is emphasising with these examples is that members of a kind share a (typically hidden) essence. Whatever this essence is (perhaps a universal), it will determine what kind of thing subsequent uses of the term refer to. Associated descriptions, general knowledge, etc., will *not*.

3.2.3 Putnam's Twin Earth

Kripke was among the first to defend a kind of *externalism* about mental content. According to Kripke's sketch of a theory, what one refers to with a given term is never solely determined by a description in one's head. The *causal history* of a term has a role in determining extension, and this is not something internal to any language user.

Another important contribution to the development of externalism is Putnam (1975). Putnam's contention is that sameness of intension does not entail sameness of extension (1975: 219). The essence of his claim is that being in a certain psychological state cannot, by itself, determine extension. Putnam illustrates the claim with his notorious "Twin Earth" thought experiment.

Putnam imagines a planet, which he calls Twin Earth, identical to Earth except in one particular detail. Wherever we have H_2O on Earth, there is some other liquid whose complex chemical formula we abbreviate to XYZ. This other liquid is, for all intents and purposes, indistinguishable in its appearance and behaviour from H_2O.

Putnam then supposes that on Twin Earth in 1750 (before the chemical composition of water was known) there is the exact replica of an Earthling, Oscar. We may suppose that Oscar and Twin Oscar are "exact duplicates in appearance, feelings, thoughts, inner monologue, etc." (1975: 224). Thus Oscar and Twin Oscar are in exactly the same psy-

chological state. Despite this fact, Putnam claims, Oscar and Twin Oscar do not mean the same by the term 'water'.

Comparisons can be drawn with Kripke's comments about natural kinds and natural kind terms. Kripke's point was that even if, as a point of metaphysical necessity, gold is yellow, it does not follow that 'yellow' is part of the meaning of 'gold', or part of the way that 'gold' refers to gold. According to Putnam's thought experiment, it is not just in virtue of our descriptions of the superficial properties of water that 'water' refers to water. After all, Oscar's term 'water' refers to one thing, and Twin Oscar's to another. Causal interaction supports the *grounding* of the term in one sort of thing rather than another.

3.2.4 Grounding, borrowing, and the 'qua' problem

Kripke's picture of the reference relation consists in an initial grounding of a term in an object, followed by the subsequent passing of reference from user to user. He describes the idea as follows.

> A rough statement of a theory might be the following: An initial 'baptism' takes place. Here the object may be named by ostension, or the reference of the name may be fixed by a description. When the name is 'passed from link to link', the receiver of the name must, I think, intend when he learns it to use it with the same reference as the man from whom he heard it. If I hear the name 'Napoleon' and decide it would be a nice name for my pet aardvark, I do not satisfy this condition
>
> (Kripke, 1980: 96)

If Kripke is correct in thinking that the receiver must *intend* to use the term in a certain way, the theory seems to require an independent account of the intentionality or about-ness of those intentions.

A similar difficulty is raised by the so-called 'qua' problem. The problem is that while the grounding of a term depends upon ostensive contact with the thing referred to, the ostensive contact is never with the whole object. Parts of the object are obscured from the senses, and parts of the object are completely inaccessible since they exist in the future or the past. How does a name get grounded in the "whole object"? These considerations suggest that "the grounder must [...] "think of" the cause of his experience under some

general categorial term like 'animal' or 'material object'." (Devitt & Sterelny, 1999: 80). In this way, we can plausibly get from the parts of the object that are accessible, to the parts that are not via their (cross-count) identity with a unit-determining property. Note that here the realist has a considerable advantage over the nominalist, since she can talk with full ontological commitment to properties without worrying about how to paraphrase away that talk at a later time.

A similar grounding problem arises for natural kinds. Individuals typically belong to multiple natural kinds—to *animal*, *mammal*, and *cat*, for instance. In virtue of what does a grounding of a term in some individual or individuals apply to one of these kinds and not to one of the others?

Devitt & Sterelny's suggestion is that grounders ""think of" the samples under certain descriptions—perhaps, 'cause of O' where O are the observed characteristics and powers—and as a result apply the natural kind term to them" (1999: 92). This is not much of a solution, of course, unless one has an independent account of how the descriptions ('striped', 'large', 'feline') apply to the observed characteristics.[6] If such an account can be given, however, there is hope for casual-historical theories to escape the 'qua' problem. Devitt & Sterelny suggest, with very little discussion, that the solution may be to combine a teleological account of *perception* with a historical theory of reference (1999: 162). In Chapter 4, I propose a hybrid of an informational theory of reference (with a limited historical component) and a teleological theory of truth.

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[6]It's a further problem for nominalists like Devitt that there's nothing for a kind-designating term to get grounded in other than *particular* tigers, etc.

Chapter 4

Mental Content

The previous chapter introduced semantic externalism and a causal-historical approach to reference. Kripke's theory was shown to have at least two shortcomings. Firstly, the account of reference borrowing, which is integral to the theory, may depend on something like the intention to refer to whatever was refereed to by the person from whom the reference is borrowed. Secondly, the account suffers from the 'qua' problem. Kripke's theory may have a role in the account of proper names but, at the very least, it needs to be supplemented by another theory.

In this chapter I review two prominent theories of mental content, which have the potential to provide a naturalistic theory of truth. Both are teleological theories, which is to say theories for which (biological) *function* plays a central role. I begin with a presentation of Millikan's theory, which I claim is inadequate in certain respects. In particular, it fails to describe a naturalistic, causal relation of representation, even if the *function* to represent is naturalistically described. Nevertheless, her notion of a proper function proves crucial to my theory of truth.

In [4.2] I consider an alternative in the form of Dretske's informational theory. One advantage of this theory is that the representing relations it invokes are straight-forwardly causal. It has a serious disadvantage, however: it can only supply truth conditions for sentences of the form 'It's an X', where 'X' is substituted for any kind-denoting term.

I nevertheless suggest that a broadly Dretskean view of reference be adopted. I argue in [4.3] that Dretske's theory must recognise a different sort of historical dimension than originally proposed. For the purposes of fixing content, it matters which *nomic dependency* is responsible for tokenings of A during learning (i.e., whether it's one according

to which *a*s cause As, or one according to which *a*s and *b*s cause *a*s). This frees the theory from reliance on implausible nomic dependencies of the kind: all and only *a*s cause As, and thereby also avoids the disjunction problem. I assume that there is no further historical dimension of reference-borrowing, at least for kind-denoting terms.[1] In this regard, Fodor argues quite convincingly that experts, etc., are just one of the ways that we may be *nomically* related to the content of our concepts (Fodor, 1994: 34–6).

Dretske's theory serves as a theory of reference, therefore, rather than as a theory of content *per se*. Millikan's biologically normative notion of a proper function provides the basis for extending the Dretskean theory of reference to a theory of content, which is to say a truth conditional semantics for natural language. This semantic theory is described in detail throughout Chapters 5 and 6.

4.1 Millikan's theory

In this section I explore Millikan's normative theory of meaning in some detail, and consider the implications of her theory of reference for a naturalistic semantic theory. Later, in Chapter 5, I suggest that her notion of a proper function may be put to essential use in a more traditional, bottom-up semantics. Specifically, I claim that so-called "bridges" have the proper function of relating terms whose denotations are (in various ways) identical and/or distinct from one another (i.e. according to Baxter's theory of instantiation). The true expressions are those whose bridges perform their proper function.

4.1.1 Proper functions

Central to Millikan's theory is her notion of a *proper function*. Its rough definition is as follows.

> [F]or an item A to have a function F as a "proper function", it is necessary (and close to sufficient) that one of these two conditions should hold. (1) A originated as a "reproduction" (to give one example, as a copy, or a copy of a copy) of some prior item or items that, *due* in part to possession of the properties reproduced, have actually

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[1]I leave it as an unresolved problem whether the referential properties of proper names may be accounted for in terms of nomic dependencies, or whether something closer to Kripke's account of reference-borrowing is required.

performed F in the past, and A exists because (causally historically because) of this or these performances. (2) A originated as the product of some prior device that, given its circumstances, had performance of F as a proper function and that, under those circumstances, normally causes F to be performed by *means* of producing an item like A.

<div align="right">(Millikan, 1989: 288)</div>

The first part of condition (1) establishes the basis for taking A to be a token of a certain type. A must be a reproduction, which is to say a member of a "reproductively established family". The example Millikan gives, and the pertinent one for us, is that of a copy, or a copy of a copy (and so on). The historical aspect is that past items from which A is ultimately copied performed a certain function F.

It is further required that the performing of F by past items be due in part to their having properties preserved (reproduced) by the copying mechanism. For example, what makes pumping blood the proper function of a heart is that the hearts from which it is copied pumped blood, *and* that they did so in virtue of the properties reproduced—i.e., the physical properties of hearts that enable it to pump blood. Furthermore, the fact that A now exists must be due to these past performances (it has been selected and preserved by mechanisms of evolution).

Condition (2) is for *derived* proper functions, which is to say "functions derived from the functions of the devices that produce them" (Millikan, 1989: 288). This condition allows that A derive its proper function from the device that produced it. Derived proper functions are of no direct relevance to the thesis.

4.1.2 Representations

<div align="right">"Theaetetus," by itself, could not possibly map anything.</div>
<div align="right">(Millikan, 1984: 106)</div>

Whether 'Theaetetus' can map anything by itself depends on whether the semantics is top-down, as Millikan would have it, or bottom-up. What Millikan has in mind is that it's the mapping from sentences to world affairs that constitutes the basic correspondence in meaning. 'Theaetetus' cannot be said to refer outside of a particular sentence or utterance.

<div align="center">57</div>

This is a mistake. There is a very clear idea by which we take 'Theaetetus' to map onto Theaetetus. In [5.1.1], I consider in some detail Millikan's reasons for ignoring this familiar sense in which a term maps onto its referent "by itself". I argue there that Millikan doesn't have a very good case against the familiar notion of reference. Since I am committed to doing semantics "bottom-up", I want to retain reference in the ordinary sense. To claim that terms succeed in mapping in virtue of the mapping of the sentences in which they appear is, on the present view, to put the cart before the horse. This is because sentences can only represent states of affairs by way of the referential relations of their terms. There is a clear ontological priority of referential mappings over sentence-world mappings. For Millikan, however, there is no ontological priority, since the mappings themselves are purely formal (more on which below).

The top-down approach leads to more serious problems with Millikan's account of the representing relation. In the following passage, Millikan describes what it is for an "intentional icon" to have sense.

> Intentional icons have sense, and each of the various significant variant or invariant mapping elements or aspects of an intentional icon has sense, and every member of the reproductively established family of such an element has sense. This having of a sense is the icon's or the element's having as a Normal condition for performance of its direct proper functions that it map onto something else in accordance with mapping rules of the sort I have described.
>
> (Millikan, 1984: 111)

A true sentence, then—one that is performing its proper function in accordance with a Normal explanation[2]—maps by some mathematical function to its truthmaker. The mapping itself is trivial, of course, since there is always some mathematical function or other that may be described between sentence S and world affair W. What is supposed to be substantive about this account, then, is that this mapping is in accordance with certain "mapping rules" and that *this is a Normal condition for performance of S's proper function*. Millikan has the following to say about Normal conditions.

> A Normal explanation is a preponderant explanation for those historical cases where a proper function was performed. Similarly, Normal conditions to which a Normal

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[2]I henceforth abbreviate this to 'operates Normally'.

explanation makes reference are preponderant explanatory conditions under which that function has historically performed.

<div align="right">(Millikan, 1984: 34)</div>

On the face of it, it's a mystery how S's mapping to W by some mathematical function can be an *explanatory condition* for anything at all. To get any explanatory leverage, the sentence-world relations that serve as Normal conditions need to be causally integrated.[3]

Although I regard this as a crucial problem for Millikan's theory, I nevertheless think that proper functions may play a key role in the naturalisation project. If my theory of truth is correct, which involves so-called "bridges" between denotational elements, the only substantive mappings required are those of denotation. The mapping from sentence to world affair piggybacks on denotational relations, so that no further mappings are proposed. This means that we need to supplement Millikan's theory of proper functions with a substantive theory of reference. This, I propose, we get from Dretske.

4.2 Dretske's theory

We turn now to another teleological theory of content. There are a number of advantages to Dretske's theory, for our purposes. Most notably, Dretske's representing relation is straight-forwardly causal; this avoids the kinds of concerns raised against Millikan's theory, in which representations have the function of mapping to world affairs by a merely formal or mathematical correspondence. What Millikan's and Dretske's theories have in common is that they make representing a *natural function* of representations.

4.2.1 Information and indication

Dretske's theory is built upon a notion of *information* as a natural, objective commodity. The intuitive idea can be grasped through a variety of examples of natural signs. Natural signs are a kind of indicator. *That* they indicate, and what they indicate, is an objective matter of fact—independent of any possible observer.

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[3]In the notorious case of the bee dance, I suppose that the relevant mappings are the *spatial relations* between the bee, the sun, the nectar, etc. Such correspondences are not mere mathematical relations, and surely *do* serve as Normal conditions.

> What an event or condition (whether we think of it as a signal or not is irrelevant) indicates or means about another situation is the information it carries about that other situation.
>
> (Dretske, 1988: 59)

An example Dretske returns to often is that of a fuel gauge wired to a gas tank. The position of the needle in the gauge *means* (in the sense of natural meaning) that the tank is half full. In Dretske's terms, the position of the needle in the gauge carries the information that the tank is half full. For Dretske, all information is *true* by definition. This is ensured since, for something to carry information about something else, there must be a lawful (nomic) relation between them. Thus, he writes:

> The transmission of information requires, not simply a set of de facto correlations, but a network of nomic dependencies between the condition at the source and the properties of the signal.
>
> (Dretske, 1981: 76–7)

This means that for the needle's position to carry information about the amount of gas in the tank, there must be a lawful dependency in place. Information, then, is a property of an indicator. It is the property that lawfully co-varies with the state of affairs it indicates. Something that carries the information *that F* is thereby an indicator of F. Dretske underscores the following condition on information.

> Informational content: A signal r carries the information that s is F = The conditional probability of s's being F, given r (and k) is 1 (but, given k alone, less than 1)
>
> (Dretske, 1981: 65)

Here 'k' refers to existing knowledge. The idea is that getting information from a signal may depend on what one already knows. The conditional probability mentioned here is an objective probability. It depends, as noted, on the nomic connections between the information that s is F and s's being F. Given the lawful correlation, the information that s is F necessitates s's being F.

Although it is not directly relevant to our purposes, it may be noted that Dretske takes information as the basis for his reliabilist epistemology, by which knowledge is analysed as information-caused belief. He writes:

> What information a signal carries is what it is capable of "telling" us, telling us *truly*, about another state of affairs. Roughly speaking, information is that commodity capable of yielding knowledge, and what information a signal carries is what we can learn from it.
>
> (Dretske, 1981: 44)

4.2.2 Misrepresentation

Dretske takes it to be a central task for naturalistic theories of content to explain how a sign can *mis*represent a situation. To explain, he makes use of Grice's distinction between natural and nonnatural meaning.[4] The relevant distinction is that the meaning of a nonnatural sign may be either true or false, whereas whatever a natural sign "means" (i.e. indicates) is necessarily the case. Nonnatural meanings can misrepresent; natural meanings cannot.

Dretske pursues natural meaning as a source of misrepresentation despite its apparent unsuitability. Bearers of nonnatural meaning misrepresent only via the purposes of humans, and hence presuppose what we need them to explain, viz. intentionality. Dretske illustrates this with the example of the fuel gauge. Suppose that the needle of the gauge points at the '1/2' mark on the dial when the tank is in fact empty, or when it is half full of water. In neither case does the gauge indicate or *mean* in the natural sense that the tank is half full of gas, a state of affairs that by assumption does not obtain. If the gauge is to indicate at all, it must indicate a state of affairs that actually obtains. The gauge can only misrepresent when *we give it the function* of indicating the amount of fuel in the tank.

Dretske considers a more promising source of misrepresentation that does not involve human purposes. This is a scenario involving magnetically sensitive bacteria (1986: 164). These bacteria have internal magnets (magnetosomes) sensitive to magnetic fields. The biological function of this ability, it seems, is to avoid the dangers of oxygen-rich waters. If the magnetosomes have the *natural function* of indicating oxygen-free waters then, when such indication fails to take place, there may be a case of natural misrepresentation. Such a scenario is constructed by taking bacteria from the northern hemisphere and

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[4]We encountered natural meaning above, where one event carries information about another. Nonnatural meaning is the kind of meaning we are trying to account for in the intentionality of thought, linguistic utterance, etc.

transporting them to the southern hemisphere. Here the magnetic field is reversed, with the result that the bacteria travel in the opposite direction (i.e. toward the surface) which, though Normally beneficial, is a hazard in the alien environment.

Dretske considers whether this is a conclusive example of the bacteria misrepresenting the presence of oxygen-free water. He concludes that there is a problematic *indeterminacy of function*. There is a problem of why we should describe the magnetosomes as having the function of indicating oxygen-free water, rather than that of indicating geomagnetic north, or simply magnetic north.

Dretske suggests that there is a solution to this problem for organisms with sufficient complexity to indicate by two or more sense modalities. In such a case, the distal cause of indication may be common to each indicator, even if there are more proximate causes. We may therefore take it that the function of each is to indicate the distal cause (e.g. oxygen-free water, rather than magnetic north).

Fodor raises a similar problem of indeterminacy of function against Millikan's account of misrepresentation. Millikan's account is briefly this.

> The possibility of misrepresentation is derived from the possibility that a token may fail to perform a function that has been accounting for continued reproduction of its type.
>
> (Millikan, 2005: 168)

The standard example is the frog's putative fly-detector. Natural selection has equipped the frog with the ability to detect a fast-moving fly as it crosses its visual field; the frog is then able to catch the fly with its tongue and eat it. So Fodor's argument goes, when a frog's detector fires in response to a BB (an airgun pellet), it is misrepresenting the presence of a fly iff its fly-detector is genuinely a fly-detector rather than a fly-or-BB detector. Fodor's claim is that evolutionary theory is indifferent to whether the function of the detector is to detect flies or flies-or-BBs in an environment where flies-or-BBs are reliably flies. "*Darwin cares how many flies you eat, but not what description you eat them under*" (Fodor, 1990: 73).

Millikan's response is that we must focus on the systems that consume (the objects of) the representations as well as those that produce them. The system that consumes the flies cares that it's frog-food that's represented, rather than BBs, or ambient dark fast moving

things (1991). Fodor (1991: 295) replies that this claim is open to the same objection. The mechanisms that consume the flies don't care whether it's flies or flies-or-BBs that they consume in an environment where flies-or-BBs are reliably flies.

Agar (1993: 11) suggests what makes the detector a fly-detector is that it was the property of *being a fly* that did "the causal work in shaping the representation", not the property of being a fly-or-BB. It was also not the property of *being a small dark fast-moving thing*. Whether or not this provides a satisfactory solution, this kind of indeterminacy is not a problem for the purposes I have in mind for Millikan's proper functions. This is because the bulk of the work on intentionality is done at the level of reference, not at the level of the proper function of bridges (see Chapter 5). That is to say, there is no comparable indeterminacy for the proper function of bridges.

There is, however, another face to the problem of misrepresentation, and one that most particularly affects Dretske. To understand this, we must first consider the role of learning in Dretske's theory.

4.2.3 From indicator to concept

The discussion of misrepresentation provided a notion of functionally derived meaning. Dretske explicates the notion as follows.

> (M_f) d's being G means$_f$ that w is F = d's function is to indicate the condition of w, and the way it performs this function is, in part, by indicating that w is F by its (d's) being G
>
> (Dretske, 1986: 161)

The magnetosome case introduces a possible source of a *natural* functionally derived meaning. For Dretske, however, even disregarding the functional indeterminacy problem, it is essential for meaning that it be causally integrated with behaviour. Therefore, however successfully we identify natural cases of representation and misrepresentation, there will only be meaning where such representations operate as beliefs, which is to say internal states capable of effecting behaviour. The essence of his idea is that a sign may get a functionally derived meaning in the process of learning.

> [A]ccording to this recipe for thought, then, something becomes the thought that F
> by assisting in the production of an intelligent response to F.
>
> (Dretske, 1994a: 225)

Dretske (1998) provides an illuminating discussion of this problem. He notes that the intrinsic (and hence non-intentional) properties of a belief explain the fact that it causes certain behaviours, but that it's the intentional properties of the belief that explain why having those intrinsic properties causes those behaviours—i.e. why the brain is "wired" in that particular way.

Dretske separates ordinary "triggering" causes from what he calls a "structuring cause" (1988: 91). His stock example is of a thermostat connected to a furnace. The falling ambient temperature causes the bending of the bimetallic strip, which in turn causes the circuit to be closed, and finally causes the furnace to come on. This is a regular instance of a series of triggering causes; from this we say that the falling temperature caused the furnace to come on. But Dretske points out that we might ask not *What caused the furnace to come on?* but, rather, *Why is it that events of the one type (falling of the ambient temperature) tend to cause events of the other type (turning on of the furnace)?* This is not a question of what is causally responsible for the turning on of the furnace in any particular case, but why the correlation exists between those event types. These require very different explanations. The answer to the second type of question is, presumably, that someone designed the system in such a way that the one type of event would reliably cause the other type of event.

Dretske's important idea is that the content of a belief is a structuring rather than a triggering cause of the behaviour it is supposed to explain. He brings out the notion vividly with an analogy based on the intrinsic and extrinsic properties of money.

> The value [of coins inserted into Coke vending machines] doesn't explain why the
> Cokes come out, but it does explain why coins – objects of that size and shape –
> cause Cokes to come out.
>
> (Dretske, 1998: 271)

It is important to note that the role of the indicator as a structuring cause is not to be regarded as constitutive of its content. Dretske sums this up as follows.

> *That* a system believes something depends, partially, on the *effects* (on system output) of these internal states, since to qualify for cognitive content an internal structure must have executive responsibilities. But the content is determined solely by the structure's origin—by its information heritage.
>
> (Dretske, 1981: 201–2)

In light of Dretske's account of the causal efficacy of content, it is interesting to consider an argument from Fodor, based on a thought experiment from Davidson (1987),[5] which he considers to count decisively against any historical theory of mental content (1998: 117). He quotes the following lines from Davidson (1987: 443–4).

> Suppose lightning strikes a dead tree in a swamp; I am standing nearby. My body is reduced to its elements, while entirely by coincidence (and out of different molecules) the tree is turned into my physical replica. The Swampman ... seems to recognize my friends and appears to return their greetings in English. It moves into my house and seems to write articles on radical interpretation. No one can tell the difference [...]
>
> [quoted in Fodor (1994: 116)]

Fodor notes that, according to causal-historical theories of content, Swampman has "*no intentional states at all*. No beliefs, no desires, no knowledge of anything, no views on radical interpretation." This is just the consequence that Davidson intends by his remarks.

Because he endorses a causal-historical view, Davidson is prepared to accept that Swampman has no thoughts, meanings, etc. Fodor nevertheless considers these consequences a "serious embarrassment for Davidson's causal history kind of externalist semantics" (1994: 117), and presumably therefore for any causal-historical theory of content. Fodor continues:

> If it's not his believing that it's Wednesday that explains why the Swampman says 'It's Wednesday' when you ask him, what on earth does? [...] Perhaps it's true, as it were, by definition that beliefs, desires, lusts and the like are constituted by their histories; in which case, of course, Swampman doesn't have them. But, so what? It's intuitively plausible that he has states that are their exact ahistorical counterparts *and that these states are intentional*.
>
> (Fodor, 1994: 117)

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[5]Essentially the same thought experiment appears earlier in Millikan (1984: 93).

Fodor's remark calls on folk intuitions about the explanatory role of beliefs. According to the folk, the fact that someone believes that it's Wednesday might explain his saying 'It's Wednesday'. Dretske vindicates the folk intuitions since beliefs may act as structuring causes, thereby explaining a kind of causal process—a regularity between event types.

If we consider Davidson's thought experiment, it seems that the intrinsic properties of Swampman's "beliefs" may be causally responsible for his behaviour, even though nothing will explain *in his case* why beliefs with those intrinsic properties cause that behaviour (i.e., why *his* brain is wired in that particular way). The fact is an anomaly, which for a being created under such strange and miraculous circumstances seems entirely appropriate. Neander makes the point well with her notion of a swampcow (1996). She correctly observes that Swampman should be no more of an embarrassment for semantic theory than the discovery of a swampcow should be for biological theory. The present consensus in biological theory is (roughly) that something is a cow iff it is born of a cow.[6] Swampcow would not be a cow, despite the fact that it was biologically just like a cow, could breed with other cows, and so on.

4.2.4   The disjunction problem

The "disjunction problem", which was raised by Fodor (1987: 102), is a problem of the apparent impossibility of error (misrepresentation) for causal theories in which it's a law that all and only *a*s cause As.

Dretske's original proposal was that learning makes misrepresentation possible by drawing a distinction between tokenings caused during learning and tokenings caused thereafter. It's OK for As to be *b*-caused after the learning period is over, since content is fixed beforehand. The basic idea is that during the learning period, it is ensured that only *a*s cause As, and hence A comes to mean *a* (and not, e.g., *b*). *b*-caused As after the learning period is over are then misrepresentations because As mean *a*.

Fodor identifies a serious flaw in this proposal. Dretske's theory is one according to which indicating *a* is a matter of having a counterfactual supporting correlation with *a*s. Suppose we stipulate that *b*s would have caused As during the learning period. In this case, it must be that A means *a*-or-*b*. Consequently, a *b*-caused A after the learning period

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[6]However, see Devitt (2008) for a recent defence of biological essentialism.

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is over turns out to be true. And if we stipulate that *b*s wouldn't have caused As during the learning period (so that As really do mean *a*, and not *a*-or-*b* after all) then *b*s shouldn't cause As after the learning period is over. Either way, there's no opportunity for As to *mis*represent by representing *b*s (Fodor, 1990: 62–3).

In [4.3], I suggest a variant of Dretske's program that has a different historical dimension. I claim that while this move has fatal consequences for Dretske's epistemological program, the semantic outlook is far better. It has the advantage of avoiding the disjunction problem altogether.

Fodor (1990) proposes his own solution to the problem that relies on a putative *asymmetric dependency* between *a*-caused As, which are true tokenings, and *b*-caused As, which are false tokenings. I agree with the following assessment of the proposal.

> Fodor is in need of some paradigm cases of A referring to *a*s where the following is the case: *a*s cause A, *b*s cause A, and *it is obvious that the latter causal relation is asymmetrically dependent on the former*. [...] At first sight, the basic law seems to be that horses, muddy zebras, the odd cow, ...cause HORSE. [...] Fodor seems to be stipulating, or hoping for, the existence of some very complex causal dependencies, without ruling out an alternative view of these relationships that fits just as well, or better, with the empirical facts
>
> (Devitt & Sterelny, 1999: 159–60)

4.3   Indication revisited

In [4.1], I reviewed Millikan's theory of content. One problem was of key relevance to the project of providing a naturalistic semantic theory. Millikan's mapping relations (isomorphisms) are merely formal, and hence do not belong in a naturalistic theory of content. *Prima facie*, mapping by some formal relation cannot be the proper function of anything. I suggested that Millikan's notion of a proper function nevertheless has an essential role in the theory of truth, to be presented in Chapter 5.

An alternative theory of reference may be borrowed from Dretske. Owing to the disjunction problem, however, the theory requires some modification.

The disjunction problem is a problem of the impossibility of error. It is a result of the

fact that information is true, for Dretske, by definition. It may therefore be worth exploring whether Dretske's program can be carried out with a weaker form of information. Dretske is adamant that it cannot. In this regard, he makes the following remarks in reply to Slater (1994).

> Contingency between C and F may be enough for an animal to learn to respond with M in condition F, but is it enough for meaning, for C (the internal cause of M) to come to represent something as F?
>
> (Dretske, 1994b)

Dretske proceeds to give the example of learning the concept PURPLE in conditions in which purple and dark red cannot be distinguished. As noted above, it makes no difference to Dretske whether all the samples from which the concept is learnt are, as a matter of fact, purple. What matters is that *were a sample of red to be shown, it would cause a tokening of C*. If both dark red and purple samples cause C, then C indicates *red or purple*. It's essential to Dretske that in the learning situation the information that the samples are purple (hence *not red*) is transmitted. He concludes as follows.

> Contingency may be good enough for discrimination learning (after all, S learns something in the above scenario), but it is not good enough for acquiring the concept PURPLE. For that we need, not just contingency between an internal state and purple, but indication.
>
> (Dretske, 1994b)

The solution I propose to this problem is a combination of both informational (nomic) and historical accounts. I follow Dretske in claiming that there must be a nomic dependency between the tokening of the indicator and the condition of the sample (its being purple). However, I deny that the dependency is such that *were* a sample of red to be shown, the indicator would not get tokened. As Millikan insists in the following passage, this is just not plausible.

> Suppose for the sake of the argument (though very implausibly) that there are unbreakable natural laws that concern the effects of foxes on rabbit sense organs. Still, there surely are no laws that nothing *else* could possibly produce the same effects on rabbit sense organs.
>
> (Millikan, 2004: 33)

Dretske's approach appeals to background factors that have to be present in order for the dependency to hold. If we consider another of Dretske's examples (1988: 57), a doorbell ring supposedly indicates a person at the door partly because of the background condition of knowledge that *only people press doorbuttons around here*. Nevertheless, we can call into the question the plausibility of these strict background conditions. Dretske presents k as knowledge that some condition or other is in place. He acknowledges that nothing in the laws of physics prevents, e.g., small animals from pressing doorbells, yet chance is not enough: '[t]here must actually be some condition, lawful or otherwise, that *explains* the persistence of the correlation' (1988: 57). Well, if there are no basic laws that only humans press doorbuttons, what else might explain the condition? Even if we accept ceteris paribus laws, we should not necessary accept laws of the kind: ceteris paribus, all and only *a*s cause As. Furthermore, there is a strong burden of argument that all possible exceptions are *unprincipled*, and hence genuine exceptions, rather than law-breaking counterexamples. We can explain the prevailing conditions without thereby (implausibly) raising the probability to 1 that a human is at the door when the doorbell rings.

Consequently, I propose that we supplement Dretske's account with an element of historical contingency. What matters, for the purposes of fixing content, is *which nomic dependency* was actually responsible for causing the tokenings of C/PURPLE during learning. If tokenings of C were caused under a nomic dependency according to which samples of dark red *or* purple cause C, then what gets learnt is DARK COLOURED. This is because the dependency in question is a dependency between *being dark coloured* on the one hand, and C on the other. Conversely, if tokens of C were caused under a nomic dependency according to which samples of purple (rather than samples of a dark colour) cause C, then what gets learnt is PURPLE.

Crucially, this doesn't require a nomic dependency according to which *only* purple causes C/PURPLE. Rather, it requires a nomic dependency that is *only concerned with* the property of *being purple*, and not with any other property. *Such a dependency doesn't rule out further dependencies concerning causes of* C/PURPLE.

If there is some other dependency, as we assume there may be, according to which *being dark coloured* causes C/PURPLE, that's fine provided that it wasn't responsible for any of the tokenings during successful PURPLE-learning situations, which is to say situations in which (according to our theory) the learner gets the right concept of purplehood. Learn-

ing is successful if and only if the learner's PURPLE concepts are connected up to *being purple* specifically, and not *being dark coloured*. According to my proposal, then, it must be that the dependency responsible for causings of tokenings of C during learning is only concerned with *being purple*, and with no other property.

We can return to Dretske's concern about the need for genuine indication. Under my proposal, there is no genuine indication in Dretske's sense, since there is no dependency in place according to which nothing other than samples of purple causes C/PURPLE. Nevertheless, it follows from my account that the conditions of successful learning will be such that no property of the samples besides their *being purple* (e.g. their *being dark coloured*) may be responsible for the tokenings of C/PURPLE. This guarantees that the learner can tell purple from dark red during learning whenever she successfully learns PURPLE. In a situation where the learner is exposed only to purple samples, but in which the lighting conditions are such that a dark red sample would have looked the same as the purple ones, she cannot learn PURPLE successfully because the nomic dependency in operation could only be between *being dark coloured* and C. I therefore satisfy Dretske's particular concern, but without allowing dependencies that say *only* purple causes C/PURPLE.

Chapter 5

Semantic Essentials

5.1 Background

In this chapter, I present my naturalistic semantic theory. In light of the ontology presented in Chapter 2, I develop a correspondence-based theory capable of handling basic predication, negation, quantification, conjunction and disjunction. I further develop this in Chapter 6 with a thorough treatment of relations, thereby extending my theory of quantification to handle such phenomena as scope ambiguities.

Before I proceed to the details of the theory, two significant background issues need to be addressed. The first is that of the relative priority of sentence to world affair mappings and reference mappings. I defend a traditional bottom-up semantics against Millikan's criticisms. The second is that of truthmakers. I endorse the basic notion of a truthmaker as some portion of reality in virtue of which an expression is true, but take a somewhat different view from Armstrong, particularly in the matter of the truthmaking relation.

5.1.1 In defense of bottom-up semantics

Millikan argues that there is a serious problem with any correspondence theory that begins with word denotations.[1] That is to say, she believes that the correspondence of truth is first and foremost from sentence to world affair, and that the correspondence of refer-

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[1] I use the terms 'denotation' and 'referent' interchangeably throughout this and the following chapter.

ence is dependent upon this. This of course runs contrary to the standard view, and the view that I mean to defend here. In this section, I consider Millikan's reasons for adopting this stance, and show that the apparent problems for the standard, bottom-up view may be overcome.

Millikan argues for her position by attempting to show that the traditional view is untenable. The essence of her first argument is that if correspondence consists in a series of relations between parts of sentences and parts of world affairs, this cannot amount to a correspondence between a whole sentence and a whole world affair. Thus, she notes that the words of a sentence may each correspond, while the sentence as a whole does not.

> We start with the simple notion that sentences correspond to things in the world; hence sentences composed of these words correspond to world affairs composed of these things. We put some words together: "Theaetetus flies." "Theaetetus" corresponds to Theaetetus; "flies" corresponds to flies (flying). Everything seems to correspond. So what is wrong with the sentence? Unfortunately, "Theaetetus flies" does not correspond to anything. For Theaetetus does not fly.
>
> (Millikan, 1984: 102)

She goes on to note that it does not help to suggest that the *relation* between the terms corresponds to the *relation* of instantiation between Theaetetus and flying. If so, the relation between the terms corresponds to instantiation wherever it may be. It does not necessarily correspond to a relation of instantiation between Theaetetus and *flying*, where it must be for the sentence to be true.

This is not the only available strategy, of course. In light of Baxter's theory of instantiation, presented in [2.3], I claim that 'Theaetetus' corresponds to Theaetetus, 'flies' corresponds to flying, and Theaetetus and flying correspond *in and of themselves* by their cross-count identity. I do not say that they correspond by a further *relation* of instantiation. Still, the question remains of how the denotations of the individual terms of a sentence could amount to a correspondence between the sentence and a world affair. The remainder of this chapter is dedicated to answering that question (but see [5.4] in particular).

Millikan's second argument is to present Bradley's objection to relations as an attack on the notion of instantiation (1984: 108). We saw in Chapter 2 that, according to Baxter's ontology, instantiation is not a relation at all, but rather a sort of identity. Millikan's

objection is therefore irrelevant. I do not propose that an actual relation holds between Theaetetus and *flying*, hence there is no problem of infinite regress.

Millikan has a different solution to these two issues. Her vision is for a top-down semantics according to which sentences map to world affairs first and foremost, and individual words refer only in virtue of this. She writes:

> [I]f the mapping of language onto the world is as we have described it, [Bradley's] regress has no footing. World affairs are not torn apart into *sets* of objects by the mapping rules for intentional icons, hence do not have to be put together again.
>
> (Millikan, 1984: 108)

This may be a solution to the semantic problems at hand. However, I am not convinced that Millikan has sufficiently addressed the ontological issues. While it may be true that world affairs are not "torn apart" by the mapping rules, it nevertheless seems reasonable to expect Millikan to provide a *metaphysical* account of the binding between world affairs and the particulars and universals that participate in them. She dedicates only a few lines of discussion to the fundamentals of her ontology. She writes:

> The assumption that there must be *one* ideal or final articulation of a world affair, and ultimately of the world as a whole, that gets things ontologically *right*, that shows what the world affair or the world is really composed of, has driven great philosophical engines in its time. But it may be that ontology can ultimately be made simpler by dropping this assumption. Interesting transformations and corresponding invariances, structure rather than kinds of *things* would be left as the basic subject matter of ontology, things and their properties being derived from structure rather than vice versa.
>
> (Millikan, 1984: 109)

The suggestion here is that there may not always be an answer to questions of what (sorts of) things there are, and how they stand to one another. This might explain away certain philosophical puzzles, including that of instantiation. However, it does not follow from the interesting idea that things and their properties are derived from structure that we could not give a satisfactory answer to how things stand to their properties. To serve as the basis of a fully articulated theory of meaning, these vague suggestions need to be fleshed out.

I take it to be an advantage of my approach—at least if one is to be as serious about the linguistic semantics as about the philosophical problems of naturalising content—that I explicitly define how specific expressions in the language of thought are supposed to correspond to world affairs. Partly through the employment of a realist Armstrong-Baxter ontology, I am able to precisely model the correspondence of truth between *specific* semantic representations and *specific* states of affairs.

Millikan's ontology—what little of it there is[2]—seems to be designed primarily around the desire to avoid saying what things there are, *in metaphysical terms*, and how they stand to one another in world affairs. While it may be true that world affairs are not "torn apart" by the mapping rules, one has to wonder what states of affairs are like, in general and in particular, in Millikan's ontology. It is interesting to note that states of affairs are not "torn apart" under Baxter's ontology either, and that this is achieved without denying that there are particulars and universals in the usual sense. This leaves an account based on partial identity as a strong candidate for Millikan, and one that is far better articulated than her own vague suggestions. Given, then, the availability of a bottom-up approach, the top-down approach is not necessary, and must be judged on its merits.

5.1.2 Truthmakers

Truthmakers feature centrally in Armstrong's recent philosophy (see, in particular, Armstrong, 2004). Despite finding much agreement with his metaphysical views, my views on truth and truthmaking are very different from his. We are nevertheless in agreement over the general characterisation of a truthmaker, which Armstrong gives as follows.

> The idea of a truthmaker for a particular truth, then, is just some existent, some portion of reality, in virtue of which that truth is true.
>
> (Armstrong, 2004: 5)

Implied in the 'in virtue of which' is some kind of relation or correspondence between truth and truthmaker, which Armstrong refers to as the "truthmaking relation". To the

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[2]This may seem unfair given the extensive discussion of substances and properties (Millikan, 1984: 257–81). Note, however, Millikan's admission that her "category 'substance' [...] is at root an epistemological category" (1984: 275).

extent that there must be some kind of truthmaking relation, we are also in agreement. In respect of all the details, however, I disagree with Armstrong.

Armstrong takes the bearers of truth to be propositions. Propositions, he assumes, are "the *intentional objects* of beliefs and certain thoughts" (2004: 13). He goes on to say that "[propositions] are the *content* of the belief, what makes the belief the particular belief that it is; or else the *meaning* of the statement", and further notes that they are an abstraction in the sense of being types rather than tokens. Unfortunately, he says little else to provide clarification, merely noting how difficult a problem intentionality is.

In contrast, I take the bearers of truth to be token thoughts, token sentences, token utterances, etc. The truth value of such objects depends, of course, on the types that they and their parts exemplify. These are grammatical and/or semantic types, such as *being the word 'book'*, *being a noun*, or *being a verb phrase*. Whatever has the property of *being the word 'book'* (i.e., any token of the word 'book') must express (i.e., denote) the property of *being a book*. The only kinds of "intentional objects" on this view are the things that thoughts, etc., are about, which is to say the particulars and universals that they refer to.

What is perhaps more striking is that Armstrong considers truthmaking to be an *internal* relation. This goes hand-in-hand with his claim that truthmakers necessitate their truths (Armstrong, 2004: 5). The notion of "Truthmaker Necessitarianism" is incompatible with my view of truthbearers. Since I take the bearers of truth to be token thoughts, sentences, and utterances, it makes no sense to claim that a truthmaker (e.g. *John's being happy*) necessitates that certain sentences and thoughts have the property of *being true*. That they are true depends on *contingent* matters of semantic reality: that tokens of 'happy' denote the property of *being happy*, and not *being sad*, etc.

Consonant with the general approach of this thesis, I claim that the truthmaking relation consists partly in the referential relations of individual terms, and partly in the normative properties of elements that bind those referential terms into full expressions. This idea is clarified as the theory unfolds. Below I argue for the idea that a truthmaker is a *portion of reality*, rather than a state of affairs (simple or complex) *per se*.

5.2 Predication

Predication describes a certain semantic relation between two elements of a sentence. In this theory, it involves a relation between denotational terms by which each is dominated by the same bridge. The bridge is a non-denotational element of the internally represented expression. Consider the following example.

(14) a. 'John is sleeping.'

b.
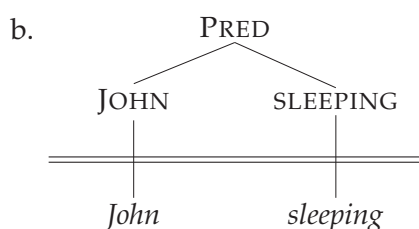
The illustration in (14) contains various elements, some belonging to the linguistic structure and some belonging to the external world. I begin with an account of the linguistic structure.

I propose that the bearers of truth are token thoughts, written sentences, and spoken (or signed) utterances, and further that the meanings of mental representations are prior, in the ontological order, to any other kind of linguistic meanings, including the meanings of spoken utterances, written sentences, and—to the extent that there is cause and justification to admit them at all—the meanings of propositions. I assume this because, plausibly, what makes something an external linguistic token is its relation to minds. A written sentence has a truth value only in virtue of the truth value of its corresponding thought. No explicit system of translation is to be provided here.[3] I merely note that this system must be suitably constrained, so that there is an objective fact of the matter about what the translation of a given thought into, say, written English is, and vice versa.

I take the approach, almost universal in linguistics, of proposing structured mental linguistic representations. I take these to be the ultimate bearers of linguistic meaning. As far as possible, I want to avoid discussion of the metaphysics of mental entities and relations. Suffice it to say that it would be consonant with my wider naturalistic goals to

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[3]Perhaps the ideal system to fulfil this role is a variant of Dynamic Syntax, a parsing-based theory in which words trigger lexically based rules that drive the construction of semantic trees, with no intermediate level of syntactic constituent structure (see Cann *et al.*, 2005).

assume a version of functionalism.[4] Nevertheless, I can say roughly what sorts of mental entities and relations these representations consist in.

The illustration in (14), above, shows three mental particulars. These are the two terms JOHN and SLEEPING, and the non-denotational element PRED. Naturally, JOHN and SLEEPING correspond to (are the internal equivalents of) the external linguistic terms 'John' and 'sleeping', respectively. The non-denotational element PRED does not correspond directly to any external linguistic item.[5] However, in the present example, it may be considered roughly equivalent to copula 'be'.

A relation between each of the terms and PRED is represented by two diagonal lines. This pair of relations is constitutive of a predication between the two terms, mediated by PRED. The relations are asymmetric; PRED dominates each of the terms, and not vice versa. Furthermore, the two relations are not identical. We see below that we must distinguish between the two terms by their respective relations to PRED.

Elements above the double horizontal lines are mental entities, which is to say "in the head". Elements below the lines are in the world (possibly, of course, including the head). Particulars and universals are represented by their names in italic type.

I turn now to the matter of truth. Assuming the ontology presented in Chapter 2, 'John is sleeping' is true just in case the particular John is cross-count identical with the universal of *sleeping*. I now describe the semantic principles that make this so.

I assume that 'John' refers to the particular John and 'sleeping' refers to the universal of *sleeping*, as indicated by the two vertical lines in the diagram. I claim that the sentence is true just in case the referent of 'John' is cross-count identical with the referent of 'sleeping'. More precisely, the sentence is true just in case PRED, the bridge of the sentence, relates two terms such that their referents are cross-count identical. This is fully
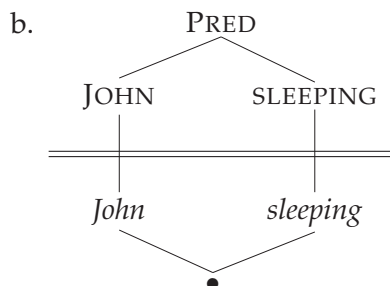
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[4]This is the idea that mental states are individuated by their causal input-output functions, rather than by their intrinsic, physical constitution. See, e.g., Rey (1997) for an overview. Note that this has nothing whatever to do with the stance of "functionalism", and the opposing stance of "formalism", in linguistics.

[5]An interesting feature of Dynamic Syntax is that the nodes of its tree structures aren't decorated with (internal representations of) words. Words are merely the triggers for lexically stored rules that generate structures and decorate them with semantic values. This makes Dynamic Syntax a good choice for this theory, since bridges do not correspond directly to words in external sentences. For further brief discussion, see [7.2.10].

illustrated in (15), where the black dot represents the shared aspect, and the lower two diagonal lines represent p- and u-identity, respectively.
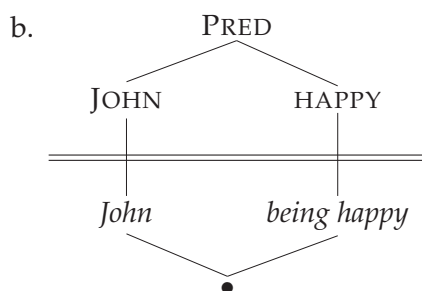
(15) a. 'John is sleeping.'

b.
$$
\begin{array}{c}
\text{PRED} \\
\text{JOHN} \qquad \text{SLEEPING} \\
\text{John} \qquad \textit{sleeping} \\
\bullet
\end{array}
$$

It was noted above that a truthmaker is a portion of reality, the existence of which (given various contingent matters of semantic reality, such as the existence of denotation relations) makes a certain expression true. In the above example, this portion of reality is everything below the double lines:[6] the particular John, the universal of *sleeping*, and the aspect in which they are identical. Arguably, we could take just the aspect in which they are identical as truthmaker. In taking this aspect, however, we *thereby* take the particular and the universal. In any case, below we find cases in which we take a particular and a universal without taking a shared aspect, since no such aspect exists. It therefore seems preferable, risking nothing more than redundancy, to take the particular, the universal, and the aspect in which they are identical as the truthmaker here.

The same principles of predication apply to adjectives. The following example is therefore analysed in just the same way, assuming that 'happy' refers to the property of *being happy*.

(16) a. 'John is happy.'

b.
$$
\begin{array}{c}
\text{PRED} \\
\text{JOHN} \qquad \text{HAPPY} \\
\text{John} \qquad \textit{being happy} \\
\bullet
\end{array}
$$

---

[6]Strictly speaking, not *everything* below the double lines, since we naturally exclude the denotation relations from the truthmaker.

That is the basic outline of the theory of predication. In the remainder of the chapter, the theory is extended to account for many more construction types.

5.3 Negation

From a naturalistic standpoint, it is unacceptable to grant any sort of existence to negative states of affairs. To say that there is a state of affairs of *John's not smoking*, in virtue of which 'John isn't smoking' is true, offends against our commonsense and philosophical intuitions, and lacks all but a semantic motivation. Nevertheless, there is a real problem here that cuts across both metaphysics and semantics. If correspondence truth holds, there must be portions of reality with which certain negated sentences correspond, and in virtue of which correspondences they are true.

There are two standard solutions to the problem. The first involves the notion of *incompatibility* or *contrariety* of universals (Armstrong uses the former term, Millikan the latter). According to this idea, there are natural incompatibilities between properties. For example, *being red* is incompatible with *being green* and *sleeping* is incompatible with *being awake*. Each incompatibility is a matter of metaphysical necessity. The "relation" of incompatibility between these pairs of universals may be metaphysically basic, much like identity and distinctness. It is certainly not an external relation, or any other kind of universal.[7]

The alternative is a *difference* theory, which holds that *not being X* amounts to being different, in every respect, from *being X*. To put it another way, not having the property F involves all of one's properties being different from F. Take an oxygen molecule M. This has the property of *being* O_2. M is not hydrogen, hence does not have the property of *being* H. According to difference theories, this requires that all of M's properties be different from *being* H. For example, *being* O_2 is different from *being* H. Similarly, the property of *being a molecule* (*tout court*), which M also has, is different from *being* H. Whatever one takes the property of *being a molecule* to be, it is (at least partly) different from *being* H.

---

[7]Note that it is surely not a disadvantage of incompatibility theories that they introduce the additional feature of incompatibility, since *prima facie* these are real incompatibilities that must be described under any total theory of the world, whether or not they contribute a solution to the problem of truthmakers for negative expressions.

Difference is a weaker thing than incompatibility. *Being red* is different from *being square*, but they are not incompatible. That is to say, red squares are a metaphysical possibility. What is most notable about difference theories is that they must employ general facts, or facts of totality: that in not being X, *all* my properties are different from *being X*. Incompatibility theories may seem to avoid facts of totality. However, there are important cases where incompatibility theories cannot plausibly do without facts of totality either. In the case of relations, incompatibility theories face a serious difficulty. Consider the following sort of relational sentence, in which negation takes scope over an existentially quantified object.

(17) 'John doesn't own a bicycle.'

I claim that besides an account based on *negative* states of affairs, which I rule out, just the following three options are available for the treatment of this example.

i) Avoid contraries, with the consequence that some expressions are made true by a distinctness of referents, rather than a state of affairs *per se*.

ii) Treat negations with contraries, with the consequence that some expressions require translating into a different logical form.

iii) Treat negations with contraries, with the consequence that some expressions require the existence of contrary relations of *non-owning*, etc.

I claim that the first option is the most satisfactory. The second option is considerably less satisfactory, in that having to provide translations that do not preserve logical structure adds an unnecessary layer of complexity. The third option is the least satisfactory over all, as some of the contrary relations that would need to exist to support the theory are highly implausible. I review these options now, in reverse order.

Above I considered contraries to properties such as *sleeping*, for which there was the natural and plausible contrary of *being awake*. Consider once more example (17). The property predicated of John is that of *not owning a bicycle*. This, of course, is a negative property of the kind I claim not to exist. Following Millikan's advice, we must find a contrary: a positive property that is incompatible with *owning a bicycle*.

Here is the difficulty: What sort of property of John could be incompatible with his owning a bicycle? Certainly, it cannot be *owning X*, where in the place of 'X' we insert a conjunction of everything he owns. Whatever John in fact owns, this is not incompatible with his also owning a bicycle. What we appear to need is the property of *owning only X*, where once more we replace 'X' with a list of everything John owns. This, however, seems to be a negative property, no better nor worse in that respect than *not owning a bicycle*. It is the fact that he owns such and such, *plus the fact that he owns nothing else*.

As a last resort, we might consider invoking a contrary relation of *non-owning* (non-ownership) between John and all of the bicycles. Unfortunately, this lacks even superficial plausibility. Supposing that I don't own a bicycle, what imaginable relation might I stand in to all of the bicycles (or, equally, the property of *being a bicycle*), in virtue of which it is necessarily the case that I do not own one? Suppose John is a Martian, and that there are no bicycles on Mars, and never have been. It is true to say that John doesn't own a bicycle, but John hasn't had the opportunity to enter into *any* sort of natural relation with bicycles or the property of *being a bicycle*. It also seems unimaginable that any positive property that John has (relational or otherwise) could actually rule out his owning a bicycle. Contraries of this kind, and therefore any approach that necessarily employs them, must be excluded.

The second major option involves a fact of totality or, to use the Russellian terminology, a general fact. It was noted above that we seem to require the property of *owning only X*, where 'X' stands for everything John owns. To represent this general fact, one needs to change the logical structure of the expression. That is to say, it requires a translation from the original sentence into the following one.

(18) 'Everything John owns is a non-bicycle.'

To instantiate *being a non-bicycle* is to instantiate a property that is, in one way or another, incompatible with *being a bicycle*. For this account to go through, therefore, one must at least grant the existence of contraries of this kind. Such contraries seem far more plausible than relations of *non-owning*, etc., so I grant them for the sake of argument. I assume, therefore, that every non-bicycle has at least one property that precludes it from being a bicycle (*being a motorcycle*, for example, but not *being two-wheeled*, or *being red*). The problem, as noted, is that the analysis requires a translation into a different logical form.
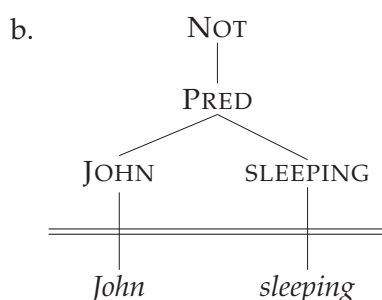
This is a process that, all else being equal, we should prefer to avoid.

The final and preferred option is to adopt a difference-based theory. I give the difference-based analysis of (17) on page 128.

5.4 Truth

Consider the following sentence, and its proposed representation.

(19) a. 'John isn't sleeping.'

b.

```
              NOT
               |
             PRED
           /        \
      JOHN          SLEEPING
        |               |
   =========       =========
        |               |
      John           sleeping
```

It would seem that this sentence is true just in case the bridge of the sentence NOT dominates a bridge of an expression that is not true.[8] We can use this idea to construct an initial theory of truth.

(20) THEORY OF TRUTH (Preliminary version):

An expression is true iff either a) its bridge is of type PRED and this immediately dominates its two terms such that their denotations are cross-count identical, or b) its bridge is of type NOT and this immediately dominates an expression that is not true by a) or b).

The problem with the definition I give here is that it doesn't really define truth as a correspondence. Granted, according to the theory, truth partly consists in a correspondence. But it also partly consists, rather anomalously, in the type of the bridge. Crucially, the theory doesn't explain how the type of the bridge is constitutive of a correspondence between expression and world affair. The only "correspondence" described between the

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[8]I return to the full analysis of (19) on page 100.

type of bridge and the truthmaker is the *mere conjunction* of 'and'. At most, the type of the bridge contributes an arbitrary, merely formal correspondence.

It should be clear that the bridge's *merely* being of one type or another does not constitute any sort of natural relation between the bridge and the truthmaker. To think otherwise is to make the mistake that Fodor (1987) illustrates wonderfully with his example of H- and T-particles. Fodor defines it so that something is an H-particle at time t iff a certain dime of his is heads-up at t, and a T-particle at t iff that same dime is tails-up at t. Of course, being an H- or a T-particle is not a *natural* relational property, grounded in any natural relation. Something is missing from the theory: something that explains how the type of the bridge is constitutive of the truthmaking relation between the expression and the truthmaker.

We can draw comparisons with a model-theoretic definition of truth. Consider the following clauses, which handle quantification (modified from Dowty *et al.*, 1981: 158).

(21) a. $\forall u\phi$ is true (for a variable assignment g) iff ϕ is true for all variable assignments g' that may differ in the value they assign to u.

b. $\exists u\phi$ is true (for a variable assignment g) iff ϕ is true for a variable assignment g' that may differ in the value it assigns to u.

For present purposes, it doesn't much matter what is on the right-hand side of the biconditionals, only that they describe different conditions. Suppose that each expression is a mental particular, each of which must stand in a certain correspondence with the world. What is that correspondence in each case?

Each of the expressions has three main components: a quantifier ($\forall$ or $\exists$), a variable (u), and a formula (ϕ). The variable has any of several possible values, depending on the variable assignment. The formula contains one or more instances of the variable, which again has any of several possible values. It also contains one or more predicate constants, each of which denotes a set. Therefore, every element apart from the quantifier corresponds in one way or another with the world, *and that correspondence is the same, for any given model, variable assignment, and value of ϕ, regardless of which quantifier precedes them*. What about the quantifier itself? How is that related to the world? Insofar as the theory is concerned, it isn't. Its presence merely indicates how the *rest* of the expression needs

to be related to the world (i.e., which of the two truth-conditions applies) in order for the expression to be true. In this way, the quantifier symbols are just like PRED in the definition of truth above, and the theories suffer from the same problem. A quantifier cannot form part of the correspondence by determining, *merely by its presence in the expression*, which of several truth-conditions applies. To see this, we simply have to state the theory of truth *in general*, in such a way that specific features of the expression are not given on the left-hand side of the biconditional. For example:

(22) An expression S is true iff:

S has the form $\forall u\phi$ and [repeat right-hand side from (21a.)] or S has the form $\exists u\phi$ and [repeat right-hand side from (21b.)]

It is clear from this way of stating the theory that it makes essential reference to non-relational facts about the expression—i.e., the fact that it contains either the symbol $\forall$ or the symbol $\exists$. The pairing of the symbol $\forall$ with one condition, and of $\exists$ with the other condition, is a trivial formal correspondence: that of *mere logical conjunction*.

Under Generalized Quantifier Theory, the situation is quite different. For any expression QAB, where Q is a quantifying determiner and A and B are predicate constants, all three elements have a denotation (Q's as part of the model-theory, and A's and B's as part of the denotation function). There is no problem of arbitrariness, therefore, provided that a naturalistic account could be given, at least in principle, of all three denotations. Unfortunately, the idea that a quantifier should *denote* a certain correspondence between properties is simply untenable under any plausible naturalistic ontology. This is clear if we consider the account of the correspondence involved in predication.[9] Identity is the main component of this correspondence. Since identity is not a *thing* or *entity* in any sense, it cannot be denoted as though it were a particular or a universal. But it is precisely because we *don't* treat identity as a further *thing* that we avoid a vicious regress in the theory of instantiation.

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[9]The account of the correspondences involved in quantification follow in this chapter. These correspondences also have *sorts of identity* as their main components. Even though GQT doesn't propose a "quantifier" for predication (equivalent to PRED), it proposes quantifiers that would have to have sorts of identity in their denotations.

Since I cannot propose a denotational value for quantifiers in the way that GQT does, my theory is in a position similar to that of the model-theory in (21). If quantifiers are non-denotational elements, there must be some other way in which they form part of the correspondence between expression and world affair. I suggest that the basis for a good solution is provided by Millikan's normative approach to meaning, presented in [4.1]. Along these lines, I claim that bridges of certain kinds (e.g., those of type PRED) have the proper function of relating elements whose denotations are, in various ways, either identical or distinct. In this way, the type of the bridge is actually constitutive of the truthmaking relation between the expression and the truthmaker.

Bridges are a kind of mental entity, ultimately realised in physical brain tissue. Like hearts, they have a proper function that is determined by their evolutionary history. We might consider this with respect to the bridges introduced so far. I have claimed that PRED is supposed to dominate terms whose denotations are cross-count identical. Similarly, we might say that NOT is supposed to immediately dominate an expression whose bridge is operating *ab*Normally.[10] I now reformulate my theory of truth as follows. The technical term 'main bridge' refers to the bridge that dominates all others in the structure, where present, and the sole bridge otherwise.

(23) THEORY OF TRUTH (Final version):

An expression is true iff its main bridge is operating Normally.

This means that *being true* is standing in a naturalistic relation to a truthmaker *in accordance with naturalistically defined normative conditions*. Consider example (14) again. The bridge of this sentence is PRED. I suggest that PRED operates Normally (i.e. fulfils its proper function in accordance with a Normal explanation) just in case it relates two terms whose denotations are cross-count identical. To define its proper function, it is useful to have terminology to distinguish between its two terms. I define the "left-hand" term, which is to say the term corresponding to the argument of the sentence, as the Argument term. Similarly, I define the "right-hand" term, which is to say the term corresponding to the predicate of the sentence, as the Predicate term. The following is the initial formulation of the proper function of PRED, to be superseded by a general account.

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[10]For reasons that will be made clear, I offer a different final account of its proper function on page 100.

(24) PROPER FUNCTION OF PRED (in lieu of a general account):

PRED operates Normally iff it immediately dominates an Argument term A and a Predicate term F such that the denotation of A is p/u cross-count identical with the denotation of F.

The specified normative conditions provide the required non-arbitrary connection between what the bridge *is* (a token of PRED, for example), and the circumstances under which its dominating two terms constitutes a true or a false sentence. The matter of falsity, or the property of *being false*, presents no difficulty. I claim that falsity is simply the absence of *being true*. In other words, an expression is false just in case it is not true, which is to say just in case its main bridge operates *ab*Normally.

5.5   A two-factor theory

The idea that any given token of PRED would be a reproduction of past tokens of PRED is perfectly plausible. A trickier notion is that it would be *due* ("in part") to the possession of certain reproduced qualities that tokens of PRED have performed their proper function in the past (and now continue to do so).

If PRED's proper function, as I have hypothesised, is to dominate two terms whose denotations are cross-count identical, then there ought to be a *reproducible* property of PRED that could (in part) account for the performance of this proper function. We can compare the fact that the physical make-up of hearts partly accounts for their performing of their proper function (i.e., they are constructed in such a way as to be able to pump blood).

Prima facie, PRED is no better qualified, in terms of its reproducible qualities, for relating two terms whose denotations are cross-count identical, than NOT is. We must identify a property of PRED, *independently of its hypothesised proper function*, that differentiates it from the other bridges, and which might plausibly account for its fulfilling its putative proper function.

I suggest that this is its inferential role. What I have in mind is roughly this: Bridges represent the logical apparatus of the representation language. Accordingly, I propose that there are bridges for predication, negation, conjunction and disjunction (see [5.6]), and quantification (see [5.7]). Although I consider a bridge's main semantic contribution

to be its *correspondence* with the world (via the denotations of its terms), there is room for a supporting inferential role, which is a matter of certain relations between bridge-types within a language-user's internal cognitive system. This role is necessary, in fact, to get the representational system off of the ground. Mine, then, is a two-factor theory.

5.6   Conjunction and disjunction

The equivalent of 'and' in my proposed representation language is AND, which is a bridge between bridges. I give its proper function as follows.

(25) PROPER FUNCTION OF AND:

AND operates Normally iff it dominates two bridges such that both of them operate Normally.

An example sentence and illustration is given in (26). Both aspects shown, along with the particulars and universals with which they are identical, constitute the truthmaker.

(26) a. 'John is sleeping and Mary is laughing.'

b.
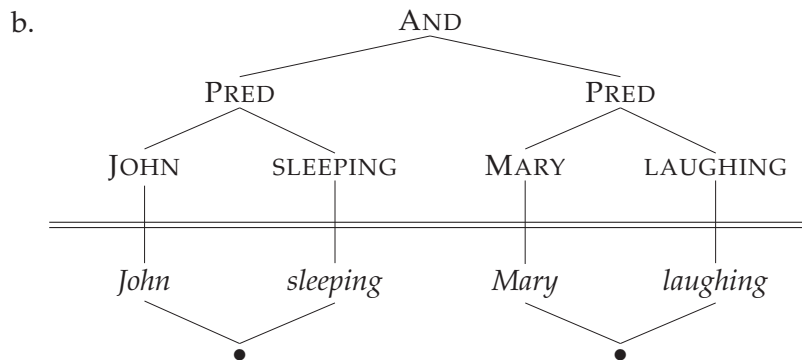
Similarly, the equivalent of 'or' is OR, which is another bridge between bridges. I give its proper function as follows.

(27) PROPER FUNCTION OF OR:

OR operates Normally iff it dominates two bridges such that at least one (/exactly one) of them operates Normally.

An example sentence and illustration is given in (28). A truthmaker of the sentence is either one of the aspects illustrated below, represented in outline only. On an inclusive-'or' reading, if there are two such aspects, they are each truthmakers in their own right. On an exclusive-'or' reading, if there are two such aspects, the sentence is false.

(28) a. 'John is sleeping or Mary is laughing.'

b.
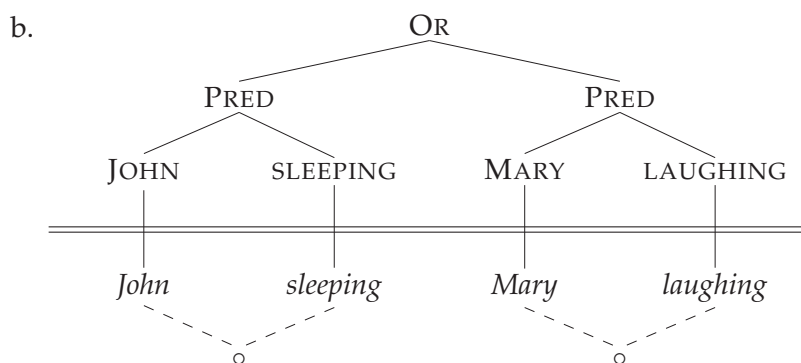
5.7 Quantification

5.7.1 SOME

Within my semantic theory, quantifiers are another kind of bridge or, more precisely, quantifying determiners correspond, in the translation from external sentences to internal representations, to a kind of bridge.

In order to analyse the quantifying determiner 'a', which has the force of singular existential quantification, I introduce the bridge SOME. I give the following preliminary definition of its proper function.

PROPER FUNCTION OF SOME (in lieu of a general account):

SOME operates Normally iff it immediately dominates an Argument term A and a Predicate term F such that a particular is p/u cross-count identical with the denotation of A and cross-count identical with the denotation of F.

I illustrate this with the following example. Observe that the referents of both the Predicate term and the Argument term are universals.

(29) a. 'A man is sleeping.'

b.
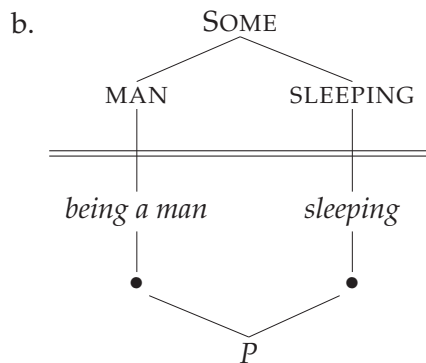
Two aspects are shown, one u-identical with the referent of the Argument term (*being a man*), and the other u-identical with the referent of the Predicate term (*sleeping*). These aspects are each p-identical with the same arbitrary particular P. The approach to truthmakers detailed above applies here also, so that we take all the entities below the line, along with their identities, as truthmaker. This is roughly equivalent to taking the two aspects (states of affairs) *P's being a man* and *P's sleeping*, or rather a complex, conjunctive state of affairs *P's being a man and sleeping* as truthmaker.

5.7.2 EVERY

A special case of cross-count identity is required to distinguish singular from plural quantification. Take, for example, a particular P that is cross-count identical with the universal U of *being a man*. I claim that what makes P a single man, and not a collection of several men, is that P shares an atomic aspect with U.[11] In this special case, we say that the particular and universal are *cross-count unit identical*. The following is the general definition.

(30) CROSS-COUNT UNIT IDENTITY:

A is ϕ/ψ cross-count unit identical with B iff there is an *atomic Z* such that A is ϕ-identical with Z and B is ψ-identical with Z.

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[11]The reader should refer back to [2.3.3] for a definition and some discussion of atomicity. I note there that collections are ordinary existents under some version of Baxter's thesis of composition as identity. Collections just are their parts, and may be considered as ordinary existents provided that one is careful to avoid "double counting" (e.g., counting a six-pack of beer as seven distinct things). There is no reason to suppose that collections are non-naturalistic entities.

In a case where a collection A of particulars are individually cross-count unit identical with the same universal B, we say that A is *plurally* cross-count identical with B.[12]

(31) PLURAL CROSS-COUNT IDENTITY:

A is plurally ϕ/ψ cross-count identical with B iff A is a collection of parts each of which is ϕ/ψ cross-count unit identical with B.

A special case of plural cross-count identity is where the collection of aspects Z in which A and B are plurally cross-count identical is the *totality* of aspects of B. We then say that the collection of particulars is *fully cross-count identical* with the universal.

(32) FULL CROSS-COUNT IDENTITY:

A is fully ϕ/ψ cross-count identical with B iff A is plurally ϕ/ψ cross-count identical with B in Z, and Z is the totality of B.

We can put the notion of fully cross-count identical to use in the following initial formulation of the proper function of EVERY.

(33) PROPER FUNCTION OF EVERY (in lieu of a general account):

EVERY operates Normally iff it immediately dominates an Argument term A and a Predicate term F such that there is a collection of particulars fully p/u cross-count identical with the denotation of A, and plurally p/u cross-count identical with the denotation of F.

Note here the crucial asymmetry. If every man is sleeping, the men in question are necessarily *all* the men, but not necessarily all the sleepers. It follows that the collection of particulars must be fully cross-count identical with *being a man*, but only (plurally) cross-count identical with *sleeping*.[13]

---

[12]Cross-count identity, as defined in (8), is not equivalent to plural cross-count identity. If we assume that a collection of aspects is an aspect, and that collective p- or u-identity is *distributive*, then John $\oplus$ Mary is cross-count identical with *sleeping $\oplus$ laughing* just in case either a) John is sleeping and Mary is laughing, or b) John is laughing and Mary is sleeping. It would presumably follow that cross-count *unit* identity is the basic form of cross-count identity, and the most interesting, both metaphysically and semantically.

[13]It is standardly assumed that 'Every man is sleeping', etc., is true in case there are no men. The problem, as I understand it, hinges on a supposed equivalence between 'It's not the case that every man is sleeping'

For the following illustration, the world is depicted as containing exactly three men, and three or more sleepers of which three are men. The triangle between *being a man* and its three aspects represents totality.

(34) a. 'Every man is sleeping.'

b.
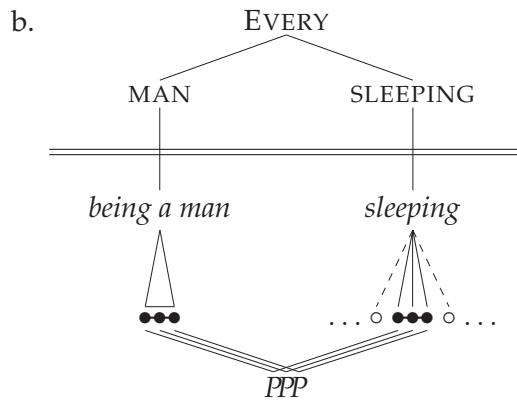
I assume here that whatever holds between the denotation of the Argument term (*being a man*) and the particulars that are all of the men is nothing more than identity of a certain kind. This claim, that totality is a kind of identity, warrants further discussion.

Armstrong argues that we must posit an *external* relation of totality. For him, this is because totality, unlike the internal relations that stand for numbers, must be contingent (1997: 199).

This strikes me as an unnecessary multiplication of entities. Let me make a mereological comparison. Take, for example, the particular that is the Eiffel Tower. It has many parts. Some collections of those parts constitute *all* of the Eiffel Tower, which is just to say *the Eiffel Tower*. Must we say that for such a collection (remembering that parts overlap) there is an external relation of totality holding between them and it? Presumably not. Rather, given the Eiffel Tower and given certain collections of its parts, you have that the former is totalled by the latter, a matter of mere identity. This is an *internal* relation, of course, in Armstrong's sense.

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and 'A man is not sleeping'. I deny this equivalence on the grounds that there are two basic ways in which 'Every man is sleeping' may be false, which is to say ways that EVERY may operate abNormally. It may be that there is a non-sleeping man, but it may just be that there are no men, and hence that there is no witness of EVERY. On my theory, therefore, 'Every man is sleeping' is *false* in case there are no men.

This analysis is very plausible in the mereological case. It may seem less plausible for the relation between, e.g., *being a man*, and the fusion of men which, right now, happens to be all of them. Nevertheless, I suggest that we can have it both ways. We can have totality as a sort of identity (i.e., nothing over and above the terms themselves), without it thereby being *necessary* that, e.g., a given collection of men is *all* the men.

What makes the property of *being a man* the same property from one moment to another, and across worlds, is its u-identity. However, what makes a collection of men *all* the men is a matter of *cross-count* identity. Recall from [2.3.5] the account of change. A universal retains its u-identity across time even though what and how many aspects it has may differ. A consequence of this is that, at any given moment, what is cross-count identical with *being a man* (i.e., which individuals are men) is an internal relation, a matter of identity, even though it is a contingent one.

If we accept that mereological totality is mere identity, there is a good *prima facie* case for accepting cross-count totality as mere identity also. Just as the relation of *all* the mereological parts of something to the whole is nothing more than their identity, the relation of all the aspects of something to the whole is similarly nothing more than their cross-count identity. In view of this, what we have described as plural cross-count identity between a particular and a universal may be recognised, in the general case, as a *partial* cross-count identity.[14] Full cross-count identity between a fusion of particulars and a universal is thus analogous to regular (non-partial) identity between the mereological fusion of *all* parts and the whole.

5.7.3 Quantification and negation

The treatment of negation offered in [5.3] is very limited. I considered only a case of wide scope negation over an unquantified subject ('John isn't sleeping'). This analysis made use of NOT as the main bridge, dominating a PRED structure. It was temporarily assumed

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[14]I am grateful to Donald Baxter for alerting me to the fact that he uses "the term 'partial cross-count identity' to distinguish sharing some aspect across counts as opposed to sharing all aspects across counts" (p.c.). For Baxter, an example of the latter is a whole identical to all of its parts in a count. We clearly agree, therefore, that mereological totality is a matter of identity, although I still prefer the many-one version. What I propose here is Baxter's account of the part-whole relation applied to totality in Armstrong's sense, as between a fusion of particulars and a universal.

that NOT operates Normally just in case the bridge that it dominates (e.g., PRED) operates *ab*Normally.

This analysis is clearly not sufficient for all cases involving quantified arguments. Consider, for example, the following ambiguous sentence, which involves both negation and an existentially quantified subject.

(35) 'A man isn't sleeping.'

This sentence has two readings. They may be roughly paraphrased as 'There is a man such that he isn't sleeping', in which existential quantification takes wide scope, and 'It isn't the case that a man is sleeping' (or 'No man is sleeping'), in which negation takes wide scope. The former but not the latter entails the existence of a man.

Under the former reading, the existentially quantifying bridge SOME takes scope over the negative bridge NOT. Corresponding to this, SOME is the main bridge, and NOT is its Predicate term. NOT, in turn, takes SLEEPING as its Predicate term. The account of the interpretation of this structure involves a substantial amount of additional theory, and a streamlining of the principles proposed above, which then provides the theoretical basis for the analysis of a much wider range of phenomena, including negation, numerals, and quantification within relations.

So far, I have treated the proper function of SOME simply in terms of its Argument and Predicate term *denotations*. When SOME takes scope over NOT, however, there is no denotation, *per se*, of SOME's Predicate term. What seems to be required for the expression to be true is that there be a particular that is cross-count identical with its Argument term, and *p-distinct* from each of the totality of aspects that are u-identical with NOT's Predicate term's denotation. This is illustrated in (36).

(36) a. 'A man isn't sleeping.' ($\exists x[man'(x) \land \neg sleep'(x)]$)

b.
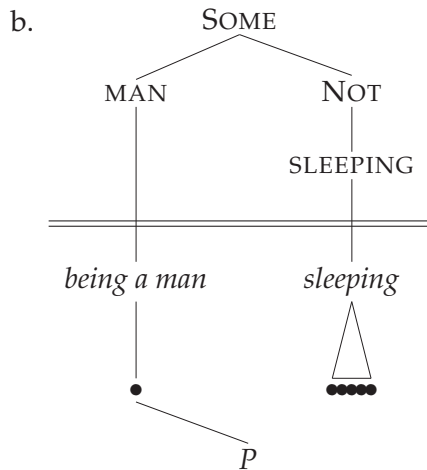
To give an account of the proper function of PRED that covers this case, we first need to introduce the notion of a *witness* of a bridge.[15] These are defined, for certain bridges only, as follows.

(37) DEFINITIONS OF A WITNESS (First version):

A witness of PRED is a particular that is denoted by its Argument term.

A witness of SOME when negatively scoped, NO when negatively scoped, and EVERY when positively scoped is a particular that is fully p/u cross-count identical with its Argument term.

A witness of SOME when positively scoped, NO when positively scoped, and EVERY when negatively scoped is a particular that is p/u cross-count unit identical with its Argument term.

What constitutes a witness of the bridges SOME, EVERY and NO depends upon whether they are positively or negatively scoped. I claim that certain bridges introduce a negative scope feature $[-]$. All other bridges introduce a positive scope feature $[+]$. These features accumulate downward, along the path of Predicate terms, with any two negatives resolving to a positive, any number of positives resolving to a positive, and a positive and a negative resolving to a negative. The bridges to be considered in this thesis that *introduce* a negative scope feature are NOT and NO. If the features on a term resolve to a negative then we say that the term is *negatively scoped*. If the features on a term resolve to a positive then we say that the term is *positively scoped*.

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[15]I borrow the term 'witness' from the epsilon calculus.

SOME and NO have the same witnesses under the same scope, but differ in the scope features that they introduce. EVERY and NO have the same witnesses under different scopes, and differ in the scope features they introduce. SOME and EVERY have different witnesses under the same scope, but introduce the same scope feature.

A witness might be regarded, very informally, as a possible noun or determiner phrase "denotation". For example, one might take the phrase 'a man' to denote an arbitrary man, and the phrase 'every woman' to denote the totality of particular women (assuming that both terms are under positive scope). Whether or not any quantified noun phrase should be considered as having a "denotation", I claim that bridges have (or, rather, *may* have) witnesses, as defined above.

It might be that a bridge has a singular witness, in which case there is no need to distinguish between parts of the witness. However, it might also be that a witness consists of several distinct *units* with respect to the Argument term (e.g., a particular that consists of several distinct individual men). In order to account for certain features of quantification, therefore, I define a subwitness as follows.[16]

(38) DEFINITIONS OF A SUBWITNESS:

A subwitness of a witness W of PRED is W.

A subwitness of a witness W of a quantifying bridge B is a part of W that is p/u cross-count unit identical with the denotation of the Argument term of B.

I now give the definitions of a *satisfier* for a witnessed bridge (where the latter is any type of bridge for which a witness is defined), for a denotational term, and for NOT.

(39) DEFINITIONS OF A SATISFIER:

A satisfier of a witnessed bridge B is a collection consisting of just a subsatisfier for each subwitness of a given witness of B.

A satisfier of a denotational term is its denotation.

A satisfier of NOT is a satisfier of its Predicate term.

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[16]The notion of a quantifying bridge should be taken to include numerals in addition to SOME, EVERY, and NO, although numerals are not introduced until [5.8], below.

Just as there are subwitnesses of a witness, there are subsatisfiers of a satisfier. A subsatisfier is defined as follows.[17]

(40) DEFINITION OF A SUBSATISFIER (First version):

A subsatisfier of a witnessed bridge B is a (possibly atomic) collection of aspects each of which is p-identical with a given subwitness of a witness of B, and u-identical with the denotation of its Predicate term, or that of a right-dominated bridge.

A right-dominates B iff there is an undisrupted path of right- or single-branch domination between A and B. The notions of a satisfier and a subsatisfier can be explained with respect to some earlier examples. The following is repeated from (15), above.

(41) a. 'John is sleeping.'

b.

Witness of PRED[+] and sole subwitness

Satisfier of PRED[+] and sole subsatisfier
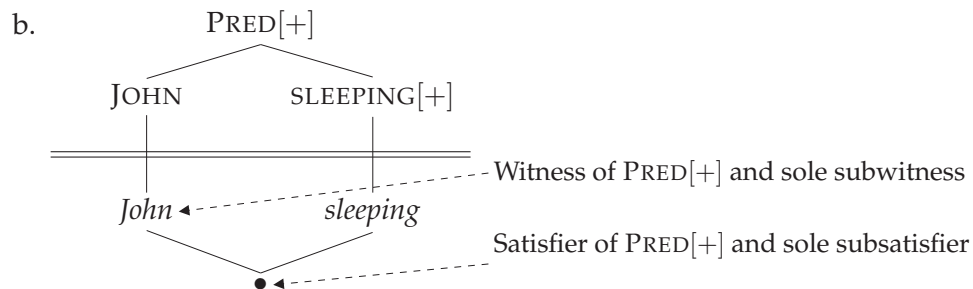
In this diagram, an aspect shared by a witness and the property of *sleeping* is labelled as both a satisfier and the sole subsatisfier constituting that satisfier. The fact that the very same aspect is u-identical with a satisfier of SLEEPING is made use of presently, when I give a revised, general definition of the bridge's proper function. John is the witness of PRED[+] and its sole subwitness. The next example is repeated from (29), above.

(42) a. 'A man is sleeping.'

_____

[17]The definition of a subsatisfier is updated below once for the account of numerals and once more for the account of relations. The final version is on page 114, and in the list of final definitions in Appendix A.

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b.

SOME[+]

MAN   SLEEPING[+]

being a man   *sleeping*

Satisfier of SOME[+] and sole subsatisfier

Witness of SOME[+] and sole subwitness

P
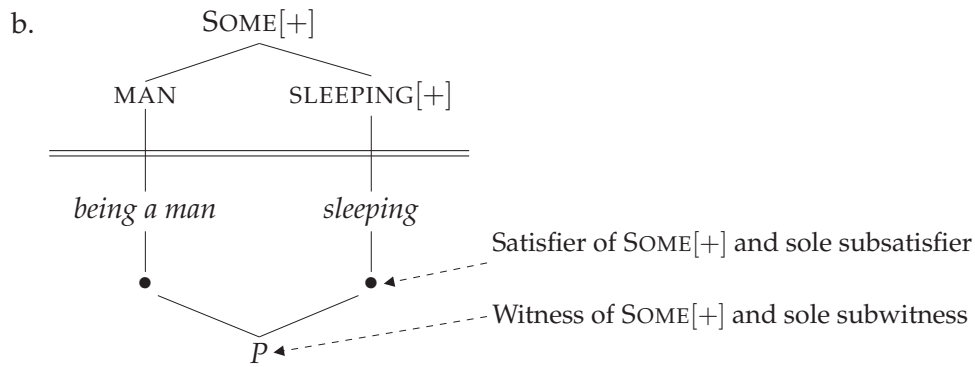
As in the previous example, a single aspect is labelled as both a satisfier and the sole subsatisfier constituting that satisfier. *P*, which is an arbitrary individual man, is labelled as witness and sole subwitness. The last of the three examples is repeated from (34).

(43) a. 'Every man is sleeping.'

b.

EVERY[+]

MAN   SLEEPING[+]

being a man   *sleeping*

Satisfier of EVERY[+] has three subsatisfiers

Witness of EVERY[+] has three subwitnesses

PPP
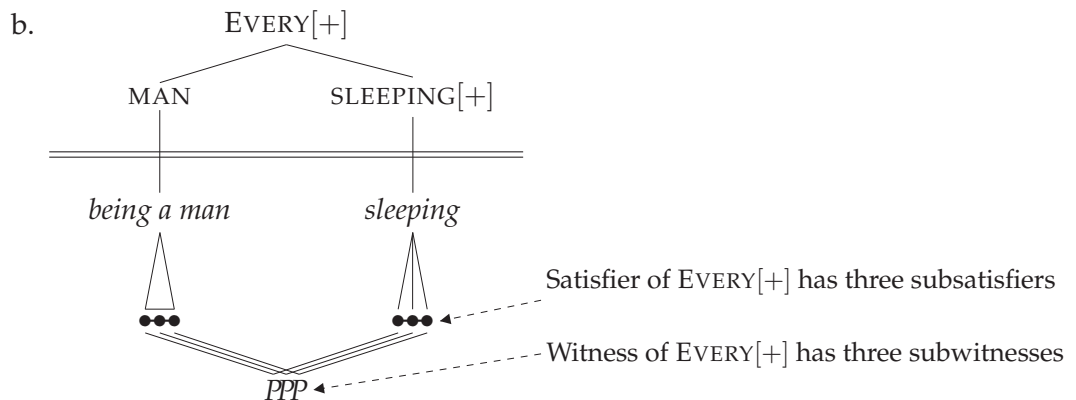
This example is distinguished by the fact that the witness consists of (possibly) several distinct subwitnesses (three shown) and, correspondingly, the satisfier consists of (possibly) several subsatisfiers (also three shown, equal to the number of subwitnesses). Below, in the account of the proper function of this and other witnessed bridges, I make use of the fact that each subsatisfier is u-identical with a satisfier of SLEEPING.

In order to give an adequate treatment of negation, I define the notion of a *dis*satisfier.

(44) DEFINITION OF A DISSATISFIER:
    A dissatisfier of a witnessed bridge *B* is a collection consisting of just a subdissatisfier for each subwitness of a given witness of *B*.

Just as satisfiers have subsatisfiers, dissatisfiers have subdissatisfiers. These are defined

as follows.[18]

(45) DEFINITION OF A SUBDISSATISFIER (First version):

A subdissatisfier of a witnessed bridge B is a collection of aspects each of which is p-distinct from a given subwitness of a witness of B, and u-identical with the denotation of its Predicate term, or that of a right-dominated bridge.

I occasionally refer to a subsatisfier (/subdissatisfier) that consists of a single aspect as a *simple* subsatisfier (/subdissatisfier), and one that consists of multiple aspects (each p-identical with a given subwitness) as a *complex* subsatisfier (/subdissatisfier). These distinctions are not necessary for the formal specification of the theory, but have a certain expository value. Henceforth, I adopt the convention that a complex sub(dis)satisfier is shown as several overlapping aspects (e.g., ●●●), and a complex (dis)satisfier is shown as several aspects, or several collections of overlapping aspects, connected by a short horizontal bar (e.g., ●●● or ●●●●●●●●●).

In many cases the *very same collection* of aspects may be a subdissatisfier of each unit of a given witness, in which case the subdissatisfier and dissatisfier are fully identical. For example, for a sentence such as 'Two men are not sleeping,'[19] (with narrow scope negation), a dissatisfier of the one waking man is the very same totality of u-distinct aspects of *sleeping* as a dissatisfier of the other waking man, assuming that the sentence is true. There are examples, however, where the subdissatisfiers are distinct.[20] An example of a subdissatisfier *and* dissatisfier (of SOME) is the aspects shown under *sleeping* in (46), repeated from (36), above. This is a collection of aspects p-distinct from P and u-identical with *sleeping* which, assuming the expression is true, is fully identical with a satisfier of the Predicate term (i.e., *sleeping*).

(46) a. 'A man isn't sleeping.' ($\exists x[man'(x) \wedge \neg sleep'(x)]$)

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[18]The definition of a subdissatisfier is updated below once for the account of numerals and once more for the account of relations. The final version is on page 114, and in the list of final definitions in Appendix A.

[19]Compare the analysis of 'Five men are not sleeping' in (64) on page 109.

[20]See, for example, the analysis of 'No man loves every woman' in (91) on page 131.

b.
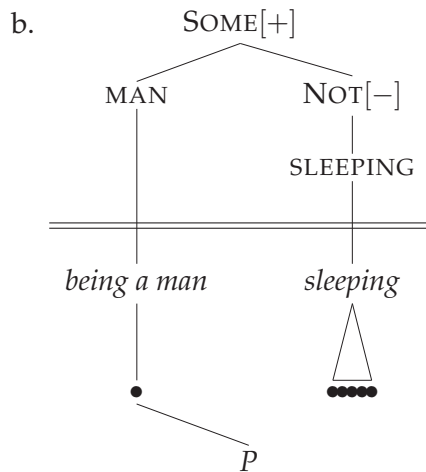
The proper function of any witnessed bridge may be described in terms of the notions of satisfier and dissatisfier.[21] This definition, in conjunction with the definitions of a witness, a subwitness, a satisfier, a subsatisfier, a dissatisfier, and a subdissatisfier, supersedes the temporary definitions of the proper functions of PRED, SOME, and EVERY.

(47) PROPER FUNCTION OF A WITNESSED BRIDGE (First version):

A witnessed bridge B operates Normally iff:

a) B has a satisfier, such that each of its subsatisfiers is u-identical with a satisfier of a positively scoped Predicate term, or

b) B has a dissatisfier, such that each of its subdissatisfiers is fully u-identical with a satisfier of a negatively scoped Predicate term, or

c) B has a negatively scoped Predicate term with no satisfier.

If we consider examples (41), (42), and (43) once more, we see that their main bridges fulfil condition a) above, and therefore operate Normally in virtue of the fact that they each have a satisfier, such that each subsatisfier is u-identical with a satisfier of their respective Predicate terms (i.e., *sleeping*).

If we consider (46), we see that it fulfils condition b) above, and therefore operates Normally in virtue of the fact that its main bridge SOME has a *dis*satisfier—i.e., a subdissatisfier (the same one for each subwitness), which is p-distinct from each subwitness—that is *fully* identical with a satisfier of its negatively scoped Predicate term NOT (i.e., *sleeping*), which is to say identical with the totality of u-distinct aspects of *sleeping*. As noted above,

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[21]The theory of the proper function of a witnessed bridge is updated once below for the account of relations. The final version is on page 115, and in the list of final definitions in Appendix A.

rather than assume that every truthmaker is a simple or complex state of affairs, I suggest that we take whatever is below the horizontal lines of the diagrams as truthmaker, which is still a *portion of reality* in some sense. In the case of certain negations, the truthmaker is partly constituted by a degree of distinctness between entities.

Condition c) applies in cases of negative scope where the predicate fails to denote. For example, consider a situation in which nothing is sleeping. In this sort of case, there is no dissatisfier for any witness to be distinct from, and the expression is thereby true. Other, more complex applications of condition c) are considered below.

The final component of the theory of negation is to give the revised theory of the proper function of NOT, which is as follows.

(48) PROPER FUNCTION OF NOT:

NOT operates Normally iff it immediately dominates a bridge that operates Normally.

The reason I claim that NOT operates Normally when its Predicate term operates *Normally*, and not *ab*Normally, is that NOT's work is done via its negative polarity feature. When NOT has SOME as its Predicate term, for example, (and the negative feature it introduces isn't resolved to a positive by another negative feature higher in the structure) the witness of SOME is then defined as a particular *fully* cross-count identical, rather than cross-count *unit* identical, with SOME's Argument term, and SOME's proper function is to have a *dis*satisfier rather than a satisfier. If it were NOT's function to have a Predicate term that functions *ab*Normally, the negative feature and the proper function would effectively cancel one another out, leading to the wrong prediction concerning the expression's truth conditions. I light of the revised theory, I return to the analysis of (19), repeated below.

(49) a. 'John isn't sleeping.' (wide scope negation)

b.
NOT[−]
|
PRED[−]
JOHN   SLEEPING[−]
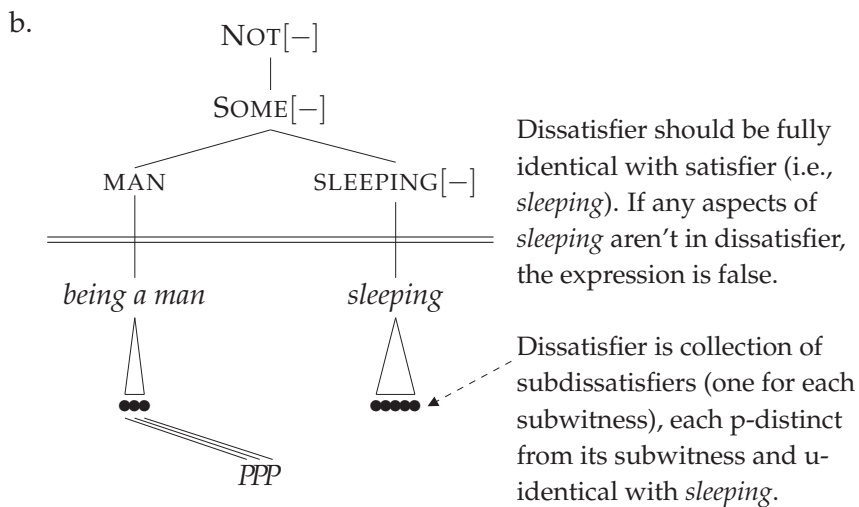| |
John   *sleeping*
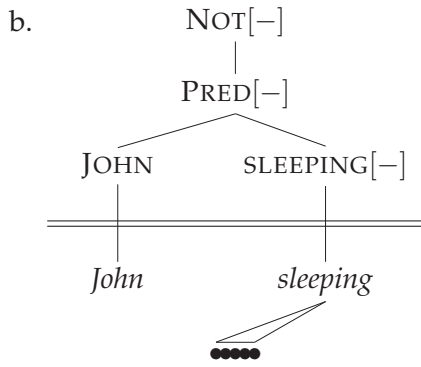
The wide and narrow scope negation readings of (49) are truth-conditionally equivalent for an unquantified subject such as 'John'. Nevertheless, I provide an illustration of narrow scope negation in (50), for the sake of completeness.

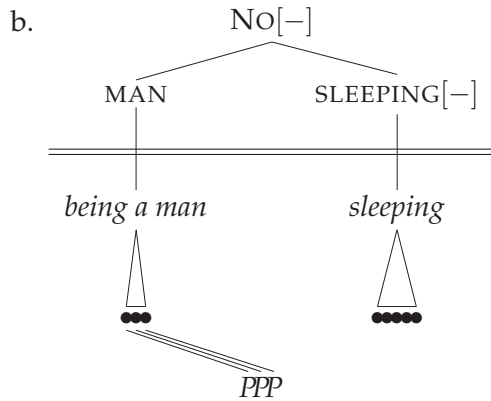(50) a. 'John isn't sleeping.' (narrow scope negation)

b.
PRED[+]
JOHN   NOT[−]
| |
            SLEEPING[−]
| |
John   *sleeping*
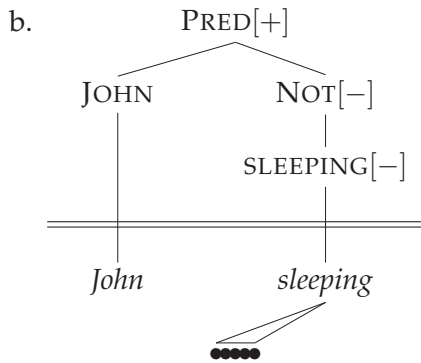
In (51), I illustrate the wide scope negation reading of 'A man isn't sleeping'.

(51) a. 'A man isn't sleeping.' ($\neg[\exists x[man'(x) \land sleep'(x)]]$)

b.
NOT[−]
|
SOME[−]
MAN   SLEEPING[−]
| |
being a man   *sleeping*
            PPP

Dissatisfier should be fully identical with satisfier (i.e., *sleeping*). If any aspects of *sleeping* aren't in dissatisfier, the expression is false.

Dissatisfier is collection of subdissatisfiers (one for each subwitness), each p-distinct from its subwitness and u-identical with *sleeping*.

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The treatment of the next example is essentially the same as the previous one, except that in this case both negation and quantification are provided by the single bridge NO.

(52) a. 'No man is sleeping.'

b.
$$
\begin{array}{c}
\text{NO}[-] \\
\diagup\ \diagdown \\
\text{MAN} \qquad \text{SLEEPING}[-] \\
\text{being a man} \qquad \text{sleeping} \\
\end{array}
$$

As noted above, I propose that there are two sorts of witness for NO. The relevant sort of witness for this example is a collection of particulars fully cross-count identical with the denotation of its Argument term. This is because NO is negatively scoped here. NO has a dissatisfier according to condition b) under precisely the same conditions as NOT[−] (i.e., SOME[−]) in the previous example.

In the next example, NO takes scope over a negative polarity term in the form of NOT. Intuitively, the truth conditions of this expression are precisely those of 'Every man is sleeping' (see example (34) on page 91), and this is predicated by the theory.

(53) a. 'No man isn't sleeping.'

b.
$$
\begin{array}{c}
\text{NO}[-] \\
\diagup\ \diagdown \\
\text{MAN} \qquad \text{NOT}[+] \\
\qquad\qquad \text{SLEEPING} \\
\text{being a man} \qquad \text{sleeping} \\
\end{array}
$$

Three simple subsatisfiers constitute complex satisfier
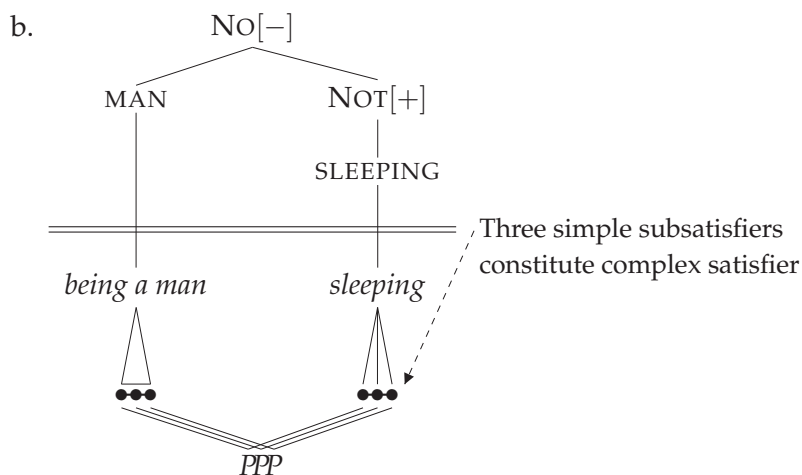
As in the previous example, a witness for NO is a collection of particulars that are fully cross-count identical with its Argument term's denotation. NOT introduces a negative scope feature, which cancels out the negative scope feature introduced by NO. Consequently, NO requires a satisfier rather than a dissatisfier. A satisfier of NO is a collection consisting of a subsatisfier for each subwitness of a witness of the bridge. Each subsatisfier is u-identical with a satisfier of NOT (i.e., the satisfier/denotation of its Predicate term, SLEEPING, which is *sleeping*). In such a case, the expression is true.

The final expression to consider is one in which NOT takes scope over NO. This expression is true just in case some man or other is sleeping.

(54) a. 'It's not the case that no man is sleeping.'

   b.
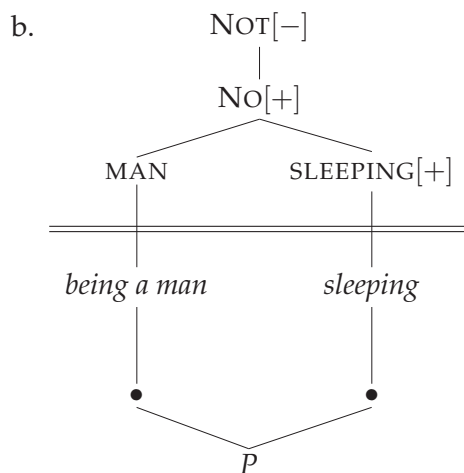
In the above example, NO is immediately dominated by a negative polarity bridge (i.e., NOT); consequently, its witness is defined as a particular cross-count *unit* identical with its Argument term's denotation. It also follows from the fact that NO's Predicate term is positively scoped that it requires a satisfier according to condition a). NO operates Normally iff it has a satisfier, such that its sole subsatisfier is p-identical with a satisfier of SLEEPING (i.e., its denotation *sleeping*). It has the same truth conditions as (42), but the examples may differ in respect of the anaphora they license. For example, (55a.) is well-formed, but (55b.) is not.

(55) a. 'A man is sleeping. He's tired from a long day's work.'

   b. 'It's not the case that no man is sleeping. *He's tired from a long day's work.'

See [7.2.5] for a very limited treatment of anaphora.

5.8 Numerals

I propose that numerals, like the quantifiers described above, correspond to bridges in the language of thought. English 'two' translates to mentalese TWO; English 'forty five' translates to mentalese FORTY FIVE, and so on. I illustrate the basic analysis in (56), below.

(56) a. 'Two men are sleeping.'

b.
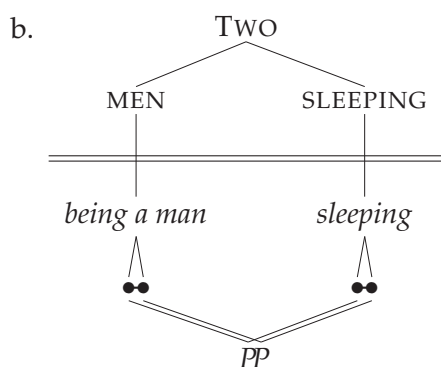
The illustration shows two aspects of *being a man* and two aspects of *sleeping*. Within each pair, the aspects are p-distinct (though u-identical), and hence p-identical with distinct particulars.

Numerals pose a similar challenge to sentences in that their proper function cannot be attributed to their individual histories. Just as for sentences, there are an infinite number of numeral types that have never been tokened, and may never be tokened.[22] Even where a numeral type has been tokened before, that history may be insufficient for it to have a content on that basis. Nevertheless, it is clear that every numeral is composed of individual symbols, each of which has a rich history. Those symbols are recombined according to a syntax with its own rich history.

For example, the individual history of '783532256' is presumably insufficient to attribute it with a proper function on that basis, and its proper function has not been transmitted *as* a function of '783532256'. Therefore, a solution must be found in terms of the proper function of its components, '7', '8', '3', '5', '2', and '6', and the way that they are combined (or, rather, the mechanisms that combine them into larger meaningful strings).

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[22]By numeral *type*, I refer to such things as the type exemplified by all instances of the numeral '142' (or 'one hundred and forty two'). Similarly, there is the sentence type shared by all tokens of 'I'm not hungry'.

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In the preceding section, I concluded that numbers were forms of identity and distinctness. Unit identity carves out the *ones* (i.e. the units), and the distinctness between them determines the multiples. The distinctness, although essentially "flat" in structure, lends itself to an iterative treatment. Iteration, as we might expect, is our metaphysical and semantic handle on numbers.

We are concerned with two different levels of normativity that interact to give the semantics of numerals, where these are understood to be a kind of bridge. On the one hand, there are facts about relations among numerals. Among these facts is that '7' is the successor of '6', which in turn is the successor of '5', etc. I take this to be a normative fact that consists in a relatively simple set of public rules (which must be internalised by any numerate individual) according to which, for any given n, there is a determinate $n + 1$. These facts are independent of any correspondence between numerals and numbers in the world.[23]

On the other hand, there are normative facts about the correspondence between numerals and numbers. The correspondence is unlike the correspondence of reference—as, for instance, that between 'John' and John, or between 'love' and *loving*. I do not claim, therefore, that 'ten' refers to the set of ten-membered sets, or any such thing. Rather, the correspondence is very much like that between SOME and cross-count unit identity, or between EVERY and full cross-count identity. Just as SOME is supposed to relate terms whose denotations "meet" in a single particular, TEN is supposed to relate terms whose denotations "meet" in ten distinct particulars.

Having specified, in terms of the ontology, what this pattern of identity and distinctness is, much of the work has been done. A crucial component remains, however. How can it be that each of the infinity of natural numbers has its own normative character, defining a correspondence with a certain worldly quantity? I propose a recursive solution in terms of the notion of a witness.

ONE is supposed to relate its two terms such that their denotations are cross-count unit identical, which is to say that they share an atomic aspect with one particular. This much is determined by the individual history of the concept-type ONE, in conjunction with its

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[23]This is another sense in which I propose a two-factor theory. Facts about precedence among numerals are closely related to facts about their inferential role. Because '3' is the successor of '2', 'Three men laughed' entails 'Two men laughed', etc.

inferential properties.

TWO is supposed to relate its two terms such that their denotations are cross-count unit identical in two distinct particulars. This, of course, entails a distinctness between particulars that are identical in a universal, and depends on the unity of each of those particulars with respect to the universal. Having represented a unity with respect to a certain universal, we represent the quantity of *two* as a further p-distinct unity with respect to the same universal.

The metaphysical account of *three* was that it was a distinctness of a unity from a *two*. We can therefore represent any THREE provided that we can represent such a distinctness. That this is the quantity represented by THREE rather than any other numerical concept is given by the fact that THREE is the successor of TWO (a fact about relations among numerical concepts), that TWO represents *two*, and that any numeral represents a unit distinctness from whatever its predecessor represents. All that remains is to give a general recursive account of a witness of a numeric bridge in terms that depend on the successor relation between bridge-types.

Let us suppose that every numeric bridge token (apart from tokens of ONE) is assigned multiple types. Specifically, a numeric bridge token is assigned a type corresponding to the numeral it stands for (e.g., a bridge that translates to and from 'five' has the type FIVE), but also the types corresponding to every numeral that precedes it, down to and including ONE.

This means that a token of FIVE is not only of type FIVE, but also of types FOUR, THREE, TWO, and ONE. For a numeral bridge to fulfil its proper function, it must do so with respect to its highest type (according to the aforementioned precedence relations among numerals). As suggested above, this is achieved in terms of the definition of a witness for each numeral bridge-type. The witness of a numeric bridge qua type ONE is defined separately as follows. It represents the termination condition on the recursive definition of other numeral bridge-types.

(57) WITNESS OF A NUMERIC BRIDGE QUA TYPE ONE:

A witness of a numeral bridge B qua type ONE is a particular p/u cross-count unit identical with B's Argument term.

A witness of the remaining numeral bridge-types is defined below. Crucially, since a bridge of type TWO is also of type ONE, the definition may call on its having type ONE in the characterisation of TWO's proper function. Similarly, for a bridge of type THREE, the definition can call on its having type TWO and type ONE.

(58) WITNESS OF A NUMERIC BRIDGE QUA TYPE $N >$ ONE:

A witness P of a numeral bridge B qua type $N >$ ONE is a fusion of Q and P', such that Q is p/u cross-count unit identical with B's Argument term, P' is a witness of B qua type $N-1$, and Q and P' are distinct.

Being of type $N-1$ is being of whichever type precedes N in the order of semantic precedence for numerals. This, as stated, is defined independently of any bridge's representational properties. We update the full set of definitions of a witness as follows.

(59) DEFINITIONS OF A WITNESS (Final version):

A witness of PRED is a particular that is denoted by its Argument term.

A witness of SOME when negatively scoped, NO when negatively scoped, and EVERY when positively scoped is a particular that is fully p/u cross-count identical with its Argument term.

A witness of SOME when positively scoped, NO when positively scoped, and EVERY when negatively scoped is a particular that is p/u cross-count unit identical with its Argument term.

A witness of a numeral bridge B qua type ONE when positively scoped is a particular p/u cross-count unit identical with B's Argument term.

A witness P of a numeral bridge B qua type $N >$ ONE when positively scoped is a fusion of Q and P', such that Q is p/u cross-count unit identical with B's Argument term, P' is a witness of B qua type $N-1$, and Q and P' are distinct.

I also redefine the definitions of a subsatisfier and a subdissatisfier of a bridge. Note that the only change is the addition of the clause 'qua its highest type'. Therefore, these versions function identically, for previously analysed examples, to the versions they supersede. The highest type of a non-numeral bridge is its sole bridge-type (e.g., PRED, SOME, EVERY, etc.).

(60) SUBSATISFIER OF A BRIDGE (Second version):

   A subsatisfier of a bridge B is a collection of aspects each of which is p-identical with a given subwitness of a witness of B *qua its highest type*, and u-identical with the denotation of its Predicate term, or that of a right-dominated bridge.

(61) SUBDISSATISFIER OF A BRIDGE (Second version):

   A subdissatisfier of a bridge B is a collection of aspects each of which is p-*distinct* from a given subwitness of a witness of B *qua its highest type*, and u-identical with the denotation of its Predicate term, or that of a right-dominated bridge.

The proper function of a numeral bridge is given by the existing definition of the proper function of a witnessed bridge. We now consider how these definitions apply to the example in (62).

(62) a. 'Five men are sleeping.'

   b.   FIVE

      MEN   SLEEPING
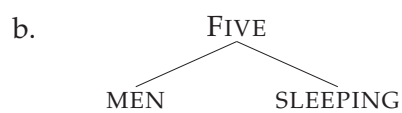
The bridge of this structure, which is represented by its highest type, has the following types: FIVE, FOUR, THREE, TWO, and ONE. As determined by the definition of a subsatisfier, it is the highest of these types (i.e. FIVE) that is directly relevant to its proper function. The lower types become relevant to the expression's truth value by the recursive definition of a witness qua type $N >$ ONE.

Consider how the condition on the proper function of witnessed bridges applies to the bridge in the example. Since FIVE $>$ ONE in the ordering on numerals, we begin with the definition of a witness qua type $N >$ ONE. A witness of the bridge qua type FIVE is a collection of particulars P that consists of a single man Q (i.e., a unit with respect to *being a man*), and some distinct P'. This P' must be a witness of the same bridge qua type $N-1$, which is FOUR. If we follow the recursive definition through to $N-1$ is ONE, the witness P consists of five distinct men (or units with respect to *being a man*). That is to say that a witness of FIVE, within this expression, is defined as some arbitrary collection of five men.

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A satisfier of FIVE is defined as a collection consisting of a subsatisfier for each subwitness of that bridge (qua type FIVE), and u-identical with the denotation of its Predicate term, or that of a right-dominated bridge. The witness, as determined above, is an arbitrary collection of five men. Therefore, a satisfier of FIVE is a collection of aspects p-identical with a collection of five men and u-identical with *sleeping*.

The main bridge operates Normally just in case each of the satisfier's subsatisfiers is u-identical with a satisfier of its (positively scoped) Predicate term (i.e., *sleeping*). This is illustrated in (63), below.

(63) 'Five men are sleeping.'

FIVE
MEN   SLEEPING

being a m.   *sleeping*

PPPPP
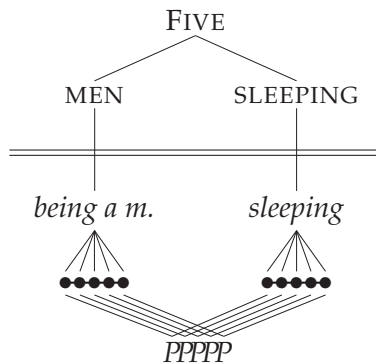
We should also consider this account of numerals with respect to negation. The following example involves negation in the scope of the numeral. The expression is true just in case there are five (or more) non-sleepers. There is a reading of *exactly* five that I do not take into account here (but see [7.2.2] for an 'exactly' reading of a numeral under the scope of negation).

(64) a. 'Five men are not sleeping.'

b.   FIVE[+]
MEN   NOT[−]
SLEEPING

being a m.   *sleeping*

PPPPP
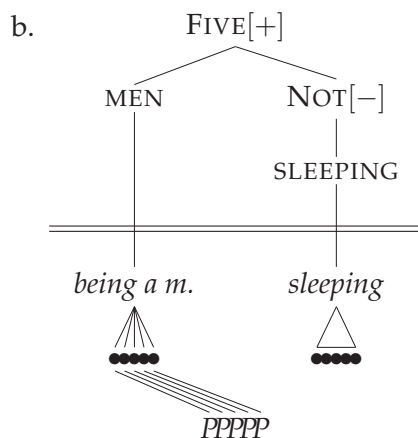
Since the bridge FIVE dominates a negatively scoped Predicate term, it requires a dissatisfier in order to meet the definition of truth. To have a dissatisfier, it must have a witness, which was determined above to be an arbitrary collection of five men. A dissatisfier is a collection consisting of a subdissatisfier for each subwitness of a witness, each of which is a collection of aspects p-distinct from a subwitness, and u-identical with the denotation of a right-dominated Predicate term (i.e., *sleeping*). The dissatisfier must be fully identical with a satisfier of its Predicate term (i.e., *sleeping*). These conditions are jointly met just in case there are five or more particular men each of which is p-distinct from every (u-distinct) aspect of *sleeping*.

'Exactly' readings and numerals in the scope of negation are a complex topic, and are not considered here. For further discussion, see [7.2.2].

Chapter 6

Relations

6.1 Introduction

This chapter is concerned with the semantics of relations. Before I proceed to the main topic, I briefly remind the reader of the ontology of relations, as presented in Chapter 2. I proposed, following Baxter, that in the case of a relation such as *loving* that holds between two particulars, one particular (e.g., John) instantiates the relation-part of *loving-by*, while the other (e.g., Mary) instantiates the relation-part of *loving-of*. Together, these two relation-parts constitute the whole relation of *loving*. Whoever instantiates *loving-by* is the lover, while whoever instantiates *loving-of* is the beloved.

For John to instantiate *loving-by* (*tout court*) is for John to love someone (or some*thing*). Who John loves depends on which aspect of the relation-part of *loving-by* he instantiates. I suggest that *loving-by* consists of myriad relational properties, each of which is a universal. To instantiate any of those universals is to love someone in particular. *Which* someone depends on a fundamental link between each aspect of *loving-by* and some aspect of *loving-of*.

Suppose, for example, that John loves Mary. In this case, it must be that John instantiates *loving-by* and Mary instantiates *loving-of*. This requires only that John love (someone) and that Mary be loved (by someone). There is then the further condition that *John's loving* be conecessitated by *Mary's being loved*. This is just to say that some aspect in which *John's loving* consists conecessitates (the aforementioned fundamental link) some aspect

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in which *Mary's being loved* consists.

It bears repeating that John *qua lover* instantiates the relation-part of *loving-by*, but that each universal of *loving-by* is a relational property of *loving of* a particular individual. Similarly, universals belonging to *loving-of* are relational properties of *being loved by* a particular individual. The relation-parts are so-named to reflect the role of the particular that instantiates them (i.e., either lover or beloved), not the names that we give to relational properties. The fact that a given universal belonging to *loving-by* amounts to the relational property of loving *of* someone is due to the fact that every aspect of that universal conecessitates an aspect of *loving-of* that is p-identical with the beloved.

6.2 Relations among single individuals

In line with the metaphysical view of relations just described, I suggest that relational concepts have as many parts as their corresponding relations. The concept of LOVING consists of the concept-parts of LOVING-BY and LOVING-OF. The overall correspondence consists in the correspondence between the parts of the concept and the parts of the relation. This claim is central to the analysis of any sentence that expresses a relation between two individuals. In the following example, each individual is denoted by a proper name.

 (65) 'Mary lifted John.'

My account involves analysing the sentence into one of two possible semantic constituent structures. Either the verb forms a constituent with the subject, giving [[MARY LIFTED] JOHN], or else the verb forms a constituent with the object, giving [MARY [LIFTED JOHN]]. Either of the embedded constituents, [MARY LIFTED] or [LIFTED JOHN], supplies a property (specifically, a relational property) for the value of the remaining argument to instantiate. The former supplies the property of *being lifted by Mary* for John to instantiate. The latter supplies the property of *lifting John* for Mary to instantiate. For this sentence, since the arguments are unquantified, it is arbitrary which constituency structure we choose. For illustrative purposes, I assume that the structure is [MARY [LIFTED JOHN]] or, rather, [MARY [JOHN LIFTED]], with Argument terms preceding Predicate terms, as in the tree structures.

Although 'lifted John' is a sentence fragment, and therefore can be neither true nor false, its corresponding semantic representation is truth-apt, since it is identical with that of the passive sentence 'John was lifted'. The structure that I assign to both is very similar to that of the non-relational subject-predicate structures I proposed in Chapter 5. Both sorts of structures involve the instantiation of a universal by a particular. For either the fragment or the corresponding passive sentence, I propose the semantic structure in (66). Note that this is a PRED structure, with the same basic features as any of the PRED structures introduced in Chapter 5.

(66) a. 'John was kissed,' or 'kissed John' (fragment)

b.
$$\text{PRED}_{of}$$

JOHN   KISSED
-OF

John   *kissing-of*

•
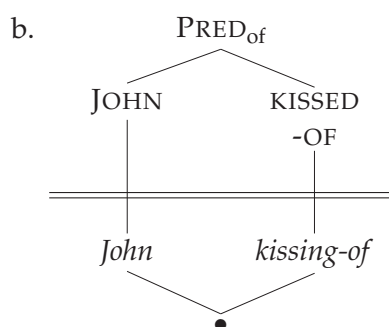
PRED in (66) has a subscript 'of'. I propose that there are 'by'-forms, 'to'-forms, etc., of PRED, and all other witnessed bridge types. PRED$_{of}$ is a subtype of PRED. The subtype has a role in defining the proper function of the bridge, details of which are provided presently. It should be noted that the Predicate term is the 'OF'-part of the concept, viz. KISSED-OF, which denotes the relation-part of *kissing-of*.

Consider the aspect in which John and *kissing-of* are cross-count identical, shown in (66). This is a state of affairs: *John's being kissed (by something)*. This affair must contribute to the truthmaker of the complete sentence of which [$_{\text{PRED}_{\text{OF}}}$ JOHN KISSED] is a fragment. Two components of the analysis of this sentence remain. Firstly, in addition to the state of affairs shown in (66), we need a further state of affairs of *Mary's kissing something*. Secondly, and crucially, it must be that (any) two such states of affairs co-necessitate: that *John's being kissed by something* co-necessitates *Mary's kissing something*.

The first component requires Mary to instantiate *kissing-by*. The second component requires conecessitation between the two aspects. Some aspect in which John and *kissing-of* are identical must have this connection to some aspect in which Mary and *kissing-by* are

identical. To achieve this, the structure in (66) is embedded within a further PRED struc-
ture. This is illustrated in (67).

(67) a. 'Mary kissed John.'

b.
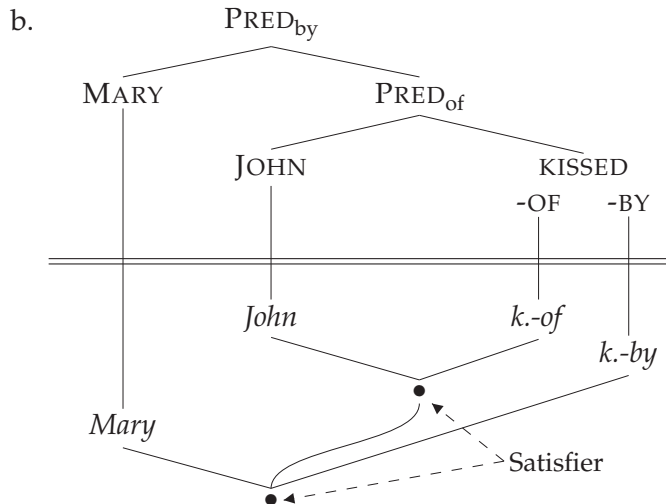
The reader is familiar with the notion of a satisfier from Chapter 5. It is necessary to
slightly modify the definitions of a subsatisfier and subdissatisfier to accommodate this
theory of relations. The revised and final versions of the definitions apply to the non-
relational bridges from Chapter 5 identically to the versions they supersede. That is to
say, the definitions are simply modified to allow for the different way in which a re-
lational (i.e., 'of', 'by', etc. subscript) bridge may have a sub(dis)satisfier. Parts of the
definitions in square braces are optional elements that, if applicable, apply together. '/r-'
is to be understood as substituting 'u-' for 'r-'.

(68) SUBSATISFIER OF A BRIDGE $B[_\theta]$ (Final version):

A subsatisfier of $B[_\theta]$ is a collection of aspects each of which is p-identical with
a given subwitness of a witness of $B[_\theta]$ qua its highest type, and u-[/r-] identical
with [the θ-part of] the denotation of its Predicate term, or that of a right-dominated
bridge.

(69) SUBDISSATISFIER OF A BRIDGE $B[_\theta]$ (Final version):

A subdissatisfier of $B[_\theta]$ is a collection of aspects each of which is p-distinct from
a given subwitness of a witness of $B[_\theta]$ qua its highest type, and u-[/r-] identical
with [the θ-part of] the denotation of its Predicate term, or that of a right-dominated
bridge.

The modifications are such that r-identity rather than u-identity is the relevant dimension, and the theta-part of the Predicate term rather than the whole Predicate term is the relevant denotational element. It is also necessary to make a small modification to the theory of the proper function of a witnessed bridge.

(70) PROPER FUNCTION OF A WITNESSED BRIDGE (Final version):

A witnessed bridge B operates Normally iff:

a) B has a satisfier, such that each of its subsatisfiers is u-identical with or conecessitates a satisfier of a positive scoped Predicate term, or

b) B has a dissatisfier, such that each of its subdissatisfiers is fully u-identical with or fully conecessitates a satisfier of a negatively scoped Predicate term, or

c) B has a negatively scoped Predicate term with no satisfier.

The final version differs from the first version only in that the words 'or conecessitates' follow the words 'is identical with' in clauses a) and b). This captures the fact that, in relational expressions, the satisfiers of inner structures must conecessitate the (dis)satisfiers of outer structures, rather than be u-identical with them. As in the diagrams in Chapter 2, conecessitation is represented by a curved line, which may be observed between the satisfiers in (67), above.

We now consider the precise conditions under which the sentence and expression in (67) are true, according to the theory. Firstly, the main bridge PRED_{by} must be operating Normally, since this is the condition under which the whole expression is true. Specifically, this requires that it have a satisfier, and that each of its subsatisfiers (which, in this case, is just the one subsatisfier identical with the satisfier) conecessitate a satisfier of a dominated bridge. A subsatisfier of PRED_{by} is an aspect that is p-identical with a subwitness of a witness of its Argument term (in this case, all subwitnesses of a witness are just the individual Mary), and r-identical with either the denotation of the θ-part of its Predicate term (in this case, there isn't one) or else that of a right-dominated bridge. PRED_{by} right-dominates another bridge in the structure, which is PRED_{of}. The Predicate term of PRED_{of} has a 'BY'-part with a denotation, and this is the relation-part of *loving-by*. This, in turn, is r-identical with an aspect p-identical with Mary, so PRED_{by} has a satisfier. This must conecessitate a satisfier of PRED_{of}, the dominated bridge.

PRED$_{of}$ has a satisfier if there is an aspect that is both p-identical with its Argument term's denotation (the individual John), and r-identical with the denotation of the 'OF'-part of its Predicate term (the relation-part *loving-of*). There is such an aspect, and this is conecessitated by the above satisfier of PRED$_{by}$. Therefore, the complete expression is true.

6.2.1 Relations with quantifiers

I introduced the theory of quantification in [5.7]. There I gave accounts of the bridges SOME, EVERY, and NO in terms of the proper function of a witnessed bridge. In this section, I show how these bridges operate within relational structures. I begin with an analysis of the sentence in (71), which has the existentially quantified object 'a table'.

(71) 'Mary lifted a table.'

Since there is no quantifier scope ambiguity, it is of no consequence which of the two possible semantic constituency structures are assigned, [MARY [TABLE LIFTED]] or [TABLE [MARY LIFTED]]. I opt once more for the former in which the object makes a constituent with the verb. I take this fragment to have the same semantic value as the passive sentence 'A table was lifted'. The fragment and passive sentence are each associated with the following structure.

(72) a. 'A table was lifted,' or 'lifted a table' (fragment)

b.
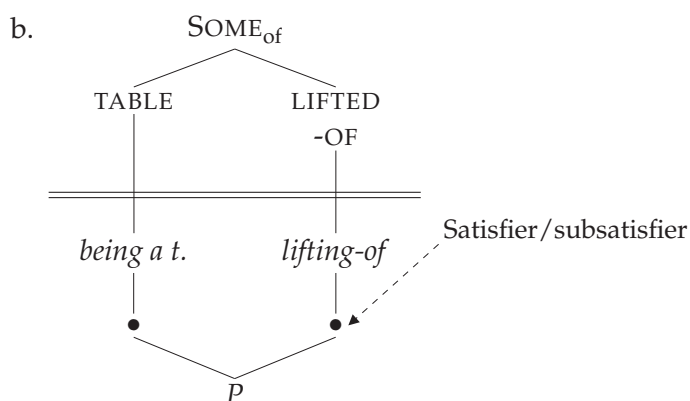
This is very similar to previously considered structures involving SOME, and its proper function is given by the final definition in (70), above. A satisfier of SOME$_{of}$ is given by the definition in (39) as a collection consisting of a subsatisfier for each subwitness of a given

witness of SOME$_{of}$. There is just a single subwitness of a witness of SOME$_{of}$ (i.e., a single table), hence any satisfier consists of a single subsatisfier. A subsatisfier of SOME$_{of}$ is given by the definition in (68) as a collection of aspects (in this case, a single aspect) which is p-identical with some subwitness of a witness (i.e., some table), and r-identical with the denotation of the OF-part of its Predicate term (i.e., *lifting-of*). A satisfier/subsatisfier (*some table's being lifted by something*) is labelled in the diagram. For the analysis of the complete sentence, this structure is embedded within a containing PRED$_{by}$ structure. This is illustrated in (73).

(73) a. 'Mary lifted a table.'

b.
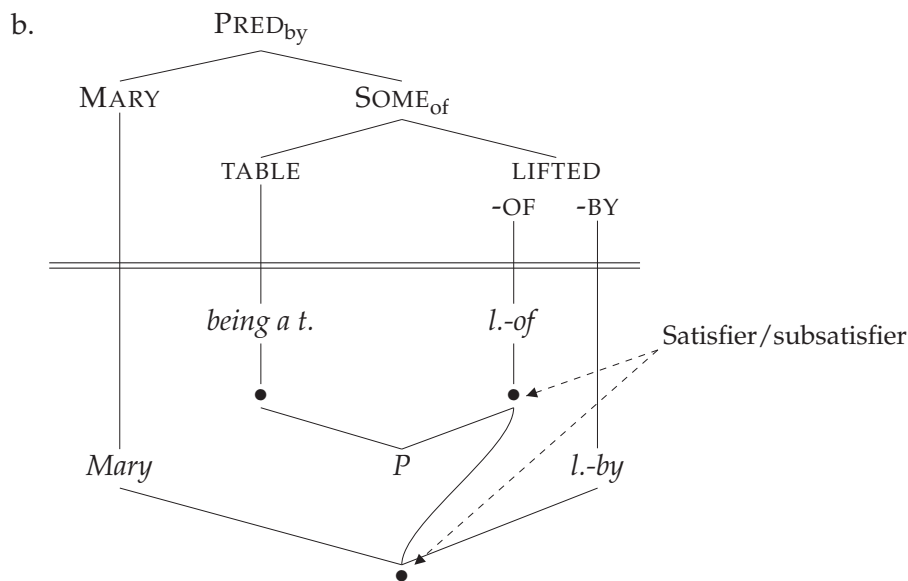
A satisfier of PRED$_{by}$ is defined as a collection consisting of a subsatisfier for each subwitness of a witness of SOME$_{by}$. Since a witness of PRED$_{by}$ is just the denotation of its Argument term, Mary is both the sole witness and sole subwitness. A subsatisfier of PRED$_{by}$ is a collection of aspects (in this case, just a single aspect) which is p-identical with a given subwitness of a witness (i.e., Mary) and r-identical with the denotation of the BY-part of a right-dominated bridge's Predicate term (i.e., *lifting-by*). A satisfier is therefore some aspect in which Mary lifted something. Just in case some aspect in which Mary lifted something conecessitates some aspect in which some table was lifted (a satisfier of SOME$_{of}$), as illustrated, the expression is true.

We turn now to the analysis of a sentence with two quantified arguments. I propose the following structure for this sentence. As the foregoing analyses would suggest, the

expression consists of a SOME structure embedded within a further SOME structure. Once again, I take [TABLE LIFTED] to be a constituent.

(74) a. 'A woman lifted a table.'

b.
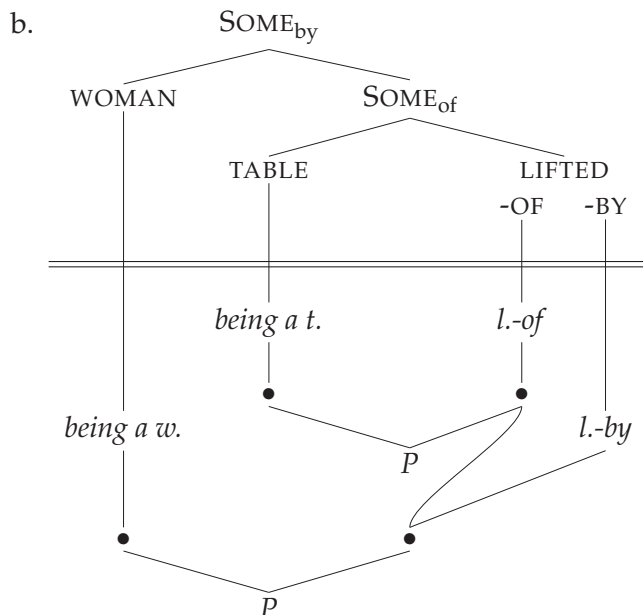
The analysis of SOME$_{of}$ in this expression is precisely as described above for (73). A satisfier of SOME$_{by}$ is a single subsatisfier. A subsatisfier of SOME$_{by}$ is a collection of aspects (in this case, a single aspect) p-identical with some woman, and r-identical with the denotation of the BY-part of a right-dominated bridge's Predicate term (i.e., *lifting-by*). If this satisfier/subsatisfier of SOME$_{by}$ conecessitates a satisfier of SOME$_{of}$ (as described above), which is to say that an aspect in which some woman lifts something conecessitates an aspect in which some table is lifted by something, the expression is true.

6.3   Relations among plural individuals

In the previous chapter, I gave an account of some structures involving plural individuals (e.g., sentences with 'every'), along with some genuine plurals (e.g., sentences with numerals). Such examples involved multiple subwitnesses per witness, and hence multiple subsatisfiers of a satisfier. The truth conditions for these examples only required the consideration of a single satisfier for any given truthmaker. That is to say, any single satisfier, possibly consisting of multiple subsatisfiers, was sufficient for the truth of even

a plural expression, such as 'Five men are sleeping' in (63).

The idea that a structure may have multiple satisfiers is related to the fact that it may have several truthmakers. If a sentence has several truthmakers, any one of those truthmakers is sufficient for the sentence to be true. If Colin is a barking dog and Cedric is a barking dog, then both Colin's barking and Cedric's barking are satisfiers of the sentence 'A dog is barking'. Either of them is sufficient for the sentence to be true.

There are relational expressions which, in order to be true, require a bridge to have *multiple* satisfiers, each of which may have multiple subsatisfiers. It is important to keep the notion of a collection of subsatisfiers that serves as a single satisfier separate from the notion of a collection of (simple or complex) subsatisfiers that each serve as a different satisfier. The distinction is explained by example in what follows.

In (75), I show three aspects, each individually shared by John and *kissing-of*. Each of these is a different (that is, u-distinct) subsatisfier and satisfier of the PRED_{of} structure in which they appear.

(75) a. 'John was kissed,' or 'kissed John' (fragment)
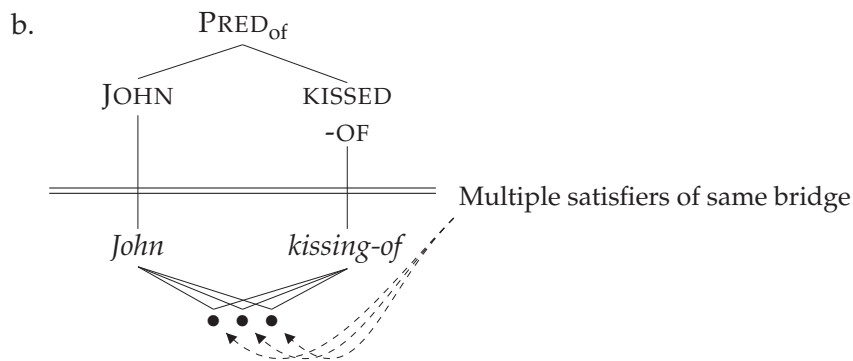
The fact that there may be more than one satisfier of a structure is crucial to the analysis of relations with plural individuals in wide scope. Consider the sentence in (76). This sentence is true just in case each subsatisfier of a satisfier of EVERY_{by} conecessitates a satisfier of PRED_{of}, which is to say any of the various u-distinct aspects that are p-identical with John and r-identical with *kissing-by*.

(76) a. 'Every woman kissed John.'
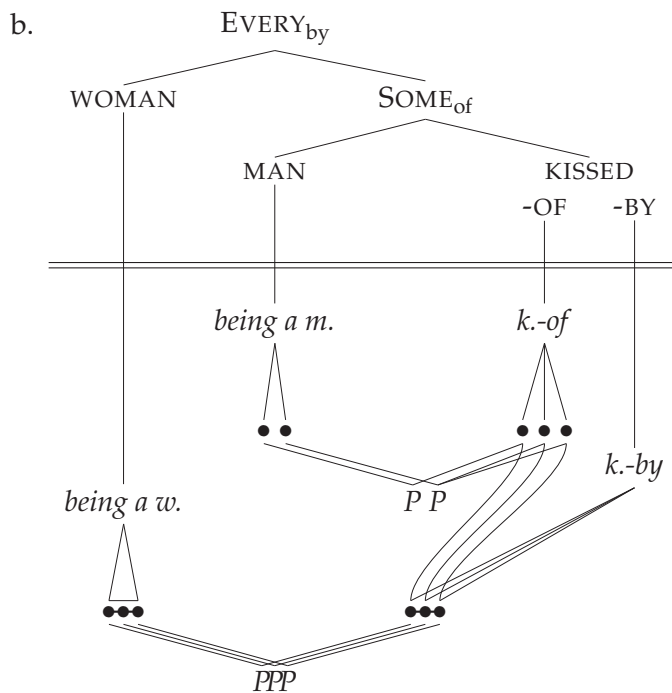
b.

EVERY$_{by}$

WOMAN PRED$_{of}$

JOHN KISSED

-OF -BY

John *k.-of*

k.-by

being a w.

●●● ●●●

- - -> Single complex satisfier (below)
conecessitates multiple
satisfiers (above)

●●● ●●●

PPP
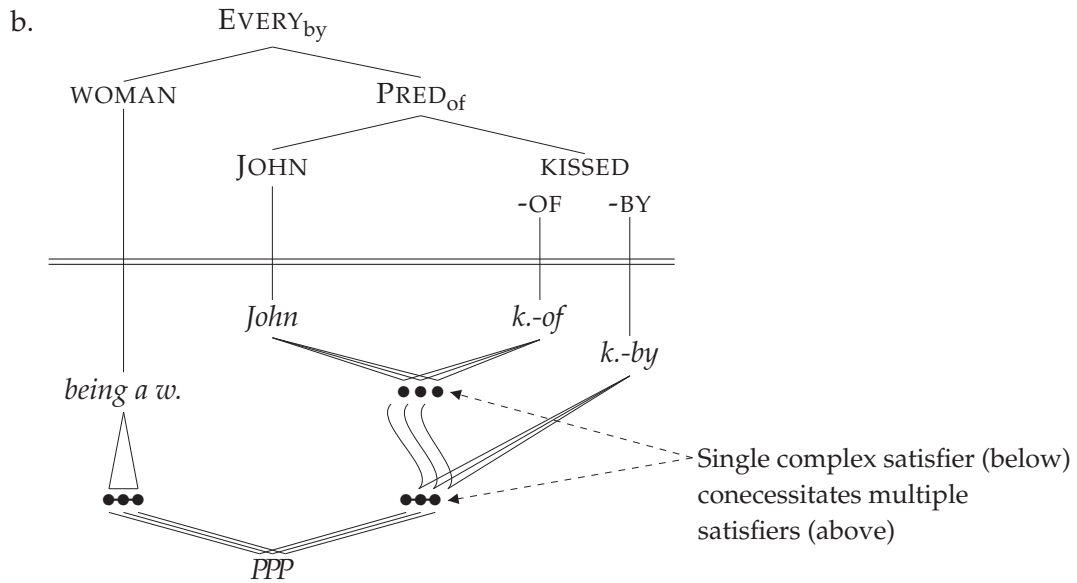
6.3.1 An account of quantifier scope ambiguity

I propose that quantifier scope ambiguities arise from the relative dominance of quantifying bridges in relational expressions. The rules or constraints responsible for licensing these representations is a matter of syntax. Here I focus just on the interpretation of the different structures. I demonstrate the account with an analysis of the sentence in (77), beginning with the wide scope subject reading.

(77) a. 'Every woman kissed a man.' ($\forall x[woman'(x) \rightarrow \exists y[man'(y) \wedge kiss'(x,y)]]$)

b.

EVERY$_{by}$

WOMAN SOME$_{of}$

MAN KISSED

-OF -BY

being a m. *k.-of*

●● ●●●

k.-by

being a w. *P P*

●●● ●●●

PPP

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According to this reading, every woman is such that she kissed a possibly different man. As was noted in Chapter 2, a relation-part (e.g., *kissing-of*) differs from a universal in that the same particular may instantiate the same relation-part more than once at any given time (i.e. in several u-distinct but p- and r-identical aspects).

It is not necessary for each woman to kiss a different man for the sentence to be true. Consequently, there may be fewer men than women in the truthmaking affair. The diagram in (77) illustrates this with a totality of three women, and only two men. Note that of the two Ps each representing a different man, the right-hand one instantiates *kissing-of* twice, and hence in two u-distinct aspects. These two satisfiers of SOME$_{of}$ have u-distinct co-necessitating aspects, each of which is a subsatisfier of the single complex satisfier of EVERY$_{by}$. The remaining subsatisfier is conecessitated by a satisfier shared by the other man and *kissing-of*.

There is another reading of the same sentence, in which the object takes wide scope. For the wide scope object reading, SOME$_{of}$ dominates EVERY$_{by}$. Note that the bridges dominate the same Argument terms and the 'of's and 'by's are associated with the same bridges since, on either reading, the quantifiers modify the same arguments and the argument structure is the same.

The complex state of affairs, represented in (78), involves just a single man and the totality of three women, each of which kissed him. In the diagram, a single P represents the man, which is shown to be identical with three distinct aspects of *kissing-of*. These u-distinct subsatisfiers co-necessitate three p-distinct (in this case, u- and r-identical, since *the same man* is loved by each woman) satisfiers of *kissing-by*, which are each p-identical with a different women, represented by three Ps.

(78) a. 'Every woman kissed a man.' ($\exists y[man'(y) \wedge \forall x[woman'(x) \rightarrow kiss'(x,y)]]$)

b.

SOME_{of}

MAN   EVERY_{by}

WOMAN   KISSED

-BY   -OF

being a w.   *k.-by*

● ● ●   ● ● ●

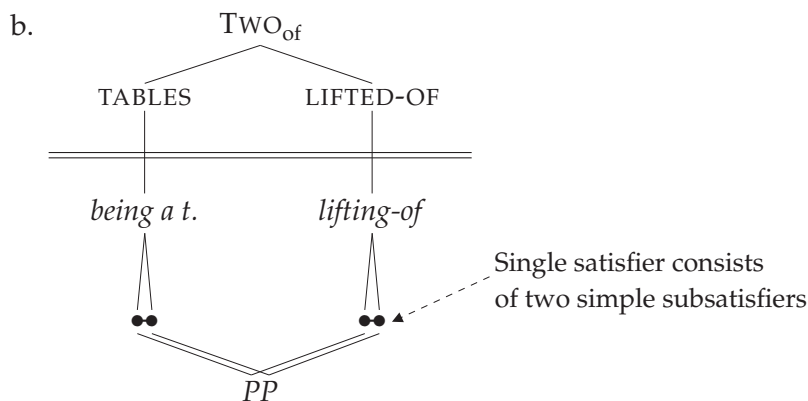*being a m.*   *PPP*   *k.-of*

●   ● ● ●

P
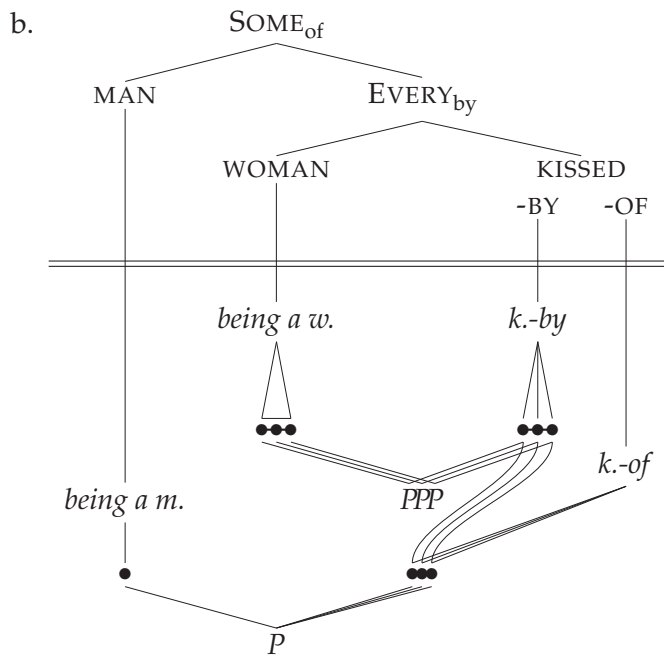
6.3.2   Numerals in relations

I now extend the basic account of numerals given in [5.8] to account for their interpretation within relational sentences. We begin with the example in (79), in which the subject denotes a simple individual, and the object denotes a complex or plural individual.

(79) 'Mary lifted two tables.'

I treat the verb and object as a constituent, which has the same semantic value as the passive sentence 'Two tables were lifted'. This is illustrated in (80), below.

(80) a. 'Two tables were lifted,' or 'lifted two tables' (fragment)

b.

TWO_{of}

TABLES   LIFTED-OF

being a t.   *lifting-of*

Single satisfier consists
of two simple subsatisfiers

● ●   ● ● ▲

PP

Since a satisfier of this structure is a pair of aspects of *lifting-of*, I illustrate one such pair as a single fused aspect. This whole structure embeds within a larger PRED structure, as shown below in (81).

(81) a. 'Mary lifted two tables.'

b.
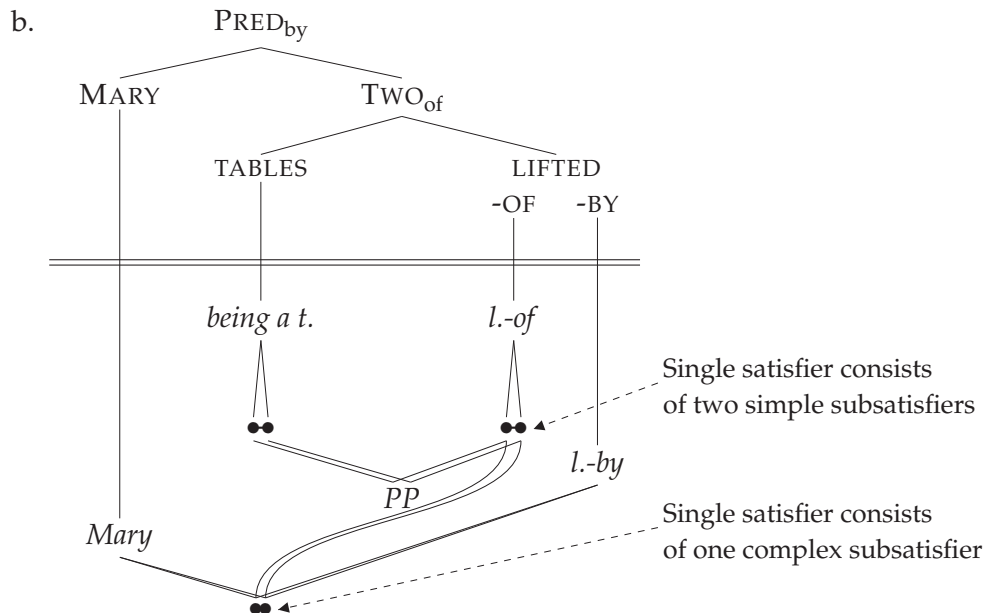
In this diagram, Mary is shown to be p-identical with a pair of aspects that co-necessitates a satisfier of the embedded structure, in accordance with the proper function of PRED_{by}.[1] This pair of aspects is both a complex subsatisfier and a satisfier of PRED_{by}.

I now consider the more complex example in (82), which has both a plural subject and a plural object.

(82) 'Three women lifted two tables.'

First we consider what it is, within the ontology, for three women to lift two tables. Here I am only concerned with the two distributive-distributive readings, which is to say the readings under which each lifting is performed by an individual woman on an individual

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[1]The conecessitation between the complex subsatisfier of PRED_{by} and the complex satisfier of TWO_{of} is distributive, which is to say that the subsatisfier of PRED_{by} is exhausted by parts each of which conecessitates a part of the satisfier of TWO_{of}, and vice versa.

table.[2] Because the sentence describes a somewhat complex state of affairs, it is useful to see exactly what it looks like in the proposed ontology. Below is an illustration of a state of affairs that makes the sentence true under the wide scope subject reading. The reading entails that three (or more) women each lift two tables. There may be anywhere between two and six tables involved: two if each woman lifts the same two tables, and six if each woman lifts two tables different from those lifted by the other women. I consider a middle case, with a degree of overlap of tables. Specifically, woman-2 (w_2) and woman-3 (w_3) each lift table-1 (t_1) and table-3 (t_3), while woman-1 (w_1) lifts table-1 and table-2 (t_2). Curved lines represent the co-necessitating connection between aspects. A different line thickness is used for each woman to make the connections easier to read. The relational properties corresponding to each row of aspects are labelled in square brackets.

(83)

| | w_1 | w_2 | w_3 | $\dots$ | t_1 | t_2 | t_3 |

lifting-by$_{784}$ [=*lifting (of)* t_1]
lifting-by$_{785}$ [=*lifting (of)* t_2]
lifting-by$_{786}$ [=*lifting (of)* t_3]
$\dots$
$\dots$
lifting-of$_{523}$ [=*being lifted by* w_1]
lifting-of$_{524}$ [=*being lifted by* w_2]
lifting-of$_{525}$ [=*being lifted by* w_3]
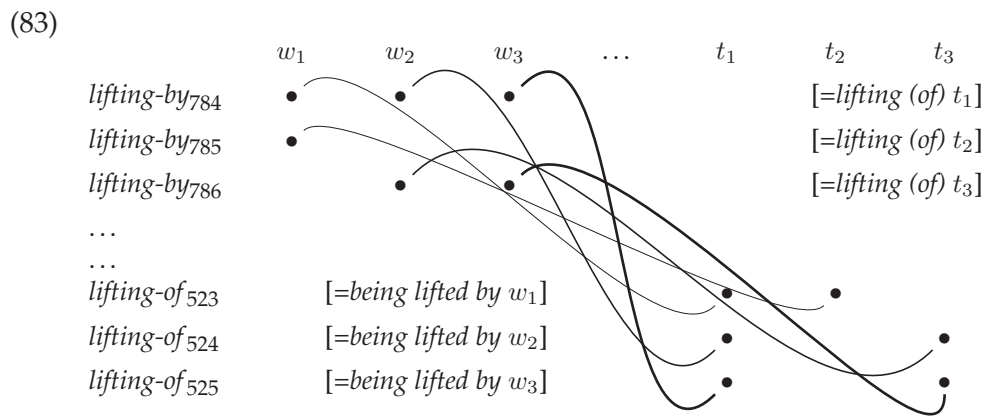
The diagram shows six lifting events, one for each pair of co-necessitating aspects. Note, for example, that all three women instantiate *lifting-by*$_{784}$, which corresponds to the property of *lifting (of)* t_1. Consequently, a different curved line links an aspect of each woman and *lifting-by*$_{784}$ to three different aspects of t_1.

We turn now to the semantic representation of the sentence. This is given in (84).

(84) a. 'Three women lifted two tables.' (wide scope subject)

b.

$$\text{THREE}_{\text{by}}$$

WOMEN TWO_{of}

TABLES LIFTED

-OF -BY

being a t. *l.-of*

Three satisfiers, each
consisting of two
simple subsatisfiers

PP PP PP *l.-by*

being a w.

One satisfier consists of
three complex subsatisfiers

PPP
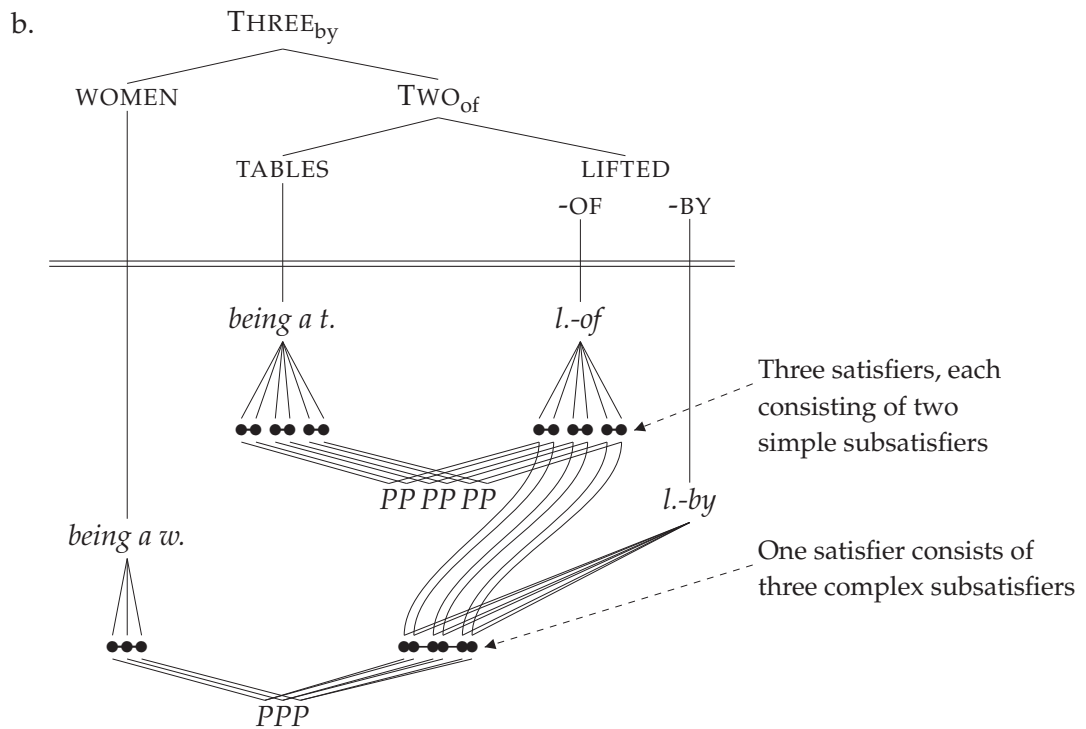
The diagram warrants careful consideration. We begin with the inner structure TWO_{of}. This is the structure associated with the fragment 'two tables were lifted', as analysed in (80). As before, a satisfier of this structure consists of two simple subsatisfiers, which is to say two subsatisfiers each consisting of a single aspect. In the above diagram there are three such satisfiers shown, and each has a role in the truth of the expression.

The outer structure THREE_{by} requires a subsatisfier for each subwitness of a witness. Any witness of THREE must consist of three subwitnesses, so there must be three subsatisfiers to any satisfier. Each subsatisfier must be p-identical (in each aspect) with one subwitness and r-identical with *lifting-by* and must conecessitate a satisfier of TWO_{of}. Since each satisfier of TWO_{of} consists of two single-aspect subsatisfiers, each subsatisfier of THREE_{by} must also consist of two individual aspects, as shown.

I now turn to the other reading in which the object takes wide scope. As before, I begin with a representation of a complex state of affairs. In this case, there are exactly two tables (since TWO_{of} takes wide scope), and a total of four women, with woman-2 and woman-3 each lifting both tables, and woman-1 and woman-4 each lifting a different table.

(85)
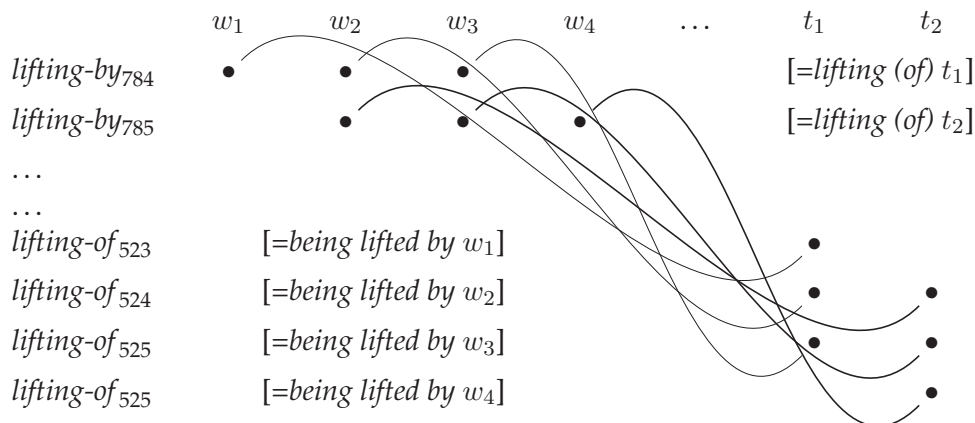
The semantic representation of this reading is given below. For the sake of clarity, a total of six distinct women are shown with no overlap between them.

(86) a. 'Three women lifted two tables.' (wide scope object)

b.
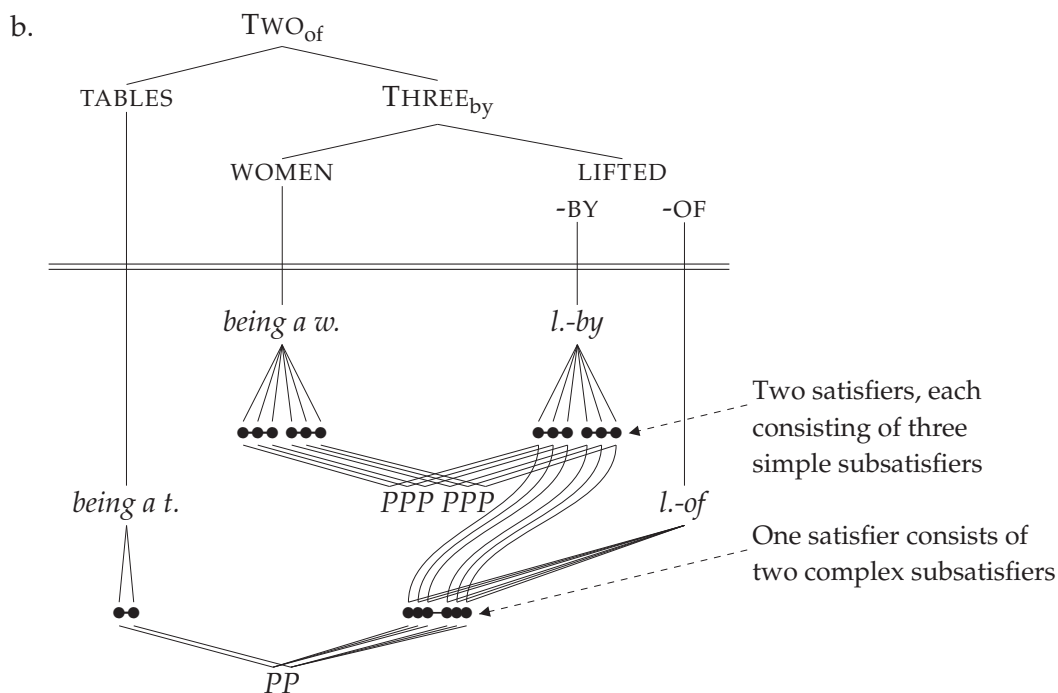
Under the wide scope object reading, the relative dominance of the two bridges is reversed, so that THREE$_{by}$ is the inner bridge and TWO$_{of}$ the outer one. A satisfier of THREE$_{by}$ is defined in just the same way as above. The difference is that we must take into account two satisfiers (one for each subsatisfier of the outer bridge TWO$_{of}$), rather than just one. Conversely, we need only consider one satisfier of TWO$_{of}$, rather than the three that were taken into account under the wide scope subject reading.

Any one satisfier of THREE$_{by}$ consists of three subsatisfiers, one for each subwitness of a witness. Two satisfiers are shown, each consisting of three aspects, each of which is p-identical with a distinct woman. *Within* a satisfier, the three women must be p-distinct from one another, but there is no such distinctness required *across* satisfiers. This is the potential for overlap discussed above. If the two tables are lifted by the same three women then the two satisfiers are r- *and* p-identical, but nevertheless u-distinct. This is because lifting two distinct tables amounts to instantiating different relational properties, hence different "rows" of *lifting-by*, as illustrated in (85), above. Even with a total overlap of women, each of them must instantiate *lifting-by* in two distinct "rows", which is to say two u-distinct relational properties, in order that each lifts (the same) two distinct tables.

Each satisfier of THREE$_{by}$ is conecessitated by a different subsatisfier of TWO$_{of}$, each of which is in turn p-identical with a different subwitness of TWO$_{of}$.

6.4 Negation in relations

6.4.1 Simple examples

I proposed the general approach to negation in Chapter 5. In this section, I demonstrate how the theory, with no further modification, handles negation within relational structures. The first example that I consider has no quantifiers, and a narrow scope negation.

(87) a. 'Mary doesn't love John.'

b.

$\text{PRED}_{\text{by}}[+]$

MARY NOT$[-]$

$\text{PRED}_{\text{of}}[-]$

JOHN LOVES
-OF -BY

John *l.-of*

l.-by
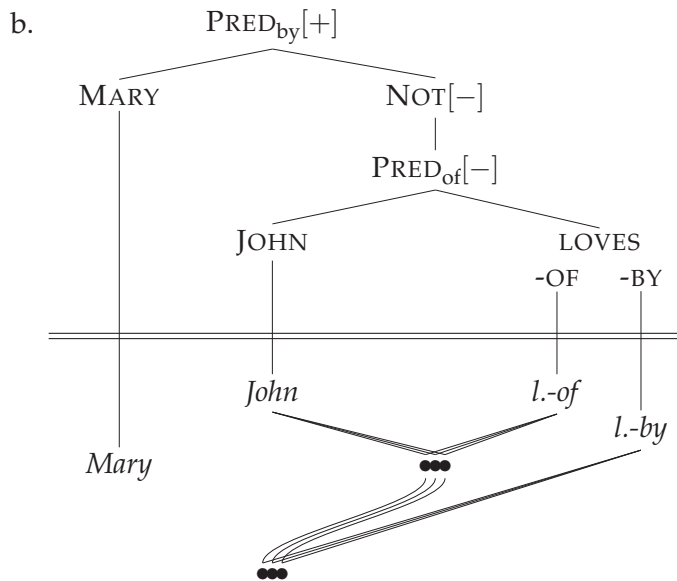
Mary

Consonant with a difference-based approach to negation, I propose that Mary's not loving John consists in her being different from every aspect in which John is loved (that is, from the property of *loving John*). I argued in [5.3] that this ought to be preferred to a contrariety-based analysis according to which Mary instantiates some contrary of *loving John* (e.g., *non-loving John*).

For the expression in (87) to be true, the main bridge PRED_{by} must meet one of the conditions of the proper function of a witnessed bridge in clauses a), b), and c). a) is ruled out because PRED_{by} has a negatively scoped Predicate term. This leaves conditions b) and c). Condition c) applies iff NOT has no satisfier. A satisfier of NOT is a satisfier of its Predicate term PRED_{of}. Therefore, the expression is true in case there is no aspect in which John instantiates *loving-of*, which is just to say that no one loves John. Condition b) covers any other case in which the expression may be true. This is any case in which Mary has a dissatisfier that fully conecessitates a collection of satisfiers (which may just be a single satisfier) of NOT. The dissatisfier is the totality of aspects each of which is p-distinct from Mary and u-identical with *loving-by*. This must fully conecessitate a satisfier of NOT, which is to say John inasmuch as he is loved (by something). To fully conecessitate just a single satisfier is to conecessitate John's *loving-of* in every u-distinct aspect (e.g., John's being loved by Jane, John's being loved by Alex, etc.). The expression is true, therefore, just in case every aspect of *loving John* is p-distinct from Mary.

We turn now to the example that was considered above in [5.3] with respect to the problem of contraries of relations. The analysis is very similar to that of the previous example.

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(88) a. 'John doesn't own a bicycle.'

b.
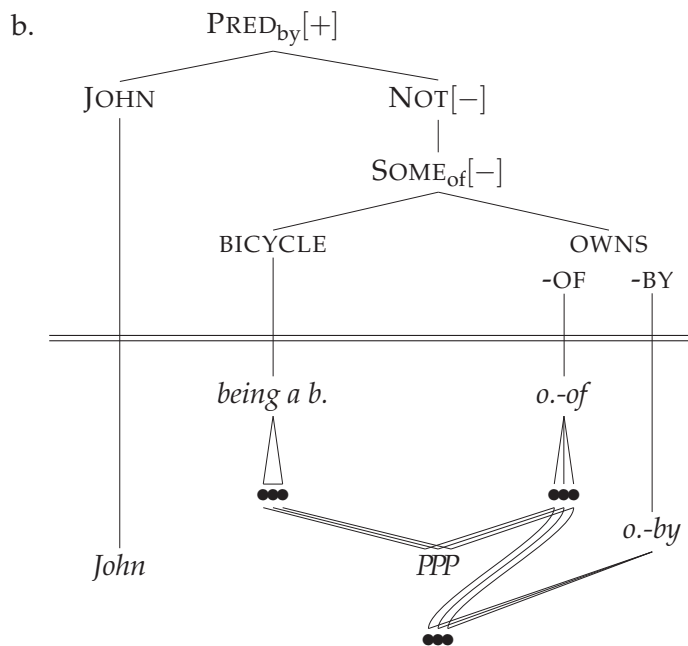
As previously, only conditions b) and c) apply. Condition c) applies if no bicycle is owned *tout court*. Condition b) applies otherwise. PRED$_{by}$ must have a dissatisfier that consists of a single complex subdissatisfier, the aspects of which fully conecessitate a satisfier of NOT in its various u-distinct aspects.

6.4.2 Multiple quantifiers

In this section I give an account of the interaction of quantificational bridges in relational sentences. The examples are analysed with their subjects in wide scope only. The interpretation of negation in narrow scope is treated in [6.4.3], below. The first example to consider involves the interaction of two instances of EVERY.

(89) a. 'Every man loves every woman.'

b.

Single complex satisfier
consists of three
subsatisfiers

Single complex satisfier
consists of three complex
subsatisfiers
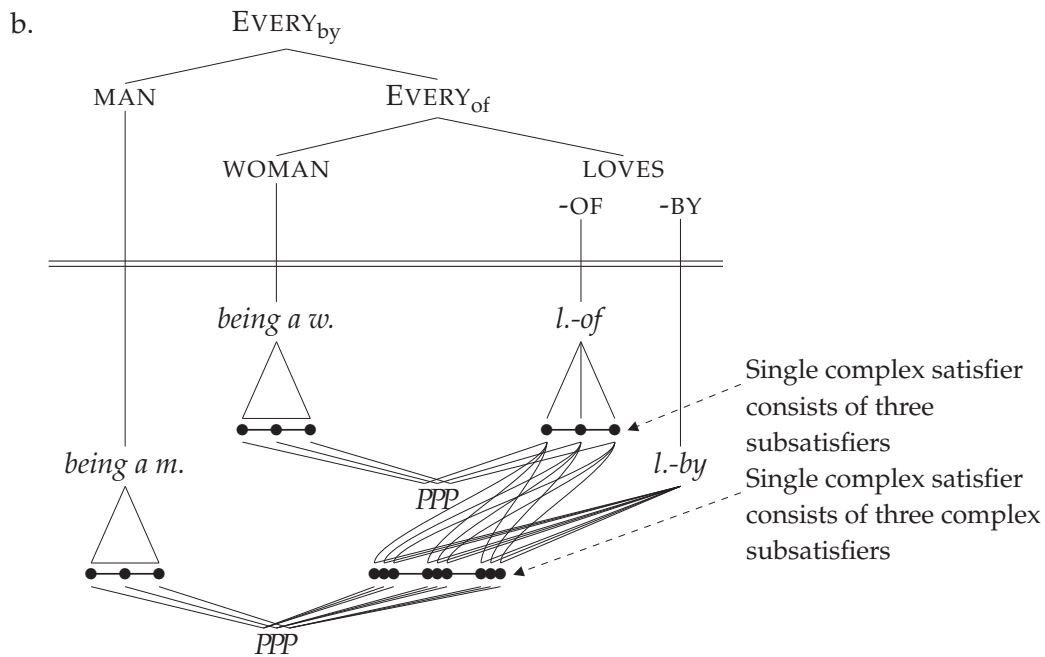
A relevant example to compare is that of 'Every woman kissed a man,' with the subject in wide scope, as given in (77) on page 120, above. In that example, each subwitness (i.e., each individual woman) of the witness (i.e., the totality of women) of EVERY$_{by}$ must be p-identical with a *simple* subsatisfier that conecessitates some aspect in which a man (any man) is kissed. In the present example, each subsatisfier of EVERY$_{by}$ is complex, consisting of as many aspects as there are women, since the satisfier that each subsatisfier must conecessitate is complex. Specifically, the fusion of aspects comprising each subsatisfier conecessitates the whole complex satisfier of EVERY$_{of}$ by conecessitating each of EVERY$_{of}$'s subsatisfiers in a different aspect.

A complication of the analysis that is not adequately captured by the diagram should be observed. Each of the three distinct subsatisfiers of the single complex satisfier of EVERY$_{of}$ has distinct aspects within the u-count. For example, Mary is loved not just by John but also by Lee and by Alex. This means that Mary instantiates *loving-of* in three u-distinct aspects, although only one such aspect is represented in the diagram. Whereas it appears, purely from the diagram, that aspects p-identical with all three men conecessitate the very same aspect, shared (e.g.) by Mary and *loving-of*, they in fact conecessitate three u-distinct aspects of that one shared aspect. Because of the further distinction afforded by the u-count, the same satisfier of EVERY$_{of}$ may be conecessitated by the three distinct subsatisfiers of the satisfier of EVERY$_{by}$. The subsatisfiers of EVERY$_{of}$ are shown as single aspects because *qua subsatisfiers of* EVERY$_{of}$ they are simple.

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I now consider two examples of NO in wide scope. In the first of these, NO takes scope over the existentially quantifying bridge SOME.
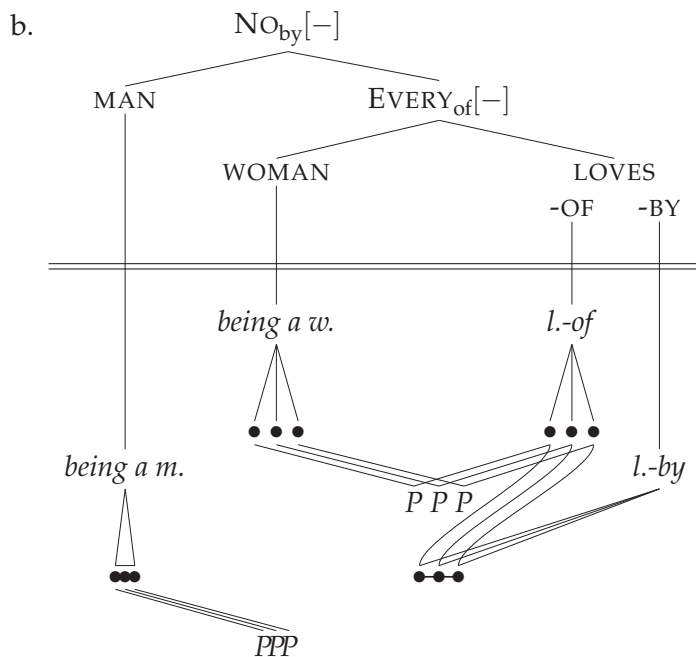
(90) a. 'No man loves a woman.'

b.
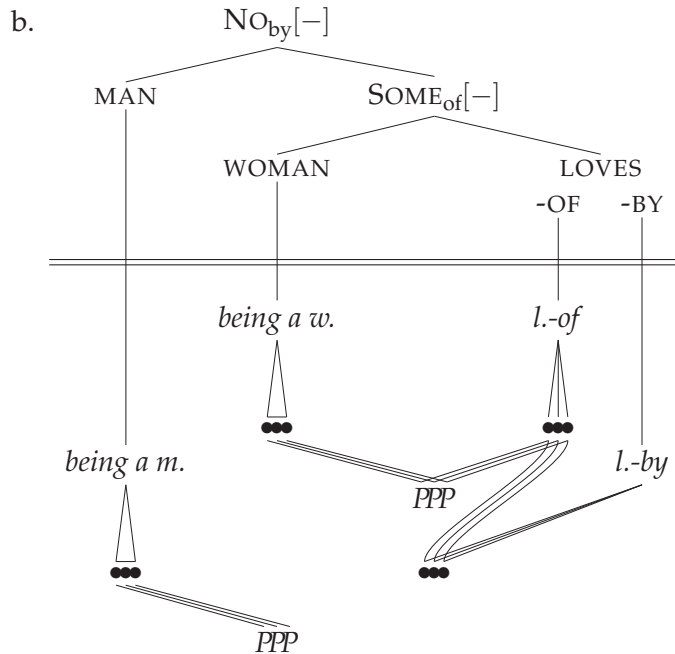
Since NO$_{by}$ has a negatively scoped Predicate term, conditions b) and c) apply. c) applies just in case no woman is loved by anything, in which case the expression is true. b) applies otherwise. According to b), NO$_{by}$ requires a dissatisfier. A dissatisfier is a collection consisting of a (not necessarily distinct) subdissatisfier for each subwitness of a witness. A subdissatisfier is a collection of aspects each of which is p-distinct from a given subwitness of a witness and r-identical with *loving-by*. There is a further condition on a dissatisfier that each of its subdissatisfiers fully conecessitates a satisfier of SOME$_{of}$. This is the totality of aspects in which any woman is loved (by something). In the above simplified diagram, only one aspect per woman is shown, although there may be several u-distinct aspects per woman. Any collection of aspects that fully conecessitates the totality of aspects in which any woman is loved is thereby the property of *loving a woman*. The expression is true just in case every subwitness of the totality of men is distinct from this property.

In the second example, NO takes scope over the universally quantifying bridge EVERY, as illustrated in (91), below.

(91) a. 'No man loves every woman.'

b.

Since NO$_{by}$ has a negatively scoped Predicate term, either condition b) or condition c) applies. Condition c) applies just in case no woman is loved *tout court*, in which case the expression is true. Condition b) applies otherwise. According to b), NO$_{by}$ requires a dissatisfier. A dissatisfier is a collection consisting of a subdissatisfier for each subwitness of a witness. A subdissatisfier is a collection of aspects each of which is p-distinct from a given subwitness of a witness and r-identical with *loving-by*. In the above simplified diagram, a dissatisfier is shown to consist of three subdissatisfiers. A further condition on each subdissatisfier is that it fully conecessitate a satisfier of EVERY$_{of}$, which is to say a satisfier in its (possibly) several u-distinct aspects. Since EVERY$_{of}$ is in the negative scope of NO$_{by}$, a satisfier may be any aspect shared by *loving-of* and some individual woman. Take one such satisfier: Mary's *loving-of*, which is Mary's being loved (by someone). A subdissatisfier that fully conecessitates this satisfier (i.e., conecessitates it in all u-distinct aspects) is thereby the universal of *loving Mary*.

Suppose that the totality of men consists of John, Lee, and Frank, and that the totality of women consists of Mary, Jane, and Sue. Suppose also that there are the following satisfiers of EVERY$_{of}$: Mary's being loved, Jane's being loved, and Sue's being loved. For the expression to be true, there might be the following three subdissatisfiers of NO$_{by}$: i) an aspect (the universal of *loving Mary*) p-distinct from John and r-identical with *loving-by* that fully conecessitates Mary's being loved; ii) an aspect (the universal of *loving Jane*)

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p-distinct from Lee and r-identical with *loving-by* that fully conecessitates Jane's being loved; and iii) an aspect (the universal of *loving Sue*) p-distinct from Frank and r-identical with *loving by* that fully conecessitates Sue's being loved. The expression is true iff every man *doesn't* love some woman or other (i.e., is p-distinct from *loving her*).[3]

6.4.3   NO and NOT in narrow scope

I now give analyses of several examples of NO and NOT in the scope of a quantifying bridge. In the first two examples, the existentially quantifying bridge SOME takes wide scope. I begin with the example in (92), which has NO in narrow scope.

(92)   a. 'A man loves no woman.' ($\exists x[man'(x) \wedge \neg \exists y[woman'(y) \wedge loves'(x,y)]]$)

b.
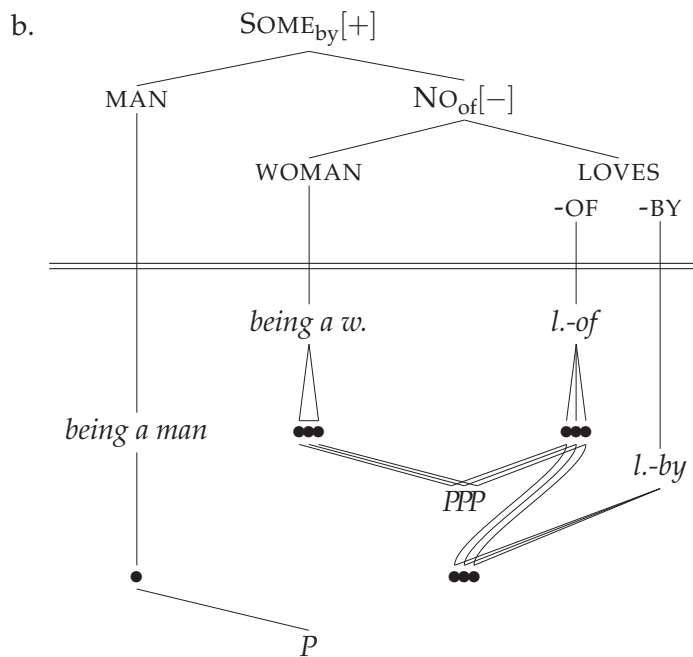
SOME$_{by}$ must have a dissatisfier according to condition b), or else NO$_{of}$ must have *no* satisfier according to condition c), in which case no woman is loved (by anything). A dissatisfier of SOME$_{by}$ is a single subdissatisfier, which is a collection of aspects each of which is p-distinct from some man and r-identical with *loving-by*. This dissatisfier must fully conecessitate a satisfier of NO$_{of}$. A satisfier of NO$_{of}$, when negatively scoped, is a

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[3]It might be that the same woman is not loved by every man, in which case there might be just the one dissatisfier (e.g., the universal of *loving Mary*) for every subwitness of the totality of men.

totality: specifically, a collection consisting of aspects shared by each of the totality of women and *loving-of*.

To be p-distinct from a collection of aspects that fully conecessitates this collection of aspects in which each of the totality of woman are loved (in their various u-distinct aspects) is to love no woman. The expression is true just in case an arbitrary man is p-distinct from this dissatisfier.

The next example is true under the same conditions as the previous one (assuming that the object is interpreted with narrow scope), although those conditions are captured slightly differently in this case. In (93), SOME has scope over NOT, which has scope over a further instance of SOME.

(93) a. 'A man doesn't love a woman.' ($\exists x[man'(x) \wedge \neg \exists y[woman'(y) \wedge loves'(x,y)]]$)

b.
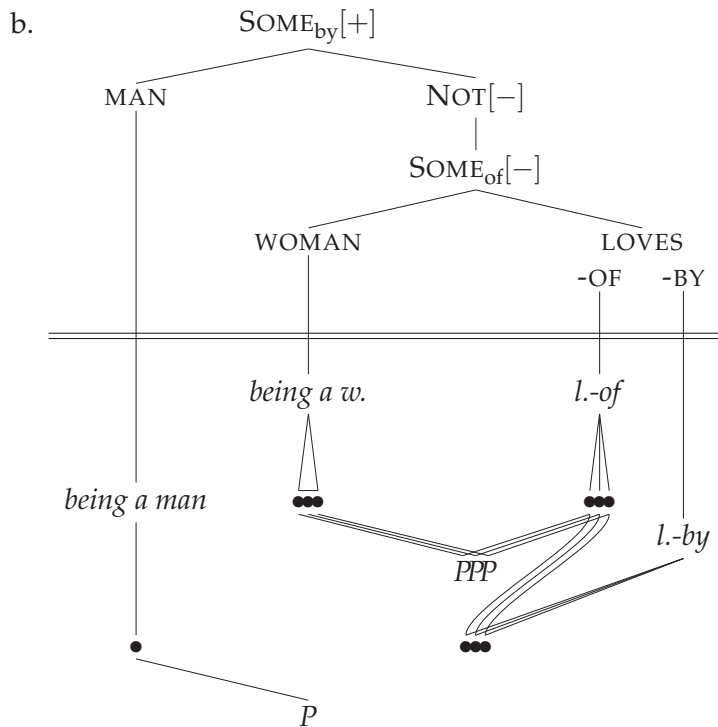
Because it is immediately dominated by NOT[$-$], SOME$_{\text{of}}$ is negatively scoped in this context. Accordingly, conditions b) and c) apply. Since a witness of SOME in negative scope is defined to be the same as a witness of NO in negative scope, the remainder of the analysis is just as described for (92).

In the next two examples, EVERY takes scope over an instance of negation. These are given in (94) and (95), respectively.

(94) a. 'Every man loves no woman.' ($\forall x[man'(x) \rightarrow \neg\exists y[woman'(y) \land love'(x,y)]]$)

b.

$\text{EVERY}_{\text{by}}[+]$

MAN $\text{NO}_{\text{of}}[-]$

WOMAN LOVES

-OF -BY

being a w. *l.-of*

●●● ●●●

being a m. *l.-by*

PPP

●●● ●●●

PPP

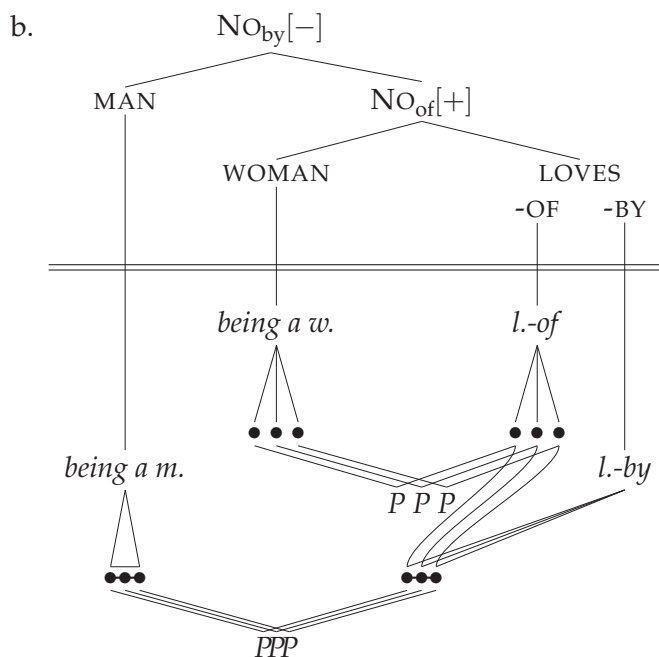(95) a. 'Every man doesn't love a woman.' ($\forall x[man'(x) \rightarrow \neg\exists y[woman'(y) \land love'(x,y)]]$)

b.

$\text{EVERY}_{\text{by}}[+]$

MAN $\text{NOT}[-]$

$\text{SOME}_{\text{of}}[-]$

WOMAN LOVES

-OF -BY

being a w. *l.-of*

●●● ●●●

being a m. *l.-by*

PPP

●●● ●●●

PPP
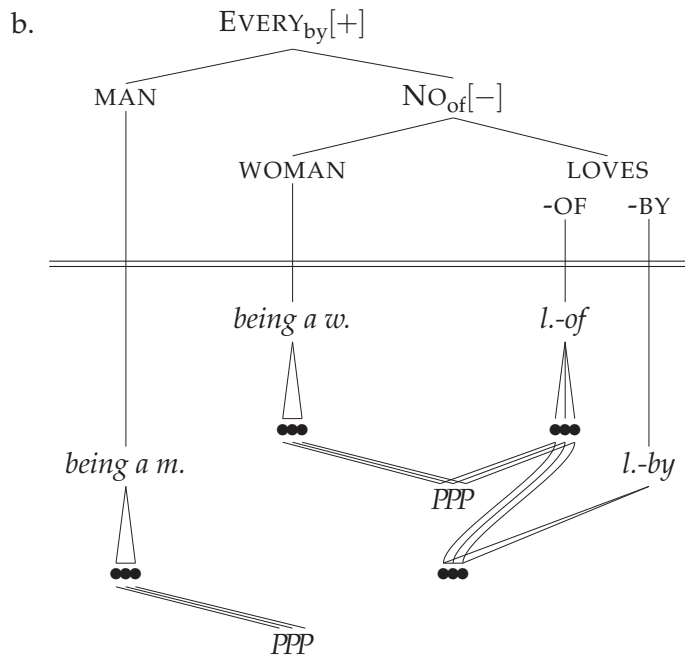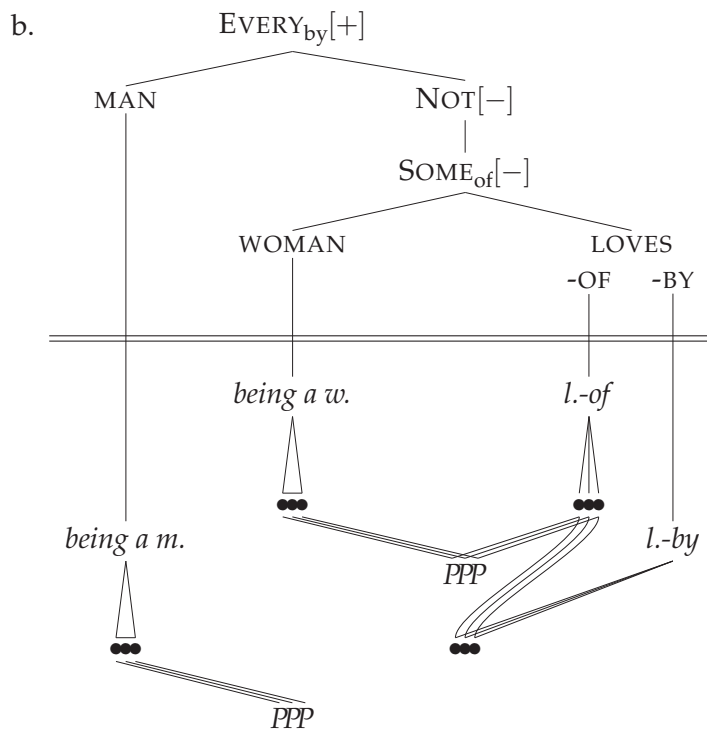
The analysis of the first expression is very similar to that of (92). In both cases, the dissatis-fier of NO_{of} consists of a single subdissatisfier that conecessitates a collection consisting of

aspects shared by each of the totality of women and *loving-of*. The expression is true just in case each subwitness of the totality of men is p-distinct from the same subdissatisfier.

The expression in (95) should be compared with that in (93). It is true just in case each subwitness of the totality of men is p-distinct from the same subdissatisfier, which conecessitates a collection consisting of aspects shared by each of the totality of women and *loving-of*.

In the final two examples, NO takes scope over another instance of negation. The first of these may be usefully compared with the example of 'No man loves every woman' in (91), above. The NO$_{of}$ structure and the conditions under which it has a satisfier are just the same as for EVERY$_{of}$ in the earlier example.

(96) a. 'No man loves no woman.' ($\forall x[man'(x) \rightarrow \exists y[woman'(y) \land love'(x,y)]]$)

b.

The crucial difference is that, in the present example, the main bridge has a positively scoped Predicate term, and therefore requires a *satisfier* rather than a dissatisfier. This satisfier consists of a distinct subsatisfier for each subwitness of the totality of men, and each of which conecessitates a satisfier of NO$_{of}$. Accordingly, the sentence has the same truth conditions as 'Every man loves a woman'.

The sentence in (97) has just the same truth conditions as described for (96), provided that the object is interpreted with narrow scope.

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(97) a. 'No man doesn't love a woman.' ($\forall x[man'(x) \rightarrow \exists y[woman'(y) \wedge love'(x,y)]]$)

b.

NO$_{by}$[−]

MAN   NOT[+]

SOME$_{of}$[+]

WOMAN   LOVES

-OF   -BY

being a w.   *l.-of*

● ● ●   ● ● ●

being a m.   *l.-by*

P P P

● ● ●   ● ● ●

PPP
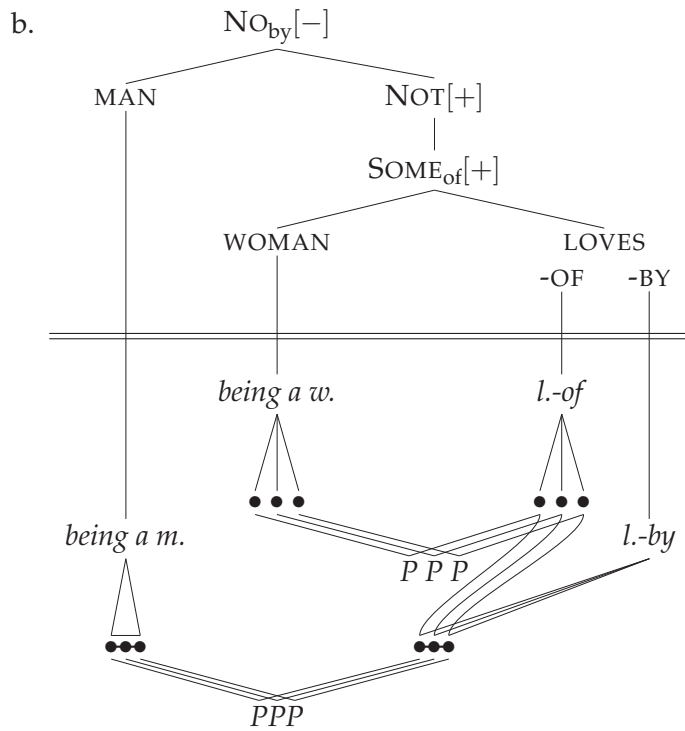
In this expression, the main bridge NO$_{by}$ dominates NOT and the existentially quantifying bridge SOME$_{of}$. Since it has a positively scoped Predicate term, it requires a satisfier rather than a dissatisfier. As in the previous example, a satisfier of NO$_{by}$ consists of a distinct subsatisfier for each subwitness of the totality of men, and each subsatisfier must conecessitate a satisfier of NOT (which is defined as a satisfier of its Predicate term SOME$_{of}$).

Chapter 7

Concluding Remarks

7.1 Summary

The purpose of this thesis was to propose a truth-conditional semantic theory for natural language that meets the requirements of semantic naturalism.

I began by arguing in Chapter 1 that existing linguistic approaches to natural language (NL) semantics fail to meet the joint requirements of naturalism and correspondence truth, and that there is no clear way of modifying them in line with those requirements. The truth-conditional approach of model-theoretic semantics fails the criterion of naturalism in its approach to quantification.

The pure-psychology approaches of lexical and cognitive semantics fail the criterion of correspondence truth. Such approaches typically regard correspondence as a non-semantic or otherwise inconsequential notion. Even if we consider it a component of semantic theory to describe truth conditions in terms of a correspondence between language and internally represented situations, this fails the criterion of correspondence truth, which requires a correspondence between language and (typically) external states of affairs.

I claimed that a new theory was needed. This raised a number of important questions relating to ontology, the theory of reference, and the theory of truth.

Chapter 2 was dedicated to identifying a suitable metaphysic to run alongside the natu-

ralistic, correspondence-based semantic theory. I began by examining a number of considerations against class nominalism and other forms of nominalism. Besides its incompatibilities with naturalism, I noted several other significant problems with class nominalism. Firstly, as argued by both Armstrong and Rodriguez-Pereyra, class nominalism reverses the natural order of explanation for the possession of a property. Secondly, class nominalism cannot explain the naturalness of certain classes; it must stipulate that certain classes are *irreducibly* natural. I claimed that the best solution is to reject class nominalism and, due to both its naturalistic foundations and its intuitive explanation of resemblance in terms of strict identity, to opt for a version of Armstrong's "immanent realism".

The second part of the chapter was dedicated to Baxter's theory of instantiation. This represents a crucial part of the thesis, since the plausibility of Armstrong's realism—particularly as an alternative to resemblance nominalism—depends on whether there is a satisfactory account of how particulars and universals "come together" into states of affairs. Adopting the position that Baxter's counts are "dimensions" of strict identity (and therefore different ways of being strictly identical), and that there are dimensions corresponding to particulars (p-identity) and universals (u-identity), I analysed Baxter's cross-count identity (instantiation) as the p-identity of a particular with an aspect that is u-identical with a universal. I also gave a detailed ontology of relations following on from Baxter's theory that relations consist in the instantiation of distinct conecessitating aspects, and developed a theory according to which relational properties are strictly identical, in a third dimension, with the relation-parts to which they belong.

In Chapter 3, I reviewed some philosophical and linguistic theories of reference and word meaning. It was noted that description theories of reference are at best incomplete, and at worst hopelessly cut loose from the world. I reviewed Kripke's historical theory of reference in some detail, along with related externalist considerations.

The need for a naturalistic theory of truth led me to review Dretske's and Millikan's respective theories of content. These theories, whilst instructive, provided no clear understanding of the truth-conditional semantics of particular NL sentences or mentally represented expressions. I argued that Millikan's theory has a variety of problems in this respect, including its dependence on contraries, its top-down approach, its vaguely specified ontology, and its non-naturalistic mapping functions. I consequently rejected Millikan's theory, and proposed a theory that incorporates Millikan's notion of a proper

function in a novel way. I suggested that a clearly naturalistic notion of the property of *being true* (and *being false*) may be understood by attributing proper functions to non-denotational "bridges", and referential relations for denotational terms according to a modified version of Dretske's theory. This provides the crucial step from naturalistic reference to naturalistic truth. It makes key use of Baxter's theory of instantiation to give a satisfying solution to Millikan's Theaetetus problem, and provides a clearly articulated, bottom-up approach to truth-conditional semantics.

The details of the semantic theory were proposed throughout Chapters 5 and 6. There I gave a general definition of the proper function of bridges in terms of the notions of witness, subwitness, satisfier, and dissatisfier. In these terms, I gave an account of a wide range of linguistic examples involving predication, negation, quantification, conjunction, disjunction, and relations.

7.2 Topics for further research

In this section I make some suggestions for further development of the theory. I consider a number of semantic phenomena that were not covered within the main part of the thesis, and explore the potential for an account of those phenomena within the framework.

7.2.1 Three-place relations

The account of two-place, or dyadic, relations may be extended quite naturally and simply to three place relations and beyond. Following Baxter, I analysed the dyadic relation of *loving* as consisting of two relation-parts, *loving-by* and *loving-of*. Similarly, a triadic relation such as *introducing* may be analysed as consisting of three relation-parts. These are *introducing-by*, *introducing-of*, and *introducing-to*. For there to be an *introducing* state of affairs, a different particular must instantiate each of the three relation-parts in a different aspect. As for a dyadic relation, these aspects must co-necessitate one another. This is illustrated in (98), where the curved lines represent co-necessitation.

(98)

John   Mary   Sam

introducing-by

introducing-of
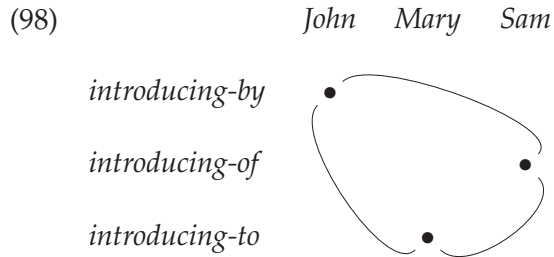
introducing-to

The three relation-parts of *introducing* are represented as the rows of the diagram, and the three distinct particulars John, Mary, and Sam are represented as the columns. Where a particular instantiates a relation-part there is a shared aspect. John's *introducing-by* conecessitates both Mary's *introducing-to* and Sam's *introducing-of*, which must also conecessitate one another. This is the basis for the analysis of the sentence, as illustrated in (99).

(99) a. 'John introduced Sam to Mary.'

b.

PRED$_{by}$

JOHN   PRED$_{of}$

SAM   PRED$_{to}$

MARY   INTRODUCED

-TO   -OF   -BY

Mary   *i.-to*

i.-of

Sam   *i.-by*

John
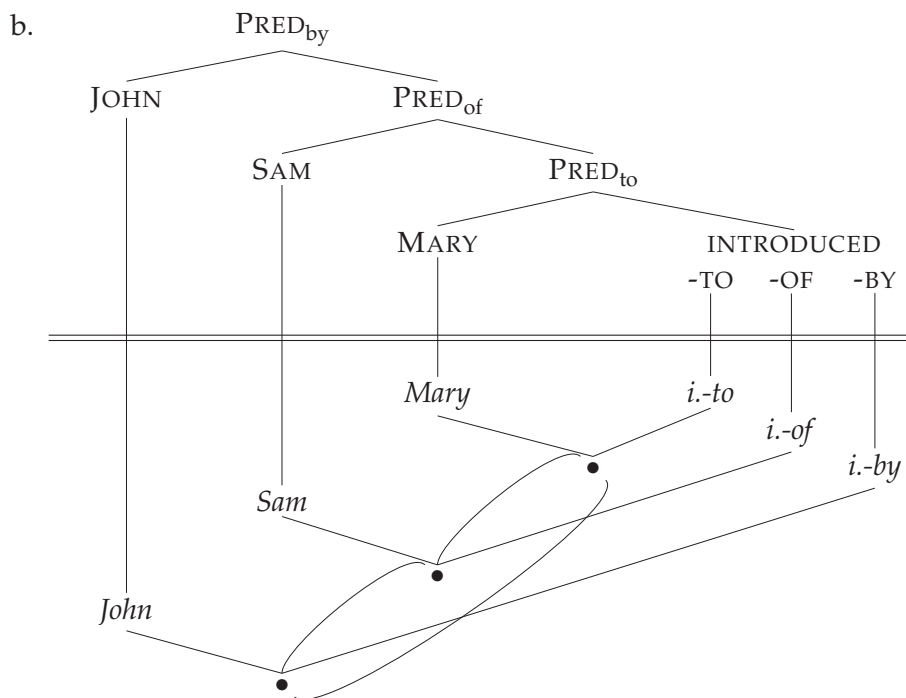
The interpretation of this structure is *not* covered by the final version of the proper function of a witnessed bridge, proposed in (70) on page 115. There is no mechanism there to ensure that all three satisfiers conecessitate. An important topic for future work, therefore, is how the definition should be extended to account for triadic relations in such a

way that all predictions concerning negation, etc., are correct.

7.2.2 Numerals in the scope of negation

Consider the following example, which involves a numeral in the scope of negation.

(100) 'It's not the case that three men are sleeping.'

This sentence is true iff either a) fewer than three (zero, exactly one, or exactly two) men are sleeping, or b) more than three men are sleeping. If no men are sleeping, then every man is not sleeping. If exactly one man is sleeping, then a man is sleeping, and every other man is not sleeping. If exactly two men are sleeping, two distinct men are sleeping, and every other man is not sleeping.

Suppose that a numeral in the scope of negation may have a two-part witness. The first part of that witness is just the witness of the numeral qua some type lower than its actual highest type (e.g., TWO).[1] The second part of that witness is the totality of things cross-count unit identical with the numeral's argument term, *less* the witness of the numeral as though positively scoped. There must be a satisfier for which the first part serves as witness, and a non-satisfier for which the second part serves as witness. This might be illustrated in something like the following way, in which exactly two men are represented as sleeping.[2]

(101) a. 'It's not the case that three men are sleeping.' (*Fewer than three* reading)
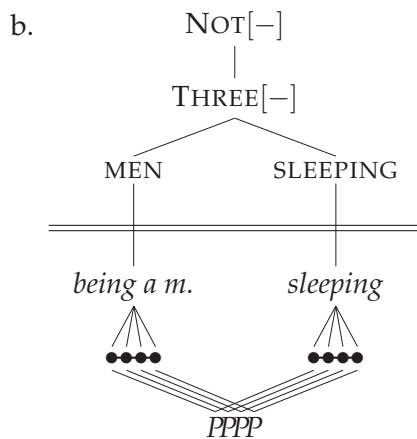
---

[1]If that type is ZERO, then the witness has only the second of the two parts, and the expression is equivalent to 'No man is sleeping'.

[2]This suggests very similar analyses for the sentences 'Exactly two men are sleeping,' and 'Only two men are sleeping'.

b.
```
            NOT[−]
              |
           THREE[−]
           /        \
        MEN        SLEEPING
         |            |
     being a m.    sleeping
        /\            /\
      •• •••        •••••
         PP PPP
```
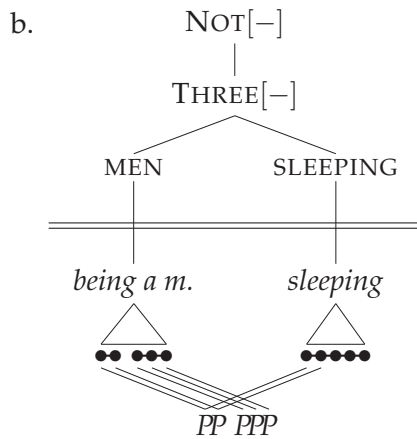
Alternatively, a numeral in the scope of negation may have a single part witness qua any type greater than its actual highest type (e.g., FOUR). This reading is given as follows.

(102) a. 'It's not the case that three men are sleeping.' (*More than three* reading)

b.
```
            NOT[−]
              |
           THREE[−]
           /        \
        MEN        SLEEPING
         |            |
     being a m.    sleeping
        /|\          /|\
      ••••         ••••
          PPPP
```

It should be noted that the above approach to numerals in the scope of negation is *ad hoc*, and therefore significantly increases the overall complexity of the theory of the proper function of a witnessed bridge.

7.2.3   Objects outside the scope of negation

There is an important class of readings that have yet to be accounted for. These are readings under which not just the subject but also the object is outside the scope of negation.

In this thesis I treat the scope of negation structurally. When a negative bridge is higher in the tree than a quantifying bridge (provided that another negative feature does not intervene), its negative polarity feature feeds down to the quantifier and its Predicate

term, thereby determining whether the bridge ought to have a satisfier or a dissatisfier, and potentially affecting the kind of witness it has.

To keep in line with this treatment, it would seem that when both arguments are outside of the scope of NOT, this ought to appear lower in the tree than either of them. The alternative would be to introduce some artificial means by which the quantifier in the scope of negation takes whatever witness it normally has *outside* of the scope of negation. I dismiss that approach as not only *ad hoc*, but also against the spirit of the structural treatment of negation. The following illustrates a version of the former approach.

(103) a. 'A man doesn't love a woman.' ($\exists x \exists y [man'(x) \wedge woman'(y) \wedge love'(x,y)]$)

b.
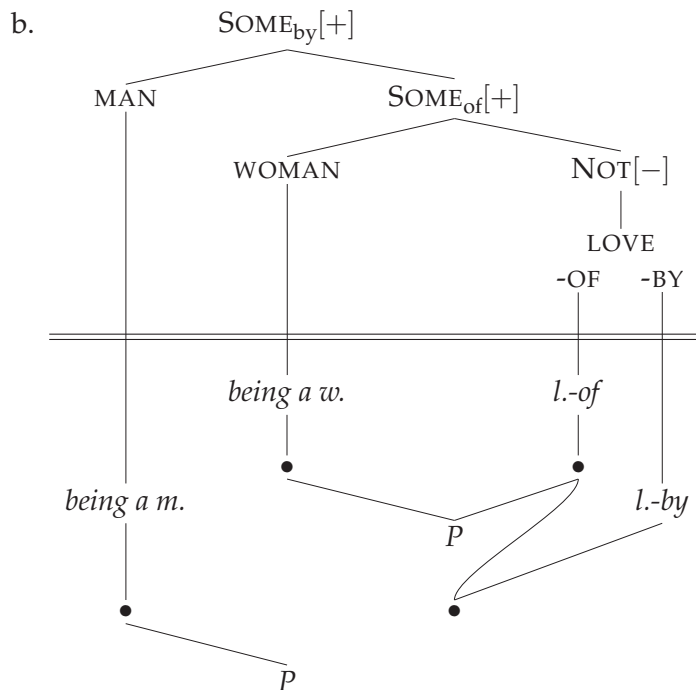
The problem with this analysis is that it cannot be captured by the final version of the proper function of a witnessed bridge, as given in (70). That version requires SOME_{by} to have a negatively scoped Predicate term if it is to be true in virtue of having a *dis*satisfier. The negative polarity feature of NOT is introduced too deeply within the structure for it to have the required effect. The theory of the proper function of a witnessed bridge must be adapted, therefore, to be sensitive to negative polarity on either the Predicate term itself, or on a more deeply embedded Predicate term. This is reminiscent of the definitions of a subsatisfier and a subdissatisfier, which make reference to "a right-dominated bridge".

7.2.4 Collective readings

Link (1983) presents a comprehensive theory of the interpretation of plurals that depends heavily on a mereological, lattice-theoretic ontology. Rather than treating plural entities as sets of singular entities in the traditional way, he treats them as basic individuals according to the mereological principle of unrestricted composition, that wherever there are several things there is their fusion.

The present theory takes advantage of the same mereological principle within a realist ontology. Unlike Link's, however, my account so far extends only to the distributive readings of plurals, thereby failing to treat the alternative collective readings. Subjects and objects may be independently interpreted as either collective or distributive so that, in addition to the distributive-distributive readings supplied in [6.3.2], collective-collective, collective-distributive, and distributive-collective readings may be given. Despite this omission, I think there is reason to think that my account can be extended to cover the collective readings. To understand the notion of a collective reading, we can consider the following example.

(104) 'Three women lifted a table.'

The relevant ambiguity here is in whether three women each lifted a table (perhaps the same table at different times), or three women lifted a single table between them. The property of *lifting a table* is assumed to be the same, in either case. The difference is in whether that property is instantiated three times, or just once by a fusion of three women.

Whenever a non-atomic particular instantiates a universal, it may be a case of plural cross-count identity (introduced in [5.7.2]), or it may be a case of *collective* cross-count identity. Collective cross-count identity, at the *metaphysical* level, is just like cross-count unit identity. The whole of the particular consisting of the three individual women shares just a single aspect with *lifting-by*.

It seems necessary to accept this idea, in any case, for non-semantic reasons. Consider, for example, a car's instantiating the universal of *being a car*. In the mereological sort of framework that I am assuming, cars are not atomic particulars. Cars have various parts such as wheels, engines, exhausts, etc., each of which are particulars in their own right. Every car is a fusion of such particulars. Therefore, if a car can share an aspect with *being*

a car, it must be that complex particulars can instantiate universals in their own right. The case is analogous to the one in which three women lift a single table together, even though one doesn't usually think of three women as one particular.

The analysis of the collective reading of (104) may require just a small amendment to the theory. A witness of THREE is the same under either reading: an arbitrary collection of three women. To force the collective reading, we could define any subwitness of a witness *under that reading* as just the witness itself. In this way, the theory vacuously distributes over an effectively singular witness, thereby giving a collective reading.

7.2.5 Anaphora

Anaphora is an important phenomenon that any semantic theory ought to give an account of. Here I make some suggestions toward an analysis of a pronoun such as 'he'. Below I define the referent of such a pronoun.[3]

> DENOTATION OF A PRONOMINAL HE$_x$:
> The referent of HE$_x$ is identical with a (masculine gender) witness that some x-binding bridge in the expression has, partly in virtue of which the expression operates Normally.

The definition may be put to use in the analysis of the following expression, in which the pronoun 'he', represented by HE$_x$, is associated with the same variable x that is bound by the bridge SOME$_{of}$. Accordingly, 'he' shares its reference with a man that Mary loves, which is to say whatever we take a witness of SOME$_{of}$:x to be.

(105) a. 'Mary loves a man and he is happy.'

---

[3]A more adequate account might allow 'he' to refer to an arbitrary man loved by Mary even when the expression as a whole was false (because no such man is happy). In this case, it seems that the bridge that ought to be operating Normally partly in virtue of the relevant witness is not AND but PRED$_{by}$. The boundary seems to be (roughly) a clausal one. A further matter for investigation, therefore, is how to define such a boundary within the theory. Such boundaries should presumably be defined if only for the sake of binding theory.

b.

AND

PRED$_{by}$ PRED

MARY   SOME$_{of}$:x HE$_x$ HAPPY

WOMAN   LOVES

-OF -BY

being a m.   *l.-of* $\star P$ *being h.*

Mary $\star P$ *l.-by*
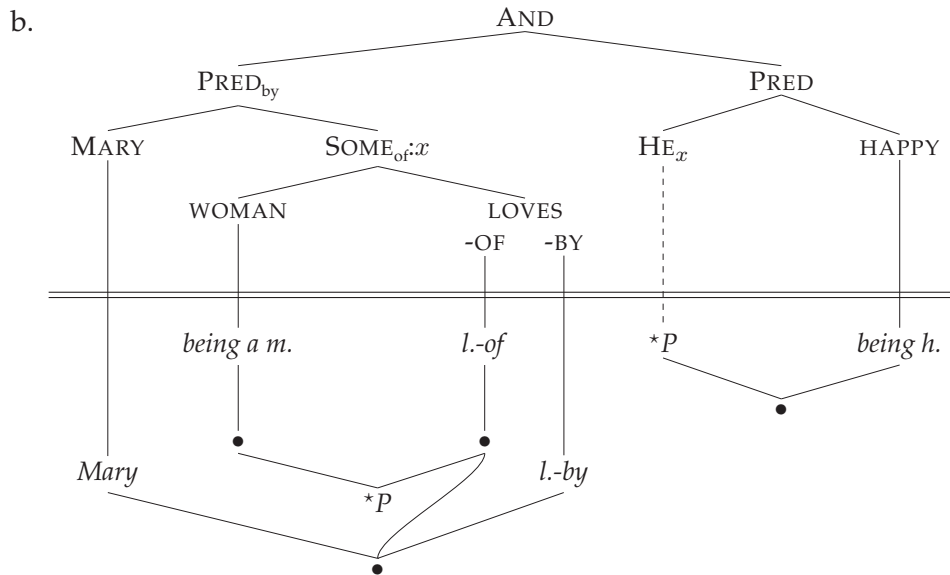
7.2.6 Relative clauses

Below is an example of a non-restrictive relative clause.

(106) a. 'John, who doesn't smoke, runs.'

b.

AND

PRED:x PRED

JOHN   RUNS   N-WHO$_x$ NOT

SMOKE

$\star$*John*   *running* $\star P$ *smoking*
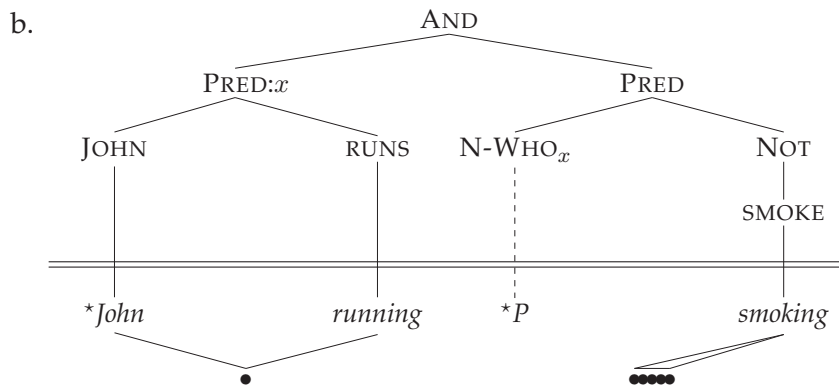
The denotation of non-restrictive N-WHO is defined similarly to that of a regular pronoun. N-WHO's denotation is defined to be identical with a witness of an x-binding bridge. The presence of the non-restrictive relative, as for an ordinary pronoun, has no bearing whatever on what the witness may be, even if the witness is of a quantifying bridge such as SOME. This is what distinguishes a non-restrictive relative from a restrictive one, an example of which is given below.

(107) a. 'A man John knows is vegan.'

b.
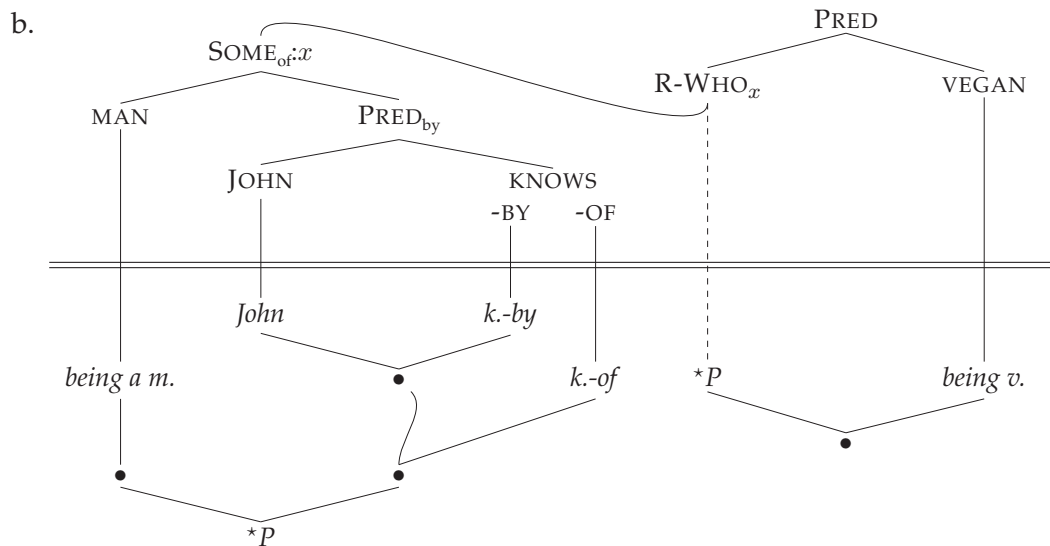
The analysis involves a main structure on the right-hand side with a linked structure on the left-hand side. Structurally, the analysis is somewhat inspired by the *LINK* structures of Dynamic Syntax (Kempson *et al.*, 2001: 109–20), although their means of interpretation is, of course, very different.

The idea is that the determiner phrase 'a man' is interpreted along with its relative clause in the separate linked structure. This determines a suitable witness of SOME$_{of}$, which is an arbitrary man that John knows. The denotation of restrictive R-WHO is defined to be identical with any witness that SOME$_{of}$ has, since it binds the variable x. The expression is true, therefore, if a witness of SOME$_{of}$ has the property of *being vegan*. Unlike the previous example, a witness for the phrase 'a man' is determined with respect to the modifying relative.

This sort of analysis extends quite simply to a relative clause embedded (in this case, centre-embedded) within another relative clause. The interpretation of R-WHO in the main clause is dependent on the interpretation of the first linked clause. The interpretation of R-WHO in the first linked clause is dependent, in turn, on the interpretation of a second linked clause.

(108) a. 'A man who a woman John likes knows is vegan.'

b.

$\text{SOME}_{\text{of}}{:}x$

PRED

MAN PRED_{by}

R-WHO_x VEGAN

R-WHO_y KNOWS

-BY -OF

$^{\star\star}P$ *k.-by*

k.-of $^{\star}P$ *being v.*

being a m.

$^{\star}P$

$\text{SOME}_{\text{of}}{:}y$

WOMAN PRED_{by}

JOHN LIKES

-BY -OF

John *l.-by*

being a w. *l.-of*

$^{\star\star}P$
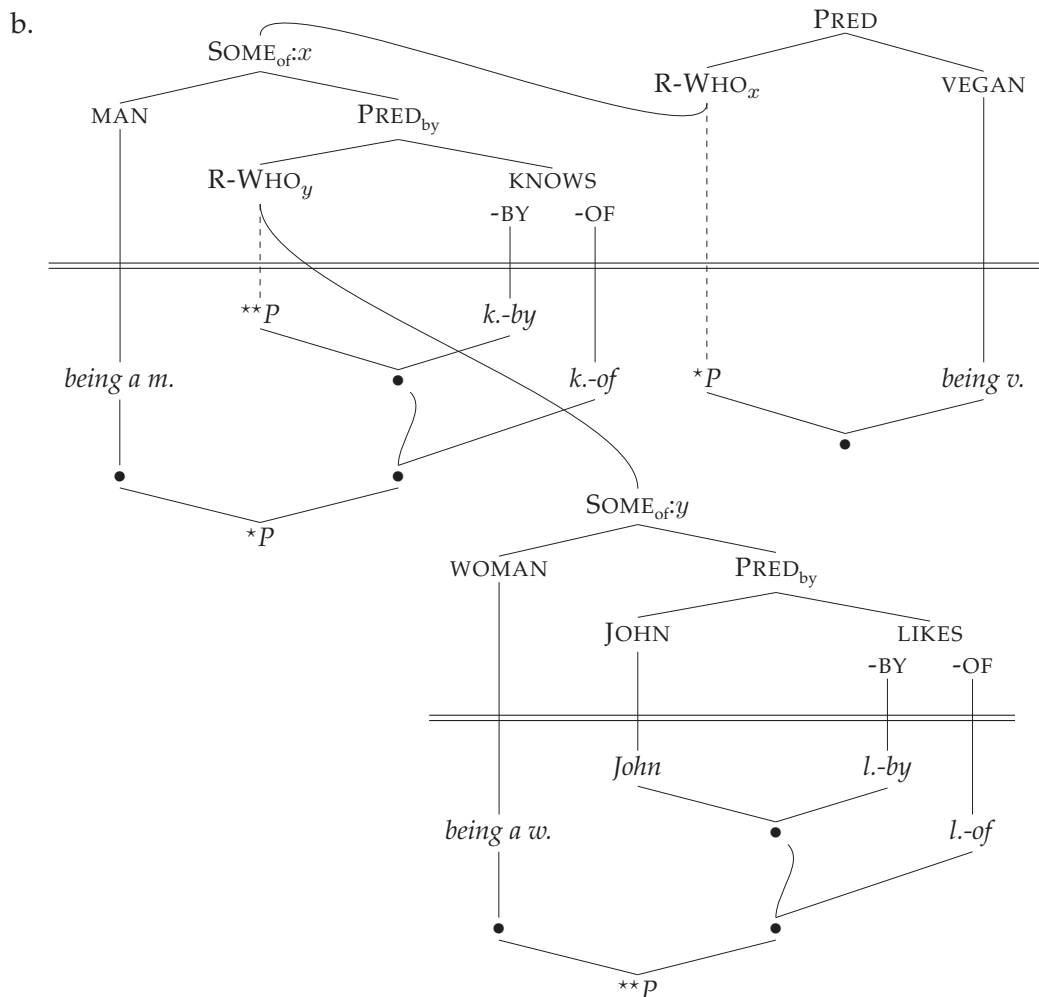
7.2.7 Attitude ascriptions and 'that'-clauses

Attitude ascriptions present a further case of embedding that the theory ought to be able to handle. Here I present only the most cursory of treatments of a simple 'that'-clause attitude ascription, as exemplified by the following sentence.

(109) a. 'Mary thinks that John is sad.'

b.
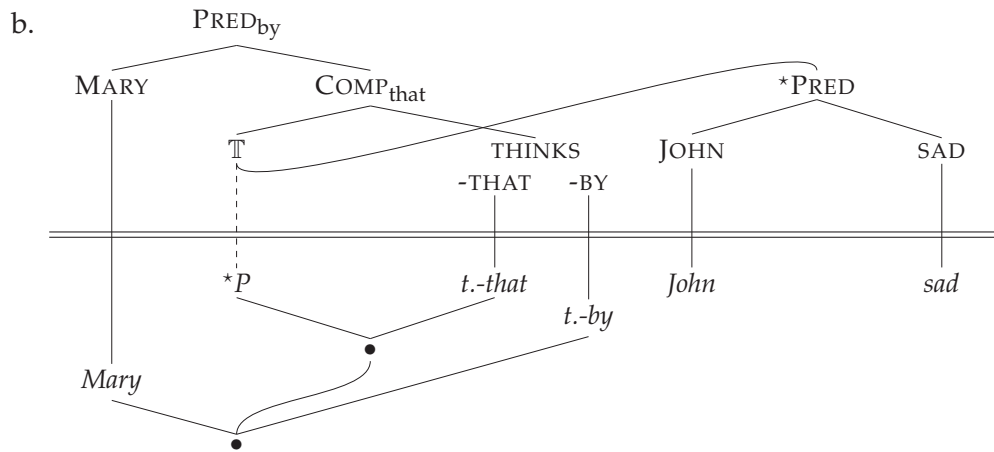
The diagram in (109) involves another kind of linked structure. The left-hand structure is the main one, and therefore the one whose main bridge must operate Normally for the expression to be true. This structure is true provided that Mary instantiates *thinking-by* in an aspect that conecessitates a further aspect in which some entity $\star P$ (more on which presently) instantiates *thinking-that*. The inner substructure is dominated by a new kind of bridge, which I call COMP. COMP is interpreted similarly to PRED, with the crucial difference that its Argument term $\mathbb{T}$ must be linked to a further expression—here, the right-hand structure [PRED JOHN SAD]. In virtue of being linked to that structure, $\mathbb{T}$ is considered to denote the entity $\star P$ which, when the expression is true, instantiates *thinking-that*. $\star P$ is identical with a token of the linked structure, which must be represented in some way by the bearer of the attitude (in this case, Mary). That is to say that for 'Mary thinks that John is sad' to be true, Mary must represent the thought [PRED JOHN SAD] in one way or another. There may be significant differences between the linked structure and $\star P$, so that both opaque and transparent readings are possible. For example, if 'Mary thinks a man is sad' is true, it may be in virtue of standing in the appropriate attitude to either an instance of [SOME MAN SAD] or an instance of [PRED JOHN SAD].

7.2.8 Tense

I have avoided the issue of tense in this thesis, and hence interpreted past tense example sentences as though they were present tense. Nevertheless, in [2.3.5], I proposed that time be treated as yet another dimension of identity following proposals from Baxter. Assuming that this represents a reasonable approach to the metaphysics of time, it ought to be possible to describe the temporal aspects of sentences within the present truth-

conditional framework.

Present tense sentences may be assumed to be covertly indexical, so that the state of affairs described is said to hold *now*, at the time of utterance. For example, the sentence 'John is running' may be said to express that *John is running now*. This can be handled straightforwardly if we assume that the covert *now* denotes the approximate time (in the technical sense) of utterance. For the sentence to be true, it must be that the aspect shared by John and *running* is also shared by that time.

Past and future tense sentences must also make covert reference to an indexical present. In these cases, however, there is more involved than identity with a particular moment. The past, for example, may be treated as an extended time with which all past events are (partially) t-identical, but one that occurs *before* whatever counts as the present moment. Such notions of *before* and *after* make essential reference to a linear ordering on times. Since I have no theory of what this linear ordering might consist in, a more developed account depends on further research.

7.2.9 Adjuncts

My semantic theory provides an account of determiner phrase complements to verbs. I have proposed possible extensions to the theory in this chapter that might also account for preposition phrase complements (see [7.2.1]) and clausal complements to verbs. I have not, however, presented a theory of adjuncts. The following discussion is limited to PP adjuncts specifying either temporal or spatial relations.

Adjuncts involving time, such as 'on Tuesday', may be dealt with along the lines suggested above for tense. Since we have the outline of a metaphysical account of time, there is potential for a corresponding semantic theory. The word 'on', in the context of 'on Tuesday', bears the meaning of *t-identical with*. For times of the day (e.g. '5 o'clock'), 'at' has the same function. Other time-relevant prepositions such as 'before' and 'after' require a kind of linear ordering on times, as discussed for tense above.

Spatial relations, which were not discussed above, present an important topic in their own right. Taking just a naive, Newtonian view of space, what seems to be required is three dimensions of linear orderings on points in space. Points in space might be iden-

tified with particulars, but this seems implausible. Rather, particulars seem to be things that *occupy* points in space.[4] One possibility presents itself along the lines of the treatment of time discussed in [2.3.5] and above. Points in space, like moments in time, may be another basic sort of entity. If so, we can analyse the notion of occupying a point in space as strict identity of a new sort (spatial-, or s-identity).

What remains to be accounted for, as with time, is the linear orderings on points in space. I have little to say about these orderings—only that they could not plausibly be treated as universals (e.g., external relations holding between adjacent points in space or moments in time).

7.2.10 Syntax

A notable feature of the semantic structures in this theory is that they enforce no syntactic constraints, which is to say constraints over the organisation of words into complex expressions. The representations used are purely semantic, and therefore the terminal nodes of the tree structures are not required to correspond one-to-one with NL words. Therefore, the semantic structures may have a quite indirect relation to the structure of NL expressions.

I assume that the semantic structures I propose are universal and therefore essentially language-independent. The syntactic theory may therefore generate identical semantic tree structures for very different expressions from different NLs. It is beyond the scope of this thesis to provide a syntactic theory to account for the structures used in Chapters 5 and 6, but something may be said about its general architecture.

Following the lead of Dynamic Syntax, I assume that the structure of NL expressions is exhausted by their linear word order. NL expressions, by which I mean the external objects consisting in vocally-produced sounds, inscriptions, hand signals, etc., have no hierarchical structure of their own. There is therefore no sense in which NL words are organised, at any level of abstraction, into hierarchical tree structures. Since there is little agreement on what the non-linear structural features of NL expressions are,[5] a theory

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[4]Although not the *only* things, since a universal is everywhere that it is instantiated.

[5]For example, in the sentence 'John loves Mary', there may or may not be a constituent 'John loves'. Tests that aim to reveal constituency structure are notoriously contentious.

that dissolves this issue seems attractive.

The semantic structures that I propose bear little relation to those of Cann *et al.* (2005), except that they consist in binary branching tree structures that bear semantic values at their terminal nodes. A key difference is that, according to Dynamic Syntax, the value at the top node of a tree is "computed" from the values of its daughter nodes by a process of lambda reduction. The matter of interpretation of the values, which are predicate logic formulae, receives little attention from the authors, since a standard model-theoretic interpretation is always available.[6]

Of course, the matter of interpretation of the semantic structures is central to the present theory, but no psychological "process" of interpretation is involved. For example, there is no need to compute any kind of logical formula from the values throughout the tree (even though the trees themselves must be constructed according to syntactic principles). Rather, the entire tree is analogous to a formula, and its truth conditions are determined by the principles laid out in Chapters 5 and 6.

Dynamic Syntax is a parsing-based theory that takes the processing of language as central to understanding linguistic structure. To construct the correct trees, Dynamic Syntax treats words as the external triggers of internal processes of tree construction. Words are associated with lexical entries that contain a combination of instructions to build structure and semantic values that attach at certain points in the structure. Since the theory places considerable burden on the content of its lexical entries, it is correspondingly flexible and may be adapted for the kinds of semantic values employed in this theory's semantic structures.

7.3   Final remarks

For anyone convinced of the merits of naturalistic approaches to reference and mental content, this thesis contributes a concrete linguistic application of those philosophical ideas. I have argued that the step from existing theories of reference and content to a truth-conditional semantics for natural language is not trivial, yet attainable under plau-

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[6]The authors use the term 'interpretation' rather a lot, but only in reference to the construction of these predicate logic formulae according to the principles of the syntactic theory—not in reference to interpretation, in the truth-conditional sense, of the completed formulae.

sible assumptions. I have demonstrated that immanent realism offers a viable foundation for a naturalistic semantic theory, and that nominalisms of various sorts are less well suited to the task.

A dominant trend in linguistics is to treat the truth-conditions described by model-theoretic semantics as something a competent language-user must possess propositional knowledge of, without giving sufficient consideration to the nature of the correspondence itself—in particular, to the plausibility of its consisting in natural relations. I have shown that there is an alternative for anyone concerned with providing rigorous analyses of natural language semantic phenomena.

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Appendix A

List of definitions

What follows is a list of *final* definitions from the thesis. Example numbers and page references are given for all versions of each definition. The final (or sole) example number and page reference for each definition is always to the final version (as it occurs in the main text).

> An expression is true iff its main bridge is operating Normally.

> AND operates Normally iff it dominates two bridges such that both of them operate Normally.

> OR operates Normally iff it dominates two bridges such that at least one (/exactly one) of them operates Normally.

> A is ϕ/ψ cross-count unit identical with B iff there is an *atomic Z* such that A is ϕ-identical with Z and B is ψ-identical with Z.

> A is plurally ϕ/ψ cross-count identical with B iff A is a collection of parts each of which is ϕ/ψ cross-count unit identical with B.

A is fully ϕ/ψ cross-count identical with B iff A is plurally ϕ/ψ cross-count identical with B in Z, and Z is the totality of B.

A witness of PRED is a particular that is denoted by its Argument term.

A witness of SOME when negatively scoped, NO when negatively scoped, and EVERY when positively scoped is a particular that is fully p/u cross-count identical with its Argument term.

A witness of SOME when positively scoped, NO when positively scoped, and EVERY when negatively scoped is a particular that is p/u cross-count unit identical with its Argument term.

A witness of a numeral bridge B qua type ONE when positively scoped is a particular p/u cross-count unit identical with B's Argument term.

A witness P of a numeral bridge B qua type $N >$ ONE when positively scoped is a fusion of Q and P', such that Q is p/u cross-count unit identical with B's Argument term, P' is a witness of B qua type $N-1$, and Q and P' are distinct.

A subwitness of a witness W of PRED is W.

A subwitness of a witness W of a quantifying bridge B is a part of W that is p/u cross-count unit identical with the denotation of the Argument term of B.

A satisfier of a witnessed bridge B is a collection consisting of just a subsatisfier for each subwitness of a given witness of B.

A satisfier of a denotational term is its denotation.

A satisfier of NOT is a satisfier of its Predicate term.

A subsatisfier of $B[_\theta]$ is a collection of aspects each of which is p-identical with a given subwitness of a witness of $B[_\theta]$ qua its highest type, and u-[/r-] identical with [the θ-part of] the denotation of its Predicate term, or that of a right-dominated bridge.

A dissatisfier of a witnessed bridge B is a collection consisting of just a sub-dissatisfier for each subwitness of a given witness of B.

A subdissatisfier of $B[_\theta]$ is a collection of aspects each of which is p-distinct from a given subwitness of a witness of $B[_\theta]$ qua its highest type, and u-[/r-] identical with [the θ-part of] the denotation of its Predicate term, or that of a right-dominated bridge.

A witnessed bridge B operates Normally iff:
a) B has a satisfier, such that each of its subsatisfiers is u-identical with or conecessitates a satisfier of a positive scoped Predicate term, or
b) B has a dissatisfier, such that each of its subdissatisfiers is fully u-identical with or fully conecessitates a satisfier of a negatively scoped Predicate term, or
c) B has a negatively scoped Predicate term with no satisfier.

NOT operates Normally iff it immediately dominates a bridge that operates Normally.

Appendix B

List of linguistic examples analysed