Content and Composition – An Essay on tense, content and
semantic value

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CONTENTS

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semantic.

Introduction

A remarkable thing about natural language is that we can use it to share our beliefs and thoughts about the world with other speakers of our language. To be a competent speaker in a linguistic community is the closest one gets to being telepathic. You cannot literally read my mind, but I can tell you what's on my mind by using our common language. For instance, take a scenario where I believe that there's a storm approaching and want to share this information with you. Then I will simply assert the sentence

(1) A storm is approaching.

Since we speak the same language, you will be able to interpret the sentence, and assuming that you find me reliable you will come to form the belief that a storm is approaching, and take the relevant action given your situation. If you're at home you will close your windows, if you're at sea you will take in sail and seek a safe harbor. What has happened here is that, as a result of the successful communication between us, our beliefs about the state of the world have become slightly more similar. My belief has been transferred to you, as it were. That we have this ability is so natural to us that we take it for granted in our everyday life, and rarely stop to think about how it's possible. Nevertheless, it's a phenomenon that calls for explanation.

The notion of 'content' plays a central role in an explanation of instances of successful communication, like the scenario described above. First, the belief of the speaker is a mental state with a certain *content*. Second, the speech act that the speaker performs is an assertion with a certain *content*. Third, the sentence uttered is a linguistic expression which relative to the context of utterance has a certain *content* or meaning. Finally, the mental state of the hearer, belief or other, which is the result of interpreting the

sentence is a mental state with a certain *content*. In order to explain how linguistic communication is possible, we must account for the relationship between these four instances of content.

In particular we must relate the meaning of the sentence with the content of the speech act. The simplest possible relation would be identity; the meaning of a sentence is simply the belief expressed by an assertion of the sentence in a given context of utterance. However, a number of problem cases in the literature suggest that this cannot be the case. This dissertation will address some of these problem cases. I will begin the discussion by presenting the problem in detail.

CHAPTER 1

THE PROBLEM

1.1 SEMANTICS AND COMMUNICATION

A main task for a formal semantic theory for a natural language like English or Swedish is to assign meanings to the sentences of the language and show how these are derivable from the meanings of less complex expressions. A main task for an overall theory of linguistic communication is to explain how speakers are able to express their beliefs and share them with others. There is a straightforward way to connect these two tasks; if the meaning of a sentence relative to a context of utterance, which is assigned to it by the semantic theory, simply *is* the content of the belief expressed by an utterance of that sentence in that context, then formal semantics has a key role to play in an explanation of successful communication.

It is standardly held that in order for a formal semantic theory to play this explanatory role it must assign the right *kind* of meanings to sentences in the right *way*. This is in turn taken to mean that it must assign *propositions* as the semantic values of sentences in context, and that it must do it *compositionally*, that is, in accordance with the following constraint.

> COMPOSITIONALITY. The meaning of a complex expression is determined by the meanings of its parts and their syntactic mode of composition.

That the theory assigns propositions as the meanings of sentences is supposed to secure that the semantic values of sentences are of the same kind as the objects of belief and assertion, thus explaining how sentences express beliefs. That it is done compositionally is supposed to secure that the semantic values of sentences are derivable from the meanings of their parts and their mode of composition, thus explaining how speakers are able to understand sentences they encounter for the first time. That the theory assigns semantic values relative to contexts is a requirement since communication takes place in contexts and one and the same sentence type may express different beliefs on different occasions. Given these assumptions we can give a fairly simple explanation of communicative success in terms of compositionally determined semantic values: A speaker who wishes to communicate her belief that p in a context c expresses her belief by means of asserting a sentence whose semantic value relative to c is p. Furthermore, p is what is recovered when the utterance is successfully interpreted by a hearer, assuming that the hearer knows what the context of utterance is. Thus, if semantic theories assign propositions to the sentences of the

language it is very natural to think that a semantic theory for that language has an important explanatory role vis-á-vis communication, and consequently that facts about communicative success constrain natural language semantic theories in general. Conversely, if we take communication to be a central explanandum for a semantic theory, this gives us reasons to require that our semantic theories assign propositions to sentences of natural language. I will refer back to the explanatory model sketched here as *the simple picture*.

> THE SIMPLE PICTURE. Successful communication involves the transfer of a belief from a speaker to a hearer. The objects of belief are classical propositions. The speaker expresses her belief that p by uttering a sentence s whose assertoric content in the context of utterance c is p. The hearer computes the compositional semantic value of s relative to c and thereby comes to entertain p.

The simple picture of communication and semantics presupposes that the following, intuitively plausible, constraints on meaning are consistent.

> SAME BELIEF. Two sentences have the same meaning if asserting them in the same context of utterance conveys the same information, or expresses the same belief.

> SAME CONTRIBUTION. Two sentences have the same meaning only if they can be substituted for each other in larger expressions without changing the meaning of that expression.

As to the second constraint, it is entailed by the compositionality constraint. If the meaning of a sentence is determined by its parts and their mode of composition, then substituting an expression for a synonymous expression cannot affect the meaning of the sentence.

However, it seems that the two constraints cannot both be correct. Sentences have parts which by the compositionality assumption determine their meaning. If the simple picture is correct, then they also determine which belief an assertion of that sentence expresses. But sentences also occur as parts in larger sentences determining what these sentences express, and this is where the problem arises. Certain sentences that intuitively express the same belief as uttered in the same context make different com-

13

positional contributions in certain larger expressions. The following examples illustrate the kinds of simple sentences that give rise to this problem. Arguably the following four pairs of sentences have the same assertoric content, respectively.

(2) The sun is shining.

(3) The sun is shining now.

(4) The author of *Pride and Prejudice* wrote *Pride and Prejudice*.

(5) The actual author of *Pride and Prejudice* wrote *Pride and Prejudice*.

(6) Licorice is tasty.

(7) Licorice is tasty to me.

(8) It's raining.

(9) It's raining here.

However, they cannot be exchanged for each other in certain complex expressions. That is, (2) and (3), (4) and (5), (6) and (7), and (8) and (9), respectively, don't satisfy the SAME CONTRIBUTION-criterion on having the same meaning since they embed differently, for instance in the following constructions:

(10) It will always be the case that the sun is shining.

(11) It will always be the case that the sun is shining now.

(12) Necessarily, the author of *Pride and Prejudice* wrote *Pride and Prejudice*.

(13) Necessarily, the actual author of *Pride and Prejudice* wrote *Pride and Prejudice*.

(14) Salman insists that licorice is tasty.

(15) Salman insists that licorice is tasty to me.

(16) No matter where Anna goes, it's raining.

(17) No matter where Anna goes, it's raining here.

It's possible that (10) is false, while (11) is true. The same goes for the other three pairs. The upshot is that sentences that intuitively express

the same belief make different compositional contributions to certain sentences. Something has gone wrong.

Let's introduce some terminology. In communication we assert sentences in order to express beliefs. Call the content of our assertions *assertoric content*. Formal semantic theories assign meanings relative to contexts of utterance to the sentences of the language, in accordance with the principle of compositionality. Call the meanings so assigned *semantic values*. The question raised by the problem cases above is then how compositional semantic value is related to assertoric content As mentioned, the simple picture presupposes that the answer is that assertoric content and semantic values are the same thing, namely the proposition expressed by a sentence in a context of utterance.

> IDENTITY. The compositional semantic value of a sentence in
> a context is identical to the assertoric content of that sentence.

However, faced with cases like (2)-(17), where sentences that intuitively have the same assertoric content apparently have different semantic values, an increasingly popular view is that we should distinguish assertoric content from semantic values and simply drop the IDENTITY-requirement. The idea goes back to Michael Dummett (1973) and David Lewis (1980).

> In this case, however, we must distinguish, as we have seen,
> between knowing the meaning of a statement in the sense of
> grasping the content of an assertion of it, and in the sense of
> knowing the contribution it makes to determining the content
> of a complex statement in which it is a constituent: let us refer
> to the former as simply knowing the *content* of the statement,
> and the the latter as knowing its *ingredient sense*. (Dummett,
> 1973: 446)

In Dummett's case, *ingredient sense* corresponds to semantic values, and *content* to assertoric content.

> To go beyond syntax, a compositional grammar must associate with each expression an entity that I shall call its *semantic value*. [...] these play a twofold role. First, the semantic values of some expressions, the *sentences*, must enter somehow into determining whether truth-in-English would

15

be achieved if the expression were uttered in a given context. Second, the semantic value of any expression is to be determined by the semantic values of the (immediate) constituents from which it is built, together with the way it is built from them. [...] Semantic values may be anything, so long as their jobs get done. (Lewis, 1980: 83. Emphasis in the original).

By only requiring that the semantic values of sentences "enter somehow" into determining the truth-conditions of an utterance of that sentence, Lewis opens the door for looser relation between the two than identity, something which he explicitly argues for later in the same paper. Dummett's and Lewis's suggestion has recently been revived, and the need for the distinction has been defended by among others Jason Stanley, Dilip Ninan, Brian Rabern, and Seth Yalcin. (Cf. Stanley (1997, 2002), Ninan (2010), Rabern (2012a, 2012b) and Yalcin (2014).) They argue that the IDENTITY-requirement is unmotivated, and that once the distinction is made, cases like (2)-(17) no longer pose a problem. However, once the distinction is made, another challenge emerges. Arguably, compositional semantic values are not very interesting in their own right but mainly as a tool for explaining why sentences express the beliefs they do. If the relation between the semantic value of a sentence and its assertoric content is not identity, it must be such as to nevertheless allow for an explanation of how sentences express beliefs.

1.2 THE PLAN

In this dissertation I will assess the arguments for, and the consequences of, distinguishing compositional semantic value from assertoric content, as well as offer a constructive account of what the relation between the two could be - if not identity - in order to secure a prominent role for compositional semantics in an overall explanation of communication. I will approach the issue by looking closer at tense and temporal expressions.

The problems raised tense and temporal expressions are surprisingly many. As we will see, they invite us to consider the nature of content, the role of semantic theories in explanations of communication, and the workings of context sensitivity. So, although the discussions of this dissertation might

struck some readers as rather limited in scope, I hope that they will provide a precise background for reflections on more general philosophical questions concerning meaning and content.

The dissertation is divided into five main chapters, excluding the present one. In the following chapter, I present the principle of compositionality, focusing in particular on the different formal explications of the principle. The chapter also contains an assessment of the main arguments in favor of compositionality. I then go on to the main argument of the thesis, which stretches from the third chapter to the sixth.

My point of departure is David Kaplan's intensional treatment of tense and temporal expressions in his seminal essay 'Demonstratives'. (Kaplan, 1989) In Kaplan's semantic framework, the truth-value of a sentence depends on extra-linguistic context in two ways. Context-sensitive expressions, such as indexicals like "here" and "now" get their reference determined by the *context of utterance*. Given that reference assignment the sentence can be true or false at different *circumstances of evaluations*. Semantic clauses thus have the following general form, specifying the truth-conditions relative to both a context and a circumstance of evaluation.

(18) $[\![\phi]\!]_i^c = 1$ iff ϕ is true as uttered at the context c and evaluated at circumstance i

Usually it is the context of utterance - that is, the world, time and location of the speaker - that is the relevant circumstance of evaluation. However, certain operators require us to evaluate sentences at other worlds, times or locations. Let's take an example:

(19) Winter is coming

Now, embed this sentence under a modal operator, a location operator, and a temporal operator, respectively:

(20) It's possible that winter is coming.

(21) In the north, winter is coming.

(22) Winter is coming tomorrow.

Whether (20) is true depends on whether (19) is true in some other world than the actual, whether (21) is true depends on whether (19) is true in the

north, and whether (22) is true depends on whether (19) is true at some time in the near future. Because they shift the relevant circumstance of evaluation for the sentence they embed, these operators are known as *shifty* operators. There's an argument in Kaplan - which I discuss in some detail in chapter three - that shifty operators have some far-reaching consequences. The argument shows that the following three claims are jointly inconsistent:

> IDENTITY. The assertoric content of a sentence is identical to its compositional semantic value.

> WORLD ONLY. The content of assertion and belief only varies in truth-value across possible worlds.

> OPERATORS. English contains shifty sentential operators.

An analogous argument is given in Lewis (1980). That is, technical considerations on how to best treat, in this case, tense and temporal expressions lead to the conclusion that we must either reject IDENTITY, or accept that what we say varies in truth-value over time and not only over possible worlds. The latter would amount to rejecting *eternalism* in favor of *temporalism*.

> ETERNALISM. The contents of assertions and beliefs do not vary in truth-value across time.

The term *eternalism* comes from Richard (1981), who distinguishes it from *temporalism*.

> TEMPORALISM. The contents of assertions and beliefs may vary in truth-value across time.

In chapter three, I consider, and reject, arguments by Lewis and Mark Richard for the claim that we should give up IDENTITY. That is, I offer some support for Kaplan who is naturally interpreted as maintaining IDENTITY at the cost of WORLD ONLY. I show that a key premise in Richard's argument is the following belief retention principle.

> SAME PROPOSITION. To retain a belief from a time t to a later time t' is to believe the same proposition at t and t'.

I then argue that this principle can equally well be used to criticize eternalism. Hence, Richard is ill-advised to use it in arguments against temporal-

ism.

In chapter four, I consider solving the inconsistency by rejecting OPERA-TORS. *Prima facie*, this is the philosophically least controversial way to solve the problem. If technical considerations give rise to the problem, then the solution can be expected to be technical as well. This view is defended by Jeffrey King in his influential King (2003). I argue that this strategy gives rise to an analogous problem, however, and hence that it fails to dissolve the inconsistency.

In chapter five, I present what I believe is the best argument against IDEN-TITY with respect to Kaplan's framework: Plausible principles concerning assertoric content entail (i) that sentences with the same assertoric content may differ in their Kaplanian content, and (ii) that sentences with different assertoric content may still have the same Kaplanian content. Hence, Kaplanian content cannot serve as assertoric content.

In chapter six, drawing on the negative results from the preceding chapters, I present two constructive accounts that aim to solve the inconsistency. I end the chapter by updating the SIMPLE PICTURE in light of these results.

Finally, in chapter seven, I draw the main conclusions from the general discussion, as well as present some further issues raised by, but not answered in, the dissertation. The general upshot of the dissertation is that the relation between compositional semantic value and assertoric content cannot be settled by technical considerations alone, but that it will depend on your views on what the scope and purpose of formal semantics are and what role you take assertoric content to play.

1.3   LIMITATIONS

I want to emphasize that there are many problems for IDENTITY that I will not even touch upon in this dissertation. The huge literature on the so-called *semantics/pragmatics interface* abounds with potential such problems. Before moving on, I would like to spell out the relation between the problems discussed in this thesis and the debate on whether there is pragmatic intrusion on assertoric content.

The semantics/pragmatics distinction (under this very label, at least) has

been around since Morris (1938) and Carnap (1938). Morris and Carnap divide the study of language into three distinct areas, where syntax is the study of formal relations between expressions, semantics the study of the relation between expressions and the world, and pragmatics the study of the relation between expressions and their users.

> The complete theory of language has to study all these three components. We shall call pragmatics the field of all those investigations which take into consideration [the action, state, and environment of the speaker]. Other inquiries are made in abstraction from the speaker and deal only with the expressions of the language and their relation to their designata. The field of these studies is called semantics. (Carnap, 1938: 4)

Semantics was originally conceived of as independent from pragmatics. Carnap, whose primary concern was formal language, held that the scope of semantics is restricted to the part of language that remains constant across contexts of use. Those who turned their attention to natural language, such as (Reichenbach, 1980), (Bar-Hillel, 1954), and (Montague, 1970) kept the Carnapian terminology - reserving "semantics" for context invariant meaning - but stressed the need for a systematic "pragmatic" theory of context dependence. As the methods for dealing with context-sensitive expressions became more sophisticated, as for instance in Kaplan (1989), the terminology shifted and the term "semantics" came to mean the study of truth-conditional or propositional content, and consequently came to include the study of context-sensitivity as well.

Pair this with Grice's theory of implicatures, and we get a theory of linguistic communication in which the division of labor between semantics and pragmatics is quite clear (Grice, 1989). Successful communication takes place when the hearer recovers the semantic (read propositional) content of the expression uttered by the speaker, which is the meaning of the expression relative to the context of utterance, and from this pragmatically recovers the relevant implicatures. On this view, semantic interpretation is assigned a privileged role in interpretation since the output of it is propositional content, which in turn serves as the input to the pragmatic inference. This "classical" model of interpretation is summed up in the following quote from Stanley.

> It is very natural to divide the process of linguistic interpre-

tation into two phases. In the first phase, the hearer assigns denotations to each element of the logical form produced by the speaker, denotations that are determined by the meanings of the elements of the logical form plus perhaps contextual factors. The hearer then combines these values in accordance with the structure of the logical form to derive the interpretation of the logical form, relative to that context. [...] In the second phase, the hearer evaluates the result of the first phase with respect to general conversational maxims, such as relevance, quality, or quantity. This second stage of interpretation is not linguistic in nature. It does not involve the assignment of values to elements of a structured representation produced by the speaker. Accordingly, the first state of interpretation is 'semantic', the second, 'pragmatic'. [...] the phase of interpretation that is semantic is the one that results in truth-conditions. (Stanley, 2000: 393f)

The characteristics of this model are the following. (i) The output of semantic interpretation is propositional content. (ii) Semantic interpretation involves resolving ambiguity, determining the referential content of context sensitive syntactical elements in the logical form of the expression, and semantic composition. (iii) Pragmatic interpretation takes the result of the semantic interpretation as input. In this model, at least when it comes to declarative sentences and assertions, we are entitled to speak of the semantic value of a sentence in context, the propositional content of a sentence in context and the content of an utterance in a context interchangeably.

What we have here are four kinds of meaning: Literal or standing meaning, meaning in context/semantic content, assertoric content/propositional content, and communicative content/implied meaning. (The terminology is far from uniform.) The current semantics/pragmatics debate concerns the relation between meaning in context/semantic content and assertoric content/propositional content.

Over the past decades the classical model has been challenged in two ways. The first challenge - the challenge from *truth-conditional pragmatics* - is directed at the identification between semantic content and truth-conditional content. The second challenge - the challenge from *minimal semantics* - accepts the identity of semantic content and truth-conditional content, but challenges the identification of truth-conditional content and

assertoric content. Both thereby reject the identification of semantic content and assertoric content.

As to the first challenge, for example Bezuidenhout (2002), Carston (2008), Recanati (2004, 2010), Soames (2008), Sperber and Wilson (1995), and Travis (1997, 2006) challenge the identification between semantic content and truth-conditional content. The critique is basically that the classical model gets the degree and nature of context dependence wrong, and that semantic interpretation does not have the suggested privileged role in communication. Instead, it is argued that pragmatic mechanisms enter into the determination of propositional content. Another way of phrasing this is that the semantic value of a sentence in context is not in general, or at least not always, the proposition expressed by an utterance of that sentence in the same context. For instance, Bezuidenhout argues that the propositional content of many utterances is context sensitive in a way that goes beyond assigning values to indexical expressions and resolving ambiguity. Therefore, the semantic value of a sentence in context underdetermines propositional content.

> What is expressed by the utterance of a sentence in a context goes beyond what is encoded in the sentence itself. [...] That is, even after disambiguating any ambiguous words in a sentence and assigning semantic values to any indexical expressions in the sentence, truth-conditions may vary with variations in the background. (Bezuidenhout, 2002: 105)

For example, she holds that an expression such as "My apple is red" is context sensitive, and that the context sensitivity is pragmatically triggered. She argues that, even after assigning a context meaning to the overt indexical "my", it may - depending on the context of utterance - express the proposition *that my apple is red on the outside, that my apple is red on the inside, that my apple is of a sort that typically is red* or some other proposition, and that an analysis of the meaning of "red" or the logical form of the expression will not give us an explanation of this.

As to the nature of context sensitivity, others argue that even in cases where there is some syntactic element responsible for the context sensitivity of the expression, determining its referential content is a matter of recovering what the speaker intends to say, which would make it more 'pragmatic' than 'semantic' in nature.

> For example, a possessive phrase such as 'John's car' arguably means something like the car that bears relation R to John. The free variable 'R' must be contextually assigned a particular value; but that value is not determined by a rule. What a given occurrence of the phrase 'John's car' means ultimately depends upon what the speaker who utters it means. That dependence upon speaker's meaning is a characteristic feature of 'semantically underdetermined' expressions, which are pervasive in natural language. (Recanati, 2002: 229)

If the semantic content of a sentence is less than propositional as these remarks suggest, then the role of semantic content in communication is smaller and less systematic than on the traditional view. Pragmatic interpretation enters at an earlier stage in interpretation than at the post-propositional Gricean stage.

On these views, the semantic value of a sentence relative to a context does not play the same crucial role in communication as the one suggested by Stanley (2000), given that it does not determine the propositional content of the utterance of that sentence.

The second kind of challenge comes from so-called minimal semantics or insensitive semantics, advocated mainly by Borg (2004, 2012), and Cappelen and Lepore (2005). Contrary to truth-conditional pragmatics, they argue that context-sensitivity of truth-conditional content is a very limited phenomenon. However, like the proponents of truth-conditional pragmatics, they argue that semantic content radically underdetermines the assertoric content of a sentence in a context. According to the so-called *speech act pluralism* of Cappelen and Lepore "there can be no systematic theory of speech act content" (Cappelen and Lepore, 2005: 190). Truth-conditional pragmatics and minimal/insensitive semantics are sometimes represented as occupying the opposite extremes of the semantics/pragmatics debate. They do indeed differ in how specified the semantic value of a sentence needs to be in order to be truth-conditional, but when it comes to the relation between the semantic value of a sentence and its assertoric content they both strongly reject the classical model.

With this said, the problem cases for IDENTITY that will be discussed throughout of this dissertation are such that they would arise even if there were no pragmatic intrusion on truth-conditional content at all. Likewise,

even if a solution to the problems that will be discussed here can be given, it would not mean that IDENTITY is vindicated, since the possibility of pragmatic intrusion on assertoric content will not thereby be excluded.

CHAPTER 2

THE PRINCIPLE

CHAPTER ABSTRACT. The principle of compositionality states that the meaning of a complex expression is determined by the meanings of its parts and how they are composed. The issue of whether IDENTITY holds depends of how the principle is interpreted. The chapter presents a formal framework and uses it to give and relate several formal explications, including so-called general compositionality. I also present and discuss the most common arguments for compositionality.

2.1 INTRODUCTION

Formal semantic theories are as a general rule compositional. This means that they impose as a constraint on the meanings - *semantic values* - of expressions that they, together with syntax, determine the meanings of complex expressions that have them as parts. This holds true both of the model-theoretic semantics in the tradition of Richard Montague, David Kaplan and David Lewis, which are the focus of this dissertation, and of the axiomatic tradition of Donald Davidson, developed notably in Larson and Segal (1995). The principle is often informally expressed along the following lines:

> COMPOSITIONALITY - FUNCT. The meaning of an expression is a function of the meanings of its parts and of the way they are syntactically combined.

Compositionality can also be stated as a substitution property:

> COMPOSITIONALITY-SUBST. If an expression t is substituted for a synonymous expression u in a complex expression e, then the resulting complex expression $e[t/u]$ is synonymous with e.

The principle as such says nothing about what the meanings of atomic expressions are, or about how atomic expressions obtain their meaning. It's a principle that regulates the semantic relation between a complex expression and its constituent expressions. It does say something about the meanings of complex expressions under the assumption that their parts are meaningful.

The thesis that meaning must be compositional is usually attributed to Frege. In 'Über Sinn und Bedeutung', Frege observes that the truth-value

of a sentence remains the same if a subexpression of the sentence is substituted for another expression with the same reference/*Bedeutung*. This is naturally interpreted as him holding that reference is determined compositionally. Famously, he concluded from this that expressions must refer to their *sense/Sinn* in indirect contexts. (Frege, 1948: 216) Carnap is the first one to attribute the principle of compositionality for reference to Frege, albeit not under that name. (Carnap, 1956: 121). Carnap also attributes to Frege the view that sense/*Sinn* is compositional, but that attribution is more controversial. (Cf. e.g. Pelletier (2001), and Janssen (2012).) The term "compositionality" first occurs in Katz and Fodor (1963). The standard contemporary, informal formulation of the principle is due to Partee (1984: 281). Since then, increasingly rigorous accounts of the principle and its properties have been given, as well as assessments of the arguments in favor of the principle, and the past fifteen or twenty years have seen important technical and conceptual developments concerning the interpretation of the principle. (Cf. in particular Hodges (1998, 2001), Janssen (1997), Jönsson (2008), Pagin (2005), Pagin and Westerståhl (2010a,b,c), Pelletier (1994), Szabó (2009); Szabó (2015), Westerstahl (2012), and the contributions in Werning et al. (2012).)

The interpretation, truth-value and methodological status of the principle are matters of ongoing debate. Is it a substantial empirical principle, as for instance Szabo (2009) argues, or is it 'merely' a methodological principle, as suggested by Janssen (1997)? Is it a priori true, or is it rather an empirical fact that natural languages are (not) compositional? (Pelletier, 1994) Is it a desirable feature of a semantic theory and, if so, why? Can compositionality be made compatible with the pervasive context-dependence of natural languages and, if so, how? (Pagin (2005), Recanati (2010), Westerståhl (2012).) There is no consensus on any of these issues among philosophers and linguists. Nevertheless, the principle under some interpretation or other is widely endorsed as a guiding principle in semantics. A clear indication of this is that many of the central problems in the philosophy of language consist in failures to provide a compositional semantics for some fragment of English. For instance, the problem of modal embeddings for descriptive theories of proper names (Kripke, 1980), the different variants of Frege's puzzle, and the nesting problem for two-dimensional semantics (Soames, 2009) all have in common that two expressions that the semantic framework under consideration predicts to be synonymous fail to be substitutable *salva veritate* in certain complex expressions. That is, they are

all failures of compositionality. I think it is not too great an exaggeration to say that many important advances in formal semantics are the results of the quest to provide compositional semantics for in particular philosophically interesting fragments of English.

The purpose of this chapter is to present the principle in some detail, in order to give the necessary background for the rest of the dissertation. Since indexicals will be a main concern throughout the dissertation, I spend some time on spelling out different ways of accounting for context sensitivity within a compositional framework. I also present a new version of the principle which takes both linguistic and extra-linguistic context into account. This is a development of the notion of *general compositionality* from Glüer and Pagin (2006) and Pagin and Westerståhl (2010c). This version of the principle will be important in chapter six. I discuss the claim that compositionality is a trivial property that all languages have, and argue that that depends on what we mean by 'a language'. I end by discussing some of the main arguments in favor of the principle as well as its methodological status. The chapter is mainly a survey of the literature, and does not present any original arguments for or against the compositionality contraint.

2.2 LANGUAGES

The informal formulation of the principle is open to several interpretations. A formal framework is useful to make these explicit. I will use a slightly simplified version of the algebraic framework of Hodges (2001), Pagin and Westerståhl (2010a), and Westerstahl (2012). The framework describes three aspects of the represented language: The words used by the speakers (the *expressions*), their derivation and structure (the *grammatical terms*), and finally their meanings (the *semantic values*). Let us begin by saying what a language is.

We can characterize a language in at least two ways: As a rather coarse-grained object or as a quite fine-grained object. On the former characterization, a language is simply a mapping from strings of sounds or inscriptions to meanings. (Cf. Lewis (1975)). On the fine-grained conception of language, a language has a fair amount of structure, containing at least expressions, grammatical terms, and meanings. Grammatical terms are

called *structural analyses* of strings, and it's the grammatical terms that are mapped to meanings. This way of characterizing language allows us to account for ambiguity, such as in (23) and (24).

(23) The bank is around the corner.

(24) Every philosopher attended a talk.

Once we make the distinction between expressions and terms we may analyze sentences such as (23) as containing to two different terms, which in turn are mapped to two different meanings.

(25) The bank$_1$ is around the corner

(26) The bank$_2$ is around the corner.

In the case of (24), the same sentence string is analyzed as a result of applying different syntactic rules. I will mainly be concerned with fine-grained languages in this chapter. This corresponds to what Lewis (1975) calls "a grammar". However, I'll return to the different ways of conceiving languages in the section on trivial compositionality. Let us now specify what such a language/grammar is, and then spell out the principle of compositionality in some detail.

We distinguish between the *expressions* and *grammatical terms* of a language L. The expressions are the types of strings of marks or sounds used by speakers, but it is the grammatical terms that are mapped to meanings. Both the systems of expressions and of grammatical terms are represented as *algebras*. The expressions are represented as an expression algebra, $\mathbf{E}(E,A,\Sigma)$, where E is the set of well-formed expressions in L and A is the set of atomic expressions. $A \subset E$. Σ is a set of functions defined on (not necessarily all of) E^n. The elements in Σ correspond to syntactic rules. Each function $\sigma \in \Sigma$, with the arity n, is a partial mapping $E^n \to E$. The grammatical terms are represented as another algebra, $\mathbf{GT}(GT,A_{GT},\Sigma_{GT})$, with the analogous structure: GT is the set of grammatical terms. A_{GT} is the set of atomic terms, and $A_{GT} \subset GT$. Σ_{GT} is the set of syntactic rules such that each rule $\sigma \in \Sigma_{GT}$ maps elements in GT^n to elements in GT, where n is the arity of σ. Even though expressions are used by the speaker of the language, not the grammatical terms, the grammatical terms are nevertheless needed since they are what the semantic function maps to meanings or semantic values. Furthermore, since speakers are able to disambiguate expressions, there are some empir-

ical reasons to represent speakers as interpreting grammatical terms rather than expressions. A function $val : GT \rightarrow E$ maps the elements in GT to the expressions in E. If t is a grammatical term and e is an expression corresponding to t, then $val(t) = e$. t is called a structural analysis for e. In most cases, if t is atomic, then val is identity. But in case e is atomic and lexically ambiguous, then $val(t_1) = val(t_2) = e$, where $t_1 \neq t_2$. This way, an ambiguous expression will have distinct structural analyses. If t is a complex term of the form $\overline{\sigma}(t_1, ..., t_n)$, where $\overline{\sigma}$ is the name of σ, then $val(t) = \sigma(val(t_1), ..., val(t_n))$. val is total: Every $t \in GT$ is an argument for val. Furthermore, every $e \in E$ is the value of some argument for val (i.e. val is surjective). Most importantly, every term is mapped to a unique expression but more than one term may be mapped to the same expression. One and the same string may therefore have different structural analyses. Since meanings are assigned to the terms in GT and not to the strings in E, we can give a simple treatment of lexical or structural ambiguity.

We have now seen how expressions and terms are generated and structured, and we can introduce the semantics. The semantics for L consists of a set M of semantic values (meanings) and a semantic function $\mu : GT \rightarrow M$. That is, μ maps grammatical terms to meanings. If t is a grammatical term, then $\mu(t)$ is the meaning of t. For simplicity, I will assume that μ is total and hence that all grammatical terms are meaningful. On this general level it is not necessary to know what the elements in M are, only to know what it is for two terms to have the same meaning. Let t and u be grammatical terms and $\equiv_\mu$ be the synonymy relation. Then:

$$t \equiv_\mu u \text{ iff } \mu(t) = \mu(u)$$

That is, two terms are synonymous when and only when they are mapped to the same semantic value.

Illustration 1. Expressions, grammatical terms, and semantic values.
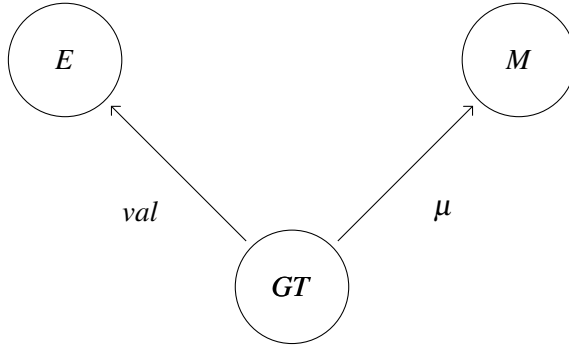
Summing up, a language *L* in the fine-grained sense consists of (i) an expression algebra, (ii) a grammatical term algebra, (iii) a set of semantic values, (iv) a function that maps grammatical terms to expressions, and (v) a semantic function that maps grammatical terms to meanings. To give a semantic theory for *L* is to specify the semantic function μ that maps grammatical terms to meanings. An important part of this task is to choose suitable semantic values. Against this background, what is required for the semantics to be compositional?

2.3 COMPOSITIONALITY FOR CHARACTER AND CONTENT

The informal formulation of the principle that was introduced in the beginning doesn't explicitly mention context-sensitivity, and neither does the most straightforward formal explication of it. This version of the principle is often referred to as *standard compositionality*. (Cf. Pagin and Westerståhl (2010a) and Westerstahl (2012).)

> **Standard compositionality.** For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any terms $t_1, ..., t_n \in GT, \mu(\overline{\sigma}(t_1, ..., t_n)) = r_\sigma(\mu(t_1), ..., \mu(t_n))$, if σ is defined for $t_1, ..., t_n$.

Since standard compositionality doesn't make context-sensitivity explicit, it's not ideal for natural language semantics. We must therefore modify the

principle in order to make it adequate for natural languages. In order to do that we must define different semantic functions. We can define a range of different semantic functions that take different arguments and yield different values. In order to do so, let *GT* be the set of grammatical terms, as before. Furthermore, let *C* be the set of *contexts of utterance*. A context of utterance is (at least) an ordered tuple of a world, time, location and speaker, but, again depending on our theory, it may contain much more. Let $\mu(t,c_1)$ denote the meaning of the term *t* in the context of utterance c_1. Say that a term *t* is *context sensitive* if and only if there are at least two contexts $c_1, c_2 \in C$ such that $\mu(t,c_1) \neq \mu(t,c_2)$. Furthermore, let *I* be a set of *circumstances of evaluation*. In the standard case, a circumstance of evaluation is simply a world at which a sentence is evaluated for truth or falsity. Depending on our framework we may include other parameters as well, such as time or location.

Now we can begin to define different semantic functions, with which we'll be able to formulate the different versions of the compositionality principle. "$[X \rightarrow Y]$" denotes the set of functions from *X* to *Y*. I begin with the most straightforward semantic function, the one that operates on character.

(i) $\mu_{character} : GT \rightarrow [C \times I \rightarrow extensions]$

(i) is the semantic function which takes grammatical as arguments and yields a new function - from pairs of contexts of utterances and circumstances of evaluation to extensions - as value. Intuitively, this corresponds to what Kaplan calls *character* and others call *standing meaning*. We'll introduce variations on this function in stages.

Standard compositionality does not take semantically relevant contextual parameters into account. In the terminology of Kaplan (1989), the claim that a language is standardly compositional is therefore most naturally interpreted as the claim that *character* is determined compositionally.

> **Compositionality for character.** For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any terms $t_1, ..., t_n \in GT, \mu_{character}(\overline{\sigma}(t_1, ..., t_n)) = r_\sigma(\mu_{character}(t_1), ..., \mu_{character}(t_n))$, if σ is defined for $t_1, ..., t_n$.

An adequate version of the principle for the purpose of natural language semantics must take context sensitivity into account in order to account for

indexicality. This can be done in three ways:

I. By using the character function: $\mu_{character} : GT \rightarrow [C \times I \rightarrow extensions]$

II. By defining a semantic function $\mu_{content} : GT \times C \rightarrow [I \rightarrow extensions]$, that is, a function that takes the semantic value of a term in context and yields an intension.

III. By introducing a set of new semantic functions, one for each context $c \in C$: $\mu_{content-c} : GT \rightarrow [I \rightarrow extensions]$.

Using either of these semantic functions, we can formulate a version of the principle of compositionality that takes context sensitivity into account.

Compositionality for content.

CC1. For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any term $t_1, ..., t_n \in GT$, and each context of utterance $c \in C$,
$\mu_{character}(\overline{\sigma}(t_1, ..., t_n)(c)) =$
$r_\sigma(\mu_{character}(t_1)(c), ..., \mu_{character}(t_n)(c))$,
if σ is defined for $t_1, ..., t_n$

CC2. For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any term $t_1, ..., t_n \in GT$, and each context of utterance $c \in C$,
$\mu_{content}(\overline{\sigma}(t_1, ..., t_n), c) =$
$r_\sigma(\mu_{content}(t_1, c), ..., \mu_{content}(t_n, c))$,
if σ is defined for $t_1, ..., t_n$

CC3. For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any term $t_1, ..., t_n \in GT$, and each context of utterance $c \in C$,
$\mu_{content-c}(\overline{\sigma}(t_1, ..., t_n)) =$
$r_\sigma(\mu_{content-c}(t_1), ..., \mu_{content-c}(t_n))$,
if σ is defined for $t_1, ..., t_n$

The first version, where the meaning operation operates on the results of applying the character of the constituents to the context, seems to be closest to the formulation of compositionality for *content* that Kaplan has in

mind when he presents his version of what he calls 'Frege's principle of intensional interchange':

> The Content of the whole is a function of the Content of the parts. That is, if two compound well-formed expressions, each set in (possibly different) contexts, differ only with respect to components which *when taken in their respective contexts* have the same content, then the content of the two compounds *each taken in its own context* is the same. (Kaplan, 1989: 507. Emphasis in the original.)

Note that Kaplan doesn't give any formal presentation of compositionality for content. The second formulation is introduced in Pagin (2005), under the name *ec-comp*. The third version is suggested in Westerståhl (2012: 207).

The distinctive feature of CC1-CC3 is that they allow the constituents to vary in meaning between contexts, thus potentially letting the meaning of the complex vary in meaning between contexts. However, there is no room for context-sensitivity that is not traceable to a syntactic constituent of the complex expression. Therefore, we cannot us it to account for what Pagin (2005) calls *context-shift failure*: Cases where a complex expression varies in meaning across two contexts while none of its constituents do. This may happen if the semantics allow for so-called *unarticulated constituents*. In Perry (1986), John Perry argues that

(27) It's raining.

may vary in truth-value between different locations even though there is no location-indexical in the logical form of the sentence. If it exists, this kind of context-sensitivity can - contrary to first appearances, perhaps - be dealt with within a compositional semantics. The trick is to allow the context to occur as a separate argument of the semantic function. ((Pagin, 2005), (Pagin and Westerståhl, 2010a), (Westerstahl, 2012)).This gives us the weak version of compositionality for content, first introduced in (Pagin, 2005):

> **Weak compositionality for content.** For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any term $t_1, ..., t_n \in GT$, and each context of utterance $c \in C$,
> $\mu_{content}(\overline{\sigma}(t_1, ..., t_n), c) =$

$$r_\sigma(\mu_{content}(t_1, c), ..., \mu_{content}(t_n, c), c),$$
if σ is defined for $t_1, ..., t_n$ and c.

CC1-CC3 entail weak compositionality for content, but not vice versa. Furthermore, if content is compositional (weakly or not) then character is compositional, but again not vice versa. (Cf. Pagin (2005) and Westerstahl (2012) for proofs.)

2.4 GENERAL COMPOSITIONALITY

The final and most recent formal explication of compositionality is so-called *general compositionality*. General compositionality is a version of the principle of compositionality that takes *linguistic* context into account. It's general in the sense that e.g. standard compositionality can be defined as a special instance of it. It is introduced in Pagin and Westerståhl (2010c) in order to give a compositional account of pure quotation, and has also been applied to proper names in modal contexts. (Glüer and Pagin, 2006). They also suggest that it might be applied to belief-contexts. (Pagin, *unpublished*) The idea, going back to Frege's suggestion that a sentence refers to its truth-value in direct contexts but switches reference to its ordinary sense/*Sinn* in indirect contexts, is that a term can make different contributions to the meaning of a complex expression depending on in which linguistic context it occurs. Or, in other words, that two terms are synonymous in *one* type of linguistic context does not entail that they are substitutable *salva veritate* in all types of linguistic contexts.

In order to formulate general compositionality we need to define what a linguistic context is. Informally, the idea is this. Picture a derivation tree for a sentence. Each node in the tree represents a linguistic context. What we need is a unique way of picking out linguistic contexts in the tree. This unique way may then be used as an argument for the semantic function. Consider the following example:

(28) Amir believes that Hesperus is Phosphorus.

(29)

```
                        S
              ┌─────────┴─────────┐
             NP                   VP
              │            ┌───────┴───────┐
            Amir           V              CP
                        believes      ┌────┴────┐
                                     Comp        S
                                      │       ┌──┴──┐
                                     that   Hesperus is Phosphorus
```
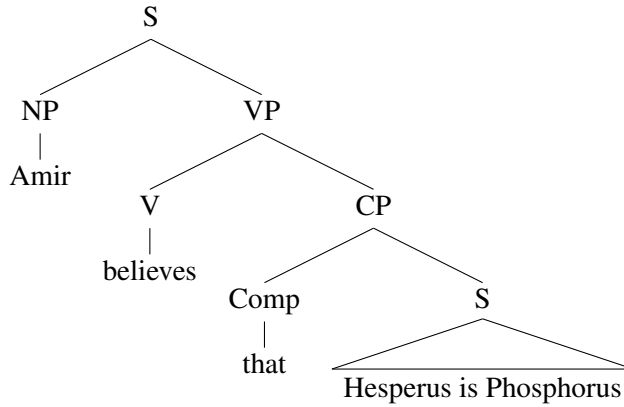
In (28), "Hesperus is Phosphorus" occurs in a belief-context, which is a semantically relevant linguistic context. If s is a term, for instance "Amir believes that Hesperus is Phosphorus", and o is an occurrence of a subterm of s in s, for instance "Hesperus is Phosphorus", then $cxt(o,s)$ is the linguistic context of o in s. Now, each non-terminal node in (29) corresponds to a syntactic rule. Call them α, β and γ, respectively. Assign each argument place in the syntactic rules a natural number corresponding to their place in the three.

(30)

```
                        α
              ┌─────────┴─────────┐
             1                   β,2
              │            ┌───────┴───────┐
            Amir           1              γ, 2
                        believes      ┌────┴────┐
                                      1          2
                                      │       ┌──┴──┐
                                     that   Hesperus is Phosphorus
```
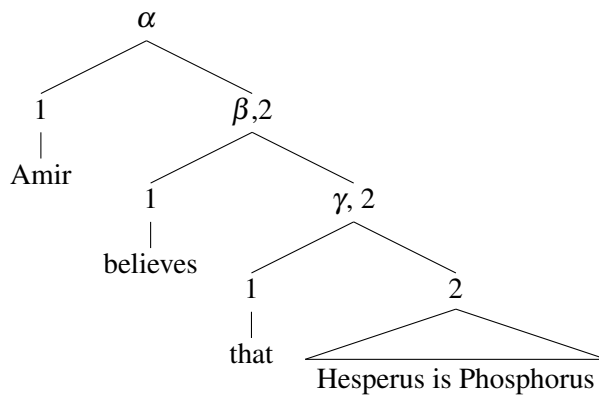
Now we can describe the linguistic context of "Hesperus is Phosphorus" in (28) in terms of the rules and the natural numbers as a 'path' from the top-node to the terminal node "Hesperus is Phosphorus". The 'path' is a sequence consisting of the ordered pairs of a syntactic rule and the natural number of the argument place, starting from the top and leading down to the occurrence under consideration: ctx("Hesperus is Phosphorus", "Amir believes that Hesperus is Phosphorus") $= \langle (\alpha,2),(\beta,2),(\gamma,2) \rangle$. Using this

idea, Pagin and Westerståhl (2010c: 396), give the following general inductive definition of a linguistic context.

> **Linguistic context.** For any term s, and any occurrence o of a subterm of s, $ctx(o,s)$ is defined as a finite sequence consisting of pairs of syntactic rules and a natural number corresponding to an argument place of the syntactic rule:
>
> 1. $cxt(s,s) = \langle \rangle$ (the null-context),
>
> 2. If $cxt((\alpha(o_1,...,o_n),s) = \delta$, then $cxt(o_i,s) = \delta$ concatenated with $(\alpha,i), 1 \leq i \leq k$.

Let *LC* be the set of linguistic contexts, that is, the range of *cxt*. We presuppose that the set of contexts is partitioned into a finite collection of context types, depending on the intended application; see Pagin and Westerståhl (2010c) for precise definitions. In chapter six, we will see an application where there are two relevant context types. With the precise notion of linguist context in place, Glüer and Pagin (2006) and Pagin and Westerståhl (2010c) formulate a new semantic function that takes the linguistic context of the subterms of a complex expression into account in an analogous way as CC1-CC3 take extra-linguistic context into account. These authors only consider general compositionality as applying to meaning relative to linguistic context. However, I want to introduce an even more general version of the principle which takes both linguistic and extra-linguistic context into account.

We can begin by introducing a general semantic function for character:

(ii) $\mu_{gen_{char}} : GT \rightarrow [LC \times C \times I \rightarrow extensions]$

Now, we can define general compositionality for character. It is almost identical in its formulation to regular compositionality for character. The only difference is the semantic function.

> **General compositionality for character.** For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any terms $t_1,...,t_n \in GT, \mu_{gen_{char}}(\sigma(t_1,...,t_n)) = r_\sigma(\mu_{gen_{char}}(t_1),...,\mu_{gen_{char}}(t_n))$, if σ is defined for $t_1,...,t_n$.

The general semantic function for character is a function from character to a new function, which takes *triples* of contexts of utterances, linguistic

contexts types and circumstances of evaluation to extensions. Things are a bit more complex when we extend the notion of general compositionality to content. As in the case of regular compositionality for content, there are (at least) three available strategies:

   I. By using the general character function: $\mu_{gen_{char}} : GT \to [LC \times C \times I \to extensions]$

  II. By defining the semantic function $\mu_{gen_{content}} : GT \times LC \times C \to [I \to extensions]$, that is, a function that takes the semantic value of a term in both a context of utterance and a linguistic context type and yields an intension.

 III. By introducing a set of new semantic functions, $\mu_1, ..., \mu_k$, one for each semantically relevant linguistic context type.

The intuitive idea behind the third strategy is that we let different semantic functions be associated with different linguistic contexts. For example, we could have one semantic function for the null context, and another for modal contexts, and a third for temporal contexts. The important thing is that we have a way of pairing the right context type with the right semantic function. For the third version, let S be a finite set of semantic functions, $\mu_1, ..., \mu_k$, and Ψ be a selection function that, given the linguistic context of the expression, picks out the associated semantic function μ_i from S. Cf. Pagin and Westerståhl, 2010: 389 for a precise formulation.

Using either of these strategies, I can formulate a general version of the principle of compositionality that takes context sensitivity into account. Let "$\frown$" be the concatenation operator. I'll give the second and third version here. Pagin and Westerståhl (2010c) proves that the two versions are equivalent.

> **General compositionality for content II.** For every syntactic rule $\sigma \in \Sigma$ there is an operation r_σ such that for any term $t_1, ..., t_n \in GT$, each context of utterance $c \in C$, and each linguistic context type $lc \in LC$,
> $\mu_{gen_{content}}(\sigma(t_1, ..., t_n), lc, c) \qquad\qquad =$
> $r_\sigma(\mu_{gen_{content}}(t_1, (lc \frown ctx(t_1, \sigma(t_1, ..., t_n))), c),$
> $..., \mu_{gen_{content}}(t_n, lc \frown ctx(t_n, \sigma(t_1, ..., t_n)), c), lc, c), \quad$ if $\quad \sigma \quad$ is defined for $t_1, ..., t_n$

> **General compositionality for content III.** For every syntac-

tic rule $\sigma \in \Sigma$, any term $t_1, ..., t_n \in GT$, each context of utterance $c \in C$, and every $\mu \in S$ there is an operation $r_{\sigma,\mu}$ such that if $\mu(\overline{\sigma}(t_1, ..., t_n), c)$, if σ is defined for $t_1, ..., t_n$, then

$$\mu_{gen_{content}}(\overline{\sigma}(t_1, ..., t_n), c) = r_{\sigma,\mu}(\mu_1(t_1, c), ..., \mu_n(t_n, c))$$

where $\mu_i \in S$ is the relevant semantic function, corresponding to the linguistic context type of the subterms $t_1, ..., t_n$, picked out by Ψ.

So far, I've mainly been concerned with spelling out the details of the different versions of the principle. I'll return and apply some of these in chapter six, where I will appeal to the third version and make use of two different semantic functions. In chapters three, four, and five, I will by 'compositionality' mean non-general compositionality.

The moral of this section and the previous one is that there are several ways to understand the informally stated principle of compositionality. This means that the claim that assertoric content is not compositional semantic value needs to made precise in order to be assessable.

2.5 TRIVIAL COMPOSITIONALITY

Before moving on to the discussion of the arguments for compositionality, I would like to address the suggestion that compositionality is a trivial property that every language has. For instance, Zadrozny (1994) and Janssen (1986) argue that compositionality is empirically vacuous. They conclude from this that the principle should be interpreted as a methodological principle, guiding formal semanticists when constructing theories, and not an empirical hypothesis about natural languages. There is indeed a sense in which compositionality is a trivial property, but this depends on what we take a language to be. Compositionality is a trivial property of coarse-grained languages, but not of fine-grained ones. Partee (1984:281) notes:

> If the syntax is sufficiently unconstrained and meanings are sufficiently rich, there seems to be no doubt that natural languages can be described compositionally. Challenges to the principle generally involve either explicit or implicit arguments to the effect that it conflicts with other well-motivated constraints on syntax and/or the mapping from syntax to

meaning.

Take a language L in the coarse-grained sense of Lewis (1975), that is, a mapping from strings (expressions) to meanings. This language does not have a specified syntax and it is not given what the meanings of the expressions are. Now, say, that we want to give a semantics for this language. This semantics can always be made compositional by adjusting the syntax and the semantics of the sub-sentential expressions accordingly. The easiest way to do this is by assigning semantic values in such a way as to not have any synonymous expressions. One way of doing this is to let the domain of meanings, M, consist of ordered pairs of intuitive meanings and the expressions themselves. (Westerståhl, 1998) Then, there will be no distinct expressions with the same meaning, and the language will thereby be compositional. The reason is that a language without synonymous expressions is guaranteed to be compositional.

> **Fact 1.** A language that contains no synonymous expressions is always compositional.

To see why, consider the substitution version of compositionality.

> COMPOSITIONALITY-SUBST. If an expression t is substituted for a synonymous expression u in a complex expression e, then the resulting complex expression $e[t/u]$ is synonymous with e.

Either $t = u$ and thus $e = e[t/u]$, or $t \neq u$ and thus the antecedent in the conditional false. In both cases the conditional is true, and compositionality is trivially obtained. Arguably, this particular strategy is not viable for a natural language like English or Swedish, which intuitively contains synonymous expressions. Another argument against this strategy is that translation between languages would be impossible if the expression itself were part of its semantic value.[1]

However, take a language in the fine-grained sense. Such a language has a fixed syntax and semantics. Hence, compositionality is a property that some of these languages will have and others not. However, that the syntax and semantics are fixed does not by itself mean that it is an empirical question whether English or Swedish have compositional semantics. This would follow only if it was settled beforehand and independently of

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[1]Thanks to Eric Johannesson for this point.

compositionality which of the fine-grained languages represents English or Swedish. And as will become clear in the next section, it is far from clear that this can be done.

2.6   ARGUMENTS FOR COMPOSITIONALITY

Why should we care about compositionality? Personally, I'm interested in what compositionality and compositionally determined semantic values are for the rather prosaic reason that the principle has been so influential as an adequacy condition on semantic theories. The fact that the compositionality constraint is so widely accepted in the semantic tradition is reason enough to pose the question whether compositionally determined semantic values are what we say and believe. If that is indeed the case, that is, if doing compositional semantics tends to lead us right when it comes to assigning meanings to our utterances and contents to our thoughts, then that is as good an argument for the principle as any other, I believe. With that said, the philosophical motivations for imposing the compositionality constraint on semantic theories are not always explicitly stated, and on closer inspection the most common arguments in favor of the principle are rather weak.

Throughout this thesis we will discuss problem cases for the claim that we assert compositionally determined semantic values. Why do these cases lead theorists to deny the identity of compositional semantic value and assertoric content, rather than simply give up the compositionality constraint? The explanation is that to give up the compositionality assumption is an option only if compositionality is treated as an empirical hypothesis about some natural language. Crucially, this requires an independent understanding of what meanings or semantic values are. The functional version of compositionality is equivalent to a substitution version. Given some independent criterion for when two expressions are synonymous, applying this principle to a language L may give inductive support for, or a counterexample to, the hypothesis that L is compositional. But in formal semantics the principle of compositionality does not typically have the status of an empirical hypothesis. Rather, compositionality is taken to be constitutive of meaning, in so far as meaning is captured by the semantic values posited in the theory. That is, it is motivated by meta-semantic arguments: Methodological arguments and arguments from productivity. Let's

look at each in turn.

Partee ascribes the following view to Richard Montague:

> Meanings can be anything you like, as long as they form an algebra homomorphic to the syntactic algebra. (Partee, 1984: 282)

This is a very abstract way of stating that the only requirement on meaning is that it is compositional. Intuitively, the idea is this: There is a function from syntax to meaning that yields the meaning of each syntactic object. And for each syntactic operation, there is a meaning operation such that when applied to the meanings of syntactic elements it yields the meaning of the syntactic operator applied to the same elements.

In spirit, if not in wording, Montague's view is similar to David Lewis's instrumentalist views on the meanings of sub-sentential expressions:

> In order to say what a meaning is, first ask what a meaning does, and then find something that does that. (Lewis, 1970: 5)

> The semantic values of non-sentences have only one job: to do their bit toward determining the semantic values of the sentences. Semantic values may be anything, as long as their jobs get done. Different compositional grammars may assign different sorts of semantic values, yet succeed equally well in telling us the conditions of truth-in-English and therefore serve equally well as chapters in the systematic restatement of our common knowledge about language. (Lewis, 1980: 83)

Lewis appears to advocate something like the following methodology: We have intuitions about the truth-conditions of sentences. We then assume compositionality. Then, all there is to say about the meanings of sub-sentential expressions is what they contribute to compositionally determining the intuitive truth-conditions of sentences. But why should we assume compositionality? Lewis gives the following answer:

> A concise grammar for a big language - for instance, a finite grammar for an infinite language like ours - had better work on the compositional principle. Most linguistic expressions must be built up stepwise, by concatenation or in some more complicated way, from a stock of basic expressions. (Lewis,

1980: 82)

Since natural languages are infinite, our semantic theories would become
unmanageable unless we had a systematic way of describing how the
meanings of complex expressions depend on the meanings of their parts,
Lewis points out. Lewis, as many others, crucially assumes that our lan-
guage is infinite while our grammars are finite. This is a problematic claim,
as pointed out in Pagin and Westerståhl 2012b. An implicit assumption in
the reasoning is that the semantics may succeed or fail in correctly provid-
ing a systematic way of assigning meanings to the full, infinite language.
That is, it is assumed that all the expressions of the language have a de-
terminate meaning, independently of the semantic theory. There is some-
thing circular about this; once we introduce a compositional semantic func-
tion the described language will indeed contain infinitely many expressions
with determinate meanings, and this will be explained by the fact that the
semantic function is indeed compositional. However, whether there are
independent reasons to believe that there are infinitely many expressions
with a determinate meaning is not so clear. And if not, we only call for a
compositional theory, because we have already assumed that there is one.
Methodological arguments are never conclusive, and in this particular case
it presupposes its conclusion.

What about the productivity arguments? The perhaps most common ar-
gument (or, strictly speaking, family of arguments) for compositionality
draw on various productivity facts and achievements of natural language
speakers that the formal semantic theory can be expected to explain:

> Human speakers have limited cognitive capacities. In partic-
> ular, their memories are limited and they are not telepathic.
> Nevertheless, they can understand larger amounts of expres-
> sions than can be learnt one by one, and they can understand
> complex expressions that they have never encountered before
> if they understand their parts and their mode of composition.
> This would be impossible if their languages were not compo-
> sitional. Hence, actual natural languages are compositional.

A precursor of the of this argument can be found already in Frege:

> It is astonishing what language can do. With a few syllables it
> can express an incalculable number of thoughts, so that even
> a thought grasped by a human being for the very first time

can be put into a form of words which will be understood by someone to whom the thought is entirely new. This would be impossible, were we not able to distinguish parts in the thought corresponding to the parts of a sentence, so that the structure of the sentence serves as an image of the structure of the thought. To be sure, we really talk figuratively when we transfer the relation of whole and part to thoughts; yet the analogy is so ready to hand and so generally valid that we are hardly ever bothered by the hitches which occur from time to time. If, then, we look upon thoughts as composed of simple parts, and take these, in turn, to correspond to the simple parts of sentences, we can understand how a few parts of sentences can go to make up a great multitude of sentences, to which, in turn, there correspond a great multitude of thoughts. (Frege, 1963: 1)

For a modern classic statement of the learnability argument and the argument from understanding, see **?** and Davidson (1967). Note that this argument supports general compositionality to the same extent as any of the stronger versions, as long as there is only a finite number of linguistic context types. The following quote is a recent and ardent defense of the productivity arguments by Seth Yalcin:

The raison d'être of the assumption of compositionality in natural language semantics is the aim of explicating the productive, generative character of the linguistic understanding of competent speakers. Semantics with no treatment of productivity is not semantics. (Yalcin, 2014: 42)

Yalcin makes reference to Lewis's claim that semantics with no treatment of truth conditions is not semantics (Lewis, 1970: 18). If the productivity arguments succeed in establishing compositionality as a constraint on meaning, then the induction on the intersubstituitivity of synonymous expressions transforms from an argument for a particular language being compositional into a test to see whether a suggested semantics for particular language captures the property that the language described is already known to have. Since it is arguably a fact that natural languages are learnable and that speakers understand expressions they encounter for the first time, and the arguments in this family claim that compositionality is a necessary condition for these achievements, there is no reading of these ar-

guments that leaves it an open question whether a learnt natural language is compositional, if the arguments are sound. However, they are not sound, despite their popularity, as shown by Janssen (1997), Dever (2006) and Pagin and Westerståhl (2010b), independently. Here is why. What is minimally needed in an explanation of productivity facts is that the meanings of complex expressions are computable from the meanings of their parts and their mode of composition. But compositionality is neither a sufficient nor a necessary condition for computability. First, as we have seen, a language that contains no synonymous expressions is trivially compositional but that fact does not guarantee that the meanings of the complex expressions are derivable for the speaker from the meanings of the parts and their mode of composition. Compositionality holds trivially for such a language since, as we have seen, either $u \neq t$ and then the antecedent in the substitution version of compositionality is false, or $u = t$. For such a language, no explanation of the productivity facts would be forthcoming from the mere fact that the language is compositional. Second, computability does not entail compositionality. For example, the meaning of every sentence in a language can be computable from the meanings of the parts of the expressions and some non-semantic feature such as the number of letters in the first word of the sentence. This language will have a computable but not a compositional semantics. So, even if one agrees with Yalcin's Lewis paraphrasing slogan that 'semantics with no treatment of productivity is not semantics', it does not follow that one is committed to the principle of compositionality. In response to these objections one may observe that virtually all actual compositional semantics for fragments of natural languages are computable. So, even if compositionality doesn't entail computability, the compositionality constraint is a strong heuristic device for securing computability. In fact, Pagin (2012) shows that compositional semantics are computationally less complex than non-compositional semantics. Hence, compositionality offers an explanation of how we understand expressions as fast an efficiently as we do.

2.7 CONCLUDING REMARKS

This chapter has presented the formal properties and variants of the principle of compositionality. I have briefly presented the main types of arguments for imposing the constraint and the main criticism against them from

the literature. However, even if the standard arguments in favor of the principle are in poor shape it is still nevertheless an interesting and substantial question to ask whether doing compositional semantics leads to the correct predictions about assertoric content, which, if so would be an argument in favor of the compositionality constraint.

CHAPTER 3

CONTENT AND TEMPORALISM

CHAPTER ABSTRACT. I present double-indexed semantics, David Kaplan's intensional treatment of tense and temporal expressions, and the Kaplan/Lewis argument for the incompatibility of an intensional treatment of tense, eternalism and the identity of assertoric content and compositional semantic value. Contra David Lewis (1980) and Mark Richard (1981), I argue that rejecting eternalism is a viable solution to the problem.

3.1   INTRODUCTION

In 'Demonstratives', David Kaplan distinguishes between three levels of semantic values: *Character, content*, and *extension*. (Kaplan, 1989) Furthermore, he distinguishes between two ways in which extra-linguistic context, broadly construed, effects the truth-value of a sentence: The *context of utterance* is responsible for assigning content to the context sensitive elements in the sentence. After this, the *circumstance of evaluation* determines the truth-value of the sentence, given that assignment of content and the state of the world. The character of an expression is the aspect of its meaning that remains constant across all contexts of utterance; it is a function from contexts of utterance to contents. The content of an expression is defined as the meaning of an expression in a context; it is a function from circumstances of evaluations to extensions (truth-values in the case of sentences). For technical reasons which will become clear in the next section, Kaplan takes the circumstances of evaluation to be world-time pairs, which has as a consequence that the contents of some sentences are temporal rather than classical propositions.

David Lewis (1980) objects to Kaplan's three levels of semantic values, and argues that there is no particular reason to single out the intermediate level of *content* - what Lewis calls 'simple but variable semantic values' - in a semantic theory. Instead of the two-step procedure from character to extension advocated by Kaplan, Lewis holds that we may equally well take one step straight from character - what Lewis calls 'complicated but constant semantic values' - and pairs of contexts of utterance and circumstances of evaluation to extensions. Lewis argues that nothing vital is lost if we discard the level of content and work only with character and extension in our semantic theories, since (a) it is not necessary to isolate the level of content to determine the truth-conditions of English sentences, and (b) Kaplan's content does not correspond to any privileged pre-theoretic notion

48

of content or meaning. The first point is uncontroversial. (Cf. Wester-ståhl, 2012: 199, 203.) Therefore, this chapter will mainly be concerned with the second claim. In particular, Lewis argues that Kaplanian contents cannot play the privileged role of being the contents of beliefs and assertions.

> I cannot complain against Kaplan, as I did against Stalnaker [(1970)], that his so-called contents are not semantic values because they violate compositionality. But Kaplan cannot plausibly claim, as Stalnaker did, that his contents have an independent interest as suitable objects for propositional attitudes. (Lewis, 1980: 96)

Why so? The reason that Lewis is hostile to the idea that the Kaplanian contents of sentences could be the objects of belief is precisely that they are *temporal propositions* (sets of world-time pairs). Now, the standard view is that what we believe and assert are classical propositions (sets of possible worlds). This view is summed up in the principle WORLD ONLY.

> WORLD ONLY. The content of assertion and belief only varies in truth-value across worlds.

In particular, contents are not relative to time:

> ETERNALISM. The content of assertion and belief do not vary in truth-value across time.

It is possible to be an eternalist without thereby being committed to WORLD ONLY; perhaps one holds that some objects that we stand in the belief and assertion relation to vary in truth-value across systems of norms or standards of precision, but not across times. (Gibbard, 1990: 96). For the purposes of this chapter, this possibility is irrelevant, and I will abstract from it. However, I will nevertheless continue to use the label WORLD ONLY, to mark that many of the arguments here are not specific to tense and temporal expressions. There are analogous arguments concerning e.g. location.

The term *eternalism* comes from Richard (1981), who distinguishes it from *temporalism*.

> TEMPORALISM. The content of assertion and belief may vary in truth-value across time.

Lewis's argument against Kaplan relies on the falsity of TEMPORALISM. So, the question arises whether it indeed is the case that temporal propositions cannot be the objects of assertion and belief. I will argue that they can and sometimes are.

The chapter proceeds as follows. Section 3.2 presents Kaplan's argument for the contents of sentences being temporal propositions. Section 3.3 argues that temporal propositions can serve as the objects of belief and assertion. Section 3.4 criticizes Richard's influential argument from belief retention against temporalism.

3.2 KAPLAN'S ARGUMENT FOR TEMPORAL PROPOSITIONS

Kaplan's distinction between character and content is important and influential, as is the distinction between the two ways in which the truth-value of a sentence depends on the world. The *context of utterance* determines the referents of the context sensitive expressions of the sentence (the indexicals) and in that way determines what the sentence says in that context, and the *circumstance of evaluation* determines whether what the sentence says is true or false. Take the following simple example:

(31) I'm hungry.

First, who the speaker is determines the referent of "I" in (31) and thus what the sentence says. If the speaker is Bob, the sentence says that Bob is hungry. If the speaker is Dave, it says that Dave is hungry. Second, how the world is determines whether the sentence is true or false, given that reference assignment. (31) as uttered by Bob is true in worlds where Bob is hungry and false in worlds where he is not. The Kaplanian framework provides the tools to account for these two kinds of world dependence. Let ϕ be a sentence, c the context of utterance, s_c the speaker in c, and i the circumstance of evaluation, the *index* in Lewis's terminology. The truth-conditions of (31) are then

(32) $[\![$ I'm hungry $]\!]_i^c = 1$ iff s_c is hungry at i

Semantic clauses have the following general form, specifying the truth-conditions relative to both a context and a circumstance of evaluation.

(33) $[\![\phi]\!]_i^c = 1$ iff ϕ is true as uttered at the context c and evaluated at circumstance i

The context is a tuple of parameters such as time, location, speaker, world, standard of precision etc. Which parameters go into the context varies between theories. So-called double indexed frameworks as such is neutral on this issue. (Cf. Westerstahl (2012)) The circumstance of evaluation contains at least a world-parameter, and possibly also a time-parameter or place-parameter, again depending on the details of the particular semantic theory.

Although character and content are technical notions, Kaplan takes them to correspond to two more intuitive and pre-theoretic notions. *Character* roughly corresponds to what the competent speaker knows about the meaning of the expressions of her language, independently of the context of use.

> Because character is what is set by linguistic convention, it is natural to think of it as *meaning* in the sense of what is known by the competent language user. (Kaplan, 1989: 505)

It is worth noting that this characterization is strictly speaking false in Kaplan's own semantic framework where proper names are directly referential. That they are entails that co-referential proper names have the same character (the person they refer to) and should have the same cognitive significance. But a competent speaker of English may very well fail to know that 'Mark Twain' and 'Samuel Clemens' have the same character. However, since this text is not on the semantics of proper names, I will leave this issue to the side. When it comes to other expressions than proper names the claim that the competent speaker knows the character (but not necessarily the content) of the expressions of the language, seems plausible enough.

Content, on the other hand, is supposed to capture the pre-theoretic notion of what an expression says when uttered in a context.

> Let us call this first kind of meaning - what is said - *content*. [...] I take *content* as a notion applying not only to sentences taken in context but to any meaningful part of speech taken in context. (Kaplan, 1989: 500-501)

Consider for instance (31). That sentence can be used to say different things, depending on who the speaker is. Conversely, the different sentences (34) and (35) intuitively say the same thing in a context where the salient location is Stockholm.

(34) It's raining here

(35) It's raining in Stockholm

Kaplanian content thus captures one aspect of what it is for two sentences to say the same thing. However, it cannot be the full story, since sentences with the same Kaplanian content in a context can differ importantly when it comes to the information they convey. Take John Perry's example: I may be perfectly aware that the meeting starts at 12.00 and still learn something new when my colleague runs down the corridor and explains his hurry with the assertion of (36). (Perry, 1979: 5)

(36) The meeting starts now.

(37) The meeting starts at 12.00.

Since (36) and (37) have the same Kaplanian content in a context where the time is 12.00, we cannot use that notion to explain how I learn something new in that situation. The notion of Kaplanian content captures one aspect of sameness of meaning, but not others. We will return to this issue in chapter five.

What about the circumstances of evaluation? In many cases the circumstance of evaluation is simply the circumstance of the context of utterance, only performing the job of assigning extensions rather than intensions. That is, sentences are uttered and evaluated relative to the same parameters. However, in some cases we must evaluate sentences for truth and falsity in other circumstances than the circumstance of the original context of utterance. For example, in order to evaluate a sentence containing a modal operator, we must evaluate the sentence embedded under the modal operator at other worlds than the actual world. In such cases, the modal operator is said to "shift" the world of the circumstance of evaluation from the world of the context of utterance. If we follow Kaplan, Lewis, and Prior (1967), and treat tense by means of temporal sentential operators and wish to evaluate a sentence containing such an operator, then the embedded sentence must be evaluated at other times than the time of the context of utterance.

(38) It's possible that it will rain.

(39) It always rains.

(40) $[\![\text{POSSIBLY}, \phi]\!]^c_{<w,t>} = 1$ iff, for some w', $[\![\phi]\!]^c_{<w',t>} = 1$

(41) $[\![\text{ALWAYS}, \phi]\!]^c_{<w,t>} = 1$ iff, for all t', $[\![\phi]\!]^c_{<w,t'>} = 1$

The choice to treat tense by means of intensional operators is crucial. Just as modal operators must operate on modally neutral propositions, temporal operators must operate on temporally neutral propositions, that is, propositions that may vary in truth-value across times. If they didn't, then temporal operators would be semantically vacuous, and they are not. To see this, consider:

(42) It is raining in Helsinki.

Let 11 pm be the time of the context of utterance and we get the following semantics for (42).

(43) $[\![\text{It is raining in Helsinki.}]\!]^c_{<w,t>} = 1$ iff it is raining in Helsinki at 11 pm (relative to w)

If this is the correct semantics for (42), then adding the temporal operator *Now* wouldn't add anything to the meaning of it. So (42) and (44) would say the same thing as uttered in the same context.

(44) It is raining in Helsinki now.

However, if they have the same content, they should be substitutable for each other *salva veritate* in larger expressions, which they are not. Compare for example:

(45) It will always be the case that it is raining in Helsinki.

(46) It will always be the case that it is raining in Helsinki now.

Since temporal operators are not vacuous, what they operate on must be temporally neutral. That is, they must operate on temporal propositions, and not classical propositions. So, Kaplan concludes, the correct semantics for (42) is

(47) $[\![\text{It is raining in Helsinki.}]\!]^c_{<w,t>} = 1$ iff it is raining in Helsinki at $<w,t>$.

And in general:

(48) $[\![\phi]\!]^c_{<w,t>} = 1$ iff ϕ is true as uttered at c and evaluated at $<w,t>$

Just as modal operators require us to evaluate the embedded sentence at other worlds than the actual, temporal operators require us to evaluate the embedded sentence at different points in time. The compositional semantic value of a sentence, in Kaplan's case, must therefore be a temporal proposition.

Recall the view that the objects of belief and assertion only vary in truth-value across worlds.

> WORLD ONLY. The content of assertion and belief only varies in truth-value across worlds.

If this view is correct, then Kaplan's argument entails that the following principle is false.

> IDENTITY. The compositional semantic value of a sentence in a context is identical to the assertoric content of that sentence in that context.

But without IDENTITY, there is nothing special about Kaplanian content. This is precisely the critique raised in Lewis (1980: 96f.) against Kaplanian content: Temporal propositions are not suitable objects of assertion and belief. Classical propositions are. Hence, there are no reasons to single out the Kaplanian content of a sentence in a semantic theory that treats tense by means of index-shifting operators.

Interestingly, this was no longer Lewis's view when 'Index, context and content' was published in 1980, apparently a few years after being written. In 'Attitudes *de dicto* and *de se*' (Lewis, 1979) Lewis famously advocates centered propositions (sets of world-time-agent triples) as the proper object of attitudes. That is, he moves even further away from the classical propositions than Kaplan does in advocating temporal propositions. (Cf. (Lewis, 1997: 39), where Lewis comments briefly on this change in views.)

Now, Kaplan is by no means committed to equating his notion of content with the contents of belief and assertion, but it is plausible to ascribe to him that view given that he holds that his content corresponds to what a sentence *says* in a context. Otherwise he would need a distinction between what a sentence says and what is asserted when that sentence is uttered. Under the further assumption that what is said by a sentence, but not as-

serted, is an interesting notion we then still would have reasons to single out Kaplanian content in our theory. On the other hand, if we equate what a sentence says with what is asserted by a sentence in a context, temporal operators commit us to the view that the objects of belief and assertion (sometimes) are temporal propositions.

> If we built the time of evaluation into the contents (thus removing time from the circumstances leaving only, say, a possible world history, and making contents *specific* as to time), it would not make sense to have temporal operators. To put the point another way, if *what is said* is thought of as incorporating reference to a specific time, or state of the world, or whatever, it is otiose to whether what is said would have been true at another time, in another state of the world or whatever. Temporal operators applied to eternal sentences (those whose contents incorporate a specific time of evaluation) are redundant. Any intensional operators applied to *perfect* sentences (those whose contents incorporate specific values for all features of circumstances) are redundant. (Kaplan, 1989: 503)

The argument presented in this chapter is somewhat problematic as an argument for temporalism. The objects of attitudes and assertions may very well be temporal propositions, but our reason for believing that they are should not be that we have decided to treat tense by means of operators (rather than extensionally). Rather, the argument should go in the other direction: We may treat tense by means of temporal operators if we have independent reason to think that the objects of attitudes and assertion are temporal propositions. However, as we will see in the next section, the issue is largely independent of whether tense is treated intensionally or extensionally.

Let us sum up this section by combining Kaplan's and Lewis's arguments. Assume that English contains non-vacuous temporal operators with an index-shifting semantics. This means that they must operate on temporal propositions, which in turn presents us with following *prima facie* unpalatable options:

Either:

> A. Temporal propositions are what we assert and believe. This option amounts to denying eternalism, in order to maintain the

> identity between assertoric content and compositional seman-
> tic value.

or,

> B. Temporal propositions are not what we assert and believe.
> This option amounts to denying the identity between asser-
> toric content and compositional semantic value, in order to
> keep eternalism. The latter may vary in truth-value over time,
> but not the former.

Kaplan opts for option A, while Lewis prefers option B. There is some re-
maining work for each option. Proponents of A need to give an account of
temporal assertion and belief, and respond to standard objections to tem-
poralism. This will be the topic of the rest of the chapter. If temporal
propositions can be the objects of belief and assertion then IDENTITY to-
gether with the temporal index-shifting operators does not provide us with
an argument against the viability of Kaplanian content as the content of
assertion and belief. In the rest of this chapter I argue that temporal propo-
sitions are viable as assertoric content, and hence that Lewis has not pro-
vided an argument against assigning Kaplanian content a privileged role.
Proponents of B need to give an account of the relation between composi-
tional semantic value and assertoric content in order to secure a prominent
role for semantics in an account of communication. I will return to this
question in chapter six.

3.3   BELIEVING AND ASSERTING TEMPORAL
PROPOSITIONS

Can we believe and assert temporal propositions? There is a very simple
argument that the answer is that we can. There is nothing strange as such in
the idea that we believe things that vary over *some* parameter. Indeed, even
the eternalist take the objects of belief to vary in truth-value over possible
worlds. Here is a simple picture of belief on the eternalist picture:

> To believe a proposition is to ascribe to the actual world the
> property of being a world where that proposition is true. To
> believe that a proposition is possible is to ascribe some world
> the property of being a world where that proposition is true.

To believe that a proposition is necessary is to ascribe every world the property of making it true. In all of these cases, the subject evaluates the proposition across a parameter, namely, world.

There does not seem to be anything particularly odd or unintuitive in letting the object of belief vary across an additional parameter, such as time. To believe and assert a temporal proposition is to ascribe to the actual world and a time the property of being a world and a time where that proposition is true. So, insofar as we can believe and assert classical propositions, we can believe and assert temporal propositions.

What I'm advocating here is an instance of what Glanzberg (2009: 302) calls 'the easy road to relativism'-argument. The argument is quite modest in its ambitions. It is not supposed to show that we actually do assert temporal propositions, for instance. Rather it is supposed to emphasize that we already do work with some notion of relative truth - relative to possible worlds, models or assignments for instance - and hence that the relativity as such is not an argument against temporalism. Glanzberg is not impressed by this kind of argument. Among other things he argues that in possible world semantics, possible worlds are not analogous to times, locations and other parameters in the index. We quantify over times etc. both in the metalanguage and in the object language. This is not the case with possible worlds, which only occur in the metalanguage. Hence, the easy road to relativism is blocked. I disagree. We *do* quantify over possible worlds in the object language.

(49) There's no possibility that he will win.

or

(50) In a possible future scenario, we drive flying cars.

Both of these cases are plausibly read as quantification over possible worlds or scenarios. Note that the easy road to relativism argument only shows that it is not conceptually impossible that what we say varies in truth-value across more parameters than worlds.

However, do we *in fact* believe and assert temporal propositions? Yes. Or at least our intuitions about what is said by certain utterances support this claim. Consider the following exchange, and assume that it takes place on Monday, April 5th 2015. Both participants know what day it is.

(51) Ann: Yesterday, you believed that it was Sunday. Do you still be-
lieve that?

(52) Mary: No.

Arguably, it would be at least odd, and even false, for Mary to reply "Yes"
to Ann's question. However, if what Mary believed on Sunday was the
eternal proposition *that April 5th, 2015 is a Sunday*, she should answer
"yes", since the truth-value of that proposition remains the same. That the
intuitive answer is "No" suggest that what she believed was a temporal
proposition, true evaluated with respect to Sunday and false evaluated with
respect to Monday.

Now, consider the following case. Suppose that the president of France is
under a lot stress. After having been accused of corruption, more and more
voices call for his resignation. Nevertheless, he holds a press conference
on Monday where he declares that he has no intention of resigning.

(53) I have no intention to resign as president. (Uttered on Monday)

On Tuesday he holds a second press conference.

(54) What I said at the press conference yesterday still holds. (Uttered on
Tuesday)

This would be a trivial assertion if the proposition referred to was the eter-
nal proposition *that the president on Monday April 6th, 2015, has no in-
tention of resigning*. But, intuitively, (54) is not a trivial assertion but an
informative one. That suggests that the proposition referred to is a tem-
poral proposition, i.e. something that is able to vary in truth-value across
times. The temporal proposition *that the president has no intention of re-
signing* is true both with respect to both Monday and Tuesday, and by ut-
tering (54) the president conveys the new information that the proposition
that could have been false relative to the Tuesday is in fact true relative to
that day.

This is not to suggest that these examples are impossible to explain with
eternal propositions and Gricean mechanisms. However, it shows that tem-
poral propositions are not just a theoretical construct, but for independent
reasons fit nicely with some of our intuitions about assertoric content. (As
we will see in the next section, however, we should perhaps not put too
much weight on such intuitions.)

3.4 Richard's argument against temporalism

An influential argument by Mark Richard appears to show that temporal propositions are a non-starter. (Richard, 1981) Richard presents us with an inference that is only apparently valid, according to Richard, and then argues that the temporalist must judge it to be valid. Hence, Richard concludes, we should reject temporalism. Here is the inference.

(55) 1. Mary believed that Nixon was president.

2. Mary still believes everything that she once believed.

3. Hence, Mary still believes that Nixon is president.

To see why the temporalist would be committed to the validity of (55), let *m* stand for Mary, *n* for the temporal proposition *that Nixon is president*, and *t* and t' for times such that t' is later than t. (56) would then appear to be the correct rendering of the inference in (55).

(56) 1. $\text{Believe}(m,n,t)$

2. $\forall p\ ((\text{Believe}(m,p,t) \rightarrow \text{Believe}(m,p,t')))$

3. Hence, $\text{Believe}(m,n,t')$

The argument comes out as valid, but Mary need not now believe that Nixon is (still) president just because she once believed it and still believes everything she once believed. Or so Richard argues. The crucial step in Richard's argument is his analysis of the second premise of (55). For the inference to be valid, belief retention must be understood in accordance with the following principle.

> SAME PROPOSITION. To retain a belief that *p* from a time *t* to a later time t', is to believe the same proposition *p* at *t* and at t'.

However, I agree with temporalists such as Brogaard (2012) and Recanati (2007) that belief retention does not always work in this strict manner. Sometimes, the following more liberal principle captures what it is to retain a belief.

> RELATION. To retain a belief that *p* from a time *t* to a later time t', is to believe some proposition *q* at t', such that *q* is appropriately related to *p*.

Identity is one such appropriate relation, but not the only one, and not always the relevant one. I believe that Richard-style arguments only show that belief retention reports are ambiguous between the two understandings. To say that a subject believes the same thing as before is sometimes most naturally interpreted as saying that she stands in the belief relation to the same proposition, and sometimes most naturally interpreted as saying that she stands in the belief relation to some appropriately related, but not identical, proposition.

Let *u* be the proposition *that Nixon used to be president*. When faced with evidence that Nixon is no longer president, Mary changes her belief that he is president to the related, *tensed* belief that Nixon was president. Mary has simply adjusted her belief appropriately according to the change in temporal perspective vis-à-vis Nixons presidency. Still, in an intuitive sense, she qualifies as retaining her original belief, it seems to me. Let *R* be the appropriate relation between two propositions *p* and *q*. For a full account, I would need to say more about this relation but for present purposes this will do. I will say something about the relation in chapter six. Now, we can give the following rendering of (55).

(57)   1. $\text{Believe}(m, n, t)$

2. $\forall p\, (\text{Believe}(m, p, t) \rightarrow \exists q (R(p, q) \wedge \text{Believe}(m, q, t')))$

3. Hence, $\text{Believe}(m, n, t')$

Now, we have a temporalist interpretation of (55) on which the argument is invalid.

To reject SAME PROPOSITION might seem like an *ad hoc* move on the part of the temporalist, but it is not. On the contrary, it is something that even the eternalist must do. Consider the following inference. It is similar to Richard's argument, but this time it causes problems for the eternalist.

(58)   1. Mary believed that she was in Barbados.

2. Mary still believes that she is in Barbados.

3. Hence, there is at least one thing that Mary still believes.

This argument is valid, at least on one natural reading. Letting *b* be the proposition that Mary is in Barbados, the temporalist can explain

why:

(59)   1. Believe(m,b,t)

       2. Believe(m,b,t')

       3. Hence, $\exists p$ (Believe(m,p,t)$\wedge$Believe(m,p,t'))

However, an eternalist who subscribes to SAME PROPOSITION, is forced to classify it as invalid. Let b_t be the eternal proposition believed at t and $b_{t'}$ be the eternal proposition believed at t':

(60)   1. Believe(m,b_t,t)

       2. Believe($m,b_{t'},t'$)

       3. Hence, $\exists p$ (Believe(m,p,t)$\wedge$Believe(m,p,t'))

(60) is invalid. The eternalist can of course insist that there is no reading of (58) on which it is valid, but that seems simply to be false. Given this, not even the eternalist should require belief retention to always accord with SAME PROPOSITION. However, without that very principle, Richard's argument against temporalism loses its force.

Since the requirement in SAME PROPOSITION causes problem for eternalists and temporalists alike when accounting for inferences involving belief retention, Richard is ill-advised to appeal to it in arguments against temporalism. I conclude that Richard's argument does not pose a particular problem for temporal propositions. It poses a problem for the thesis that retaining a belief should always be understood as standing in the belief relation to the same proposition over time, but that is an unnecessarily strong condition anyway, even for the eternalist. In so far as intuitions about what is said are a guide to the semantic type of our assertions and beliefs, temporalism seems to fare equally well as eternalism.

3.5   CONCLUSION

Kaplan (1989) and Lewis (1980) show that the existence of temporal operators in a language entails that either IDENTITY or WORLD ONLY must be rejected. Lewis opts for rejecting the former, while Kaplan rejects the latter, at least under the assumption that *what-is-said* is the assertoric content of a sentence. I've presented some support for Kaplan's thesis that

temporal propositions are sometimes the assertoric content of sentences. I've also argued that Richard's argument from belief retention against temporalism fails. The upshot of the chapter is that, contrary to Lewis's claim, the fact that the compositional semantic value of some sentences must be temporal propositions in Kaplan's framework does not in itself entail that IDENTITY is false.

CHAPTER 4

QUANTIFICATIONAL APPROACHES

CHAPTER ABSTRACT. I present Jeffrey King's argument that the dilemma arising from the Kaplan/Lewis argument can be avoided by treating tense extensionally rather than intensionally, and explain how an analogous dilemma arises for the extensional treatment as well. I relate this problem to the general debate on contextualist versus relativist semantics.

4.1 INTRODUCTION

As we saw in the previous chapter, Kaplan and Lewis show that the following three claims are inconsistent: (i) The assertoric content of a sentence only varies in truth-value across worlds (WORLD ONLY), (ii) The assertoric content of a sentence is its compositional semantic value (IDENTITY), and (iii) The language contains temporal operators with an index-shifting semantics (OPERATORS). I considered solving the problem by denying the first claim, which is a natural interpretation of Kaplan's own view. This chapter considers attempts to solve the inconsistency by denying that English contains temporal operators.

4.2 EXTENSIONAL TREATMENTS OF TENSE

The fact that tense (and location) are treated intensionally, that is, by means of index shifting sentential operators, plays a central role for both Kaplan (1989) and Lewis (1980). Consider again the Kaplan/Lewis-argument:

(61) 1. English contains non-vacuous temporal operators.

   2. If a language contains non-vacuous temporal operators, then the compositional semantic value sof some sentences are temporal propositions.

   3. Hence, either the assertoric content of some sentence varies in truth-value across world and *time*, or the assertoric content of certain sentences is distinct from their compositional semantic value.

In Kaplan's case, the combination of the claim that tense and temporal expressions are operators and the claim that the compositional semantic value

64

of a sentence in context is the assertoric content of that sentence in a context commits him to rejecting WORLD ONLY and instead hold that the assertoric contents of some sentences are temporal propositions. In Lewis's case the combination of the same claim about the index-shifting operators and the claim that the assertoric content of a sentence is a classical proposition commits him to rejecting IDENTITY. Both approaches reject key components of what I call *the simple picture* of the role of compositional semantic values in the explanation of successful communication.

> THE SIMPLE PICTURE. Successful communication involves the transfer of a thought from a speaker to a hearer. The content of a belief is a classical proposition, p. The speaker expresses her belief that p by uttering a sentence s whose assertoric content in the context of utterance c is p. The hearer computes the compositional semantic value of s relative to c and thereby comes to entertain the belief that p.

Since the second premise in (61) is uncontroversial, it is not surprising that responses to the argument have focused on the first premise. That is, the question whether tense and temporal expressions are indeed index shifting sentential operators. For instance, in his influential (King, 2003), Jeffrey King argues that English in fact doesn't contain such operators and that the dilemma of the conclusion thereby can be avoided. If the only index-shifting operators in English are the modal ones, then the only parameter of the circumstances of evaluation that ever needs to be shifted is the world parameter. That in turn means that the compositional semantic value of the sentences that the operators operate on will only need to vary in truth-value across worlds. So the compositional semantic value of embedded sentences will be classical propositions. Hence, neither IDENTITY nor WORLD ONLY needs to be rejected. Or so the argument goes. In response, a number of recent arguments suggest that the status of WORLD ONLY and IDENTITY is orthogonal to the question whether tense is best treated intensionally or extensionally. We will look at these arguments in turn.

King's explicit goal is to:

> argue against Lewis (and so to some extent in defense of [(Stalnaker, 1970)]) that [...] sentences *can* be assigned semantic values relative to contexts in such a way that propo-

sitions are compositionally assigned to sentences relative to
context and are the semantic values relative to those contexts
of the sentences in question. And we need not assign sen-
tences any second sort of semantic value. (King, 2003: 206)

As will become clear, I agree with King that IDENTITY is an attractive idea
which deserves to be our default position, and I believe it is fair to say that
the burden of proof lies with those who wishes to deny it. I thus disagree
with Rabern (2012a), who somewhat provocatively posits the following
challenge:

I challenge theorists who adhere to the identification thesis
to give either a direct argument in its favor or a substantial
objection to views that deny it. Why should we think that the
things we say are identical to the things our sentences mean?
(Rabern, 2012a: 95)

I interpret Rabern as asking why we should believe in the identity thesis
in the first place. The straightforward answer to this question is that that
would be our simplest compositional theory of what we say when we utter
sentences.

In the semantic frameworks under consideration in this dissertation seman-
tic clauses have the following general form.

$[\![\phi]\!]_i^c = 1$ iff ϕ is true as uttered in the context c and evaluated
at the circumstance i

That is, the truth-value of a sentence depends both on the context of utter-
ance, which determines the referents of the context sensitive expressions
of the sentence, and the circumstance of evaluation at which the sentence
is evaluated for truth or falsity given the reference assignment determined
by the context of utterance. Which parameters need to be included in the
circumstance of evaluation depends on which so-called "shifty" operators
the language contains. Of course, one can include any parameter in the cir-
cumstance of evaluation, but it is only the shifty operators that *require* that
a particular parameter is included in the circumstance of evaluation. As
we have seen, Kaplan and Lewis account for tense in basically the same
way as they treat modality: Temporal expressions are treated as operators
that shift the time-parameter in the index/circumstance of evaluation in the
same way as modal operators shift the world-parameter in the index.

Their treatment is not the only, or even the most common way of treating tense and temporal expressions; many linguists and formal semanticists prefer to treat tense *extensionally*, by means of quantification over time-variables in the object-language. The motivation is *inter alia* evidence that temporal expressions function syntactically much like pronouns, as argued for instance in Partee (1973). (Cf. also Ogihara (1996), Kratzer (1998), and Kusumoto (2005).)

To see the difference between the intensional and the extensional treatment, consider the following sentences.

(62) The sun was shining in Oslo.

(63) It will always be the case that the sun is shining in Oslo.

On an operational treatment of tense, we get the following semantic clauses for (62) and (63). For ease of exposition I abstract away from the context of utterance and other parameters than time (t) and world (w) in the circumstance of evaluation.

(64) $[\![\text{PAST}(\text{The sun is shining in Oslo})]\!]_{\langle w,t \rangle} = 1$ iff $[\![\text{The sun is shining in Oslo}]\!]_{\langle w,t \rangle} = 1$ at a time $t', t' < t$ in w

(65) $[\![\text{FUTURE ALWAYS}(\text{The sun is shining in Oslo})]\!]_{\langle w,t \rangle} = 1$ iff $[\![\text{The sun is shining in Oslo}]\!]_{\langle w,t \rangle} = 1$ at every time $t', t' > t$, in w

By treating tense and temporal adverbs as sentential operators, the semantic clauses quantify over time in the metalanguage. Contrast this with the following analysis, where tense and temporal adverbs are treated by means of quantification over time variables in the object language. Let t be an implicit indexical constant that always picks out the time of the context of utterance.

(66) $\exists x (x < t \land \text{The sun is shining in Oslo}(x))$

(67) $\forall x (x > t \rightarrow \text{The sun is shining in Oslo }(x))$

If these are the proper logical forms of these expressions, then what should the semantic clauses be? Let g be an assignment with the domain D which includes the set of times.

(68) $[\![\text{The sun was shining in Oslo.}]\!]^c_{g,w} = 1$ iff the sun is shining in Oslo at $g(x)$, and $g(x) < t$

(69) ⟦ It will always be the case that the sun is shining in Oslo.⟧$_{g,w}^{c}$ iff for all t' such that $g(x) = t'$ and $t' > t$, the sun is shining in Oslo at t'

The idea is this, since tense can be treated by means of quantification over times, we have no need for temporal operators. This feature is then used in a two-step argument against the Lewis/Kaplan-dilemma, as can be seen in the following reconstruction of King's argument. (King, 2003: 211ff.)

(70)   1. Extensional treatments offer a more adequate and simpler treatment of tense and temporal expressions in English.

2. If (1), then there are no temporal operators in English.

3. There are no temporal operators in English. (1, 2)

4. If (3), then classical propositions are both compositional semantic values and assertoric content.

5. Hence, classical propositions are both compositional semantic values and assertoric content.

The first part of the argument relies on something like the following principle:

> SIMPLICITY WINS. If extensional treatments of tense fare better than, or equally well as, intensional alternatives, then, due to simplicity considerations, we should prefer extensional treatments.

King actually invokes a stronger, less instrumentalist thesis than this, as can be seen in the quote below. But the argument as such only requires the weaker thesis.

> If the complex temporal facts present in natural language are most readily and easily represented by viewing tenses as involving explicit quantification over time and as expressing relations between times, that is a good reason for thinking that tenses really work this way. (King, 2003: 211]

I'm happy to grant King the first part of the argument, as I believe most of us are. If extensional treatments of tense are better at accounting for tense and temporal expressions, then there is no need to introduce temporal operators. Furthermore, it's fairly clear that *if* theories that vali-

68

date IDENTITY succeed equally well in accounting for speakers' intuitions about assertoric content as theories that reject it, then the burden of proof is with those who reject it. Why? Such theories would succeed in doing the same things as the competing theories do, without making the additional distinction between two kinds of meaning. Add to this the fact that this enables an explanation of successful communication in terms of semantic values. However, the argument nevertheless fails, as we will see in the next section.

4.3   AN ANALOGOUS PROBLEM FOR KING

Despite the above mentioned virtues, King's argument fails to dissolve the dilemma of the Kaplan/Lewis argument. The assumption in the literature has long been that the dilemma only arises if we treat tense intensionally. This is also the most natural interpretation of both Lewis (1980) and Kaplan (1989). However, the fact is that temporal operators are only a sufficient but not a necessary condition for the dilemma to arise. As it turns out, the same dilemma arises on the extensional treatment as well. This has been emphasized by Ninan (2010), Rabern (2012b), Weber (2013) and Almér and Westerståhl (2010). Here is why: In standard predicate logic, what is embedded under the quantifiers $\forall x$ and $\exists x$ is not a proper sentence but an *open formula* with a free variable x, which the quantifier binds. For instance, what is embedded under the existential quantifier in (66) is:

(71) $(x < t \land$ The sun is shining in Oslo$(x))$

Crucially, (71) does not express an eternal proposition except relative to an assignment. In other words, just as a temporal proposition is true only relative to a time, what is expressed by a formula such as (71) is true only relative to an assignment of times to the variable x. So, we face virtually the same dilemma again: either we must accept that we assert something that varies in truth-value between assignments even when the world parameter is held fixed - which amounts to rejecting WORLD ONLY - or we must reject IDENTITY. We are back at square one: It may very well be that the quantificational approach is more suitable for an account of tense and temporal propositions in English, for some other reason, but it does not avoid the IDENTITY/WORLD ONLY-dilemma. More precisely, it does

not solve the dilemma as long as we assume that it is the *same syntactic object* that is embedded and asserted in the examples considered. This is a reasonable assumption, according to me. When we ask whether assertoric content is compositional semantic value, the question presupposes that it is the same thing that is asserted and embedded. We ask whether, for a given sentence, that sentence has the same meaning when embedded and when unembedded. To deny this assumption is to say that there are cases where it merely looks as if it the same sentence that is being asserted and embedded, while it actually is not.

King is of course well aware of the importance of this assumption. As he himself notes, his solution is an instance of what Lewis, somewhat tendentiously, calls the 'schmentencite strategy'. (Lewis, 1980: 88ff) According to Lewis, a *schmentence* looks like a sentence on the surface, but is not really a proper sentence. In this particular case, the schmentence would be the open formula (71), which is a different syntactic object than the sentence "The sun is shining in Olso". The strategy that Lewis refers to avoids a negative answer to the question whether the assertoric content of a given sentence is its compositional semantic value by simply denying that the sentence actually is embedded in a given, problematic construction.

> It is worth highlighting a consequence of our version of the strategy. As already mentioned, if e.g. 'somewhere' is a quantifier, then the sentence it embeds (when it is non-vacuous) must contain a free variable of some sort. But this means that they are in some sense not genuine sentences and will not be assigned propositions as semantic values. They can only be assigned propositions *relative to an assignment of values to variables*. Hence when I claim that propositions expressed by sentences relative to contexts can be identified with Lewis's variable but simple semantic values (or compositional semantic values) had by these sentences relative to contexts, 'sentence' here must be understood to be expressions lacking free variables. On this way of using the term, [what] the expression 'somewhere' embeds in a sentence like 'Somewhere the sun is shining' is not a sentence! (King, 2003: 227)

However, the acknowledgement that it is 'schmentences' and not sentences that are embedded turns the extensional strategy into something of a Phyrric victory; it saves the identity thesis by denying that the sentence

that appears to be embedded is ever really embedded. That way, the issue of whether it has the same meaning when unembedded as when embedded simply doesn't arise. IDENTITY is trivially validated. This does of course not mean that the strategy doesn't work formally. However, it does suggest that it is not simpler and hence that it is not as clear as it seemed initially where the burden of proof lies.

Furthermore, I would like to point out that the *schmentecite*-strategy is available for Kaplan and Lewis too! They can save the identity thesis by holding that the sentence "It's raining" is systematically ambiguous: When unembedded it has the logical form "It's raining at *t*" and when embedded under a temporal operator it lacks any time-index. If this is so, it is not the same sentence that is embedded and that occurs unembedded, and the dilemma is dissolved without rejecting the intensional treatment of tense. Whether this is an attractive way of solving the dilemma is a matter of further discussion, and I will not address this issue here. For an example of this approach, see Recanati's (2002) and the use of so-called *variadic operators*. However, the observation further strengthens the claim that the dilemma between IDENTITY and WORLD ONLY is actually independent of whether tense is analyzed intensionally or extensionally. Note that this fact is equally problematic for King (2003) as for a temporalist like Brogaard (2012), who argues from the existence of temporal operators to the conclusion that we assert temporal propositions.

To sum up this chapter so far, I have two main objections to the attempt to dissolve the inconsistency by rejecting OPERATORS. First, extensional treatments of tense do not as such save the identity of compositional semantic value and assertoric content. The reason is, as we have seen, that an analogous dilemma arises in the extensional framework as well. Second, King does offer a reply to this objection, that formally saves both IDENTITY and WORLD ONLY. However, since that solution postulates systematic syntactic ambiguity between real sentences and open formulas, the simplicity considerations that initially supported the extensional strategy are no longer as clearly in its favor.

4.4 Contextualism vs. relativism

The questions discussed here are connected to some rather general methodological issues in the contextualist/relativism debate on how to best model context sensitivity or context dependence in natural languages. The common characteristic of contextualist theories is that they posit implicit variables in the object language in order to account for how the truth of a sentence depends on some feature of the context, such as time or taste.

> STANDARD CONTEXTUALISM. All extra-linguistic effects of context on the semantic value of a sentence can be traced to a context-sensitive syntactic element in the logical form of the expression, and the semantic value of a sentence in context is a classical proposition/absolute proposition.

Stanley (2000) and King and Stanley (2005) are particularly clear examples of the standard contextualist position. Relativist positions, on the other hand, posit no such variables in the object language. Instead, they raise the arity of the truth-predicate. That is, they replace truth-at-a-world, with truth-at-a-world-and-time etc.

> STANDARD RELATIVISM. All extra-linguistic effects of context on the semantic value of a sentence can be traced to explicit context-sensitive syntactic elements in the logical form of the expression, and the semantic value of a sentence in context is true relative to parameters over and above world.

For a very good overview, see Kölbel (2015). Contextualist theories in general locate as much of the contextual influence as possible on the content determination side, leaving only the world to be a parameter in the circumstance of evaluation. Relativists locate more of the context dependence on the evaluation side. To account for context dependence one must either go contextualist and take the content determination to be a rather complex story involving i.e. hidden indexicals, or you must go relativist and take truth to be a rather complex story involving i.e. temporal propositions. However, the difference should not be construed as more metaphysically charged than necessary. Up until quite recently, the debate over temporalism/eternalism has been interpreted as a debate over whether we quantify over time only in the object language (as argued by King) or sometimes in the meta-language (as argued by Kaplan, Lewis). This way of con-

struing the problems has met opposition lately. Stojanovic (2007) proves that contextualism and relativism about predicates of taste, construed as above, are formally equivalent, and that it is largely "a matter of taste" which framework one prefers. (Stojanovic, 2007: 706) A similar point is made by Almér and Westerståhl (2010) as a critique against Cappelen and Hawthorne (2009). In a similar vein, Kölbel (2004) and MacFarlane (2009) argue that a relativist semantics that is to be substantially different from a contextualist competitor, must do more than, say, assign temporal propositions as the semantic value of sentences. Instead, I suggest that we focus on the fact that some sentences have the following characteristics: they are what I choose to call *essentially relative*.

> ESSENTIAL RELATIVITY. The truth of a sentence ϕ is essentially relative to some parameter x iff (i) ϕ contains an indexical i, which is assigned x as value, or (ii) the truth-value of ϕ varies with of x.

Note that essential relativity is independent of whether we quantify over the parameter x in the object language or in the meta-language. For example, both (72) and (73) are essentially relative to time, while (74) is not:

(72) It's raining in Helsinki.

(73) It's raining in Helsinki now.

(74) It's raining in Helsinki at 11 a.m.

This feature will become important in the next chapter where I present my argument against equating Kaplanian content with assertoric content.

4.5   CONCLUSION

The status of IDENTITY and WORLD ONLY is independent of the question whether the language in question contains temporal sentential operators or not. Hence, technical considerations alone will not settle these issues. In the next chapter, I argue that the discussion must take into account what explanatory role assertoric content is supposed to play.

CHAPTER 5

ASSERTORIC CONTENT

CHAPTER ABSTRACT. I present what I take to be a better argument for the conclusion that Kaplanian content is not assertoric content: plausible constraints on assertoric content rule it out. I consider potential objections and reply to them.

5.1 INTRODUCTION

In chapter three I considered an argument against identifying Kaplanian content and assertoric content that was based on a suspicion against temporalism, and rejected it. In this chapter I will present what I believe is a better argument for the very same conclusion. Partly drawing on the discussion in the previous chapter, I will here argue that plausible principles regulating assertion disqualify Kaplanian content as assertoric content, regardless of whether one accepts temporalism or not.

The discussion and debate ensuing from the Kaplan/Lewis-argument is to a large extent technical. This is also very much true of the original arguments. However, it would be surprising if technical considerations alone were to determine what the contents of our assertions are. In order to make the question whether the contents of our assertions are the same as the compositional semantic values of our sentences substantial, we need an independent theory of assertion and assertoric content as background. Once we have that, we can ask whether our best compositional semantic theory matches it. Therefore, this chapter turns its attention to assertoric content. So far in this dissertation, I have only appealed to an intuitive notion of assertoric content. I will now give a slightly more substantial account, focusing on when two assertions have the same content. Of course, if we don't have some independent grasp of what assertoric content is, it's difficult to make sense of the question whether IDENTITY holds.

A general theory of assertion should do two things. First, it should provide an account of what makes a particular act into an act of assertion rather than some other speech act. This is a matter of ongoing debate. Authors disagree on whether assertion is an essentially normative notion or not. And, if assertion is governed by norms, then which ones? Furthermore, do we individuate assertion primarily by means of the causes or the effects of the speech act? Is there even such a unified category of speech act as assertion? (For instructive overviews on these issues cf. Brown and Cappelen (2011), MacFarlane (2005), and Pagin (2015).) These questions

are of course interesting and important, but for the purpose of this chapter I will remain neutral on the nature of the speech act of assertion. Instead, I'll focus on the other question which a theory of assertion should provide us with an answer to: What is assertoric *content* and how do we individuate it? In particular, I will center the discussion on the crucial question in the context of this dissertation, namely: When do two assertions have the same (different) contents?

The chapter proceeds as follows. I begin by introducing some intuitively plausible constraints on sameness and difference of content. I argue that if these constraints are correct, then Kaplanian content cannot be what we assert. I go on to spell out the connection between these constraints and the idea that meaning should be *transparent* in the sense that sameness and difference in content must be a priori available to the speaker. I end the chapter by responding to some potential objections to my arguments.

5.2 ASSERTION AND EXPLANATION

Why do we ascribe contents to other people's beliefs and utterances? That is, what role does assertoric content play? Intuitively, we ascribe contents to assertions in order to make sense of why people around us act and reason as they do, either in the role as speaker or in the role as hearer. As to the speaker, the primary role of the assertion is to express a belief. If the speaker is honest, an assertion expresses a belief that the speaker has. If she is not, it only seems to express a belief of the speaker. As to the hearer, the primary role of an assertion seem to be to supply her with information about the world, more specifically information about the speakers beliefs about the world. Whether hearing an assertion actually provides such information depends on whether the hearer trusts the speaker or not. If she trusts the speaker, the hearer will adjust her beliefs about the world. Consider again the example from the introduction of the dissertation. Let the speaker and the hearer be two sailors at sea.

(1) A storm is approaching.

When the hearer is contemplating on whether to trust the speaker or not, she might challenge the speaker and require the speaker to provide reasons for her assertion. The speaker is then expected to provide such reasons. In this case she might point to the dark clouds in the sky, or refer to the

weather report. If the speaker is found trustworthy, the hearer will adjust her beliefs and also come to believe that a storm is approaching. This new belief of the hearer will provide her with reasons to perform certain actions - such as taking in sail - and with reasons to draw certain inferences - such as the inference that it probably would have been better to stay at home that day. An assertion thus *provides* reasons for inference and action on the part of the hearer, and also *requires* reasons on the part of the speaker. Intuitively, which reasons an assertion provides and requires depend on its content. That is, assertions play an explanatory role vis-à-vis inferences and action based on having a certain content and thereby providing reasons for actions and inferences. In line with this idea, I propose the following constraints on sameness and difference of assertoric content.

> I. ASSERTORIC CONTENT AS SUPPLYING REASONS FOR IN-
> FERENCE AND ACTION. If an assertion of ϕ and an assertion
> of ψ in a context c all else equal give the rational and com-
> petent hearer reason to (i) make different inferences, or (ii)
> perform different actions, then ϕ and ψ differ in assertoric
> content in c.

> II. PROVIDING REASONS FOR AN ASSERTION. If asserting ϕ
> and asserting ψ in a context c all else equal gives the rational
> speaker reasons to supply different justifications when the as-
> sertion is challenged, then ϕ and ψ differ in assertoric content
> in c.

These constraints entail that some sentences with the same Kaplanian con-
tent differ in assertoric content. Let 11 a.m. be the time of the context of
utterance c. Consider the sincere assertions of (75) and (76), respectively,
in c.

(75) It's raining now.

(76) It's raining at 11 a.m.

According to each of the principles I. and II., (75) and (76) have different
assertoric contents in c: First, upon hearing an assertion of (75) in c, the
hearer obtains reason to believe that its raining where and when she is and
to infer that she will become wet unless she take out an umbrella, and
reasons to take out her umbrella, even if she is ignorant about the time.
However, if the hearer is ignorant about the time, an assertion of (76) will

not provide her with such reasons. Second, a speaker who is challenged after asserting (75) has reasons to provide evidence that it's raining at the time of the utterance, but not evidence that the time is 11 a.m. The same doesn't hold for (76); in that case the speaker is not required to provide evidence that it's raining at the time of the utterance. However, (75) and (76) have the same Kaplanian content in c, when the time of the context of utterance is 11 a.m.:

(77) $[\![$It's raining now.$]\!]_i^c = [\![$It's raining at 11 a.m.$]\!]_i^c$

Furthermore, sentences with different Kaplanian contents sometimes have the same assertoric content. To see this, consider the strengthened, but still plausible, biconditional versions of I and II:

> I*. ASSERTORIC CONTENT AS SUPPLYING REASONS FOR INFERENCE AND ACTION. ϕ and ψ have the same assertoric content in a context c iff an assertion of ϕ and an assertion of ψ in a context c all else equal give the rational and competent hearer reason to (i) make the same inferences, or (ii) perform the same actions.

> II*. PROVIDING REASONS FOR AN ASSERTION. ϕ and ψ have the same assertoric content in a context c iff asserting ϕ and asserting ψ in a context c all else equal gives the rational speaker reasons to supply the same justifications when the assertion is challenged.

Again, let the 11 a.m. be the time of the context of utterance c and consider the sincere assertions of (78) and (75), respectively, in c.

(78) It's raining

Now, we see that (78) and (75) have the same assertoric content in c: Assuming that the hearer have good reasons to trust the speaker, they commit the rational hearer to the same things, which is to perform actions and make inferences based on receiving the information that she is in a context where it is true that it is raining. Furthermore, they require the same justification when challenged, i.e. evidence that it is currently raining. However, they have different Kaplanian contents, since (78) is a temporal proposition and (75) is an eternal proposition, according to Kaplan's semantics. Hence, if either of the principles are correct Kaplanian contents are not what we assert and believe. This is not because some sentences have temporal propo-

sitions as Kaplanian contents, which was the objection considered in the previous two chapters. Rather, it is because plausible principles concerning assertoric content judge that (a) sentences that have the same Kaplanian content may have different assertoric content, and (b) sentences that have different Kaplanian contents may have the same assertoric content. Furthermore, these observations are independent of technical considerations as to whether tense is treated intensionally or extensionally. Rather they are based on observations about what the job of assertoric content is. It is claimed here that its role is to explain rational action and inference. The conclusion holds provided "Kaplanian content" is defined in terms of the Kaplanian semantics where indexical expressions get assigned a value from the context of utterance, not because this semantics yields temporal propositions. As I argued in chapter four, we may still assert Kaplanian contents in the sense of "temporal propositions", only Kaplanian semantics does not then map sentences on the Kaplanian contents we assert.

5.3 TRANSPARENCY OF CONTENT

Are the constraints I suggest plausible? That depends on what we want our theory of content to do. There is an interesting connection between the constraints presented in the previous section, and the intense debate on whether meaning and content must be *transparent*. The idea that meaning is transparent is introduced by Michael Dummett:

> It's an undeniable feature of the notion of meaning - obscure as that notion is - that meaning is *transparent* in the sense that, if someone attaches a meaning to each of two words, he must know whether the meanings are the same. (Dummett, 1978: 131)

Dummett takes it to be a constitutive feature of linguistic meaning, and a more or less obvious one, that (competent) speakers are able to recognize synonymy when they see it, as it were. Since Dummett, the thesis that linguistic meaning is transparent has been developed into the related thesis that mental content is transparent as well, notably by Paul Boghossian. (Boghossian, 1994). Dummett's and Boghossians's claims remain controversial, mainly for two reasons. First, it puts very high cognitive demands on the subjects. That the speaker herself must be able to know

when two meanings or contents are the same or different, implies that she must be able to have meta-level beliefs about the meaning of words and content of beliefs and assertions. This is perhaps more demanding than one would wish. We do not want to tie our account of meaning and content to speakers' abilities to reason *about* meaning and content. (Wikforss, 2015) For instance, it seems perfectly possible to be a competent speaker or thinker without having the capacity to reason about meaning or content on the meta-level.

Second, the constraint is incompatible with most anti-individualist or externalist theories of content. By externalism, I mean any theory according to which the meaning of some expressions and the content of certain mental states at least partly depend on the external environment. We distinguish between two different transparency claims. On the one hand there is the thesis explicitly expressed by Boghossian that sameness of content must be transparent. This means that a subject must be able to tell *a priori* whether any two contents are the same. On the other hand there is the related thesis that any difference between contents must be transparent, that is, that a subject is able to tell whether any two contents are distinct. This distinction is made in Boghossian (1994), and in a very clear way by Jessica Brown. (Brown, 2004: 160) Both of the theses cause problems for externalism. I will briefly illustrate by using two well-known cases, Frege puzzles and Twin Earth scenarios.

As to sameness of content, consider direct reference theories/Millianism about proper names, according to which the meaning of a proper name is the object the name refers to. (Mill, 1884: book 1, ch. 2, § 5) If these theories are correct, then "Hesperus" and "Phosphorus", and "Mark Twain" and "Samuel Clemens", have the same meanings respectively in virtue of referring to the same object or person. If sameness of meaning or content is transparent the subject should be able to know *a priori* that "Hesperus is Phosphorus" and "Mark Twain is Samuel Clemens" are both true. That amounts to the requirement that she should able to tell *a priori* which external circumstances obtain, such as whether Hesperus and Phosphorus are the same celestial object and whether "Mark Twain" is the pseudonym used by Samuel Clemens. She clearly is unable to know such things *a priori*. Hence, direct referentialism/Millianism is incompatible with the requirement that sameness of content is transparent.

As to difference of content, consider the Twin Earth scenarios of Hilary Putnam and Tyler Burge. (Putnam, 1973: 701ff.) (Burge, 1988: 659ff.) In the scenarios, what we normally call "water" here on Earth is H_2O, but on Twin-Earth the liquid that behaves exactly like our water, and fills the exact same function as our water, is the chemically different substance XYZ. In virtue of this external feature, thoughts and talk about the tasteless, odorless liquid which falls as rain and comes out of taps in kitchens etc., are about different stuff on Earth and on Twin-Earth. According to externalism, thoughts about watery stuff on Earth have different contents from thoughts about watery stuff on Twin-Earth. However, I cannot tell *a priori* whether I am on Earth or on Twin-Earth. Assume that, unbeknownst to me, I was moved to Twin-Earth 15 years ago. Intuitively, introspection on the content of my thoughts would not be enough to find out whether this is so. Hence, either difference of content is not transparent or meaning and content do not depend on external circumstances.

The problems for transparency or externalism, depending on how you see it, generated by Frege puzzles and Twin-Earth scenarios are well-known and have generated a vast literature. Whether the meaning of general terms like "water" and of proper names like "Samuel Clemens" indeed depend on features on the external environment, and if so what the implications are, remains a much discussed and controversial issue. Cf. in particular Brown (2004), Boghossian (1989, 1994), Burge (1979, 1988), Falvey and Owens (1994), Goldberg (1999), Sainsbury and Tye (2013), Salmon (1986), and Wikforss (2004, 2008, 2015).

I will not take a stance on these questions. However, it is useful to connect the debate on externalism and transparency in these cases to the case of indexicals, since few would deny that the content of indexical expressions, and in particular sentences containing them, depends on which circumstances obtain in the external environment. To depend on the external environment in this way is the main function of indexicals as it were. However standard, the idea that indexicals get assigned a content depending on the context runs into similar problems as the views discussed above. Assigning values to indexicals requires possessing the relevant empirical information about the external environment, such as time, place, and speaker. Even if the speaker often does possess this information and may use it to interpret what she hears she can clearly not know these things a priori. In other words, it is possible that a speaker fails to realize that the non-indexical

sentence (76) expresses the same proposition as the indexical sentence (75) since it is possible that she fails to realize that she is in a context where this is the case. Now, the reader might object that I should not let my argument against equating Kaplanian content with assertoric content rest on such a substantial and controversial thesis as transparency. It probably shouldn't, at least not without further argument. My argument does indeed require some version of the transparency thesis but, fortunately, it is a less demanding version than the one Dummett and Boghossian appear to have in mind.

In a recent paper, Åsa Wikforss makes the important distinction between *access transparency* and *functional transparency*. (Wikforss, 2015)

> ACCESS TRANSPARENCY. A subject knows *a priori* whether two mental states, speech acts or expressions (in a language that she is competent in) have the same content.

> FUNCTIONAL TRANSPARENCY. Two mental states, speech acts or expressions have the same content if and only if they are substitutable *salva significatione* in explanations of rationality and action.

The former is the most natural interpretation of Boghossian (1994). Crucially, the constraints on assertion that I suggested and used against Kaplan in the previous section only require the latter. As Wikforss points out, the thesis that content is access transparent is a very strong thesis, not least for the reason that it requires subjects to be able to have meta-level beliefs about the content of their mental states. Functional transparency is different. It is a meta-semantic constraint according to which two mental states have the same (different) contents if they have the same (different) *function* with respect to explanations of rational inference and action. The motivating idea behind introducing functional transparency as a constraint is a particular answer to the question: Why do we ascribe contents to mental states and assertions? That is, what does content do? The answer is that we ascribe content in order to explain why we reason and act as we do in specified situations. A notion of content that does not fulfill this explanatory role is lacking something important. So far we have treated semantic values as constitutively compositional. In a similar way, I suggest that mental and assertoric content is constitutively transparent in the functional sense. In 'Attitudes *de dicto* and *de se*', Lewis expresses a similar view.

> The main purpose of assigning objects of attitudes is, I take
> it, to characterize states of the head; to specify their causal
> roles with respect to behavior, stimuli, and one another. If the
> assignment of objects depends partly on something besides
> the state of the head, it will not serve this purpose. The states
> it characterizes will not be the occupants of the causal role.
> (Lewis, 1979: 526)

A plausible interpretation of this passage is that Lewis requires content to
be functionally transparent. Why should we otherwise assign contents, if
not to explain reasoning and action? The instrumentalist, function-focused
approach to mental content expressed by Lewis here is reminiscent of his
view on semantic values:

> Semantic values may be anything, as long as their jobs get
> done. Different compositional grammars may assign different
> sorts of semantic values, yet succeed equally well in telling us
> the conditions of truth-in-English and therefore serve equally
> well as chapters in the systematic restatement of our common
> knowledge about language. (Lewis, 1980: 83)

Note that neither of the principles that I have suggested requires access
transparency. That is, accepting them is consistent with holding that the
speaker may or may not realize that two sentences have the same content,
or different contents, when they do. However, they do rely on functional
transparency; we as theorists, when explaining action and rationality, ob-
serve that (75) and (78) can be substituted *salva significatione* in explana-
tions of rationality and action, but that this does not hold for (76). Fur-
thermore, I take this to be a perfectly general feature: A sentence that is
essentially relative in the sense introduced earlier, is never substitutable in
these cases for a sentence that is not essentially relative to that parameter.
I take this to be the main lesson from Perry's (1979) work on essential in-
dexicality. The reason that indexicality is essential is that it plays a special
role in explanations of rational actions and inference. (See also Recanati,
2007).

Functional transparency is less demanding than access transparency in that
it doesn't entail that speakers have meta-level beliefs about content, but it
too would appear to exclude externalism/direct referentialism. Therefore,
it's time to consider some externalist objections to my argument.

5.4 OBJECTIONS AND REPLIES

Even if functional transparency is less demanding than access transparency as a requirement on content, it is still not uncontroversial. There is not universal agreement that assertoric content and belief content must play this explanatory role. Those favorable to Kaplanian content, or direct referentialists/externalists in general, will give the following response to my arguments:

> Two sentences may have the same content, without the speaker being able to realize that they do. Given this possibility, we are not to conclude that two contents are different from the fact that two content tokens are functionally different in the sense presented here, that is, not substitutable in explanations of rational inference and action. The speaker's failure to recognize the sameness of content is the reason that they are functionally different, not that the contents as such are different. Analogously, a speaker may mistakenly take two contents to be the same when they in fact are different. This mistake is then the explanation for why they can be functionally equivalent with respect to this speaker.

Brown (2004: 160-70) offers a thorough defense of this line of argument, although she does not discuss indexicals in particular. The basic idea is that meaning and content are *opaque* (non-transparent), and hence that subjects sometimes fail to realize sameness and difference of content. The fact that subjects succeed or fail to realize that two contents are the same or different does not entail that there is such a sameness or difference in the actual content. After all, we make logical and conceptual mistakes all the time. (Brown, 2004: 188ff.). A similar strategy is deployed by Sainsbury and Tye (2013).

As an example, consider Anna. Anna believes that it's raining at 11 o'clock, but doesn't know what time it is. It is in fact 11 o'clock. Hence, despite her not wanting to get wet, she leaves the house without an umbrella. On the assumption that

(79) It's raining now.

and

(80) It's raining at 11 o'clock.

have the same content in this particular context, her behavior seems irrational. The externalist explanation of Anna's failure to realize that she should bring an umbrella is not that (79) and (80) actually differ in content, but rather that Anna makes a mistake and fails to realize that this is so. It would also be the explanation of why a subject in a situation like this might hold the contradictory belief that it's raining now but not at eleven o'clock, when in the same context. Brown (2004: 185) compares the situations to other cognitive mistakes subjects make on a daily basis, as e.g. described in Tversky and Kahneman (1983). I have two responses to this line of argument.

First, I believe that it's inadequate to describe these kind of cases as *cognitive* mistakes. That would imply that we as subjects could avoid these mistakes if we only focused enough and payed enough attention. However, no matter how hard a subject focuses and tries to avoid making logical mistakes, she will nevertheless be unable to realize *a priori* whether (79) and (80) have the same Kaplanian content in a certain context. The failure to draw certain inferences where indexicality is involved is not the result of carelessness, but rather what Burge calls "brute error", in a discussion on non-veridical perception.

> Brute errors do not result from any sort of carelessness, malfunction, or irrationality on our part. A person can be perceptually wrong without there being anything wrong with him. Brute errors depend on the independence of physical objects' nature from how we conceive or perceive them and on the contingency of our causal relations to them. The possibility of such errors follows from the fact that no matter what one's cognitive state is like (so, no matter how rational or well-functioning one is) one's perceptual states could in individual instances fail to be veridical - if physical circumstances were sufficiently unfortunate. (Burge, 1988: 567)

I think that what the externalist needs to appeal to for explaining for instance the case of Anna is really brute errors, as opposed to cognitive mistakes. Only brute errors would pardon the subject for her failure to draw a certain inference or perform the appropriate action, and make her not blameworthy for her failure to realize what the content of the assertion is.

86

But, surely, a subject is not blameworthy for failing to know whether she is on Twin-Earth or not? And, if she is not, she is not making a mistake in the proper sense of the word, but is rather subject to a brute error.

Second, do we want a notion of content that allows for brute errors? I would argue that we do not. The externalist view allows for speakers to be generally and systematically erroneous about the contents of their beliefs and assertions, which seems to be a heavy theoretical cost. On the other hand, the externalist avoids the distinction between semantic values and assertoric content, which follows from the arguments in this chapter. But, depending on the relation between the two, the mere distinction is arguably a smaller theoretical cost than postulating systematic errors. Furthermore, and more importantly, even the externalist should be interested in the following question: What must the contents of our beliefs and assertions be in order to provide an explanation of how subjects reason and act? That is, what is the content that the speaker mistakenly takes an utterance to have in situations where the subject, according to the externalist, is mistaken? Regardless of whether there is a 'real' assertoric content that the speaker is mistaken about, it would need to be the 'wrong' content that is doing the explanatory work. And once we see that, the importance of the 'real content' becomes less clear. Finally, as Wikforss (2015: 155f) points out, what the externalist has to offer is at most an excuse of why the subject makes a mistake, rather than an explanation. Meta-level beliefs about the sameness or difference of content are simply not what we use in explanations of reasoning and action, but object level beliefs.

5.5 CONCLUSION

I conclude that functional transparency is a reasonable constraint, and that it entails that some sentences have the same assertoric content, but different semantic values. Some sentences have the same semantic value, but different assertoric contents. Hence, IDENTITY is false. The remaining question is then, what the relation between the two is, and how the simple picture of successful communication must be revised. I turn to these questions in the next two chapters.

CHAPTER 6

CONSTRUCTIVE ACCOUNTS

CHAPTER ABSTRACT. I present two constructive accounts on how to handle temporal sentential operators: the post-semantic account of Lewis and MacFarlane, and my own switcher-semantic account. I compare them with respect to the arguments from the previous chapter. I conclude that both accounts respect the minimal adequacy constraint on a constructive account, but that the switcher semantics is more 'conservative' than the post-semantics.

6.1 INTRODUCTION

Up to this point, my arguments have mainly been critical. I have focused on various aspects of the Kaplan/Lewis argument to the conclusion that IDENTITY, WORLD ONLY and OPERATORS are jointly inconsistent.

> IDENTITY. The assertoric content of a sentence is identical to its compositional semantic value.

> WORLD ONLY. The content of belief and assertion only varies in truth-value across worlds.

> OPERATORS. English contains intensional temporal sentential operators.

In chapter three I argued that Lewis (1980) and Richard (1981) fail to supply reasons to reject IDENTITY in favor of WORLD ONLY. I thereby supplied some support for the most natural interpretation of Kaplan's own view, namely that we should accept temporal propositions in order to be able to maintain that the compositional semantic value - the *content* - of a sentence is also what we assert and believe. However, as we saw in chapter four in the discussion of extensional theories of tense and temporal expressions, OPERATORS is not actually essential to the problem, since an analogous dilemma arises on the extensional view; either the sentences that we assert are true relative to assignments and WORLD ONLY is false, or IDENTITY is false. The only way to keep both is to resort to the so-called *schmentencite*-strategy and postulate syntactic ambiguity. Finally, in chapter five, I argued that plausible constraints on assertion, motivated by the functional transparency constraint, entail that Kaplan's *content* is nevertheless unsuitable as assertoric content.

Against this background, the purpose of the present chapter is to provide a positive account of the relation between compositional semantic value

and assertoric content. What are the requirements on a positive account? Consider again the trio of sentences discussed in the last chapter:

(71) It's raining.

(72) It's raining now.

(73) It's raining at 11 p.m.

These examples raised two questions: What do (71) and (72) have in common that separates them from (73)? Furthermore, what is the difference between them that explains why they embed differently in certain complex constructions? A minimal adequacy condition on a constructive account is that it must offer plausible answers to these two questions. This means that a constructive account should (a) assign the correct assertoric contents, in line with the arguments in chapter five, (b) assign semantic values to sentences that predicts the correct result for when these sentences are embedded under temporal expressions, analyzed intensionally or extensionally, and (c) give an account of how the two kinds of meanings are related.

The strategy of the chapter is straightforward. First, I present two different ways of solving the problem. Second, I compare them with respect to how well they live up the adequacy constraints above. The two solutions are (a) the *post-semantics*-strategy first suggested by Lewis in his critique of Kaplan and recently defended by John MacFarlane and Brian Rabern, and (b) the *switcher-semantics*, which has been applied to modal embeddings but not previously to tense. In applying this strategy, I will need to invoke the notion of general compositionality introduced in chapter two. The main difference between the two approaches is that the latter, but not the former, allows assertoric content to be a part of the compositional semantics.

6.2 Post-semantics

6.2.1 The idea

The basic idea behind the so-called *post-semantic* approach is to drop the requirement that any level of compositional semantic value should play the additional role of assertoric content, but nevertheless define assertoric content in terms of compositional semantic value. This is Lewis's original proposal in his critique of Kaplan's content. (Lewis, 1980: 91) Once we drop that requirement, we can let functions from pairs of contexts and circumstances of evaluation be the compositional semantic values. These are what Lewis calls *complex but constant semantic values*. The suggestion has recently been defended by, in particular, John MacFarlane and Brian Rabern. (Lewis, 1980; MacFarlane 2003; Rabern, 2012b) According to MacFarlane, compositional semantic values are part of the "semantics proper", while assertoric content belongs to the so-called "post-semantics". The terminology is supposed to emphasize that the determination of assertoric content for a given expression takes place after and outside the determination of the compositional semantic value of the expression. (MacFarlane, 2003: 329) This sets it apart from Kaplanian content, which is supposed to be compositionally determined:

> The Content of the whole is a function of the Content of the parts. That is, if two compound well-formed expressions, each set in (possibly different) contexts, differ only with respect to components which *when taken in their respective contexts* have the same content, then the content of the two compounds *each taken in its own context* is the same. (Kaplan, 1989: 507. Emphasis in the original.)

Unlike Kaplanian contents, post-semantic values (assertoric contents) are not expected to compose and determine the post-semantic value of complex expressions. This move potentially avoids the embedding problems discussed so far. As Rabern puts it:

> Theorists working on the nature of assertoric content (or mental content and information) should welcome this distinction, as it allows them to theorize about the nature of content, somewhat liberated from the confines of the strict compositional-

ity principle. Likewise, theorists working in formal semantics
should welcome this distinction as they need not worry if the
semantic values they posit don't always cohere with the intu-
itive notions of "what is said". Of course, there is not total
freedom[.] (Rabern, 2012b: 25f.)

Does this mean that assertoric content falls within pragmatics, rather than
semantics? To a large extent, this is a terminological issue. If one by
'semantics' has in mind compositional semantics, then post-semantics is
not semantics. If one by 'semantics' means something like systematic as-
signments of truth-conditional content to sentences, then post-semantics
belongs to semantics. I doubt that very much hangs on the terminol-
ogy.

6.2.2   SEMANTICS AND POST-SEMANTICS

How does the suggestion work? As we have seen, the truth-conditions of a
sentence have the following general form in a Kaplanian, double-indexed
framework:

(81) $[\![\phi]\!]_i^c = 1$ iff ϕ is true as uttered at a context of utterance c and eval-
uated at a circumstance of evaluation i

The basic idea is then to replace Kaplan's two-step procedure from char-
acter and context to content and then from content and circumstance to
extension, which was presented in chapter three, with a one step proce-
dure from character and so-called *points of evaluation*, which are pairs of
contexts and circumstances, to extensions. MacFarlane explains it as fol-
lows:

Points of evaluation are sequences of parameters, for exam-
ple, speaker, location of utterance, time and assignment. The
recursive clauses for operators can vary these parameters in-
dependently: for example, the clause for 'it is always the case
that' shifts only the time parameter, while that for the uni-
versal quantifier shifts only the assignment parameter. So the
truth-at-a-point profile of '2 + 2 = 4' differs from that of 'I
am here': the former sentence, but not the latter, is true at a
point where speaker = Albert Einstein, location of utterance =
New York City, and time = summer solstice, 1387. (There is

no context of utterance corresponding to this combination of parameters.) Unlike its truth-at-a-context profile, a sentence's truth-at-a-point profile does determine the sentence's contribution to the truth-at-a-point profile of complex sentences embedding it. I call the recursive definition of truth at a point of evaluation the 'semantics proper'. Of course it is the truth-at-a-context profile that we are interested in: this tells us how to evaluate assertions and other speech acts. Truth at a point is just a technical device for defining truth at a context. (MacFarlane 2003: 329)

In order to give a semantics for modal and temporal operators it is important that the embedded sentence is evaluated in other circumstances of evaluation than the circumstance of the context of utterance. But if we are interested in pinning down the assertoric content of a sentence, what matters is the 'normal' case, i.e. when a sentence is evaluated for truth and falsity in the circumstance of the context of utterance. This corresponds to Kaplan's notion of *truth in a context*. (Kaplan, 1989: 546). Let i_c be the circumstance of the context of utterance. For instance, if w is the world of the context of utterance and t is the time of the context of utterance, then i_c is $\langle w, t \rangle$. Read "$[\![\phi]\!]^c = 1$" as "ϕ is true in the context c".

(82) $[\![\phi]\!]^c = 1$ iff ϕ is true as uttered at c and evaluated at i_c

Kaplan defines this notion in order to explain why (83) is always true when uttered despite being contingent. The explanation is given in (84): (83) is always true when uttered in a context and evaluated in the circumstance of that very context, but almost always false as uttered in a context and evaluated in a different circumstance of evaluation (which explains why it's contingent). He could also use it to explain why "I'm here now" is almost devoid of informational content.

(83) I'm here now.

(84) $[\![\text{I'm here now}]\!]^c = 1$, for all c, but $[\![\text{I'm here now}]\!]^c_i = 0$, for most c and i

Truth-at-a-context corresponds to Stalnaker's *diagonal proposition*. (Stalnaker, 2013). We can illustrate the suggestion by using Stalnaker's matrices. The truth-in-a-context profile of the sentence can then be read off on the diagonal. Let the time-points on the vertical lines be the times of

the context of utterance, and the time-points on the horizontal line be the times of the circumstance of evaluation. Let $t_1 = 11.00$, $t_2 = 12.00$ and $t_3 = 13.00$. Furthermore, let it rain at 11.00 and 12.00, but not at 13.00. This means that we get the following results for the sentences we're interested in:

(85)

It's raining.

	t_1	t_2	t_3
t_1	**T**	T	F
t_2	T	**T**	F
t_3	T	T	**F**

(86)

It's raining now.

	t_1	t_2	t_3
t_1	**T**	T	T
t_2	T	**T**	T
t_3	F	F	**F**

(87)

It's raining at 11.00.

	t_1	t_2	t_3
t_1	**T**	T	T
t_2	T	**T**	T
t_3	T	T	**T**

That (85) and (86) have the same diagonal profile, which also differs from that of (87), corresponds to the intuitions spelled out in the previous chapter. A person who doesn't know what time it is and hears either (85) or (86) is informed that she is in a context such that it is raining at the time of the context, but not what the time is. A person who hears (87) is informed that it is raining at 11.00, but will not be able to infer that it is raining at the time of the context unless she is also made aware that she is at a context such that the time of the context 11.00. Note also that if we look at the horizontal lines, (86) and (87) have the same profile as uttered at t_1 which corresponds to them having the same Kaplanian content as uttered

at t_1. However, the Lewis-MacFarlane strategy only focuses on the complete matrix - which represents the compositional semantic value - and the diagonal proposition - which represents the assertoric content.

As a final illustration of how the suggestion is supposed to work, let us look at the problem cases containing temporal expressions.

(88) FUTURE ALWAYS(It's sunny in Oslo).

(89) FUTURE ALWAYS(It's sunny in Oslo now.)

(90) It's sunny in Oslo.

(91) It's sunny in Oslo now.

The desired results are that the first two sentences should differ in truth-conditions despite the fact that the embedded sentences have the same assertoric content, which is also what this framework predicts. Let c be the context of utterance, and $\langle w,t \rangle$ the world-time pair that is the circumstance of evaluation. Together, they make up the point of evaluation. As before, it is only the parameters of the circumstance of evaluation that can be shifted. Let t_c be the time of the context of utterance, and let w_c be the world of the context of utterance.

(88) and (89) have different assertoric contents, unsurprisingly, since

(92) $[\![$ FUTURE ALWAYS(It's sunny in Oslo) $]\!]_{c,\langle w,t \rangle} = 1$ iff $[\![$ It's sunny in Oslo$]\!]_{c,\langle w,t' \rangle} = 1$ for every $t' > t_c$

(93) $[\![$ FUTURE ALWAYS(It's sunny in Oslo now) $]\!]_{c,\langle w,t \rangle} = 1$ iff $[\![$ It's sunny in Oslo now$]\!]_{c,\langle w,t' \rangle} = 1$ for every $t' > t_c$

while (90) and (91) have the same assertoric content:

(94) $[\![$ It's sunny in Oslo $]\!]_{c,\langle w,t \rangle} = [\![$ It's sunny in Oslo now $]\!]_{c,\langle w,t \rangle} = 1$ iff the sun is shining in Oslo at $\langle w_c, t_c \rangle$

The Lewis-MacFarlane suggestion generalizes into a two-dimensional account of indexicals. Let C be the set of contexts of utterance, and let I be the set of circumstances of evaluation. For simplicity, let I consist of sets of world-time pairs. Then:

> **Compositional semantic value.** The compositional semantic value of a sentence ϕ is the set of *points of evaluations* such

that ϕ is true at those points. Let $[\![.]\!]$ be the semantic function. Then $[\![\phi]\!] = \{\langle c, \langle w,t \rangle \rangle \in C \times I : [\![\phi]\!]_{c,\langle w,t \rangle} = 1\}$.

Assertoric content. The assertoric content of a sentence ϕ in a context of utterance c is the set of *contexts* such that ϕ is true as both uttered and evaluated at the circumstance of those contexts: $[\![\phi]\!]^{AC} = \{c \in C : [\![\phi]\!]_{c,\langle w_c,t_c \rangle} = 1\}$.

These clauses express the same idea as the matrices above; the compositional semantic value of a sentence in a context c is the full matrix, while its assertoric content is its diagonal proposition. The assertoric content of a sentence is determined by its compositional semantic values, but the assertoric content is not part of the compositional semantics proper. As we will see, this is a main difference between post-semantics and switcher-semantics.

Here, I've only presented a version of this strategy that accounts for temporal expressions. However, an analogous account can be given for e.g. location and modality. That would be an account that respect both the intuition that the following pairs of sentences assert the same thing (convey the same information), and the intuition that they embed differently under certain operators.

(95) It's raining here.

(96) It's raining

(97) It's actually windy.

(98) It's windy.

6.2.3 COMMENTS

Summing up so far, the noteworthy features of the post-semantics account are the following:

- IDENTITY is rejected.

- WORLD ONLY is rejected too since the assertoric content of a sentence is defined as a set of contexts, and contexts include at least the parameters *time* and *speaker*.

- That the assertoric content is identified with the diagonal proposition captures the intuition from the previous chapter that essentially relative sentences do not convey information about which context the subject is om , but only that one is in one of the contexts in which the sentence is true.

- There is a systematic relation between compositional semantic value (character) and assertoric content (truth-at-a-context profile), since the former determines the latter.

What would it take to give a semantics that keeps assertoric content within the compositional semantics proper? This is explored in the next section.

6.3 SWITCHER-SEMANTICS

6.3.1 THE IDEA

The guiding idea in switcher semantics is that one and the same expression can make different compositional contributions in different linguistic contexts. Expressions that create semantically relevant linguistic contexts are called *switchers*. By a 'semantically' relevant context, I mean a linguistic context in which an expression makes a different semantic contribution compared to the null-context, which is the linguistic context of an unembedded expression. The application of this strategy to the problem cases discussed here is fairly straightforward: I will treat assertoric content as the semantic value that a sentence has in the null-context, and treat temporal expressions as switchers that change the semantic contributions of expressions embedded under them.

A consequence of using switchers is that we must modify the compositionality constraint and require only *general compositionality*, as opposed to any of the stronger versions of compositionality. (Cf. chapter 2.)

General compositionality (informal). The meaning of a complex expression is a function of the meanings of its parts, their linguistic context relative to the complex expression, and their mode of composition (and the context of utterance).

Switcher semantics has been suggested in order to account for the different semantic contributions of proper names embedded under modal and epistemic operators, (Glüer and Pagin, 2006), and to give a compositional account of pure quotation (Pagin and Westerståhl 2010c). It has so far not been applied to tense and temporal expressions. Here, I want to spell out this possibility in some detail and connect the results to the problems discussed so far in the dissertation. I will begin by constructing a simple language, $\mathcal{L}_{\mathcal{O}}$, which includes temporal sentential operators. I will then construct a switcher semantics for it in which OPERATORS is made compatible with ETERNALISM, while nevertheless avoiding the *schmentencite*-strategy.

6.3.2 THE SEMANTICS

The formulas of $\mathcal{L}_O$ are the straightforward translations of English sentences such as:

 (99) It's raining.

(100) It's raining or the sun is shining.

(101) Sometimes, it rains.

Definition 1. Syntax. $\mathcal{L}_{\mathcal{O}}$ consists of a set of terms $a_1, a_2, ...$, and a set of predicates $P_1, ..., P_n$. The terms consists of a set of constants, $k_1, ..., k_n$ and an infinite set of variables, $x_1, x_2, ...$. Furthermore, $\mathcal{L}_{\mathcal{O}}$ contains the logical connectives $\vee$ and $\neg$, the quantifier $\forall$, and the temporal operators ALWAYS, SOMETIMES, PAST, FUTURE, FUTURE ALWAYS, and NOW. The well-formed formulas of $\mathcal{L}_{\mathcal{O}}$ are defined as follows.

1. If P is a predicate of arity n and $a_1, ..., a_n$ are terms, then $P(a_1, ..., a_n)$ is a formula.

2. If ϕ is a formula, then $\neg\phi$ is formula.

3. If ϕ and ψ are formulas, then $\phi \vee \psi$ is a formula.

4. If ϕ is formula and x is a variable, then $\forall x\phi$ is a formula.

5. If ϕ is a formula that doesn't contain a temporal operator, then ALWAYS(ϕ), SOMETIMES(ϕ), PAST(ϕ), FUTURE(ϕ), FUTURE ALWAYS(ϕ), and NOW(ϕ) are formulas.

6. Nothing else is a formula.

Free and *bound* variables are defined as usual. Formulas with at least one free variable are *open* formulas. All other formulas are *sentences*. According to clause 5 in *Definition 1*, the syntax doesn't allow for temporal operators working on sentences already containing a temporal operator. All the temporal operators are thus syntactically primitive, including FUTURE ALWAYS. We'll return to this feature after the semantics has been given. Present tense is not marked, so all formulas not containing an operator should be read as being in the present tense.

For the semantics, let $\mathcal{M} = \langle\langle W, C, D, T\rangle, I\rangle$ be the interpretation of $\mathcal{L}_O$. W is a set of possible worlds, C is a set of contexts, D is the domain of objects, T is the domain of times and I is an interpretation function into D. For a predicate of arity n, $I(P) : W \times T \rightarrow \mathcal{P}(D^n)$.

Definition 2. Denotation for terms.   Let g be an assignment of elements in D to variables. Let $[-]$ be the denotation function from terms into D. Then

1. If a is a variable, then $[a]_{c,g,w} = g(x)$.

2. If a is a constant, then $[a]_{c,g,w} = I(a)$

We now introduce the two semantic functions: $[\![-]\!]^{TO}$ and $[\![-]\!]^{EO}$. $[\![-]\!]^{EO}$ is the *eternalist* semantic function mapping sentences to classical propositions. $[\![-]\!]^{TO}$ is the *temporalist* semantic function mapping sentences to temporal propositions. The difference between the two semantic functions becomes manifest in the semantics below as the temporalist function assigns truth-values to sentences relative to contexts of utterance and world-*time*-pairs, while the eternalist function assigns truth-values to sentences relative to contexts of utterance and worlds. $[\![-]\!]^{EO}$ is the designated interpretation, which gives us the assertoric content.

Definition 3. Truth for formulas.   Let w be a world, t a time, g an assignment, and c the context of utterance. The circumstance of evaluation

is either $\langle w,t \rangle$, or w, depending on the semantic function. Truth for a formula relative to the context of utterance c and a circumstance of evaluation, $\langle w,t \rangle$ or w, is defined as follows:

1. $[\![P(a_1,...,a_n)]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$ iff $\langle [a_1]_{c,g,w}, ..., [a_n]_{c,g,w} \rangle \in I(P)(\langle w,t \rangle)$

2. $[\![\neg \phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 0$

3. $[\![\phi \vee \psi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$ or $[\![\psi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$

4. $[\![\forall x \phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$ iff for all $d \in D$, $[\![\phi]\!]^{TO}_{c,g[d/x],\langle w,t \rangle} = 1$

5. $[\![P(a_1,...,a_n)]\!]^{EO}_{c,g,w} = 1$ iff $\langle [a_1]_{c,g,w}, ..., [a_n]_{c,g,w} \rangle \in I(P)(\langle w,t_c \rangle)$

6. $[\![\neg \phi]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{EO}_{c,g,w} = 0$

7. $[\![\phi \vee \psi]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{EO}_{c,g,w} = 1$ or $[\![\psi]\!]^{EO}_{c,g,w} = 1$

8. $[\![\forall x \phi]\!]^{EO}_{c,g,w} = 1$ iff for all $d \in D$, $[\![\phi]\!]^{EO}_{c,g[d/x],w} = 1$

9. $[\![\text{ALWAYS}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$, for all t

10. $[\![\text{SOMETIMES}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$, for some t

11. $[\![\text{PAST}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$, for some $t < t_c$

12. $[\![\text{FUTURE}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t \rangle} = 1$, for some $t > t_c$

13. $[\![\text{FUTURE ALWAYS}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g\langle w,t \rangle} = 1$, for all $t > t_c$

14. $[\![\text{NOW}(\phi)]\!]^{EO}_{c,g,w} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t_c \rangle} = 1$

Other temporal operators than those in *Definition 3* are definable in a similar manner, but for brevity's sake I omit them here. As already noted, I treat all tenses and temporal expressions as primitive in this semantics. The semantics does not allow me to recursively define complex temporal operators from simple temporal operators. FUTURE ALWAYS is therefore treated as a primitive expression, and not as a result of embedding a formula of the form of ALWAYS ϕ under the temporal operator FUTURE. Since the result of applying a temporal operator to a formula is an eternal proposition, while temporal operators must operate on temporal propositions, double embedding under temporal operators is not possible in this semantics. This simplification is a considerable limitation, but I will leave it as a topic for future investigations how to modify the semantics in order to

treat complex tenses or sequences of tense. The general point that I wish to make here can be made using only simple tenses.

By using the switcher-semantics approach to sentential operators, I can define assertoric content and compositional semantic value as follows:[1]

> **Compositional semantic value.** The compositional semantic value of a sentence ϕ is determined by its linguistic context within the sentence it occurs in. In case it is embedded under a temporal expression, it is a temporal proposition, which is true relative to a world-time pair.

> **Assertoric content.** The assertoric content of a sentence ϕ in a context of utterance c is the eternal proposition expressed by the sentence in the *null-context*.

For more details on linguistic contexts, see chapter two. Now we have two main constructive suggestions on the table: the post-semantic account and the switcher semantic account. The most important difference between the two is that assertoric content is part of the (generally) compositional semantics in the switcher-semantics, while it in the post-semantics account falls outside the compositional semantics proper.

How does the switcher semantics fare with respect to arguments in the previous chapter? In line with these arguments, I want the semantics to make the following predictions about sentences (71)-(73). The desired result is that the first two sentences should have the same assertoric content, but make different compositional contributions when embedded under temporal operators. Furthermore, they should both differ in assertoric content from (73).

(71) It's raining.

(72) It's raining now.

(73) It's raining at 11 p.m.

---

[1] I have chosen to treat tense by means of index-shifting sentential operators to make the relationship to Kaplan's approach as clear as possible. However, it is also possible to construct a switcher semantics for a language which analyses tense by means of quantification over time variables in the object language.

As we saw in section 6.2.2, the post semantic strategy delivers the desired results. What about the switcher semantics? As it turns out, it delivers the correct result as well. Let c be the context of utterance, w the world of evaluation, and let t_c be the time of the context of utterance. Then:

(102) $[\![$ NOW (It's raining)$]\!]^{EO}_{c,g,w} = 1$

    iff

    $[\![$It's raining$]\!]^{TO}_{c,g,\langle w,t_c\rangle} = 1$ (by clause 14, definition 3)

    iff

    $[\![$It's raining$]\!]^{EO}_{c,g,w} = 1$ (by clause 1 and 5, definition 3)

Hence, (71) and (72) have the same assertoric content, given that I define assertoric content as the semantic value in the null-context. Furthermore, the following holds as well:

(103) $[\![$NOW(It's raining)$]\!]^{EO}_{c,g,w} = [\![$It's raining$]\!]^{EO}_{c,g,w} \neq [\![$ It's raining at 11.00$]\!]^{EO}_{c,g,w}$

What about embedding the sentences under a temporal operator? The desired result is that (71) and (72) should embed differently. Let's start with (71), for which the following holds.

(104) $[\![$ FUTURE ALWAYS (It's raining)$]\!]^{EO}_{c,g,w} = 1$

    iff

    $[\![$It's raining$]\!]^{TO}_{c,g,\langle w,t\rangle} = 1$ for all $t > t_c$ (by clause 13, definition 5)

(72) is a bit more complicated, since it involves a double embedding, which is not accounted for in *Definition 3*. An easy way to handle this issue is to introduce the following temporalist evaluation for the operator NOW.

(105) $[\![$ NOW (It's raining)$]\!]^{TO}_{c,g,\langle w,t\rangle} = 1$ iff $[\![\phi]\!]^{TO}_{c,g,\langle w,t_c\rangle} = 1$

By adding this recursive temporalist evaluation for the NOW-operator, we get the expected result for when (72) is embedded under FUTURE ALWAYS:

(106) $[\![$ FUTURE ALWAYS (NOW (It's raining))$]\!]^{EO}_{c,g,w} = 1$

    iff

$[\![\text{NOW (It's raining)}]\!]^{TO}_{c,g,\langle w,t\rangle} = 1$ for all $t > t_c$ (by clause 13, definition 3)

iff

$[\![\text{It's raining}]\!]^{TO}_{c,g,\langle w,t_c\rangle} = 1$ for all $t > t_c$ (by 105)

Hence, we get the desired prediction that the compositional semantic value of (71) differs from that of (72):

(107) $[\![$ It will always be the case that it's raining $]\!]^{EO}_{c,g,w} \neq [\![$ It will always be the case that it's raining now. $]\!]^{EO}_{c,g,w}$

6.3.3 COMMENTS

Apart from meeting the minimal adequacy constraints, the suggested switcher semantics for $\mathcal{L}_\circlearrowleft$ has several interesting, and arguably virtuous, features:

- The temporal operators systematically change the semantic contribution (the compositional semantic value) of the embedded formulas from an eternal proposition to a temporal proposition.

- Since the semantic function changes, this is done without postulating any syntactic ambiguity. Hence, we can avoid the *schmentencite*-strategy that Lewis (1980: 88-90) warns us about.

- The designated interpretation of a sentence is a classical proposition, so WORLD ONLY is maintained, *pace* Kaplan (1989).

- There are indeed two kinds of semantic values, but both are part of the compositional semantics proper, as opposed to the post-semantics, *pace* Lewis (1980), MacFarlane (2006), and Rabern (2012a).

- The semantics is only generally compositional.

Is this final feature a problem? No. As we saw in the second chapter, there are no principled reasons to insist on any of the stronger versions of compositionality unless your argument in favor of compositionality disqualifies it, which seems unlikely. For example, productivity or learnability considerations support general compositionality to the same degree as they support any of the stronger versions. Furthermore, in virtue of being

generally compositional, the switcher semantics is compatible with both WORLD ONLY and a modified version of IDENTITY.

> IDENTITY*. The assertoric content of a sentence is its general compositional semantic value.

This concludes the presentation of the constructive accounts. In the next section, I will briefly explain the impact of the respective accounts on the simple picture of communication (cf. chapter 2).
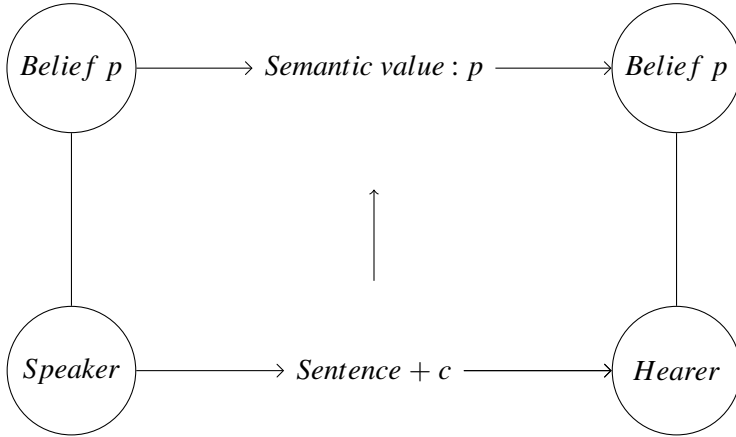
6.4 UPDATING THE SIMPLE PICTURE OF COMMUNICATION

In the first chapter, I showed how the IDENTITY-assumption allowed a simple explanation of communicative success in terms of compositionally determined semantic values.

> THE SIMPLE PICTURE. Successful communication involves the transfer of a belief from a speaker to a hearer. The objects of belief are classical propositions. The speaker expresses her belief that p by uttering a sentence s whose assertoric content in the context of utterance c is p. The hearer computes the compositional semantic value of s relative to c and thereby comes to entertain p.

Below is a schematic illustration of how content is transferred from speaker to hearer on this picture.

Illustration 2. Communication in the simple picture.

$$\begin{array}{ccc}
\textit{Belief } p & \xrightarrow{\quad\textit{Semantic value}:p\quad} & \textit{Belief } p \\[2em]
\textit{Speaker} & \xrightarrow{\quad\textit{Sentence}+c\quad} & \textit{Hearer}
\end{array}$$

A speaker who wishes to communicate her belief that *p* in a context *c* expresses her belief by means of asserting a sentence whose semantic value relative to *c* is *p*. Furthermore, *p* is what is recovered when the utterance is successfully interpreted by a hearer, assuming that the hearer knows what the context of utterance is.

Both of the constructive accounts proposed in the previous section deny IDENTITY. Still, I wish to assign formal semantic theories a prominent role in an general theory of communication. So, the question is how the simple picture of communication should be updated.

Let us begin with the post-semantics.

> **Compositional semantic value.** The compositional semantic value of a sentence ϕ is the set of *points of evaluations* such that ϕ is true at those points. Let $[\![.]\!]$ be the semantic function. Then $[\![\phi]\!] = \{\langle c, \langle w, t\rangle\rangle \in C \times I : [\![\phi]\!]_{c,\langle w,t\rangle} = 1\}$.

> **Assertoric content.** The assertoric content of a sentence ϕ in a context of utterance c is the set of *contexts* such that ϕ is true as both uttered and evaluated at the circumstance of those contexts: $[\![\phi]\!]^{AC} = \{c \in C : [\![\phi]\!]_{c,\langle w_c, t_c\rangle} = 1\}$.

Note that since the assertoric content is a set of contexts, and contexts include speakers, assertoric content on this picture is a *centered proposition*, as in (Lewis, 1979). That is, what is expressed is a so-called self-locating belief. The speaker communicates that she takes herself to be in a context such that ϕ is true and communicates that by asserting the sentence in question. This means that the resulting belief of the hearer, that is, the belief that she forms under the assumption that she trusts the speaker is *not the same* belief as the belief of the speaker, and neither is its content the same as the assertoric content of the sentence uttered by the speaker. Intuitively, the hearer locates herself in a context where she, the hearer, has the first-person perspective. The resulting revised picture of communication is thus something like the following:

> REVISION I: POST-SEMANITCS Successful communication involves the 'transfer' of a thought from a speaker to a hearer. The content of the speaker's belief is a set of contexts, p (a diagonal propsition). The speaker expresses her belief that p by uttering a sentence s, whose semantic value in c *determines* the assertoric content p. The hearer computes the assertoric content from the semantic value, and comes to believe a *related* set of contexts, p'.

There is an ongoing and intricate debate on so-called *centered* communication. I will not go into the details here, but settle for pointing out that *if* assertoric content is something like a centered proposition, then successful communication cannot be simple transfer of content. Cf. e.g. Moss (2012), Ninan (2010), and Weber (2013) for constructive accounts. Stalnaker (1981) was the first to raise doubts about de se-communication. Cf. Pagin (2016) for a recent critical account.

Furthermore, I wish to point out the immediate connection between the revised picture of communication above and the discussion about belief retention in chapter three. There, I argued against the constraint SAME PROPOSITION, in favor of the more generous constraint RELATION. It seems plausible that the discussion about the functional transparency of content, and the related constraints on belief content and assertoric content should have bearing on this issue, too.

What about the switcher semantics? As mentioned in the conclusion of the previous chapter, the switcher approach is more 'conservative' than

the post-semantics. In particular, it validates WORLD ONLY, and gives a generally compositional semantics for assertoric content. Hence, the only adjustment of the SIMPLE PICTURE that needs to be made, is that we let the speaker take linguistic context into account in interpretation. This is also manifested in the most natural explanation of communication on this account.

> THE SWITCHER PICTURE. Successful communication involves the transfer of a thought from a speaker to a hearer. The objects of belief are classical propositions. The speaker expresses her belief that p by uttering a sentence s, whose assertoric content in the context of utterance c is p. The hearer computes the *general* compositional semantic value of s relative to c and thereby comes to entertain p.

6.5 CONCLUSION

In this chapter I have presented two constructive accounts of temporal expressions: The Lewis-MacFarlane account and my switcher account. Both accounts distinguish between the meaning an expression has unembedded (assertoric content), and the meaning an expression has when embedded under a temporal sentential operator. The two main differences between the accounts are (a) that assertoric content is a classical/eternal proposition on the switcher-semantics account, but not on the post-semantic account, and (b) that assertoric content is generally compositional in the switcher semantics, while it is not compositional in the post-semantics. Furthermore, I have evaluated both of the suggestions with respect to the constraints on assertoric content presented in chapter five, and found that they both pass that test.

> I*. ASSERTORIC CONTENT AS SUPPLYING REASONS FOR INFERENCE AND ACTION. ϕ and ψ have the same assertoric content in a context c iff an assertion of ϕ and an assertion of ψ in a context c all else equal give the rational and competent hearer reason to (i) make the same inferences, or (ii) perform the same actions.

> II*. PROVIDING REASONS FOR AN ASSERTION. ϕ and ψ have the same assertoric content in a context c iff asserting ϕ

and asserting ψ in a context c all else equal gives the rational speaker reasons to supply the same justifications when the assertion is challenged.

Finally, I explained how the SIMPLE PICTURE of semantics and communication can be updated in accordance with the two accounts. The switcher semantics account is the more conservative option, and inherits the main virtues of the SIMPLE PICTURE.

An attractive feature of the post-semantics account is that it coheres nicely with and explains the intuition spelled out in chapter five that asserting a sentence containing an indexical expression x never conveys information about the value of x, and hence cannot be part of the assertoric content of the sentence containing it. Either the value is already known by the hearer, and asserting it doesn't provide any new information, or it's value is not known by the speaker and then there is no way of finding it out from the assertion alone. The challenge for this account is the transformation mechanism that needs to be involved in communication.

I conclude that it is mainly a matter of preference which technical framework you prefer. All in all, the switcher semantics is more conservative than the post-semantics. I will leave it to the reader to judge whether this is a virtue or a vice. I would also add that the main conclusion to draw from this chapter and the previous one is that the status of both IDENTITY and WORLD ONLY are not decided by technical considerations, but by philosophical considerations, and in particular your meta-semantic views on what content must be like and in particular on whether it ought to be transparent.

CHAPTER 7

WHAT HAVE WE LEARNT?

The point of departure for the dissertation was two intuitive ideas about meaning, or more precisely two conditions for when two sentences have the same meaning.

> SAME BELIEF. Two sentences have the same meaning if asserting them in the same context of utterance conveys the same information, or expresses the same belief.

> SAME CONTRIBUTION. Two sentences have the same meaning only if they can be substituted for each other in larger expressions without changing the meaning of that expression.

The ambition of this dissertation has been to critically examine the arguments for and the consequences of distinguishing these two notions of meaning: assertoric content, encoded in the first principle, and the same compositional semantic value, encoded in the second principle. Linking the two together is a central task of locating formal semantics within the larger project of explaining communicative success. I have centered my discussion around a classic argument from Kaplan (1989) and Lewis (1980). The conclusion of the argument is that the principles IDENTITY and WORLD ONLY cannot both be true in a language that contains temporal or other index-shifting sentential temporal operators over and above the modal operators.

> IDENTITY. The assertoric content of a sentence is identical to its compositional semantic value.

> WORLD ONLY. The content of belief and assertion only varies in truth-value across worlds.

I have considered the three available ways to respond to the argument: (i) To deny WORLD ONLY (chapter three), (ii) to deny that English contains the relevant kind of operators (chapter four), and finally (iii) to deny IDENTITY (chapters five and six). The first strategy is to accept temporal propositions as the contents of beliefs and assertions in order to be able to maintain that the compositional semantic value - the Kaplanian *content* - of a sentence is also what we assert and believe. In chapter three, I supplied some support for it by rejecting Mark Richard's influential argument against it. In chapter four, I argued that the second strategy is not satisfactory since an analogous dilemma arises on the extensional view; either the sentences that we assert are true relative to assignments and WORLD

ONLY is false, or IDENTITY is false. In chapter five, I argued that the following constraints, motivated by the idea that assertoric content should be functionally transparent, entail that IDENTITY is false.

> I*. ASSERTORIC CONTENT AS SUPPLYING REASONS FOR INFERENCE AND ACTION. ϕ and ψ have the same assertoric content in a context c iff the beliefs expressed by asserting ϕ and asserting ψ in a context c all else equal give the rational speaker reason to (i) make the same inferences, or (ii) perform the same actions.

> II*. PROVIDING REASONS FOR AN ASSERTION. ϕ and ψ have the same assertoric content in a context c iff asserting ϕ and asserting ψ in a context c all else equal gives the rational speaker reasons to supply the same justifications when the assertion is challenged.

Finally, in chapter six, I discussed two constructive accounts: the post-semantics account and the switcher semantics account, and found that they both respected the minimal adequacy constraints that were formulated in chapter seven with respect to the following sentences.

(71) It's raining.

(72) It's raining now.

(73) It's raining at 11 p.m.

Both frameworks predict that (71) and (72) have the same assertoric content, but different compositional semantic value, in that they embed differently under certain temporal operators. Furthermore, both of them predict that (72) and (73) differ in assertoric content, even when the context of utterance is such that the time is 11 p.m., which was the second desired result. However, a distinguishing feature of the second suggestion is that it, unlike the first, is generally compositional with respect to assertoric content. So, if we take linguistic context-dependence into account, there is in fact a compositional semantics to be given. Finally, as we saw in the previous section, the simple picture of communication must be updated accordingly.

On a more general level, the main conclusion I draw from the discussion is of a methodological character. Even if the starting point of the thesis was technical issues concerning the correct treatment of tense and temporal expressions in English, the problem of relating compositional semantic value and assertoric content is not solvable by technical considerations alone. On the contrary, the solution depends on your philosophical views on the role and nature of content. The choice between the possible positions in the debate will be constrained by one's meta-semantic views on content, compositionality, and transparency. Must content be eternal? Must content be functionally transparent, as I argued in chapter six? Technical considerations alone cannot settle these issues. And depending on your stance on these questions, different technical tools stand at your disposal, as we saw for example in chapter six.

7.1 FURTHER QUESTIONS

This dissertation has been rather narrow in its scope, focusing almost exclusively on tense and temporal expressions. But however limited the approach might seem, I hope to have conveyed how the problem cases discussed here belong to a larger and more general discussion about the nature of content and the role of formal semantics. Several questions, specific or general, have only been mentioned or alluded to, and not properly answered. Among these questions I would for example like to mention the following:

- In the discussion on belief retention in chapter three, I argued against the constraint SAME PROPOSITION, in favor of the more generous constraint RELATION. It seems plausible that the discussion about the functional transparency of content has bearing on belief retention, too. If so, how?

- The same goes for the discussion in section 6.4 on what could count as successful communication in the post-semantic framework, given that the hearer does not come to believe the same (self-locating) belief as the speaker, but rather an appropriately related belief.

Among the more technical issues, I want to mention the following questions concerning an extension of the constructive approaches presented in chapter six:

- Can the post-semantics and switcher semantics approaches be extended into a complete semantics for tense and temporal expressions, including sequence of tense?

- Which other expressions are switchers? Could the switcher semantics approach for instance be useful when constructing semantics for normative language?

- Is it possible to give an extensional treatment of tense without syntactic transformations?

I'm tentatively optimistic about these applications, but for now I will leave them as a topic for future investigation. I hope to be able to return to these questions in the near future.

This concludes this dissertation, and I would like to thank the reader for their attention.

SAMMANFATTNING

En fascinerande egenskap hos naturliga språk som svenska, arabiska eller engelska är att vi kan använda dem för att dela våra trosföreställningar och tankar med andra som talar samma språk. Att kunna ett språk och vara en del av en språklig gemenskap är på ett sätt det närmsta vi kommer att vara telepatiska. Du kan inte bokstavligen läsa mina tankar, men jag kan dela mina tankar med dig genom att använda vårt gemensamma språk. Föreställ dig exempelvis att jag tror att en storm är i antågande och vill att du ska veta det. Då kommer jag helt enkelt yttra

(1) En storm är på väg.

Eftersom vi talar samma språk kommer du kunna tolka denna sats och givet att du tror att jag är pålitlig så kommer du också börja tro att det är en storm på väg. Det kommer i sin tur leda till att du agerar på ett lämpligt sätt. Om du är hemma kommer du att stänga fönstren, och om du är till havs kommer du reva seglen och söka efter en skyddad hamn. Som ett resultat av framgångsrik kommunikation mellan oss har våra föreställningar om världen blivit en aning mer lika. Min trosföreställning har så att säga överförts till dig. Denna förmåga är så självklar och naturlig för oss att vi sällan stannar upp och funderar på hur det är möjligt, men det är ett fenomen som kräver en förklaring. Begreppet *innehåll* verkar spela en nyckelroll i en förklaring av framgångsrik kommunikation, som i fallet ovan. För det första är min trosföreställning att en storm är på väg ett mentalt tillstånd med ett visst innehåll. För det andra är mitt yttrande av (1) en talakt med ett visst innehåll. För det tredje är själva satsen (1) ett lingvistiskt uttryck som relativt en yttrandekontext har ett visst innehåll eller mening. Slutligen är det mentala tillstånd du befinner dig i efter att ha tolkat vad jag säger ett mentalt tillstånd med ett visst innehåll. Om vi vill förklara

hur kommunikation är möjligt, så måste vi redogöra för kopplingen mellan dessa fyra instanser av innehåll. Den absolut enklaste förklaringen är att relationen mellan de fyra är *identitet*: Innehållet i talakten är helt enkelt tanken som den används för att uttrycka och det är även satsens mening. Dock verkar ett antal problemfall i litteraturen visa att detta inte kan vara fallet. Denna avhandling diskuterar ett antal sådana fall.

En teori om kommunikation ska alltså förklara hur talare kan uttrycka sina tankar och dela dem med andra. Så kallade formella semantiska teorier för språk som svenska har i uppgift att tilldela *semantiska värden* (meningar) till enkla uttryck och satser, relativt yttrandekontexter, samt att visa hur meningen hos sammansatta uttryck beror på meningen hos dess enklare delar. Det är rimligt att förvänta sig att en sådan teori ska ha en framskjutande roll i en förklaring av framgångsrik kommunikation. Det har traditionellt antagits att det kräver av semantiska teorier att de tilldelar satser *rätt sorts* semantiska värden på *rätt sätt*. Det antas i sin tur betyda att de måste tilldela *propositioner* som det semantiska värdet hos satser, samt göra *kompositionellt*, dvs. i enlighet med denna princip:

> KOMPOSITIONALITET. Meningen hos ett komplext uttryck bestäms av meningen hos dess delar och deras kompositionssätt.

Att satser semantiska värde är propositioner är tänkt att garantera att de är av samma sort som innehållet i tankar och talakter, vilket förklarar hur satser kan användas för att uttrycka tankar. Kompositionalitetsvillkoret antas bland annat förklara hur talare kan förstå nya satser genom att räkna ut deras mening från delarnas mening. Att teorin tilldelar satser mening relativt yttrandekontexter är ett måste eftersom en och samma sats kan uttrycka olika saker beroende på tidpunkt, talare och plats etc. Tillsammans ger dessa antaganden en rätt enkel bild av kommunikation i termer av semantiska värden: En talare överför sin tanke att p, där p är en proposition, till en åhörare genom att hävda en sats vars semantiska värde i den kontexten är just p. Den här enkla förklaringen förutsätter att två intuitivt rimliga principer är förenliga.

> A Två satser har samma mening endast om de uttrycker samma tanke i samma kontexter.

> B Två satser har samma mening endast om de kan ersätta varandra i större uttryck utan att ändra meningen hos detta

uttryck.

Den andra principen är en konsekvens av kompositionalitetsvillkoret: Om meningen hos ett komplext uttryck bestäms av meningen hos delarna och hur de sätts samman, så kan inte meningen hos ett komplext uttryck ändras om ett deluttryck byts ut mot ett annat synonymt uttryck. Problemet är att båda principerna inte kan vara korrekta. Vissa satser som när de står ensamma uttrycker samma tanke kan inte bytas ut mot varandra i vissa komplexa uttryck, vilket vi ser is följande exempel:

(2a) Solen skiner i Oslo.

(2b) Solen skiner i Oslo nu.

(3a) Lakrits är gott.

(3b) Jag tycker lakrits är gott.

Yttrade i samma kontext uttrycker (2a) och (2b), respektive (3a) och (3b), samma tanke. Trots det kan de inte bytas ut mot varandra i vissa komplexa konstruktioner:

(4a) Det kommer alltid vara fallet att solen skiner i Oslo.

(4b) Det kommer alltid vara fallet att solen skiner i Oslo nu.

(5a) Salman insisterar att lakrits är gott.

(5b) Salman insisterar att jag tycker att lakrits är gott.

Det är möjligt att (4a) är falsk samtidigt som (4b) är sann. Detsamma gäller (5a) och (5b). Slutsatsen är att satser som uttrycker samma tanke, bidrar på olika sätt till meningen hos vissa komplexa satser. För att förklara problemet behöver vi lite terminologi: När talare vill uttrycka tankar yttrar de satser. Kalla meningen hos satser när de yttras ensamma för deras *assertoriska innehåll*. Semantiska teorier tilldelar satser meningar relativt kontexter i enlighet med kompositionalitetsprincipen. Kalla dessa meningar för *semantiskt värde*. Hur är de relaterade till varandra? Problemfallen ovan verkar visa att de inte kan vara identiska, vilket den enkla förklaringen av kommunikation förutsatte. Det vill säga, problemfallen verkar vara motexempel mot följande princip:

> IDENTITET. En sats kompositionella semantiska värde är identiskt med dess assertoriska innehåll.

I ljuset av den här typen av problem har det förslagits att vi helt enkelt måste ge upp identitetsprincipen. Den idén går tillbaka till Dummett (1973) och Lewis (1980), och har på sistone försvarats i Ninan (2010), Rabern (2012a, 2012b) och Yalcin (2014). De argumenterar för att identitetsprincipen är omotiverad och att problemfallen kan lösas så snart vi ger upp det. Men om det ges upp så står vi inför en ny utmaning: Om relationen mellan assertoriskt innehåll och semantiskt värde inte är identitet så måste det fortfarande vara en relation som möjliggör en förklaring av hur satser kan uttrycka tankar och trosföreställningar.

Denna avhandling diskuterar argumenten för och konsekvenserna av att skilja på assertorisk innehåll och kompositionellt semantiskt värde, och ger även ett konstruktivt förslag till hur de två kan vara relaterade om de inte är identiska. Jag närmar mig frågan genom att titta närmare på temporala uttryck och tempus. Utöver det första kapitlet där problemet introduceras består avhandlingen av fem huvudkapitel.

Kapitel två är ett översiktskapitel där jag presenterar kompositionalitetsprincipen i detalj och redogör för alternativa formella explikationer av principen, exempelvis olika sätt att kombinera kontexberende med kompositionalitet. Av särskilt intresse är så kallad *generell kompositionalitet*, som tar hänsyn till såväl *lingvistisk* kontext - dvs. i vilken typ av sats som ett uttryck förekommer - och utomlingvistisk kontext - dvs. när, var och av vem som en sats yttras. Jag ger även en översikt av de mest inflytelserika argumenten för kompositionalitet och de allvarligaste problemen med dessa. Efter det går jag över till avhandlingens huvudargument som sträcker sig från kapitel tre till kapitel sju.

Min utgångspunkt är David Kaplans inflytelserika Kaplan (1989), och i synnerhet hans semantik för temporala uttryck. I Kaplans semantiska ramverk beror en sats sanningsvärde på omgivningen på två sätt. Kontextkänsliga uttryck som "nu" och "här" får sin referens bestämd av *yttrandekontexten*. Givet den yttrandekontexten är satsen sann eller falsk i olika *utvärderingstillfällen*. Semantiska klausuler i teorin har därmed följande generella form, om ϕ är en sats:

$\llbracket \phi \rrbracket_i^c = 1$ omm ϕ är sann så som yttrad i kontext c och utvärderad vid i

I de flesta fall utvärderas satser i samma kontext som de yttras i, men en viss typ av uttryck tvingar oss att att ta ställning till satsens sanningsvärde

vid andra platser, tidpunkter eller världar än de som de yttras vid. Här är ett par exempel:

(6a) Vintern är på väg.

Lägg till en modal operator respektive en temporal operator:

(6b) Det är möjligt att vintern är på väg.

(6c) Vintern är på väg imorgon.

Huruvida (6b) är sann beror på om (6a) är sann vid en annan värld en den faktiska världen, och huruvida (6c) är sann beror på om (6a) är sann imorgon. På grund av att de skiftar utvärderingstillfället kallas dessa operatorer för *skiftande satsoperatorer* (eng. shifty operators). Det visar sig att dessa operatorer har långtgående konsekvenser. Kaplan (1989) och Lewis (1980) visar nämligen att följande principer är sinsemellan oförenliga:

> IDENTITET. En sats kompositionella semantiska värde är identiskt med dess assertoriska innehåll.

> VÄRLD. Innehållet i hävdanden och trosföreställningar varierar enbart i sanningsvärde mellan möjliga världar.

> OPERATORER. Engelska innehåller skiftande satsoperatorer.

Kortfattat är argumentet att det som exempelvis en skiftande temporal satsoperator opererar på måste kunna variera i sanningsvärde mellan tidpunkter, annars kan inte tidpunkten för utvärderingen. Det betyder att vi antingen måste ge upp IDENTIET eller VÄRLD. Lewis föredrar det förstnämnda medan Kaplan väljer det sistnämnda alternativet. Det innebär att han förnekar ETERNALISM till förmån för TEMPORALISM

> ETERNALISM. Innehållet i hävdanden och trosföreställningar varierar inte i sanningsvärde mellan tidpunkter.

> TEMPORALISM. Innehållet i hävdanden och trosföreställningar kan variera i sanningsvärde mellan tidpunkter.

I kapitel tre diskuterar jag Mark Richards argument mot temporalism, och ger därmed visst stöd för Kaplan. Richard hävdar att temporalister inte kan ge en adekvat teori för vad det innebär att fortsätta tro något (*belief retention*). Jag visar arr Richards argument förutsätter följande princip:

SAMMA PROPOSITION. Att fortsätta tro något mellan två tidpunkter t och t' är att tro på samma proposition vid t och t'.

Jag visar att principen även kan användas mot eternalism. Slutsatsen är att Richard inte bör använda den för att kritisera temporalism.

I kapitel fyra diskuterar försök att lösa inkonsistensen genom att förneka OPERATORER. Vid första anblick är det det filosofiskt minst kontroversiella strategin, och den har försvarats i King (2003). Jag förklarar hur strategin ger upphov till ett analogt problem som de strategier som accepterar OPERATORER, och alltså inte är att föredra framför Kaplans eller Lewis strategier i det här sammanhanget.

I kapitel fem presenterar jag vad jag anser vara det bästa argumentet mot IDENTITET med avseende på Kaplans semantiska ramverk. Frågan om huruvida semantiskt värde är identiskt med assertoriskt innehåll beror naturligtvis på vad assertoriskt innehåll är. Jag argumenterar att assertoriskt innehålls främsta roll är att ge oss förklaringar av slutledningar och rationellt handlande. I linje med det argumenterar jag för att två satser har samma assertoriska innehåll enbart om de fyller samma förklaringsmässiga roll med avseende på slutledningar och handlande. Men, två satser kan ha samma semantiska värde i Kaplanskt ramverk utan att ha samma förklaringsmässiga roll, och vice versa. Alltså är IDENTITET falsk med avseende på Kaplans ramverk, men inte av de skäl som diskuterades i kapitel tre. I kapitel sex och sju ger jag två konstruktiva förslag på vad som kan ersätta IDENITET, som respekterar resultaten från kapitel fem, och visar vilka revisioner av den enkla förklaringen av framgångsrik kommunikation som de kräver; så kallad postsemantik - där satsens assertoriska innehåll bestäms av dess semantiskt värde men inte ingår i den kompositionella semantiken - och så kallad *switcher-semantik* - där en generellt kompositionell semantik kan ges för temporala satsoperatorer. Avhandlingens generella slutsats är att (i) IDENTITET är falsk, men (ii) att frågan om hur kompositionellt semantiskt värde och assertoriskt innehåll är relaterade inte kan besvaras enbart av tekniska överväganden, men beror på vår syn på formell semantiks roll och syfte, sam vilken roll vi anser att assertoriskt innehåll ska spela.

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